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TIER I SAMPLING AND ANALYSIS PLAN FOR UNDERGROUND STORAGE TANK (UST) 26

NAS JACKSONVILLE FL

5/1/2016

RESOLUTION CONSULTANTS

FINAL
TIER I SAMPLING AND ANALYSIS PLAN

UNDERGROUND STORAGE TANK 26 KEMEN TEST CELL
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA 32212

Revision: 0

Prepared for:

Department of the Navy
Naval Facilities Engineering Command, Southeast
Building 135 North, P.O. Box 30
Jacksonville, Florida 32212-0030

May 2016

SAP WORKSHEET #1: TITLE AND APPROVAL PAGE

(UFP-QAPP Manual Section 2.1)

TIER I SAMPLING AND ANALYSIS PLAN

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Jacksonville, Florida 32212-0030

Prepared By:

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Contract Number: N62470-11-D-8013
CTO JMA2

May 2016

Cantwell.Tina Digitally signed by Cantwell.Tina DN: cn=Cantwell.Tina, o=Resolution Consultants, ou, email=tcantwell@ensafe.com, c=US Date: 2016.02.24 08:38:53 -06'00'

Tina Cantwell, Resolution Consultants
Project Chemist/QA Officer Date

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Anthony Wagner, Resolution Consultants
Task Order Manager Date

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Adrienne Wilson, Navy Division
Remedial Project Manager Date

EXECUTIVE SUMMARY

Resolution Consultants has prepared this Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) under the Comprehensive Long-Term Environmental Action Navy Contract Number N62470-11-D-8013 Contract Task Order JMA2. This UFP-SAP has been prepared for the collection and analysis of soil and groundwater data to assess potential residual jet fuel (JP-5) impacts to soil and groundwater in the vicinity of a 25,000 gallon underground storage tank (UST) 26 formerly located on the west side of the Kemen Test Cell Building 873 located at Naval Air Station Jacksonville, Florida.

The Kemen Test Cell Building 873 operates as a jet aircraft engine testing facility. The former UST, approximately 35 feet from the western edge of Building 873, provided JP-5 to the testing facility from 1974 to 2010. Contamination assessment activities conducted between 1991 and 1993 confirmed petroleum impacts to site soil and groundwater. Remedial actions consisting of impacted soil removal and thermal treatment were implemented at the site between 1994 and 1995. The 1996 Closure Report (BEI 1996), was approved by the Florida Department of Environmental Protection, allowing impacted soil to remain in place. Naphthalene was the only constituent present in groundwater at concentrations exceeding regulatory criteria; however, no further action (NFA) was determined in 1997 after completion of monitoring-only activities.

The 25,000 gallon UST was removed in 2010. During excavation, soil and groundwater impacts were identified east of the tank within the excavation, including exceedances of leachability-to-groundwater cleanup target levels (CTLs) for naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, and/or total recoverable petroleum hydrocarbons (TRPH). The compounds 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, benzo(a)anthracene, and benzo(b)fluoranthene were present in groundwater at concentrations exceeding applicable groundwater cleanup target levels (GCTLs).

This UFP-SAP includes sampling unsaturated soil and groundwater (via temporary well points) at six soil locations in close proximity to the former UST to evaluate existing conditions. Four discretionary sampling locations are reserved in the event that additional data is needed to delineate the extent of potential impacts if identified. The chemicals of primary concern (COPCs) identified in unsaturated soil include naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, and TRPH and benzo(a)anthracene, benzo(b)fluoranthene, 1-methylnaphthalene, and 2-methylnaphthalene in shallow groundwater.

Soil analytical results will be compared to industrial direct exposure CTLs and leachability-to-groundwater values (the most stringent of the applicable screening criteria). Groundwater results will be compared to applicable GCTLs.

In the event that COPC concentrations are less than respective CTLs, a recommendation for NFA without institutional controls will be recommended for the site. If COPC concentrations are greater than their respective CTLS, additional assessment, remedial action activities, and/or institutional/engineering controls may be developed to bring the site to closure.

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Appendix A Field Standard Operating Procedures
Appendix B Field Forms
Appendix C Laboratory Certification Documentation

List of Acronyms

ABB-ES	ABB Environmental Services
amu	Atomic mass unit
ASTs	Aboveground storage tanks
bls	Below land surface
CA	Corrective action
CAR	Contamination Assessment Report
CAS No.	Chemical Abstract Service Number
COPC	Chemicals of potential concern
CSM	Conceptual site model
CCV	Continuing calibration verification
COC	Constituent of concern
CV	Calibration verification
CTO	Contract task order
DDT	4,4'-dichlorodiphenyltrichloroethane
DI	Deionized water
DO	Dissolved oxygen
DoD	Department of Defense
DPT	Direct Push Technology
DQO(s)	Data quality objective(s)
DVA	Data Validation Assistant
eQAPP	Electronic quality assurance project plan
ELAP	Environmental Laboratory Accreditation Program
ECS	Environmental Compliance Services, Incorporated
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FID	Flame Ionization Detector
FL-PRO	Florida Petroleum Residual Organics
FTL	Field team leader
FRC	Federal Records Center
GC	Gas chromatograph
GC/FID	Gas chromatograph/Flame Ionization Detector
GC/MS	Gas chromatograph/mass spectrometer
GPS	Global positioning system
GCAL	Gulf Coast Analytical Laboratories, LLC
GCTL	Groundwater Cleanup Target Level
HSM	Health and safety manager
ICAL	Initial calibration
ICS	Interference check solution
ICV	Initial calibration verification
IRP	Installation Restoration Program
IDW	Investigation Derived Waste

JP-5	Jet Fuel
LCS/LCSD	Laboratory control sample/laboratory control sample duplicate
LOD	Limits of detection
LOQ	Limit of Quantitation
MDLs	Method detection limits
µg/L	Micrograms per liter
mg/L	Milligrams per liter
mg/kg	Milligrams per kilogram
ml	Milliliter
MMYY	Month and Year of sample collection, added to sample identification (ID) to create unique identifier
MS/MSD	Matrix spike/matrix spike duplicate
mV	millivolts
NA	Not applicable
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
Navy	United States Navy
NFA	No further action
NIRIS	Naval Installation Restoration Information Solution
NTUs	Nephelometric turbidity units
OSHA	Occupational Safety and Health Administration
OU	Operable unit
OVA	Organic vapor analyzer
oz	Ounce
ppm	Parts per million
ppt	Parts per thousand
%D	Percent difference
%R	Percent recovery
%RSD	Percent relative standard deviation
PAHs	Polynuclear aromatic hydrocarbons
PDF	Portable document format
PVC	Polyvinyl chloride
PM	Project manager
PSQs	Principal Study Questions
PQL(s)	Project quantitation limit(s)
QA	Quality assurance
QAO	Quality assurance officer
QAPP	Quality assurance project plan
QC	Quality control
QSM	Quality Systems Manual

r^2	Least squares regression coefficient/coefficient of determination
RAP	Remedial Action Plan
RPD	Relative percent difference
RRT	Relative retention times
RSD	Relative standard deviation
RPM	Remedial project manager
RWP	Remediation Work Plan
RMO	Risk Management Option
SA	Site Assessment
SAP	Sampling and Analysis Plan
SAR	Site Assessment Report
SIM	Selective ion monitoring
SJRWMD	St. Johns River Water Management District
SOP(s)	Standard operating procedure(s)
SSO	Site safety officer
SCTL	Soil cleanup target level
SVOC	Semi-volatile organic compounds
TBD	To be determined
TOC	Top of casing
TOM	Task order manager
TRPH	Total recoverable petroleum hydrocarbons
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
U.S. EPA	United States Environmental Protection Agency
UST	Underground storage tank
VOCs	Volatile organic compounds

SAP WORKSHEET #2: SAMPLING AND ANALYSIS PLAN IDENTIFYING INFORMATION

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number: Underground Storage Tank (UST) 26 New Kemen Test Cell B873/JMA2, Naval Air Station (NAS) Jacksonville

Contractor Name: Resolution Consultants

Contract Number: N62470-11-D-8013

Contract Title: Comprehensive Long-term Environmental Action Navy

Work Assignment Number (optional): Contract Task Order (CTO) JMA2

1. This sampling and analysis plan (SAP) was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (United States Environmental Protection Agency [U.S. EPA] 2005) and U.S. EPA *Guidance for Quality Assurance Project Plans, EPA QA/G-5* (EPA 2002).

2. Identify regulatory program: Florida Department of Environmental Protection (FDEP), Petroleum Restoration Program.

3. This SAP is a project-specific SAP.

4. List organizational partners (stakeholders) and identify the connection with lead organization:

Organization Partners/Stakeholders	Connection
Florida Department of Environmental Protection	Regulatory Oversight
United States Environmental Protection Agency*	Tier I Team Partner
Naval Facilities Engineering Command Southeast	Operator/Lead Agency
Naval Air Station Jacksonville	Property Owner
The Management Edge	Tier I Team Facilitator
CH2MHill	Tier I Team Partner
Resolution Consultants	Tier I Team Partner
Tetra Tech, Inc.	Tier I Team Partner

Note:
* Note that the Kemen Test Cell is managed under the Florida Petroleum Program; U.S. EPA is provided courtesy copies of the SAP as part of the teaming process.

5. Lead organization: Naval Facilities Engineering Command (NAVFAC) Southeast.

6. If any required SAP elements and required information are not applicable (NA) to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below: Not Applicable — All worksheets are applicable.

SAP WORKSHEET #3: DISTRIBUTION LIST

(UFP-QAPP Manual Section 2.3.1)

SAP Recipients	Title	Organization	Telephone Number (optional)	E-mail Address or Mailing Address
Adrienne Wilson	Remedial Project Manager	NAVFAC Southeast	904-542-6160	adrienne.wilson@navy.mil
Tim Curtin	IRP Manager	NAS Jacksonville	904-542-4228	tim.l.curtin@navy.mil
Aaron Cohen	Remedial Project Manager	Florida Department of Environmental Protection	850-245-8935	aaron.cohen@dep.state.fl.us
Peter Dao	Remedial Project Manager	U.S. EPA Region 4*	404-562-8508	dao.peter@epa.gov
Anthony Wagner	Task Order Manager	Resolution Consultants	904-301-4517	awagner@ensafe.com
Tina Cantwell	Project Chemist/Data Manager/ Quality Assurance Officer	Resolution Consultants	901-937-4315	tcantwell@ensafe.com
Mayra Castellanos	Field Team Leader/Site Safety Officer, Professional Geologist	Resolution Consultants	904-301-4519	mcastellanos@ensafe.com
Anna Kinchen	Laboratory Project Manager	Gulf Coast Analytical Laboratories	225-214-7052	Anna.kinchen@gcal.com

Notes:

* Note that the Kemen Test Cell UST is managed under the Florida Petroleum Program; U.S. EPA is provided courtesy copies of the SAP as part of the teaming process.

SAP = Sampling and Analysis Plan
NAVFAC = Naval Facilities Engineering Command
IRP = Installation Restoration Program
NAS = Naval Air Station
U.S. EPA = United States Environmental Protection Agency

SAP WORKSHEET #4: PROJECT PERSONNEL SIGN-OFF SHEET

(UFP-QAPP Manual Section 2.3.2)

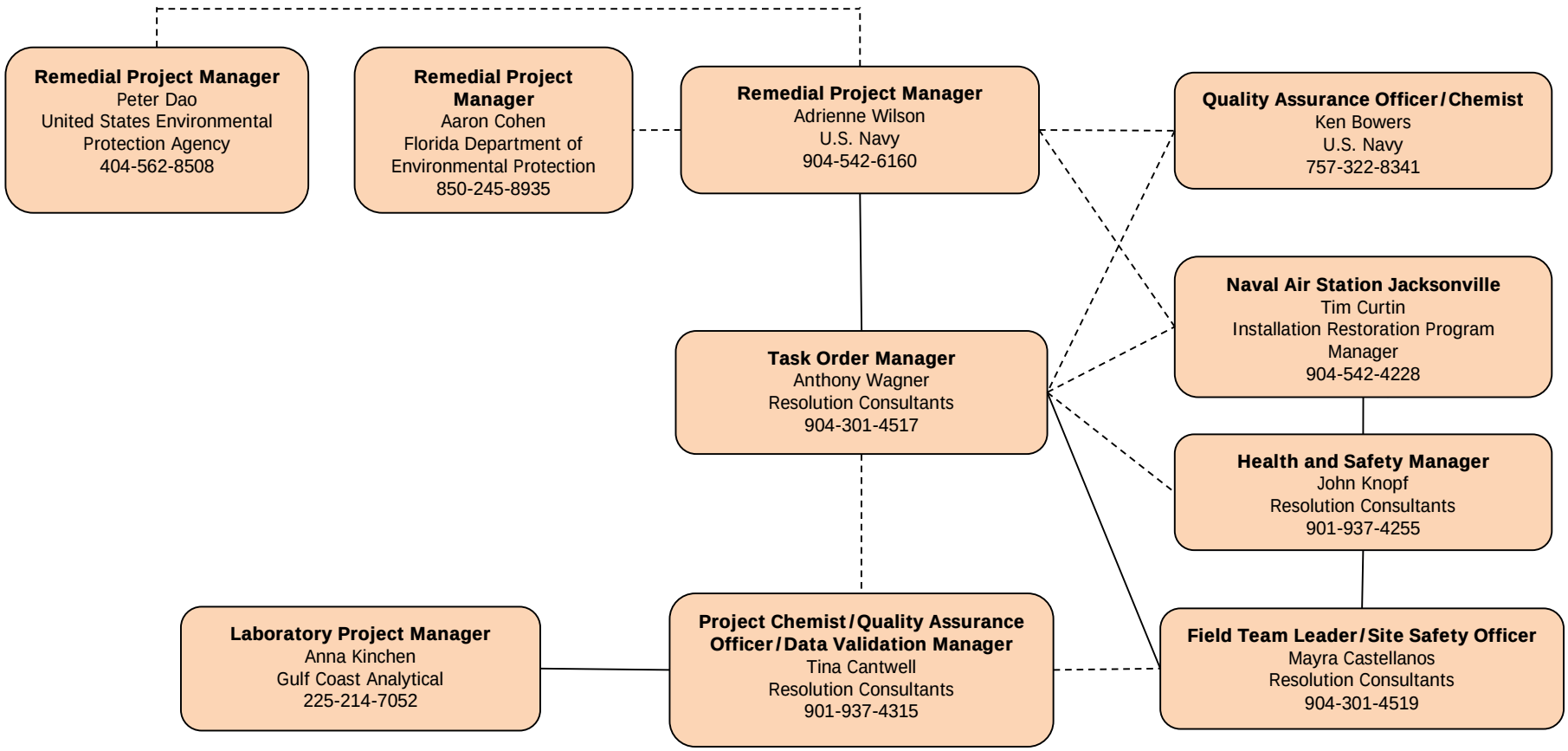
Certification that project personnel have read the text will be obtained by one of the following methods as applicable:

1. In the case of regulatory agency personnel with oversight authority, approval letters or emails will constitute verification that applicable sections of the SAP have been reviewed. Copies of regulatory agency approval letters/emails will be retained in the project files and are listed in Worksheet #29 as project records.

2. Emails will be sent to the United States Navy (Navy), Resolution Consultants, and subcontractor project personnel who will be requested to verify by email that they have read the applicable SAP/sections and the date on which they were reviewed. Copies of the verification email will be included in the project files and is identified in Worksheet #29.

SAP WORKSHEET #5: PROJECT ORGANIZATIONAL CHART

(UFP-QAPP Manual Section 2.4.1)



——— Lines of Authority

- - - - - - - Lines of Communication

SAP WORKSHEET #6: COMMUNICATION PATHWAYS

(UFP-QAPP Manual Section 2.4.2)

The communication pathways for the SAP are shown below.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Regulatory Agency Interface	Navy RPM	Adrienne Wilson	904-542-6160	The Navy RPM informs regulatory agency of work progress on a periodic basis.
Progress Reports	Resolution Consultants FTL Resolution Consultants TOM Navy RPM	Mayra Castellanos Anthony Wagner Adrienne Wilson	904-301-4519 904-301-4517 904-542-6160	FTL verbally informs the TOM on a daily basis with field updates. TOM provides a weekly update to the RPM either by phone message and/or e-mail each Friday afternoon field activities are taking place.
Gaining Site Access	Resolution Consultants FTL NAS Jacksonville IRP Manager	Mayra Castellanos Tim Curtin	904-301-4519 904-542-4228	The Resolution Consultants FTL will contact the NAS Jacksonville IRP Manager verbally or via e-mail at least 3 days prior to commencement of field work to arrange for access to the site for all field personnel.
Stop Work due to Safety Issues	Resolution Consultants FTL/SSO Resolution Consultants TOM Resolution Consultants HSM Navy RPM NAS Jacksonville IRP Manager	Mayra Castellanos Anthony Wagner John Knopf Adrienne Wilson Tim Curtin	904-301-4519 904-301-4517 901-937-4255 904-542-6160 904-542-4228	Any field team member who observes an unsafe situation has the authority to stop work. If Resolution Consultants is the responsible party for a stop-work command, the Resolution Consultants SSO will inform onsite personnel, subcontractors, TOM, HSM, and the NAS Jacksonville IRP Manager within 1 hour (verbally or by e-mail). The HSM will notify the Navy RPM within 24 of notification from the SSO. If a subcontractor is the responsible party, the subcontractor PM must verbally inform the Resolution Consultants SSO within 15 minutes, and the Resolution Consultants SSO will then follow the procedure listed above.
SAP Changes prior to Field/ Laboratory work	Resolution Consultants FTL Resolution Consultants TOM Navy RPM Resolution Consultants QAO/Chemist FDEP RPM	Mayra Castellanos Anthony Wagner Adrienne Wilson Tina Cantwell Aaron Cohen	904-301-4519 904-301-4517 904-542-6160 901-937-4315 850-245-8935	The Resolution Consultants FTL will verbally inform the TOM upon realizing a need for a SAP modification. The FTL or TOM will document the proposed changes via a SAP modification form within five days and send it to the project QAO/chemist. The project QAO/chemist will assess whether: a) the modification has the potential to affect the project's ability to achieve DQOs, b) the modification requires a change in field or laboratory methods which may affect project schedule or cost, or c) the modification does not affect DQOs, schedule, or cost and is for documentation purposes only. SAP modifications potentially affecting DQOs will be submitted to the Navy RPM and FDEP RPM for review and consideration and may require SAP amendments and approval. Modifications in laboratory/field methods, project schedule or cost will be submitted to the Navy RPM for review and consideration. Minor modifications not affecting DQOs, schedule or cost will be documented in the project file.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
SAP Changes in the Field	Resolution Consultants FTL Resolution Consultants TOM Navy RPM Resolution Consultants QAO/Chemist FDEP RPM	Mayra Castellanos Anthony Wagner Adrienne Wilson Tina Cantwell Aaron Cohen	904-301-4519 904-301-4517 904-542-6160 901-937-4315 850-245-8935	The Resolution Consultants FTL will inform the TOM verbally within same day of the need for a SAP change in the field. The TOM will inform the Navy RPM by email within 24-hours; the TOM sends a concurrence letter to the Navy RPM, if warranted, within 7 calendar days and the RPM signs the letter within 5 business days of receipt. Scope change is to be implemented before work is executed. Document the change on the SAP modification form (within 2 business days) or SAP amendment (within timeframe agreed to by Project Team). The Navy RPM will notify the FDEP RPM of any significant SAP field changes within 5 business days. Any change of the approved SAP affecting the scope or implementation of the sampling program will be made only upon authorization of the Navy RPM and FDEP RPM.
Field Corrective Actions	Resolution Consultants FTL Resolution Consultants TOM Navy RPM	Mayra Castellanos Anthony Wagner Adrienne Wilson	904-301-4519 904-301-4517 904-542-6160	The Resolution Consultants FTL will inform the TOM verbally within same day of field corrective actions. The Resolution Consultants TOM will then notify the Navy RPM (verbally or by e-mail) within 1 business day.
Recommendations to stop work and initiate work upon corrective action	Resolution Consultants FTL Resolution Consultants TOM Resolution Consultants QAO Navy RPM	Mayra Castellanos Anthony Wagner Tina Cantwell Adrienne Wilson	904-301-4519 904-301-4517 901-937-4315 904-542-6160	Responsible party verbally informs the Resolution Consultants TOM, FTL, and subcontractors within 1 hour of recommendation to stop work and within 24 hours of recommendation to restart work. Responsible party follows verbal notification with an e-mail to the Project Team within 24-hours.
Sample Receipt and Laboratory Quality Variances	GCAL PM Resolution Consultants FTL Resolution Consultants TOM	Anna Kinchen Mayra Castellanos Anthony Wagner	225-214-7052 904-301-4519 904-301-4517	The Laboratory PM will notify (verbally or via e-mail) the Resolution Consultants FTL immediately upon receipt of any chain-of-custody/sample receipt variances for clarification or direction from the Resolution Consultants FTL. The Resolution Consultants FTL will notify (verbally or via e-mail) the Resolution Consultants TOM within 1 business day, if corrective action is required. The Resolution Consultants TOM will notify (verbally or via e-mail) the Laboratory PM and the Resolution Consultants FTL within 1 business day of any required corrective action.
Analytical Corrective Actions	GCAL PM Resolution Consultants Project Chemist	Anna Kinchen Tina Cantwell	225-214-7052 901-937-4315	The analytical laboratory PM shall notify the Resolution Consultants Project Chemist of any analytical data anomaly within 1 business day of discovery. After the analytical laboratory receives guidance from the Resolution Consultants Project Chemist, the laboratory shall initiate any corrective action to prevent further anomalies.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Reporting Data Validation Issues/Data Validation Corrective Actions	Resolution Consultants Project Chemist Resolution Consultants TOM	Tina Cantwell Anthony Wagner	901-937-4315 904-301-4517	The Resolution Consultants Project Chemist or Data Validator will perform validation as specified in Worksheets #34, #35, and #36, and will contact the analytical laboratory as soon as possible if issues are found that require corrective action. If the Resolution Consultants Project Chemist or Data Validator identifies non-usable data during the data validation process that requires corrective action, the Resolution Consultants TOM will coordinate with the Project Chemist to take corrective action appropriate for the identified deficiency to ensure the project objectives are met. Corrective action may include resampling and/or reanalyzing the affected samples, as determined by the TOM.
Notification of Non-Usable Data	GCAL PM Resolution Consultants Project Chemist Resolution Consultants TOM Navy RPM FDEP RPM	Anna Kinchen Tina Cantwell Anthony Wagner Adrienne Wilson Aaron Cohen	225-214-7052 901-937-4315 904-301-4517 904-542-6160 850-245-8935	If the laboratory determines that any data they have generated is non-usable, the Laboratory PM will notify (verbally or via e-mail) the Resolution Consultants Project Chemist within 1 business day of when the issue is discovered. The Resolution Consultants Project Chemist will notify (verbally or via e-mail) Resolution Consultants TOM within 1 business day of the need for corrective action, if the non-usable data is a significant issue (i.e., critical sample data). Corrective action may include resampling and/or reanalyzing the effected samples. If a Resolution Consultants Project Chemist or data validator identifies non-usable data during the data validation process, the TOM will be notified verbally or via e-mail within 48 hours of validation completion that a non-routine and significant laboratory quality deficiency has resulted in non-usable data. The Resolution Consultants TOM will take corrective action appropriate for the identified deficiency to ensure the project objectives are met. The Resolution Consultants TOM will notify (verbally or via e-mail) the Navy RPM on any problems with the laboratory or analysis that could significantly affect the usability of the data or project failures that impact the ability to complete the scope of work. The Navy RPM, may at her discretion, contact the Navy QAO/Chemist for assistance in problem resolution. Such notification will be made within 1 business day of when the issue is discovered. The Navy RPM will notify the FDEP when any significant corrective action is taken.

Notes:

DQO = Data quality objective
FDEP = Florida Department of Environmental Protection
FTL = Field team leader
GCAL = Gulf Coast Analytical Laboratories, LLC
HSM = Health and safety manager
IRP = Installation Restoration Program
PM = Project manager
QAO = Quality assurance officer
RPM = Remedial project manager
SSO = Site safety officer
TOM = Task order manager

SAP WORKSHEET #7: PERSONNEL RESPONSIBILITIES TABLE

(UFP-QAPP Manual Section 2.4.3)

Name	Title/Role	Organizational Affiliation	Responsibilities
Adrienne Wilson	Remedial Project Manager	NAVFAC Southeast	Oversees project implementation, including scoping, data review, and evaluation.
Tim Curtin	Installation Restoration Program Manager	NAS Jacksonville	Oversees Base activities, including field work coordination, scoping, data review, and evaluation.
Aaron Cohen	Remedial Project Manager	Florida Department of Environmental Protection	Participates in scoping, data review, evaluation, and review of the SAP. Oversees project execution for FDEP.
Anthony Wagner	Task Order Manager	Resolution Consultants	Oversees project, financial, schedule, and technical day to day management of the project.
Mayra Castellanos	Field Team Leader/Site Safety Officer, Professional Geologist	Resolution Consultants	As Field Team Leader, supervises, coordinates, and performs field sampling activities, oversees drilling operations and monitoring well installation. As the Site Safety Officer, is responsible for onsite project-specific health and safety training and monitoring site conditions.
John Knopf	Health and Safety Manager	Resolution Consultants	Oversees Corporate Health and Safety Program.
Tina Cantwell	Project Chemist/Quality Assurance Officer/Data Manager	Resolution Consultants	As project chemist, prepares laboratory scopes of work, and coordinates laboratory related functions with laboratory. Performs or oversees data quality reviews and quality assurance of data validation deliverables. As Quality Assurance Officer, ensures quality aspects of the project are implemented, documented, and maintained. As data manager, performs or oversees data input in both the project database and the Navy's Naval Installation Restoration Information Solution database. Analyzes and presents analytical data. Coordinates mapping of data.
Anna Kinchen	Laboratory Project Manager	Gulf Coast Analytical Laboratories, LLC	Coordinates analyses with laboratory chemists, ensures that scope of work is followed, provides quality review of data packages, and communicates with Resolution Consultants project staff.

Notes:

NAVFAC = Naval Facilities Engineering Command
NAS = Naval Air Station
SAP = Sampling and Analysis Plan
FDEP = Florida Department of Environmental Protection

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. Each site worker will be required to have completed appropriate Hazardous Waste Operations and Emergency Response training specified in Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations 1910.120(e). Additionally, the field team leader will have the 8-hour OSHA supervisors training.

SAP WORKSHEET #9: PROJECT SCOPING SESSION PARTICIPANTS SHEET

(UFP-QAPP Manual Section 2.5.1)

The activities proposed in this SAP were developed based on Resolution Consultants review of available historical documents identified in the Naval Installation Restoration Information Solution (NIRIS) database and the objective provided in the SOW dated 28 April 2015. An overview of the SAP was presented at 10 September 2015 Partnering Team Meeting; participants, decisions, and action items pertaining to the site are provided below.

Project Name: Naval Air Station Jacksonville	**Site Name: Underground Storage Tank 26 Kemen Test Cell**
Projected Date(s) of Sampling: January 2016	**Site Location: Jacksonville, Florida**
Project Manager:	Anthony Wagner
Date of Session:	9 and 10 September 2015
Scoping Session Purpose:	Overview of proposed Sampling and Analysis Plan

Name	Title	Affiliation	Phone #	Email Address
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Notes:

NAVFAC = Naval Facilities Engineering Command
NAS = Naval Air Station
U.S. EPA = United States Environmental Protection Agency
IRP = Installation Restoration Program

Comments/Decisions:

- Resolution Consultants presented the activities proposed to be completed at the Kemen Test Cell Building 873 to evaluate existing soil and groundwater conditions after the successful removal of the former 25,000 gallon jet fuel (JP-5) UST 26 in 2010.

- No comments were generated during the presentation.

- The project team was in agreement with the proposed scope of the investigation.

Action Items:

Complete the Draft Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) and submit to the Navy for review.

Consensus Decisions:

- The Draft Navy Tier I SAP for a Site Assessment (SA) is being prepared. The SAP will include details for installation and sampling of up to 10 soil borings and temporary groundwater monitoring wells to investigate the potential for impacts to environmental media near the former tank location.

- Six initial sampling locations will evaluate the potential for affected media in the immediate vicinity of the removed UST and four additional locations will be used as step-out locations or as confirmatory locations.

- The Partnering Team members agreed with the proposed number and location of the sampling locations and with the proposed chemicals of potential concern (COPCs).

SAP WORKSHEET #10: CONCEPTUAL SITE MODEL

(UFP-QAPP Manual Section 2.5.2)

This SAP provides the framework for the collection and analysis of soil and groundwater samples to identify potential impacts stemming from the 25,000 gallon jet fuel UST formerly located on the west side of the Kemen Test Cell Building 873. This SAP worksheet includes a brief description of the site as well as previous investigations and results, which formed the basis for the general conceptual site model (CSM) developed for the NAS Jacksonville Kemen Test Cell Building 873, as it relates to potential soil and groundwater impacts from the former UST. The CSM describes probable contamination routes and exposure pathways to human receptors, and serves as the basis for the sampling and analysis program developed to implement the fieldwork to be conducted in the vicinity of Building 873. This CSM will be refined based on the results obtained from accomplishing the proposed upcoming sampling activities.

10.1 Site Description

NAS Jacksonville encompasses 3,800 acres of land adjacent to the St. Johns River in northeastern Florida located approximately 8 miles south of Jacksonville, in Duval County (Figure 10-1). The official mission of NAS Jacksonville is to provide facilities, service, and managerial support for the operation and maintenance of naval weapons, aircraft and forces of the Navy as designated by the Chief of Naval Operations. Operations at NAS Jacksonville include: fuel storage facilities, aircraft maintenance, engine repair facilities, test cells for turbo jet engines, and support of special weapons systems.

The Kemen Test Cell, Building 873, is located in the central eastern portion of NAS Jacksonville at Black Point, approximately 200 feet due west from the seawall along the St. Johns River. It operated (and continues to operate) as a jet aircraft engine testing facility. A 25,000-gallon JP-5 UST, reported to have been in operation between 1974 and 2010, was formerly located approximately 35 feet from the western edge of Building 873 (Figure 10-3).

The Kemen Test Cell Building 873 is located in the southern portion of the Fleet Readiness Center Operable Unit (OU) 3 (Figure 10-2). OU 3 consists of runways, hangars, roads, buildings, and largely paved areas between the buildings (Tetra Tech 2005). Planned remedial activities for OU 3 are concentrated primarily northwest of the Kemen Test Cell Building and south of the building (along the river); no OU 3 related remedial activities are anticipated near the Kemen Test Cell).

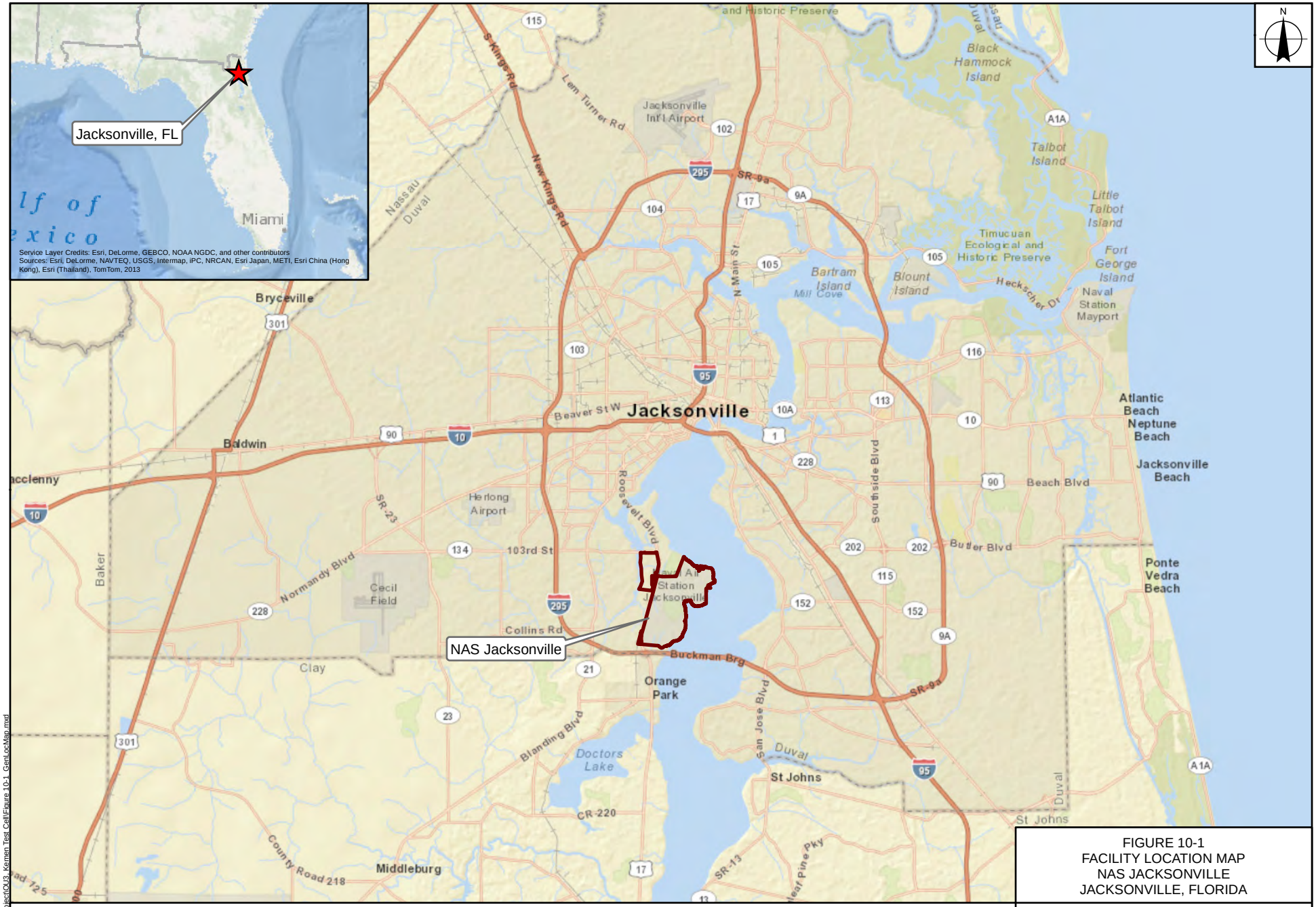


FIGURE 10-1
FACILITY LOCATION MAP
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

Legend

Installation Boundary

0 5 10 Miles

NAVFAC Naval Facilities Engineering Command

RESOLUTION CONSULTANTS

REQUESTED BY: M. Castellanos	DATE: 8/18/2015
DRAWN BY: KBurnum	TASK ORDER NUMBER: JMA2

X:\Navy\NAS_JAX\project\003_Kemen Test Cell\Figure 10-1_GenLocMap.mxd

Service Layer Credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

FIGURE 10-2
SITE LOCATION MAP
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

Legend

- Approx. Investigation Area
- Installation Boundary
- Approx. OU 3 Boundary

0 0.6 1.2 Miles

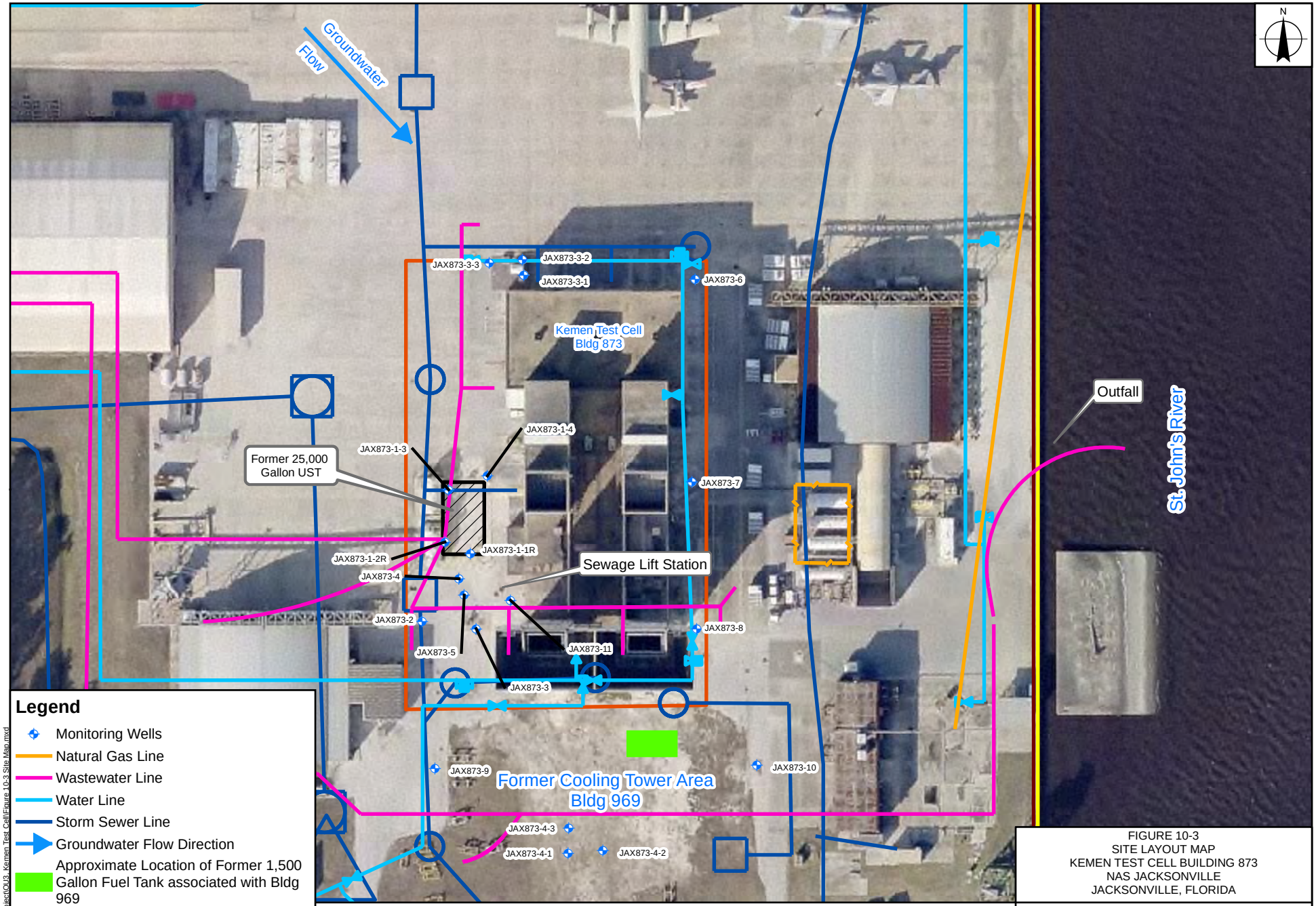
NAVFAC Naval Facilities Engineering Command

RESOLUTION CONSULTANTS

REQUESTED BY: M. Castellanos	DATE: 8/31/2015
DRAWN BY: K. Burnum	TASK ORDER NUMBER: JMA2

Service Layer Credits: City of Jacksonville

X:\Navy\NAS_JAX\project\OU3_Kemen Test Cell\Figure 10-2 Site Location Map.mxd



Legend

- Monitoring Wells
- Natural Gas Line
- Wastewater Line
- Water Line
- Storm Sewer Line
- Groundwater Flow Direction
- Approximate Location of Former 1,500 Gallon Fuel Tank associated with Bldg 969
- Approx. Investigation Area
- Approx. OU 3 Boundary
- Installation Boundary

Notes:
Utilities were obtained from the US Navy.
Below are examples of unknown structure associated with the utilities

0 80 160 Feet

FIGURE 10-3
SITE LAYOUT MAP
KEMEN TEST CELL BUILDING 873
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: M. Castellanos	DATE: 10/15/2015
DRAWN BY: K. Burnum	TASK ORDER NUMBER: JMA2

X:\Navy\NAS_JAX\project\OU3_Kemen Test Cell\Figure 10-3 Site Map.mxd

Service Layer Credits: City of Jacksonville

Numerous other potential sources for petroleum releases to soil, groundwater, surface water, or sediment have been identified and/or investigated within 500 feet of the Kemen Test Cell.[1] These include:

- Identified chlorinated solvent-impacted areas within OU 3 currently being evaluated for treatment.

- Overfilling of the Kemen Test Cell oil water separator that impacted the sewer lift station located southwest of the Building, requiring removal of the liquids (mixture of hydraulic fluid, jet fuel, and engine oil) and lift station clean-out.

Additionally, storm sewers, which have been identified as a contaminant migration pathway throughout OU 3, extend along the western boundary of the Kemen Test Cell area. In the northern part of OU 3, these sewers were slip-lined to minimize infiltration/exfiltration. However, in the Kemen Test Cell area, it is unclear whether the unlined storm sewers continue to function as migration pathways.

Figure 10-3 shows the approximate location of subsurface utilities near the former UST, including but not limited to nearby storm drains, storm sewers, sewer lines, manholes, catch basins, a lift station, and a fuel tank associated with the former cooling tower Building 969.

10.2 Previous Environmental Investigations

Numerous investigations have been conducted at the Kemen Test Cell to evaluate soil and groundwater impacts identified in the vicinity of the former 25,000-gallon JP-5 UST. Brief summaries of the results of these investigations are provided in the following paragraphs. Analytical data associated with environmental investigations performed in the area of the Kemen Test Cell are not available in the NIRIS database.

10.2.1 Basewide UST Investigation

As reported in the United States Army Corps of Engineers (USACE) *Draft Contamination Assessment Report* (CAR), *Naval Air Station Jacksonvillle, Building 873 — Kemen Test Cell* (USACE 1992), a single walled steel 25,000-gallon UST was installed in 1973 on the west side of the Kemen Test Cell Building 873.

[1] As discussed in the 9 September 2015 NAS JAX Partnering Team meeting, and supplemental discussions with current and former NAS JAX personnel on 22 September 2015.

In October 1989 field investigations were initiated to evaluate existing conditions in the vicinity of the former UST. During the installation of four compliance wells, petroleum odors were noted and reported by field personnel.

Contamination Assessment

A phased contamination assessment (CA) was initiated at the site in June 1991 to evaluate the presence and extent of potential petroleum impacts to soil and groundwater. The results of the field investigations performed were summarized in the USACE CAR. Investigation activities identified an impacted area of approximately 50 by 70 feet west of Building 873 in the vicinity of the former UST and the pump room (Figure 10-3). The CAR indicated that the impacts to soil and groundwater were primarily a result of cumulative spills due to overtopping and leaks from distribution pumps.

In January 1992, the water table at the site was encountered at depths of approximately 5.5 to 7 feet below land surface (bls). Based on groundwater elevations, groundwater flow within the surficial aquifer was determined to be towards the southeast. Free product was encountered in a well located approximately five feet southeast of the 25,000-gallon tank in the immediate vicinity of the underground fuel transfer lines at a thickness of approximately 3.5 inches. Groundwater monitoring results indicated that naphthalenes were found to be the most prevalent parameters detected in the wells sampled. Groundwater monitoring results from well JAX-873-1-2 indicated that 1-methylnaphthalene and 2-methylnaphthalene were present in groundwater at concentration of 96 micrograms per liter (μg/L) and 70 μg/L, respectively, exceeding the regulatory standard of 100 μg/L total naphthalene. The following Groundwater Cleanup Target Level (GCTL) exceedances were also reported in groundwater monitoring results from well JAX-873-1-2; anthracene and phenanthrene at 26 μg/L, acenaphthene at 14 μg/L, acenaphthylene at 13 μg/L, fluoranthene at 10 μg/L, and fluorene at 32 μg/L.

Supplemental CA activities were performed by the USACE in February 1993. Additional investigation conducted confirmed that groundwater flow was to the southeast and that very little change in the general configuration and extent of the groundwater impacts had occurred between January 1992 and February 1993 (USACE 1993).

10.2.2 Remediation Activities

A Remediation Work Plan (RWP) was developed to accomplish remedial actions described in the Remedial Action Plan (RAP) (BEI 1994). Remedial actions were implemented to:

- Reduce petroleum impacts in vadose zone soils (ground surface to 5 feet bls)
- Reduce the source of impacts to groundwater
- Reduce current and future exposure to impacted soil by humans and ecological receptors (BEI 1995)

The RAP required:

- Source removal via soil excavation. The limits of the excavation proposed in the RAP were based on previous site data (BEI 1995), existing infrastructure, and depth to groundwater.
- Thermal treatment and offsite disposal of identified excessively impacted soil.
- Abandonment and replacement of two monitoring wells located within the footprint of the proposed excavation (BEI 1995).[2]

A tank integrity test was required as part of the remedial action but was not performed at the request of NAS Jacksonville. The BEI RWP was implemented in April 1995 and completed by May 1995.

BEI reported that the excavation was extended to a depth of approximately 8.5 feet bls and that a total of 666 cubic yards of petroleum impacted soil were excavated from the Kemen Test Cell UST area during source removal activities in 1995. Potentially impacted soil was left in place, primarily along the eastern and southern excavation boundaries, due to the proximity of the building footer.[3] A light sheen of free product was noted floating on top of the groundwater within the excavation. Approximately 1/16 inch of free product was removed using an absorbent boom. The BEI Closure Report documented that the excavation area was backfilled with crushed rock to ground surface and the surrounding area was capped with six inches of 4,000 pounds per square inch fiber-reinforced concrete (BEI 1996).

[2] Excessively impacted soil was defined as soil with organic vapor analyzer (OVA) readings greater than 50 ppm.
[3] Regulatory approval allowing impacted soil to remain in-place was discussed and accepted, by Mr. Jorge Caspary of FDEP as documented in a letter *Memorandum of Understanding for The Kemen Test Cell Building 873 at NAS Jacksonville Florida* dated 11 April 1995, included in the Closure Report (BEI 1996).

BEI documented the remedial action activities performed at the site the *Closure Report, Kemen Test Cell — Building 873 at Naval Air Station Jacksonville, Jacksonville, Florida, Revision 1* (BEI 1996).

Figure 10-3 shows the general site layout and the approximate location of the 1995 site monitoring wells.

10.2.3 Post Source Removal Groundwater Monitoring: 1995-1996

Following removal actions, ABB Environmental Services, Incorporated (ABB-ES), performed quarterly groundwater monitoring of four wells for a period of one year to meet the Monitoring Only regulatory requirements (Figure 10-3). Groundwater samples were analyzed for the kerosene analytical group parameters specified in former Chapter 62-770.600(8) Florida Administrative Code (F.A.C.) which included: volatile organic halocarbons, volatile organic aromatics, 1, 2-dibromomethane, polynuclear aromatic hydrocarbons (PAHs), total recoverable petroleum hydrocarbons (TRPH), and lead (ABB-ES 1995).

Post-source removal groundwater sampling results indicated that:

- Free product was not detected in any of the four wells.
- Total lead concentrations were below the target level of 50 milligrams per liter (mg/L) in all samples and monitoring events.
- Total naphthalene concentrations exceeded remediation goals during the first quarter, but were below applicable criteria during subsequent events.

10.2.4 Underground Storage Tank Closure Assessment Report: 2010

A single wall 25,000-gallon capacity jet fuel UST was removed by Environmental Compliance Services, Incorporated (ECS) in April 2010. The tank was removed to comply with 62-761 F.A.C., which required all single wall underground storage tank systems to be upgraded to double wall by 31 December 2009. The removal activities were documented in the *Underground Storage Tank Closure Assessment Report NAS — Jacksonville Tank #873-1* (ECS 2010).

Activities to replace the UST with two 12,000-gallon double-walled above ground storage tanks (ASTs) were initiated by NAS Jacksonville in October 2009. The new ASTs were installed prior to the

removal of the UST to minimize facility downtime (ECS 2010). To minimize damaging the concrete slab supporting the two newly installed ASTs, sheet piling was advanced along the western wall of the tank excavation and partially along the eastern side of the UST to protect the building structure prior to initiating excavation. During UST closure activities, ECS inspected the condition of the tank, collected soil samples for organic vapor analyzer (OVA) headspace screening, and collected soil and groundwater samples for laboratory analysis of volatile organic compounds (VOCs), PAHs, and TRPH.

ECS collected two soil samples, SB-3, at 8 feet bls and SB-5, 8 feet bls, at the locations where the highest OVA readings were identified along the eastern wall of the excavation (950 and 506 parts per million [ppm], respectively) for confirmatory laboratory analysis. Laboratory analytical results showed that naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, and TRPH were present at concentrations exceeding applicable Soil Cleanup Target Levels (SCTLs) for Leachability.

ECS encountered groundwater at a depth of 10 feet bls during UST closure activities; which was deeper than previously reported for the site by others (between 5.5 and 8 feet bls). ECS collected a groundwater sample from a depth of approximately 10 feet for chemical analysis from a temporary well (TW01) installed near the center of the excavation east of the former UST. Groundwater analytical results indicated that benzo(a)anthracene, benzo(b)fluoranthene, 1-methylnaphthalene, and 2-methylnaphthalene, were present at concentrations exceeding applicable FDEP GCTLs.

ECS reported that the final extent of the excavation measured 50 feet (north to south) by 16 feet (east to west) by 12 feet in depth. All excavated soils were returned to the excavation following UST removal (ECS 2010). ECS reported that there were no dispensers associated with the UST removed and that the newly installed ASTs were connected to the existing piping; therefore no piping assessment sampling was conducted.

As detailed in the 2010 Closure Report, ECS recommended that SA activities in accordance with Chapter 62-770.600 of the F.A.C. (now Chapter 62-780.600) be initiated at the site. To date additional investigation activities have not been performed.

10.3 Physiography

The Kemen Test Cell Building 873 lies within the Coastal Lowland physiographic division of northern Florida, which runs roughly parallel to the coastline and extends from the Atlantic Ocean to just west of downtown Jacksonville (USACE 1992). Site elevations range from 6 to 9 feet above

mean sea level. Open areas at the site are covered primarily by asphalt and concrete. Site surface drainage is controlled by the St. Johns River located to the south and east of the site.

10.4 Site Geology

Geology underlying NAS Jacksonville consists of Pleistocene-age sedimentary materials that were deposited in a series of terraces formed during marine transgressions and regressions associated with glacial and interglacial periods (Miller 1986). As documented in the 1992 CAR, the geologic materials underlying the Kemen Test Cell and Building 873 area generally consist of unconsolidated, fine-grained sands and silty sands, with some clay, silt lenses, and varying amounts of fragmented shells; extending from land surface to depths of approximately 25 feet bls. Near-surface geology consists of brown to gray, fine-grained silty sand and brown, fine-grained, poorly-sorted sand with intermittent lenses of clayey silt or gray high plasticity clay, with abundant shells and shell fragments. No confining units were encountered during drilling activities at the site (USACE 1992).

10.5 Site Hydrogeology

NAS Jacksonville is underlain by three water bearing zones: the surficial aquifer, a shallow rock aquifer, and the Floridan aquifer system. The surficial aquifer is exposed at the surface and forms the uppermost permeable unit at NAS Jacksonville (USGS 1998). The surficial aquifer ranges in thickness from 30 to 100 feet and consists of unconsolidated silty sand interbedded with local beds of clay, silty clay, and sandy clay (USACE 1992). The low permeability clays of the Hawthorn Group underlie the surficial aquifer and form the base of the surficial aquifer in the area (USGS 1998). Recharge to the surficial aquifer is by way of infiltrating rainwater.

During drilling and groundwater sampling activities, the water table at the site was encountered at depths ranging from approximately 5.5 to 8 feet bls (USACE 1992 and USACE 1993). The general direction of ground-water flow in the vicinity of Building 873 appears to be towards the St. Johns River to the southeast. As reported in the USACE 1992 CAR, horizontal hydraulic conductivities in the upper layer, determined from aquifer tests, ranged from 0.19 to 3.8 feet per day. The horizontal hydraulic conductivity in the intermediate layer as determined from a single aquifer test was estimated to be 20 feet per day (USACE 1992).

Investigation activities at the Kemen Test Cell are restricted to the surficial aquifer.

10.6 Preliminary Conceptual Site Model

The CSM is graphically presented as Figure 10-4 and is briefly summarized below. Sources of potential impacts, the nature and extent, fate and transport mechanisms, and potential exposure

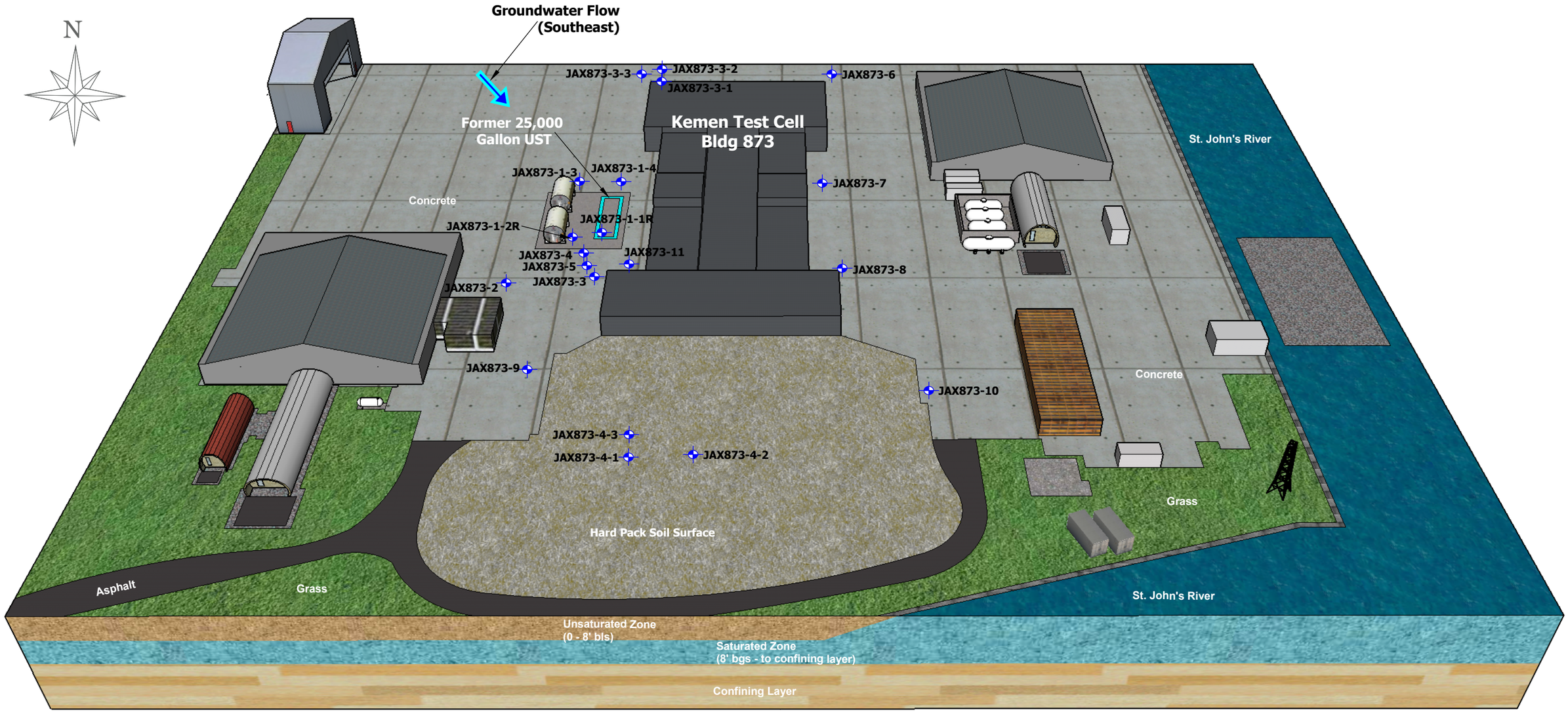
pathways and receptors are presented. Development of the CSM is an iterative process and will be refined after implementation of this UFP-SAP.

10.6.1 Potential Contaminant Sources

Based on historical subsurface investigation activities, the main source of the petroleum impacts identified at the Kemen Test Cell are associated with the former 25,000-gallon JP-5 UST that was located approximately 35 feet from the west side of Building 873. Petroleum contamination at the site was likely due to the cumulative effect of spills associated with overtopping of the underground jet fuel storage tank during filling activities and past pump seal leaks from fuel pumps located in the pump room adjacent to the former tank area.

The *UST Closure Assessment Report* (ECS 2010) indicated that the soil exceedances identified were not for direct human health exposure but for leachability to groundwater for naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, and TRPH. It was noted that the TRPH concentrations reported also exceeded the residential (two soil samples) and industrial (one soil sample) SCTLs. Benzo(a)anthracene, benzo(b)fluoranthene, 1-methylnaphthalene, and 2-methylnaphthalene were present in groundwater at concentrations above GCTL values. Benzene, toluene, and methyl tert-butyl ether were not detected, and ethylbenzene and total xylene detections were below applicable FDEP GCTLs; therefore, these analytes will not be evaluated further. Based on these historical results, additional sampling activities to verify the presence or absence of naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, and TRPH in unsaturated soil and benzo(a)anthracene, benzo(b)fluoranthene, 1-methylnaphthalene, and 2-methylnaphthalene in shallow groundwater should be evaluated at the Kemen Test Cell Building area to document current site conditions and ultimately achieve no further action status.

As noted previously, there are multiple potential sources for petroleum (and chlorinated solvent) contamination in the vicinity of the Kemen Test Cell. These secondary sources may be contributing to soil and/or groundwater contamination, and may confound completion of the Site Assessment Report (SAR) at the Kemen Test Cell.



Contaminant Source: Former Releases from UST 26

Receptors:
Human: Site Worker, Construction Worker
Ecological: None due to lack of habitat

Land Use Controls:
None

Site Chemicals of Conern: Polynuclear aromatic hydrocarbons (naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, benzo(a)anthracene, & benzo(b)fluoranthene), and total recoverable petroleum hydrocarbons

Legend

- Groundwater Monitoring Well
- Flow Direction

NOTES:

- Conceptual Site Model not to scale. Horizontal dimensions based on recent aerial imaging, and historical knowledge. Vertical dimensions exaggerated for purpose of conveying pertinent site information.
- Groundwater monitoring well locations approximated based on existing site figures and geographic information system data.

FIGURE 10-4
CONCEPTUAL SITE MODEL
KEMEN TEST CELL
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: M. Castellanos	Date: 2/12/2016
DRAWN BY: K. Burnum	CTO NO.: JMA2

J:\Jacksonville\Clients\A - L_CSMs\Navy - CLEAN\NAS Jax\KemenTestCell\Figure KemenTestCell

WS 10-12

10.6.2 Migration Pathways

Soil and groundwater are the only media of concern in the vicinity of the Kemen Test Cell and Building 873.

Although petroleum-impacted soil was removed from the area surrounding the UST in April 1995, the tank was not removed at that time, and impacted soil was documented to have been left in-place (along the eastern and southern edges of the former excavation area) due to proximity of the excavation to the Building. After the 1995 partial source removal the ground surface above the former UST was covered by gravel, while the adjacent surrounding area was covered by either concrete or asphalt (Figure 10-4). The gravel area formed a localized zone of increased surface water infiltration, which may have enhanced the potential migration of the plume towards the southeast in the general direction of groundwater flow. Currently the ground surface in the vicinity of the former UST area is covered by high pressure cement; therefore, infiltration is minimal.

Surrounding the Kemen Test Cell, most surfaces are paved. However, 100 feet to the south, the former Building 969 area remains unpaved. The St. Johns River shoreline in the vicinity of the Kemen Test Cell Building 873 is paved to the east where it meets the seawall.

Contaminant migration at this site since 2010 has been limited to transport of constituents in and near the water table due to lack of infiltration in the immediate vicinity. Groundwater fluctuations may have mobilized contaminants at or immediately above the water table from potentially impacted soils left in place during excavation activities, forming a “smear zone” and a continuing source of COPCs. Because PAHs are highly insoluble and sorb well to soil matrices it is likely that these contaminants have not migrated great distances from the source area.

10.6.3 Receptors and Land Use

Potential and future human receptors at the Kemen Test Cell Building 873 include site employees, (i.e., maintenance workers, industrial workers, utility workers) and the potential trespasser. However, trespassing at NAS Jacksonville OU 3 is unlikely. The site is fenced and access is restricted to approved and properly credentialed personnel. The Kemen Test Cell Building 873 is located in an active heavy industrial area of NAS Jacksonville. The current industrial land use is not expected to change in the future.

Future residential uses of soil or groundwater throughout the Kemen Test Cell area are not anticipated, and would be subject to the National Environmental Planning Act process and FDEP approval. Land use controls are implemented in various parts of OU 3.

SAP WORKSHEET #11: PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

(UFP-QAPP Manual Section 2.6.1)

Data quality objectives (DQOs) developed for this investigation are based on the U.S. EPA *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA QA/G-4.-EPA/240/B-6/001) (U.S. EPA, February 2006) and are presented below.

11.1 Problem Statement

Investigations of soil and groundwater at the Kemen Test Cell near Building 873 are needed to identify and evaluate potential impacts remaining at the site after the successful closure of a 25,000 JP-5 fuel UST in 2010.

Additional assessment activities are necessary to satisfy the requirements of a SA and prepare a SAR in accordance with Chapter 62-780.600 F.A.C. The objectives of this SAP are to identify and delineate the presence/absence and/or extent of potential residual chemicals remaining in soil and/or groundwater associated with the previously identified COPCs. If the results of the proposed activities do not fully delineate the impacted area, additional sampling under a separate scope of work may be required. This SAP will be fulfilled using a phased approach so that appropriate decisions based on field observations can be implemented and used to develop remedial actions if necessary.

The conceptual phased approach includes initial soil sampling in the area of the former UST. The soil samples will be evaluated for the presence of petroleum impacts (via visual, olfactory, and/or OVA readings). Upon completion of sample collection for laboratory analysis from the first six soil borings, the field observations will be discussed via telephone with the Navy Remedial Project Manager (RPM) and the Task Order Manager (TOM). If potential impacts are identified, the remaining four soil borings will be used to delineate those impacts. In the event that impacts are not noted, then the remaining four soil borings will be used to evaluate other areas of interest in the Kemen Test Cell area.

11.2 Goals of the Study

The goals of this UFP-SAP are to: i) determine the presence or absence of environmental media impacted with residual hydrocarbons; ii) evaluate the vertical and possibly lateral extent of impacted soil and groundwater; iii) determine the horizontal extent and thickness of free product (if present); and (iv) to ultimately guide remedial actions if deemed necessary.

The principal study questions (PSQs) developed to define decision statements and to ultimately resolve the problem are as follows:

PSQ1: Are any residual COPCs present in site soil?

PSQ2: Are any residual dissolved-phase COPCs present in site groundwater?

PSQ3: Are the existing historical monitoring wells accessible and in sufficiently good condition to monitor water levels and be sampled if deemed necessary at a later date?

PSQ4: Is free product present in any of the existing historical monitoring wells, or newly installed TW points?

11.3 Inputs to Problem Resolution

Data that are required to resolve the problem described above are as follows:

- Location data: Each soil boring location will be field-sited using a hand-held global-positioning system (GPS) unit, so that coordinates of each sample location can be recorded in the lithological logs.

- Soil Screening: Unsaturated soil samples will be collected from ground surface to the top of the water table for visual inspection (presence of staining and/or odor), and field screening, for the presence of volatile organic vapors using a handheld OVA equipped with a flame ionization detector (FID). The FID field-screened data will assist with characterization and confirming the selection of sample depth intervals for laboratory analysis. Results of field screening are not considered definitive; thus, any decision-making will be supported by the analytical chemical data.

- Geologic/Hydrogeological Information: Onsite geologists/engineers will use the Unified Soil Classification System to describe soil characteristics. Moisture content will be observed at each soil boring to provide information on the approximate depth to the groundwater table. The information obtained will be used to refine the CSM and shall be considered during any future investigations/risk evaluation (if necessary).

- Soil Chemical Data: To assess the presence or absence of target analytes previously identified in soil, analytical data will be collected in general accordance with the analytical requirements outlined in Chapter 62-780 Table C (Kerosene Analytical Group). Unsaturated soil samples will be collected and analyzed for the following:

  — Specific PAHs (naphthalene, 1-methylnaphthalene, 2-methylnaphthalene) via selective ion monitoring (SIM) by SW-846 Method 8270D

  — TRPH by the Florida Petroleum Residual Organics (FL-PRO) Method

  The list of soil target analytes is presented in Worksheet #15. The field sampling program is presented in Worksheet #18.

- Groundwater Level and Free-Product Measurements: Water level measurements will be made using an oil/water interface probe to determine if light non-aqueous phase liquids are present. TW top of casing (TOC) elevations (by land survey), are needed to provide information regarding the water table (elevations) at sampling locations and to calculate the direction(s) of groundwater flow. A synoptic round of groundwater level measurements and the evaluation of each well for the presence of free-product will be completed as part of these SAP field activities.

- Field Measurements: Field geochemical parameters (temperature, dissolved oxygen, pH, specific conductance, oxidation-reduction potential, salinity, and turbidity) will be monitored during well purging prior to groundwater sampling at each newly installed temporary well location.

- Groundwater Chemical Data: To assess the presence or absence of previously identified target analytes in groundwater, analytical data will be collected in general accordance with the analytical requirements outlined in Chapter 62-780 Table C (Kerosene Analytical Group). To assess the presence or absence of select target analytes, groundwater samples will be collected from each newly installed temporary well point. Groundwater samples from each temporary well point will be analyzed for:

  — Specific low level PAHs (benzo(a)anthracene, benzo(b)fluoranthene, 1-methylnaphthalene, and 2-methylnaphthalene) via SIM by SW-846 Method 8270D

The 1,2-dichloroethane, volatile organic halocarbons, and 1, 2-dibromomethane will not be included in the analytical train because these analytes were not detected in the historical groundwater data reviewed.[1] The list of proposed groundwater target analytes is presented in Worksheet #15. The field sampling program is presented in Worksheet #18.

- Previously collected data: Historical environmental data will be used in conjunction with newly obtained chemical data to compare results, establish potential trends, and determine if additional investigations and/or monitoring are needed.

- Project Action Levels: Analytical results will be compared to cleanup target levels published in Chapter 62-777, F.A.C. (FDEP 2005), as outlined below:

  — Soil analytical results will be compared to applicable FDEP Industrial and/or Leachability-to-Groundwater SCTLs (the lower of the two values).

  — Groundwater analytical results will be compared to the lowest applicable FDEP GCTLs.

Worksheet #15 identifies the lowest screening level currently identified based on the criteria defined above. The laboratory selected for current work and any laboratories selected for future work are expected to achieve Method Detection Limits (MDLs) that are low enough to measure constituent concentrations less than the screening levels identified on Worksheet #15. Analytical data reported by the laboratory will conform to standards presented in Table 1 of Chapter 62-160.700, F.A.C.

11.4 Study Area Boundaries

This SAP was designed to evaluate the presence or absence of petroleum impacts to existing shallow soil and groundwater in the vicinity of the former 25,000 gallon JP-5 UST. The Kemen Test Cell area is shown on Figure 10-3, and investigations are not expected to extend beyond these boundaries.

Soil investigations will take place from ground surface to the top of the water table, anticipated to be present between 5.5 and 8 feet bls (based on site water levels). The vertical boundary for the groundwater investigation is not expected to exceed 20 feet bls.

[1] With the exception of cis/trans-1,2-dichloroethene (2.8 µg/L), which was detected once in one well. Because this detection was below the GCTL and it was not reproduced, 1,2-dichloroethene is not included in the analytical suite.

Field activities are expected to be completed within one field mobilization requiring a minimum of two days to complete; as noted in Section 11.1, the work will be phased with planned discussion of field observations with the Navy and FDEP prior to completion of step-out samples. All analytes shown in Worksheet #15 will be sampled during this event, to comply with temporal requirements outlined in 62-780.600(4)(m) F.A.C.[2]

11.5 Analytic Approach

The scope of field activities is described in Worksheet #17, but includes the following:

- Soil sampling within the unsaturated zone
- Installation of temporary monitoring wells
- Collection of water levels and assessment of free product presence/absence
- Groundwater sampling

Analytical data collected during this SA will be evaluated in accordance with FDEP Chapter 62-780, F.A.C., and Contaminated Site Risk-Based Corrective Action Process to determine if the site qualifies for Risk Management Option (RMO) Level I, II, or III.

Decision Rules

- If COPC concentrations are less than respective cleanup target levels, No Further Action (NFA) without Institutional Controls pursuant to RMO I of Chapter 62-780, F.A.C. will be pursued. Appropriate closure recommendations will be made to the Partnering Team and documented in the SAR.

- If COPC concentrations are greater than respective CTLs, the analyte will remain as a constituent of concern (COC) and additional assessment and/or monitoring activities to bring the site to closure may become necessary. Alternatively, a determination to evaluate the site under RMO II or RMO III per Chapter 62-780, F.A.C. will be made.

- If a determination to evaluate the site under the requirements presented in RMO II or RMO III of Chapter 62-780, F.A.C. is made, closure could be attained by proceeding to the appropriate RMO option for an NFA with Institutional Controls. This would be done in conjunction with the Partnering Team.

[2] The most recent sampling of representative monitoring wells must occur no more than 270 days prior to Site Assessment Report submittal.

As discussed in the Partnering Team meeting of 9 September 2015, given the number of potential contributing sources of petroleum contamination in the immediate vicinity of the Kemen Test Cell, detections of COPCs during the proposed investigation may not necessarily be attributable to historical site releases. If this scenario is suspected, the Partnering Team will review the available data and develop an appropriate investigative response to identify contributing sources.

11.6 Performance or Acceptance Criteria

The objective of this section is to complete the following:

- Identify potential sources of study error (e.g., field error, analytical error, etc.)
- Establish and identify the methods used to reduce potential sources of error
- Determine how decision errors will be managed during the project

Sources of Error

Sources of error may be divided into two main categories: sampling errors and measurement errors. A sampling error occurs when the sampling design, planning, and implementation do not provide for a representative range of heterogeneity at the site. A measurement error occurs because of performance variance from laboratory instrumentation, analytical methods, and operator error. The U.S. EPA identifies the combination of all these errors as a “total study error” (U.S. EPA 2006). One objective of the investigation is to reduce the total study error so that decision-makers can be confident that the data collected accurately represent the chemical characteristics of the site.

Managing Decision Error

This investigation will utilize decision-error minimization techniques in sampling design, sampling methodologies, and laboratory measurement of COCs. Possible decision errors will be minimized during the field investigation by using the following methods:

- Use standard field sampling methodologies (as shown in Worksheets #14 and #21).

- Use applicable analytical methods and quality control (QC) criteria (shown in Worksheets #23, #24, #25, and #28) for sample analysis by a competent analytical laboratory certified by the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) to reduce measurement errors.

- Confirm analytical data to identify and control potential laboratory error and sampling error by using spikes, blanks, and replicated samples.

Decision errors associated with judgmental sampling are based on sample design and measurement errors. Assuming that the best possible professional judgment was used to develop the judgmental sampling plan (i.e., position sampling locations), the most important decision errors will be associated with field and laboratory techniques involved in the collection and analysis of the data.

Sampling Methodologies and Procedures

Decision errors caused by sampling errors will be minimized during the field investigation by applying standardized field sampling methodologies (discussed in Worksheets #20, #21, and #22). Sampling activities will be performed in accordance with the Standard Operating Procedures (SOPs) specified in this SAP.

Managing Laboratory Sampling Error

Control of potential laboratory measurement error and sampling error will be minimized using spikes, blanks, and duplicates. Sampling error may be introduced when the laboratory chemist selects a single portion of the field sample for laboratory analysis. However, this issue is less relevant to the discrete sampling approach as sub-sampling is generally not implemented at the laboratory.

The laboratory will provide full electronic data deliverable files, portable document format (PDF) files of the data deliverables for all project data, and a hard copy of data deliverables for all results including results from secondary subcontract laboratories. Designated samples will be used to obtain necessary sub-samples for laboratory QC measurements (i.e., analytical sample duplicate and sample matrix spike/matrix spike duplicates [MS/MSDs]). Tasks will be completed using the laboratory SOPs.

Data quality will be evaluated as part of the verification/validation and the data usability processes described in Worksheets #34 through #36. Failure to meet validation targets or limitations on data use identified during a data usability assessment shall be described in the project report.

PDF copies of all analytical data packages will be electronically stored and archived in the NAVFAC Administrative Record and uploaded onto the NIRIS system at the close of the project. All other data generated in the field and reports generated for the project will be stored as computer readable data files by Resolution Consultants.

11.7 Sampling Design or Data Collection Plan

The sampling design for this SAP was developed to optimize resources and generate data to satisfy the DQOs. The critical objective is to obtain a quality dataset. A non-statistical method was used as the primary basis for the sampling design. Worksheet #14 provides the tasks to be performed to accomplish the objective of this SAP. The sampling design, rationale, and locations are summarized in Worksheets #17 and #18. These worksheets identify where soil and groundwater samples will be collected and the analyses to be conducted for each sample.

SAP WORKSHEET #12: FIELD QUALITY CONTROL SAMPLES

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table — Field QC Samples				
QC Sample	**Analytical Group**	**Frequency**	**Data Quality Indicators**	**Measurement Performance Criteria**
Equipment Rinsate Blank	All analytical groups	One per week, per matrix, per sampling equipment. A minimum of 5% of each reported test result/matrix combination per FDEP SOP FQ 1000.	Bias/Contamination	No analytes > ½ LOQ, except common laboratory contaminants, which must be < LOQ.
Field Duplicate	All analytical groups	One per matrix per 20 field samples	Precision	Values >5X LOQ: RPD must be ≤30 (aqueous) RPD must be ≤50 (solid).
Matrix Spike/ Matrix Spike Duplicate	PAHs	One pair per 20 field samples	Accuracy/Bias/ Precision	Percent recoveries — DoD QSM Limits RPD must be ≤ 20.
Matrix Spike/ Matrix Spike Duplicate	TRPH	One pair per 20 field samples	Accuracy/Bias/ Precision	Percent recoveries — 41-101% for aqueous samples, 51-215% for soil. RPD must be ≤ 20 for aqueous samples, ≤ 25 for soil.
Sample Cooler Temperature Indicator	All analytical groups	One per cooler	Representativeness	Temperature must be above freezing and ≤ 6 Degrees Celsius.

Notes:

QC = Quality control
LOQ = Limit of quantitation
FDEP = Florida Department of Environmental Protection
SOP = Standard Operating Procedure
DoD QSM = *Department of Defense Quality Systems Manual for Environmental Laboratories*, Version 5.0, October 2013
RPD = Relative percent difference
TRPH = Total recoverable petroleum hydrocarbons

SAP WORKSHEET #13: SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

(UFP-QAPP Manual Section 2.7)

Secondary Data Criteria and Limitations Table				
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**
Historical Background Information, Monitoring well location map, Conclusions and Recommendations, guided proposed SA activities	USACE, *Contamination Assessment Report (CAR),* 1992	Originating Organization: USACE Data Types: Historical Site information, analytical data, presence of free product, findings and recommendations Data Collection Dates: June 1991 through January 1992	Background information, aided in development of current CSM, site geology, hydraulic conductivity values, tidal influence investigations, findings and additional sampling recommendations were used in planning the proposed sampling effort. Analytical data was considered to establish COPCs for proposed SA activities.	None
FDEP Letter Providing Comments on 1992 CAR	FDEP, *Review of Draft Contamination Assessment Report,* 1992	Originating Organization: FDEP Data Types: Comment Letter regarding 1992 CAR Dated: September 1992	Background information; relevant comments were considered in developing the current SAP	None
Supplemental historical background information, confirmed groundwater flow direction and extent of impacts	USACE, *Addendum 1 — Contamination Assessment Report,* 1993	Originating Organization: USACE Data Types: Confirmatory sampling analytical data, findings and recommendations Data Collection Dates: 1993	Background information, confirmed groundwater flow conditions, aided in current conceptual site model, findings and recommendations were used in planning the proposed sampling effort. Analytical data was considered in developing the current SAP.	None
Remediation Work Plan — Addendum 1; excavate and remove impacted soil associated with the 25,000 gallon JP-5 UST	Bechtel Environmental, Inc., *Addendum 1 to the Remediation Work Plan for Potential Source of Contamination 2 and the Kemen Test Cell*, 1995	Originating Organization: Bechtel Environmental, Inc. Data Types: Remedial Actions Dated: 1995	Background information, aided in development of current CSM; used to verify proposed soil and groundwater sampling and analysis rationale.	None

Secondary Data Criteria and Limitations Table

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
Post Source Removal Groundwater Results	ABB Environmental Services, Inc., *Groundwater Monitoring Activity Report Kemen Test Cell,* 1995 (Quarter 1 through Quarter 4) *Addendum 1 Second Quarter* (October 1995) Monitoring Event, dated December 1995; *Addendum 2 — Third Quarter* (January 1996) Monitoring Event, dated March 1996; *Addendum 3 — Fourth Quarter* (April 1996) Monitoring Event, dated May 1996	Originating Organization: ABB Environmental Services, Incorporated Data Types: Groundwater analytical results Data collection dates: July 1995, October 1995, January 1996, and April 1996	Background information, aided in development of current CSM; used to develop COPC list.	None
Environmental Compliance Services, Incorporated Closure Report	ECS *Underground Storage Tank Closure Assessment Report*, *NAS Jacksonville Tank #873-1*. 3 May 2010	Originating Organization: Environmental Compliance Services, Incorporated	Background information; used in developing the current SAP.	None

Notes:

SA	=	Site Assessment
USACE	=	U.S. Army Corps of Engineers
CAR	=	Contamination Assessment Report
CSM	=	Conceptual Site Model
COPC	=	Constituent of potential concern
FDEP	=	Florida Department of Environmental Protection
SAP	=	Sampling and Analysis Plan
UST	=	Underground storage tank
RAP	=	Remedial Action Plan
ECS	=	Environmental Compliance Services, Incorporated
NAS	=	Naval Air Station

SAP WORKSHEET #14: SUMMARY OF PROJECT TASKS

(UFP-QAPP Manual Section 2.8.1)

In general, this project includes investigations of soil and groundwater at the Kemen Test Cell near Building 873 to characterize the nature and extent of potential environmental impacts remaining after the successful closure of a 25,000 gallon UST, completed in 2010. Site investigations will be conducted in accordance with FDEP's *Department of Environmental Protection Standard Operating Procedures for Field Activities DEP-SOP-001/01* and the individual SOPs presented therein, adopted in 2008 and revised 1 March 2014, and will be supplemented with Resolution Consultants SOPs. Preference will be given to FDEP SOPs, with Resolution Consultants SOPs being utilized to provide supplemental information not covered in FDEP SOPs. Project-specific SOPs and field forms for field tasks referenced in this worksheet are identified by title in Worksheet #21 and copies of each SOP are provided in Appendix A.

Field tasks are as follows:

- Mobilization/Demobilization
- Site-Specific Health and Safety Training
- Site Reconnaissance (Existing Monitoring Well Evaluation)
- GPS Sampling Point Locating
- Utility Clearance
- Equipment Calibration
- Soil Headspace Monitoring, Sample Collection and Handling
- Temporary Well Point Installation and Development
- Groundwater Sample Collection and Handling
- Well Abandonment
- Land Surveying
- Field Decontamination
- Waste Management
- Site Restoration
- Field Documentation

Additional project-related tasks include:

- Analytical Tasks
- Data Management

- Data Tracking
- Data Storage, Archiving, and Retrieval
- Data Security
- Electronic Data
- Data Review and Validation
- Report Preparation

Mobilization/Demobilization

The Navy RPM and NAS Jacksonville Installation Restoration Program (IRP) Manager will be notified of Resolution Consultants' mobilization effort a minimum of seven days before the start of field activities. Mobilization will consist of the procurement, delivery, assembly, and secure storage of necessary equipment, materials, and supplies, along with the acquisition of personnel and vehicle base access badges. The Resolution Consultants Field Team Leader (FTL) or designee will coordinate with the NAS Jacksonville IRP Manager to identify appropriate locations for the temporary storage of equipment and supplies. Mobilization activities will be conducted in accordance with FDEP SOP FM 1000. The field work to be completed can be accomplished via one mobilization within two days of sampling activities.

A field team orientation meeting will be conducted prior to starting each day's fieldwork to familiarize the team personnel with the Site-specific health and safety requirements, the objectives and scope of the field activities, and chain-of-command. This meeting will be attended by the field staff and conducted by the FTL.

Demobilization will consist of the prompt and timely removal of field equipment and supplies from the site, managing investigation-derived waste (IDW), performing general site cleanup, returning rented equipment, organizing and finalizing field paperwork, and entering field records/data into the database.

Site-Specific Health and Safety Training

Site-specific health and safety training for all Resolution Consultants field personnel and subcontractors will be conducted as part of mobilization. There are no specialized/non-routine project-specific training requirements or certifications needed by personnel to successfully complete the project tasks. All field personnel will have appropriate training to conduct the field activities to which they are assigned. Each worker will be required to have completed the Occupational Safety and Health Administration 40-hour Hazardous Waste Operations and Emergency Response course and 8-hour refresher, as applicable. Additional health and safety requirements are addressed in greater detail in the Site Safety and Health Plan.

Site Reconnaissance

Prior to initiating any fieldwork in the vicinity of the Kemen Test Cell, site reconnaissance activities will be conducted. At a minimum, these activities will include a site walk-through to: locate and briefly evaluate the condition (primarily accessibility and integrity) of existing historical site monitoring wells; visually inspect the proposed sampling locations for potential obstructions (underground utilities and overhead clearance); and mark (in white paint on the ground surface) the proposed sampling locations prior to conducting the subsurface utility clearance.

Global Positioning Sampling Point Locating

A hand-held GPS unit capable of sub-meter accuracy (i.e., Trimble GeoXM or Trimble GeoHX) will be used to locate sampling points in general accordance with U.S. EPA SOP SESDPROC-110-R4. The coordinates of proposed field samples will be identified on the office computer, located, and uploaded to the field handheld GPS to allow for field personnel to mark the proposed sampling locations in the field as part of the site reconnaissance task above. These points will also be entered into a table to facilitate later cross referencing, especially if any need to be moved due to the potential presence of subsurface obstructions.

Additional GPS data will be stored in the GPS unit and downloaded to a computer daily or as soon as possible after acquisition. Data will also be manually entered into a field log as it is collected. Once downloaded from the GPS unit, the data will then be uploaded for processing by Resolution Consultants' Geographic Information System personnel. To ensure sub-meter accuracy, a minimum of six satellites is desired for each position. If GPS accuracy is not sub-meter, data will not be collected until more satellites become available and the accuracy criteria are met. In locations where the overhead canopy or buildings interfere with satellite lines-of-sight and GPS accuracy cannot be reasonably established, an alternative positioning technique will be employed (e.g., compass and tape measure, fiducials, or total station) to ensure that sample locations can be reacquired at a later date, if necessary.

Utility Clearance

A minimum of two weeks prior to the commencement of the intrusive sampling activities, Resolution Consultants will coordinate utility clearance with the NAS Jacksonville IRP Manager and Sunshine State One Call of Florida, Inc. (Florida 811). Utility clearance will be performed in accordance with established NAS Jacksonville Public Works Department procedures, Florida Statute 556, and Resolution Consultants SOP 3-01. NAS Jacksonville has internal Excavation/Digging Permit procedures and requirements to help ensure that all work that disturbs or

removes soil (such as land clearing, digging and trenching) is conducted properly and has been approved in advance by the NAS Jacksonville Environmental Department. The requirements apply to both Navy personnel and government contractors who perform work at a site. The Resolution Consultants FTL will contact NAS Jacksonville Public Works Department the Florida 811 utility locator at least three days prior to commencement of field work to complete a utility clearance ticket for the area under investigation. Sunshine "Call 811 before you dig" 811; coordinates the process between excavators and member utilities in Florida. NAS Jacksonville personnel and the Florida 811 contractor will identify and mark the location of all subsurface utilities that may be present near the proposed intrusive sampling locations.

A private utility locating vendor may also be contracted to clear sampling locations where Sunshine State One Call of Florida cannot access. Prior to initiating drilling each location will be cleared to a depth of 4 feet bls using a hand auger, ideally to the maximum diameter of the downhole sampling tool. The Resolution Consultants FTL will document the utility clearance process and obtain all required approvals, with established NAS Jacksonville Public Works Department procedures and as deemed necessary by the NAS Jacksonville IRP Manager. In the event an unidentified underground utility is encountered, then the proposed soil boring will be offset accordingly.

Utilities that are identified in the field, but not shown or incorrectly shown on the work approval documentation, will be marked on a site map which will be provided to the NAS Jacksonville IRP Manager for inclusion in their GIS database, if available.

Equipment Calibration

Field equipment (FID, YSI multimeter, turbidity meter, etc.) calibration procedures are described in FDEP SOPs FT 1000, FT 1100, FT 1200, FT 1300, FT 1400, FT 1500, and FT 1600 (see Appendix A). At a minimum, field equipment calibration or calibration verification will be performed at the beginning and end of each day, unless stated otherwise by the equipment manufacturer. Documentation of field equipment calibration is required and will be conducted in accordance with FDEP SOP FD 1000.

Soil Headspace Monitoring, Sample Collection, and Handling

The sampling and analysis program is outlined in Worksheets #17 and #18. Subsurface soil samples will be collected from each of the six primary proposed sampling locations shown on Figure 17-1. The remaining four locations will be used as delineation step-outs and will be selected in the field. The placement of any step-out locations will be selected based on the field data acquired, conditions observed, and input from the Resolution Consultants TOM, the Navy, and the FDEP RPM.

Representative soil samples at each sampling location will be obtained, continuously from ground surface to the top of the water table for field screening of organic vapors, lithological logging, and/or chemical analysis in accordance with applicable portions of FDEP SOPs FS 1000 and FS 3000 and Resolution Consultants SOP 3-19.

Prior to initiating soil sampling, the surface asphalt/concrete where present will be saw-cut/cored and removed, any road base material if present will be broken up and removed at each sampling location where present to prevent potential contamination of the soil sample. Soil samples to the top of the water table will be collected using a telescoping hand auger equipped with a pre-cleaned 6-inch stainless steel sand auger bit. The auger stems and sampling bits will be decontaminated prior to use and between sampling depths at each boring, and between borings in accordance with applicable portions of FDEP SOP FC 1000.

The unsaturated soil samples collected from each boring will be visually screened for the presence of staining and potential petrochemical impacts using a flame ionization detector equipped OVA with a minimum detection level of 1.0 ppm. The OVA readings are generally used to delineate the presence of soil potentially impacted with volatile organic vapors. Soil headspace screening will be performed according to Resolution Consulants SOP 3-19 (Headspace Screening for Total VOCs).

The OVA readings will used to identify the presence of “Excessively contaminated soil” as outlined in 62-780.200(15) F.A.C. (soil saturated with petroleum or petroleum products or soil that causes a total corrected hydrocarbon measurement of 50 ppm or higher for the Kerosene Analytical Group). Readings shall be obtained at the site with a properly calibrated FID-equipped OVA in the survey mode. A portion of each unsaturated soil sampling interval will be split into two clean, large mouth, 8-ounce jars, which will be tightly sealed with foil at the top. Each subsample shall be brought to a temperature of between 68° and 90° Fahrenheit. Headspace gases shall be allowed to develop for a minimum of 10 minutes prior taking the readings (62-780.200(15) F.A.C.). One of the readings shall be obtained with the use of an activated charcoal filter unless the unfiltered reading is nondetect. The total corrected hydrocarbon measurement shall be determined by subtracting the filtered reading from the unfiltered reading.

Soil samples below the water table will be collected for lithological descriptions only using a direct push technology (DPT) rig operated by a licensed drilling contractor. The driller will by advance a pre-cleaned 5-foot stainless steel sampler equipped with a new Macro-Core acetate sample liner in the same borehole where the unsaturated soil samples were collected. It is anticipated that the

lithological characterization below the water table using DPT drilling techniques will extend to depths of approximately 18 feet bls. No saturated soil samples will be collected for analysis.

For this UFP-SAP it is anticipated that 6 soil borings will be sampled to evaluate conditions in the immediate vicinity of the former 25,000 gallon UST and 4 borings will be reserved in the event that additional data is needed to delineate the extent of potential impacts to soil. If delineation samples are not necessary, the sampling points will be used to confirm the results of historical investigations. Unsaturated soil samples will be collected as follows: from ground surface to 0.5 feet bls, 0.5 to 2 feet bls, from 2 to 4 feet bls, and every two feet below that, to the two foot interval just above the water table. The water table is likely to be encountered at depths of approximately 8 feet bls. It is likely that five samples will be collected from each of the 10 boring locations for chemical analysis by a fixed base laboratory.

Sample collection and handling will be in accordance with FDEP SOPs FS 1000 and FS 3000. Field QC samples will be collected in accordance with FDEP SOP FQ 1000. The list of target analytes selected for analyses is presented in Worksheet #15. The sampling design, proposed sample identifications, depth of sampling, and associated analytical requirements for each location are presented in Worksheets #17 and #18.

A soil boring log will be prepared for each boring with soil descriptions and all relevant information, observations, depth to water, and field screening results. All soil samples collected will be described using the Unified Soil Classification System by the field geologist. The soil boring logs will include the unfiltered, filtered, and net field OVA readings. The soil sample collection depths will be included on the boring logs.

Temporary Well Installation and Development

This SAP includes the installation of 10 new temporary groundwater monitoring points. To evaluate groundwater conditions, Resolution Consultants proposes converting each of the 10 DPT soil borings into a temporary well point. Each temporary well point will be installed for the purpose of collecting reproducible representative groundwater samples for chemical analysis. The proposed location for the primary six temporary well points to be installed is shown on Figure 17-1. The rationale for each proposed temporary well point is described in Worksheet #17. If step-outs are not needed, the discretionary locations shown on Figure 17-1 will be sampled using the same protocol detailed above.

A licensed well drilling contractor will install each proposed temporary well in general accordance with Chapter 62-532, F.A.C. and St. Johns Water Management District Chapter 40C-3 for groundwater

monitoring well installation. Resolution Consultants field personnel will oversee all field activities associated with the TW installation process, which will be performed in accordance with applicable portions of Resolution Consultants SOPs 3-12 for well installation.

Each temporary well (to be designated as TW01 through TW010), will be completed using 2-inch diameter flush threaded Schedule 40 polyvinyl chloride (PVC) riser pipe, with a 10-foot section of 0.01 inch slotted screen of the same size and schedule as the riser pipe. The DPT rig shall be equipped with 4¼ inch internal diameter drill pipe to allow for proper placement and completion of the 2-inch diameter well points. The top of the water table is anticipated to be no deeper than 10 feet bls. It is anticipated that each well will be screened across the water table, specific well screen placement depths will be based on site-specific conditions. The well screens at each location will be set approximately 1 to 2 feet above the top of the water table. The anticipated screened intervals will range from approximately 2 to 12 feet to 7 to 17 feet bls. The annular space between the borehole wall and the PVC well will be filled with clean, bagged 20/30 silica sand to approximately 2 feet above the top of the well screen. The remainder of the annular space above the sand pack, between the well and the borehole will be filled with clean, bagged, 30/65 fine silica sand to form a temporary seal above the top of the sand pack. Each temporary well will be equipped with a bottom cap and secured with a lockable, watertight expansion plug cap at the surface. Temporary wells will be managed as stick up completions to facilitate access, development, surveying, and sampling prior to abandonment.

Following installation, the well will be developed to remove residual fines that may have entered the screen during well construction and to establish natural flow conditions that may have been altered during well construction. Each well will be developed by surging and over-pumping. Development will be conducted until the water purged from the well is free of visible particulates. If the water remains turbid (above 10 nephelometric turbidity units [NTUs]), well development will continue until the turbidity stabilizes over three consecutive readings ($\pm$10 percent if above 10 NTUs). All well development activities will be performed in accordance with Resolution Consultants SOP 3-13.

Groundwater Sample Collection and Handling

Prior to initiating purging and sampling activities, static groundwater level measurements will be obtained from each of the newly installed temporary wells and accessible historical wells (if possible) using an oil/water interface probe to identify the presence of free-product potentially floating above the water table. Water level measurements will be performed in accordance with FDEP SOP FS 2200. All depths will be measured in units of feet (to the nearest 0.01 foot) with respect to the surveyed

TOC elevation to determine the depth to water below the ground surface. Water levels will be recorded on Resolution Consultant's water level measurement form. The oil/water interface probe will be decontaminated prior to use and between each monitoring well in accordance with applicable portions of FDEP SOP FC 1000.

For the purpose of this UFP-SAP, accessible historical monitoring wells will not be re-developed or sampled.

All properly developed temporary wells will be purged prior to sampling using low-flow techniques in accordance with FDEP SOP FS 2200. Purging prior to well sampling will be initiated no sooner than 24-hours after well development to comply with applicable FDEP SOP requirements. Purging at each well will be accomplished via low flow quiescent purging techniques, consistent with SOP FS 2000 and FS 2200. Purging will be accomplished using a variable speed peristaltic pump equipped with new Teflon tubing set within 2 feet of the top of the water table. Water quality parameters (pH, conductivity, temperature, salinity, and dissolved oxygen) will be measured during purging using a field-calibrated multiparameter meter connected to a flow through cell; in addition, turbidity will be measured using a separate hand-held meter. The measured water quality parameters and physical appearance of the purge water will be recorded on a standard Resolution Consultants groundwater sampling log (a modified version of FDEP Form FD 9000-24) which is provided in Appendix B.

Once all water quality parameters have stabilized and purging is determined complete, groundwater samples will be collected directly into the laboratory provided pre-cleaned sample bottles, labeled, stored on ice, and submitted under chain-of-custody protocol to the contracted analytical laboratory for analytes listed on Worksheet #15 and analyses detailed on Worksheet #18. Worksheet #18 provides generic sample identifications that will be used for this investigation. Sample containers will be provided by the laboratory in "certified-clean" condition. The selection of sample containers, sample preservation, packaging, and shipping will be in accordance with FDEP SOPs FS 1000, FS 2000, FS 2200, and Worksheet #19. Worksheet #23 specifies the analytical methods to be used. Field and laboratory QC samples will be collected as required by FDEP SOP FQ 1000 detailed in Worksheet #20.

Land Surveying

Following sampling activities, all soil boring and monitoring well locations will be surveyed by a professional surveyor licensed in the State of Florida. The Resolution Consultants FTL or designee will provide the surveyor with the coordinate designation nomenclature and all coordinate systems

will be pre-approved prior to commencement of the survey. All land surveying activities will be performed in general accordance with Resolution Consultants SOP 3-07. The surveyor will establish the horizontal location and vertical elevation for all monitoring wells. One horizontal measurement and two vertical measurements will be required per well. The two vertical measurements required are: (1) the TOC and (2) the top of ground surface adjacent to the pipe. All of the vertical measurements should be taken from marked positions on each temporary well or, if missing a mark, on the north side of the riser pipe. The surveyor will find and use existing survey controls in place throughout NAS Jacksonville. It is anticipated that adequate control is located within one mile of the site. Horizontal position should be referenced to Florida State Plane East Coordinate System, North American Datum 1983 and accurate to the nearest 0.10 foot. Vertical elevation should be referenced to North American Vertical Datum of 1988 and accurate to the nearest 0.01 foot. The surveyor will document all work in a clear, legible, and complete manner. The field record will contain a complete description of the nature and location of the sample locations. The field record will also include a sketch of the sampling point locations and the benchmarks used for both project control and local control.

Well Abandonment

All temporary wells installed as part of this SAP will be properly abandoned by the licensed well driller that installed them. Resolution Consultants field personnel will conduct field tasks associated with well abandonment in general accordance with SOP 3-15, Chapter 62-532, F.A.C., and St. Johns Water Management District Chapter 40C-3.531.

Field Decontamination

Decontamination of reusable sampling equipment (e.g., non-disposable hand trowels and hand augers) will be conducted prior to sampling and between samples at each location. Decontamination of sampling equipment will not be necessary for dedicated and disposable sampling equipment. Decontamination of major equipment and sampling equipment will be in general accordance with FDEP SOP FC 1000 and applicable portions of Resolution Consultants SOP 3-06.

Waste Management

Prior to initiating sampling activities the Resolution Consultant FTL will contact the NAS Jacksonville Public Works Department to coordinate for the delivery and pick up of approved 55-gallon drums for IDW containment. Once filled each drum will be labeled, and sampled for site COPCs and pH for waste characterization. When site work is completed, Resolution Consultants personnel will notify the Public Works Department to have the drums picked up and stored during waste characterization.

Resolution Consultants will provide the Public Works Department with a recommendation for disposal of the drums generated based on the laboratory analytical results.

Used personal protective equipment, including gloves, wipes, discarded paper towels, and disposable equipment (i.e., tubing), will be bagged and disposed of as regular trash in an appropriate facility waste container.

Site Restoration

Once drilling, sampling, and well abandonment activities are completed the asphalt and/or concrete surface where borings penetrated the ground will be patched accordingly. All surfaces disturbed will be restored to pre-existing conditions (to the extent possible). Equipment and supplies used during the investigation will be removed at the conclusion of field activities.

Field Documentation

Field documentation will be performed in accordance with FDEP SOP FD 1000 and Resolution Consultants SOP 3-03A. A summary of field activities will be properly recorded in indelible ink in a bound logbook with consecutively numbered pages that cannot be removed. If an incorrect entry is made, striking a single line through the incorrect information will make the correction; and the person making the correction will initial and date the change. Logbooks will be assigned to field personnel and stored in a secured area when not in use. Boring logs, sampling forms, and other field forms will also be used to document field activities. Samples will be packaged and shipped according to FDEP SOP FS 1000 and Resolution Consultants SOP 3-04A.

Analytical Tasks

Chemical analysis of groundwater will be performed by a subcontracted laboratory, Gulf Coast Analytical Laboratories LLC, (GCAL) is certified by the Florida Department of Health National Environmental Laboratory Accreditation Program and the DoD Environmental Laboratory Accreditation Program. Copies of the pertinent laboratory accreditations are included in Appendix C. Analyses will be performed in accordance with the analytical methods specified in Worksheet #19. GCAL will strive to meet the screening criteria specified in Worksheet #15 and will perform the chemical analyses following the laboratory-specific SOPs identified in Worksheet #23. Full laboratory SOPs are available upon request.

The analytical data packages provided by GCAL will include raw data, summary forms for all sample and laboratory method blank data, and summary forms containing all method-specific QC information

(results, percent recoveries, relative percent differences [RPD], relative standard deviations [RSD], percent differences or percent drifts, etc.).

Data Management

The principal data generated for this project will be from field data and laboratory analytical data. The field forms, chain-of-custody, air bills, and logbooks will be placed in the project files after the completion of the field program. The field logbooks for this project will be used only for this site 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. All project records will be maintained in a secure location.

Data Tracking

The Resolution Consultants TOM, or designee, is responsible for the overall tracking and control of data generated for the project. Data are tracked from generation to archiving in the project specific files. The Project Chemist, or designee, is responsible for tracking the samples collected and shipped to the contracted laboratory. Upon receipt of the data packages from the analytical laboratory, the Project Chemist will oversee the data validation effort, which includes verifying that the data packages are complete and that results for all samples have been delivered by the analytical laboratory.

Resolution Consultants shall submit all Administrative Record Files, Site Files, and Post Decision Files in accordance with the specifications defined in the NAVFAC *Environmental Restoration Recordkeeping Manual* (NAVFAC 2009). Additionally, Resolution Consultants will update and manage the project related documents, data, and maps in NIRIS. Project related spatial data including maps, models, and associated collected or created data will also be uploaded into NIRIS. All documentation submittals for NIRIS will be coordinated with the Navy RPM.

Data Storage, Archiving, and Retrieval

After the data are validated, the data packages are entered into the Resolution Consultants 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 Resolution Consultants Field Team Leader to be entered into the file system before archiving in secure project files. Project files are audited for accuracy and completeness. Project files will be kept in a secured, limited access area. At the completion of the Navy contract, files will be shipped to the Federal Records Center for storage where the files will remain until 50 years after the last decision document for the facility.

Data Security

Access to Resolution Consultants project files is restricted to designated personnel only. The Resolution Consultants Data Manager maintains the electronic data files, and access to the data files is restricted to qualified personnel only. File and data backup procedures are routinely performed.

Electronic Data

Laboratory data, provided in electronic format, will be verified for accuracy prior to use and during the data validation process. After data are validated, the electronic data results will be uploaded into the Resolution Consultants database for use in data evaluation and subsequent report preparation. The project database will be on a password protected secure network and access to changing data files will be restricted to qualified personnel. The Resolution Consultants TOM (or designee) is responsible for the overall tracking and control of data generated for the project. All final electronic data and administrative records will be compiled and uploaded into the NIRIS database for final repository.

Data Review and Validation

After receipt of analytical laboratory results, Resolution Consultants will verify data completeness as specified on Worksheet #34. To ensure that the analytical results meet the project quality objectives, the laboratory data will undergo verification and validation as cited in Worksheets #34 through #36 and described below. The data usability assessment process is described in Worksheet #37.

Prior to data validation, electronic laboratory data will be verified for accuracy against the hardcopy laboratory report and the electronic quality assurance project plan (eQAPP) will be established using the project-specific criteria defined in Worksheets #12, #19, and #28. The laboratory will be requested to resubmit electronic data found to be inaccurate.

During the data validation process, the Resolution Consultants Data Validation Assistant (DVA) tool will be used to review method accuracy and precision data from field and laboratory QC samples contained in the laboratory electronic data deliverable and to qualify that data according to the project-specific eQAPP. The DVA tool uses EarthSoft's EQuIS relational database to assemble a series of Excel worksheets into a DVA workbook for the validator that provide:

- Data validation QC elements that need review, compared to control limits stored in the project-specific eQAPP.

- Associated sample results for duplicated samples and blanks.

- A place to make the necessary qualifications and result updates directly into an electronic format documentation of qualifications using coded reasons.

- A list of all samples affected by the qualification.

Laboratory calibration will be assessed against the criteria presented in the DoD *Quality Systems Manual* using the hardcopy laboratory report; the results of these findings will be added to the Excel DVA workbook. The DVA workbook is used to update the project database with the validator's changes, eliminating the manual data entry process and allowing for 100 percent of data to be reviewed prior to uploading to the project database.

Report Preparation

Resolution Consultants will compile, review, and compare the available historical data to the data obtained during the investigations detailed in this UFP-SAP, and evaluate existing conditions at the site to produce a SAR. The SAR report will include a summary of field efforts, deviations from the work planning documents (if any), data tables and figures, comprehensive discussion of the nature and extent of contamination, comprehensive discussion of the degradation environment in affected media, all other standard SAR requirements. The SAR will provide conclusions and recommendations for NFA, or if during the data evaluation process, additional information is required to complete the SAR; Resolution Consultants will prepare recommendations for the Navy to fill data gaps as a modification to this CTO. If contamination is confirmed in soil and/or groundwater at the site, a RAP to address the principal threats identified at the site will be prepared.

The SAR will include a Draft, Draft Final, and Final submittal, the information obtained will be presented, and discussed with NAVFAC Southeast, NAS Jacksonville, and FDEP at a Remediation Team Meeting prior to finalizing the document. Response to comments and necessary revisions will be made to the draft reports before issuing a final report. The final SAR will include a response to comments and necessary revisions to address the comments.

SAP WORKSHEET #15: REFERENCE LIMITS AND EVALUATION TABLES

(UFP-QAPP Manual Section 2.8.1)

Matrix:	**Shallow surface soil and subsurface soil**						
Analytical Group:	**Polynuclear Aromatic Hydrocarbons via Selective Ion Monitoring**						
Analyte	**CAS No.**	**Project Action Level (mg/kg)[1]**	**Project Action Level Source**	**Project Quantitation Limit Goal (mg/kg)**	**Laboratory Limit of Quantitation[2] (mg/kg)**	**Laboratory Limit of Detection[2] (mg/kg)**	**Laboratory Method Detection Limit[2] (mg/kg)**
1-Methylnaphthalene	90-12-0	3.1	FDEP Leachability SCTL	1.03	0.0033	0.00167	0.00084
2-Methylnaphthalene	91-57-6	8.5	FDEP Leachability SCTL	2.83	0.0033	0.00167	0.00084
Naphthalene	91-20-3	1.2	FDEP Leachability SCTL	0.40	0.0033	0.00167	0.00042
Matrix:	**Shallow surface soil and subsurface soil**						
Analytical Group:	**Total Recoverable Petroleum Hydrocarbons**						
Analyte	**CAS No.**	**Project Action Level (mg/kg)[1]**	**Project Action Level Source**	**Project Quantitation Limit Goal (mg/kg)**	**Laboratory Limit of Quantitation[2] (mg/kg)**	**Laboratory Limit of Detection[2] (mg/kg)**	**Laboratory Method Detection Limit[2] (mg/kg)**
Total Recoverable Petroleum Hydrocarbons by Florida Petroleum Residual Organics	NOCAS	340	FDEP Leachability SCTL	113.33	17.7	17.7	10

Notes:

[1] Florida Department of Environmental Protection (FDEP) Soil Cleanup Target Level (SCTL), Leachability Based on Groundwater Criteria or lowest applicable SCTL, Chapter 62-777, F.A.C. Table II (FDEP 2005).

[2] Laboratory quantitation, detection, and method detection limits are provided by Gulf Coast Analytical Laboratories, LLC.

Shaded = Laboratory limit of quantitation, limit of detection and/or method detection limit exceeds the project action level.
CAS No. = Chemical Abstract Service Number
F.A.C. = Florida Administrative Code
mg/kg = Milligrams per kilogram

Matrix:	**Groundwater**						
Analytical Group:	**Polynuclear Aromatic Hydrocarbons via Selective Ion Monitoring**						
Analyte	**CAS No.**	**Project Action Level (µg/L)[1]**	**Project Action Level Source**	**Project Quantitation Limit Goal (µg/L)**	**Laboratory Limit of Quantitation[2] (µg/L)**	**Laboratory Limit of Detection[2] (µg/L)**	**Laboratory Method Detection Limit[2] (µg/L)**
1-Methylnaphthalene	90-12-0	28	FDEP GCTL	9.3	0.10	0.10	0.04
2-Methylnaphthalene	91-57-6	28	FDEP GCTL	9.3	0.10	0.10	0.04
Benzo(a)anthracene	56-55-3	0.05	FDEP GCTL	0.02	0.10	0.05	0.0250
Benzo(b)fluoranthene	205-99-2	0.05	FDEP GCTL	0.02	0.10	0.05	0.0125

Notes:

[1] FDEP GCTL = Florida Department of Environmental Protection (FDEP) Groundwater Cleanup Target Level (GCTL), Chapter 62-777 F.A.C. Table I (FDEP 2005).
[2] Laboratory quantitation, detection, and method detection limits are provided by Gulf Coast Analytical Laboratories, LLC.
Shaded = Laboratory limit of quantitation, limit of detection and/or method detection limit exceeds the project action level. Laboratory detection limits exceeding GCTLs are lower than target practical quantitation limits per *Guidance for the Selection of Analytical Methods and for the Evaluation of Practical Quantitation Limits*, FDEP, 12 October 2004.
CAS No. = Chemical Abstract Service Number
DoD = Department of Defense
F.A.C. = Florida Administrative Code
µg/L = Micrograms per liter

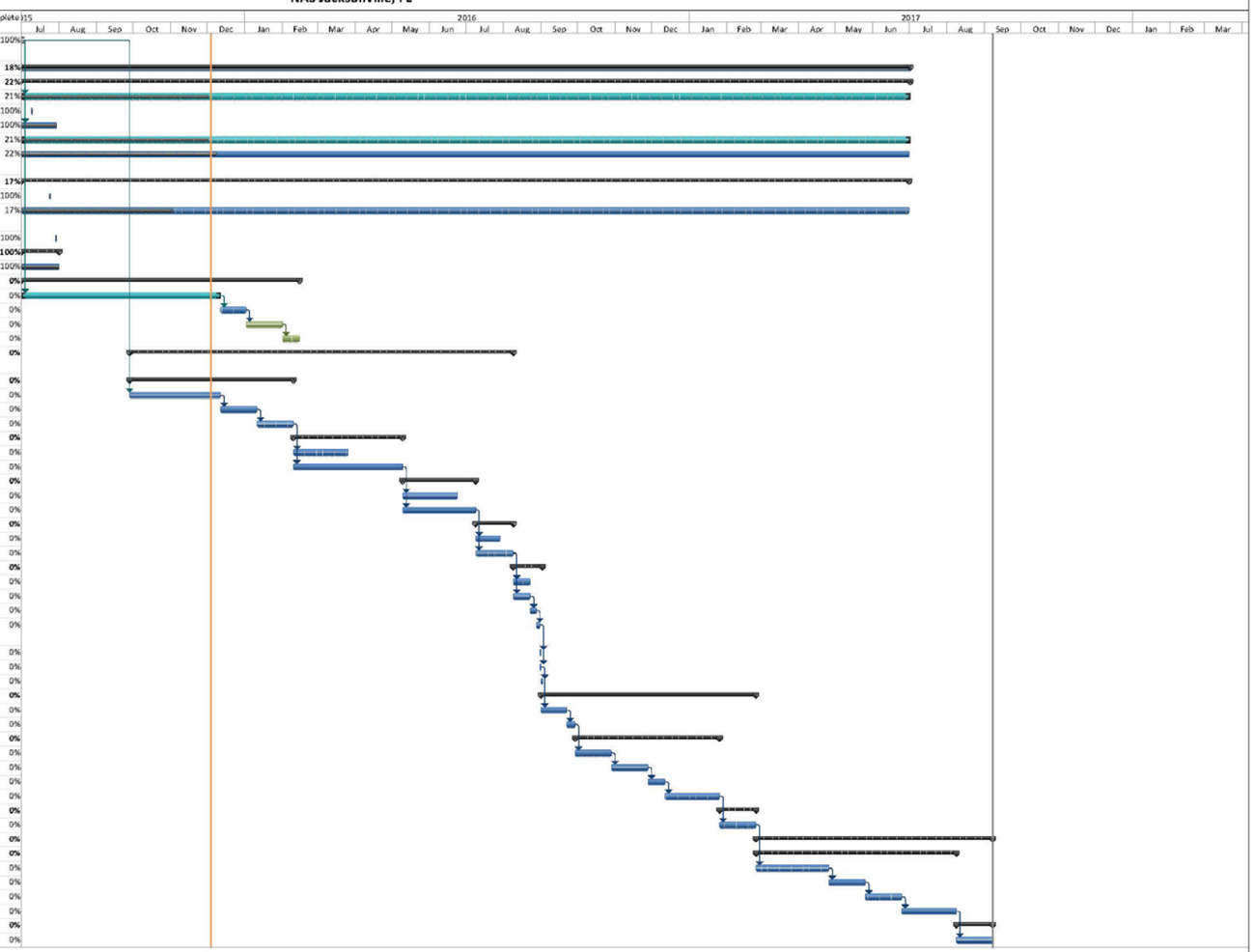
Please note that data will be reported at the limit of quantitation and method detection limit (MDL) with non-detected data being the MDL followed by a "U" qualifier as per Florida state regulations. The limit of detection is presented for completeness and compliance with the Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories (DoD QSM), Version 5.0 (DoD 2013).

SAP WORKSHEET #16: PROJECT SCHEDULE TIMELINE TABLE

(UFP-QAPP Manual Section 2.8.2)

KEMEN TEST CELL BLDG. 873 SAR/RAP
NAS Jacksonville, FL

ID	Task Name	Duration	Start	Finish	Predecessor	% Complete
1	**Project Award (Test Cell B873 SAR/RAP; Yellow Water LUC/RD; Exit Strat. Update)**	1 day	Tue 6/30/15	Tue 6/30/15		100%
2	**PP - Project Planning**	**733 days**	**Tue 6/30/15**	**Sat 7/1/17**		**18%**
3	**PP.PM - Project Management**	**733 days?**	**Tue 6/30/15**	**Sat 7/1/17**		**22%**
4	Project Management (24 months x 4.17% per month)	732 days	Wed 7/1/15	Sat 7/1/17	1	21%
5	Project Setup	1 day	Thu 7/9/15	Thu 7/9/15		100%
6	Prepare Initial Project Schedule	30 days	Tue 6/30/15	Wed 7/29/15	1	100%
7	Prepare Monthly MPRs (24 events x 4.17% per month)	732 days	Wed 7/1/15	Sat 7/1/17		21%
8	Monthly Schedule Updates (23 events x 4.35% per month)	731 days?	Wed 7/1/15	Fri 6/30/17		22%
9	**PP.MG - Project Meetings/Site Visits**	**731 days?**	**Wed 7/1/15**	**Fri 6/30/17**		**17%**
10	Kickoff/Project Scoping Meeting (Internal)	1 day	Fri 7/24/15	Fri 7/24/15		100%
11	Partnering Meetings (Bi-Monthly) (12 meetings x 8.4% per meeting)	731 days?	Wed 7/1/15	Fri 6/30/17		17%
12	Site Visit	1 day	Wed 7/29/15	Wed 7/29/15		100%
13	**PP.ED - Existing Data Review**	**31 days**	**Wed 7/1/15**	**Fri 7/31/15**		**100%**
14	Bldg. 873	31 days	Wed 7/1/15	Fri 7/31/15		100%
15	**PP.HS - Accident Prevention Plan**	**229 days**	**Wed 7/1/15**	**Sun 2/14/16**		**0%**
16	HASP Draft	164 days	Wed 7/1/15	Fri 12/11/15	1	0%
17	Navy Review	3 wks	Sat 12/12/15	Fri 1/1/16	16	0%
18	HASP Draft Final and Respond to Comments	30 days	Sat 1/2/16	Sun 1/31/16	17	0%
19	HASP Final	14 days	Mon 2/1/16	Sun 2/14/16	18	0%
20	**PP.UF - Kemen Test Cell UFP-SAP (Site Assessment [SA] Work Plan)**	**316 days**	**Mon 9/28/15**	**Mon 8/8/16**		**0%**
21	**UFP-SAP Draft**	**135 days**	**Mon 9/28/15**	**Tue 2/9/16**		**0%**
22	UFP-SAP Report Draft	75 days	Mon 9/28/15	Fri 12/11/15	1	0%
23	UFP-SAP - Navy Comments	30 days	Sat 12/12/15	Sun 1/10/16	22	0%
24	UFP-SAP Draft Final and Response to Comments	30 days	Mon 1/11/16	Tue 2/9/16	23	0%
25	**Regulatory Review (EPA/FDEP)**	**90 days**	**Wed 2/10/16**	**Mon 5/9/16**		**0%**
26	Interim Checkpoint	45 days	Wed 2/10/16	Fri 3/25/16	24	0%
27	Comments Due	90 days	Wed 2/10/16	Mon 5/9/16	24	0%
28	**Draft Final UFP-SAP and Response to Comments**	**60 days**	**Tue 5/10/16**	**Fri 7/8/16**		**0%**
29	Interim Draft-Final and Response to Comments	45 days	Tue 5/10/16	Thu 6/23/16	27	0%
30	Draft-Final and RTC	60 days	Tue 5/10/16	Fri 7/8/16	27	0%
31	**Final UFP-SAP**	**31 days**	**Sat 7/9/16**	**Mon 8/8/16**		**0%**
32	Deadline for Ext. Request	20 days	Sat 7/9/16	Thu 7/28/16	30	0%
33	Final Due	31 days	Sat 7/9/16	Mon 8/8/16	30	0%
34	**FI - Field Investigation (Bldg. 873)**	**24 days**	**Tue 8/9/16**	**Thu 9/1/16**		**0%**
35	PP.PM - Subcontractor Procurement for Field Investigation	2 wks	Tue 8/9/16	Mon 8/22/16	33	0%
36	PP.PM - Utility Clearance	2 wks	Tue 8/9/16	Mon 8/22/16	33	0%
37	FI.MD - Mobilization (Pre-Fieldwork)	5 days	Tue 8/23/16	Sat 8/27/16	36	0%
38	FI.DP - Direct Push Soil Sampling/Temporary Monitoring Well Sampling/Abandonment	3 days	Sun 8/28/16	Tue 8/30/16	37	0%
39	FI.SU - Surveying	1 day	Wed 8/31/16	Wed 8/31/16	38	0%
40	FI.ID - Investigation-Derived Waste	1 day	Wed 8/31/16	Wed 8/31/16	38	0%
41	FI.MD - Demobilization (Post-Fieldwork)	1 day	Thu 9/1/16	Thu 9/1/16	40	0%
42	**SI - Site Investigation**	**177 days**	**Thu 9/1/16**	**Fri 2/24/17**		**0%**
43	Laboratory Analyses (Subcontractor)	21 days	Thu 9/1/16	Wed 9/21/16	40	0%
44	SI.DE - Data Evaluation	1 wk	Thu 9/22/16	Wed 9/28/16	43	0%
45	**SI.DR - Site Assessment Report (SAR)/Draft**	**119 days**	**Thu 9/29/16**	**Wed 1/25/17**		**0%**
46	Draft SAR	30 days	Thu 9/29/16	Fri 10/28/16	44	0%
47	Navy Review	30 days	Sat 10/29/16	Sun 11/27/16	46	0%
48	SAR Draft Final and Response to Comments	2 wks	Mon 11/28/16	Sun 12/11/16	47	0%
49	Regulatory Review (EPA/FDEP)	45 days	Mon 12/12/16	Wed 1/25/17	48	0%
50	**SI.FR -Site Assessment Report (SAR)/Final**	**30 days**	**Thu 1/26/17**	**Fri 2/24/17**		**0%**
51	SI Report - Final and Response to Comments	30 days	Thu 1/26/17	Fri 2/24/17	49	0%
52	**RP - Remedial Action Plan (RAP) (Bldg. 873)**	**195 days**	**Sat 2/25/17**	**Thu 9/7/17**		**0%**
53	**RP.DR - RAP/Draft**	**165 days**	**Sat 2/25/17**	**Tue 8/8/17**		**0%**
54	Draft RAP	60 days	Sat 2/25/17	Tue 4/25/17	51	0%
55	Navy Review	30 days	Wed 4/26/17	Thu 5/25/17	54	0%
56	RAP Draft Final and Response to Comments	30 days	Fri 5/26/17	Sat 6/24/17	55	0%
57	Regulatory Review (EPA/FDEP)	45 days	Sun 6/25/17	Tue 8/8/17	56	0%
58	**RP.FR - RAP/Final**	**30 days**	**Wed 8/9/17**	**Thu 9/7/17**		**0%**
59	RAP - Final and Response to Comments	30 days	Wed 8/9/17	Thu 9/7/17	57	0%



Task | Split | Milestone | Summary | Project Summary | External Tasks | External Milestone | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | Deadline | Progress

Page 1

SAP WORKSHEET #17: SAMPLING DESIGN AND RATIONALE

(UFP-QAPP Manual Section 3.1.1)

17.1 General Sampling Design and Rationale

This Worksheet presents the design and rationale of the sampling and analysis program to be conducted during this investigation. The sampling approach, based on professional judgment, is biased towards locations where the presence of contamination is most likely. As detailed in Worksheet #11, data are needed to assess site conditions after the successful closure of the 25,000 gallon JP-5 UST and to make recommendations for a path forward. Detailed project tasks are summarized in Worksheet #14. A summary table, including sample identification numbers, sample collections depths, relevant SOPs, and applicable laboratory analysis are included in Worksheet #18. Field sampling and QC sample requirements are specified in Worksheets #19 and #20, respectively. SOPs for field activities are summarized in Worksheet #21 and included as Appendix A.

Figure 17-1 shows the approximate location for each of the six primary sampling points that will be advanced at the Kemen Test Cell in support of the activities presented in this UFP-SAP. The locations for the remaining four (step-out) sampling points, will be selected in the field based on the data (visual, olfactory, and OVA results) acquired and input from the Resolution Consultants TOM, the Navy, and FDEP RPM. In the event that delineation sampling is not needed, the remaining four discretionary sampling points will be advanced to evaluate other areas of the site as shown on Figure 17-1.

Professional judgment may be used to adjust sampling locations and/or depths of sampling in the field. Examples of criteria which may lead to changes to the sampling plan may include (but are not limited to) visual observations of staining, odors, elevated organic vapor readings, field identified sources, etc.

17.2 Soil Sampling Program

Subsurface soil samples will be collected from each of the six primary proposed sampling locations shown on Figure 17-1. Prior to initiating soil sampling, the surface asphalt/concrete where present will be saw-cut/cored and removed, any road base material if present will be broken up and removed at each sampling location where present to prevent potential contamination of the soil sample. Soil samples to the top of the water table will be collected using a telescoping hand auger equipped with a pre-cleaned 6-inch stainless steel sand auger bit at each sample interval.

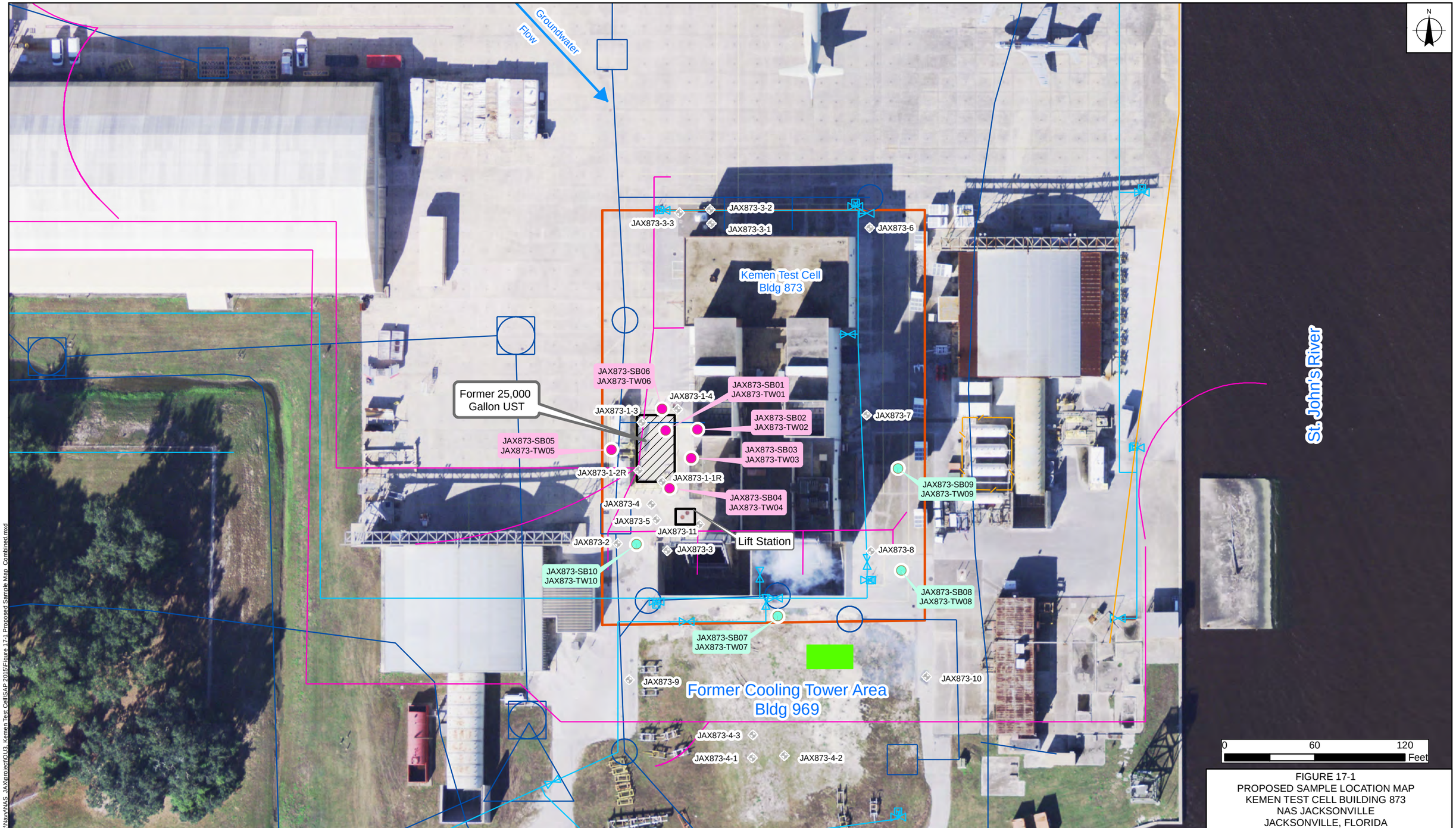


FIGURE 17-1
PROPOSED SAMPLE LOCATION MAP
KEMEN TEST CELL BUILDING 873
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

Historical Monitoring Well
Proposed Soil and Groundwater Sampling Location
Discretionary Soil and Groundwater Sampling Location
Groundwater Flow Direction
Natural Gas Line
Wastewater Line
Water Line
Storm Sewer Line
Approximate Location of Former 1,500 Gallon Fuel Tank associated with Bldg 969
Former 25,000 Gallon UST
Approx. Investigation Area

Notes:
UST - Underground Storage Tank
Utility line locations shown were supplied by the US Navy.
Below are the unknown structures associated with the utilities.

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: M. Castellanos	DATE: 2/8/2016
DRAWN BY: kburnum	TASK ORDER NUMBER: JMA2

Service Layer Credits: City of Jacksonville

X:\Navy\NAS_JAX\project\OU3_Kemen Test Cell\SAP 2015\Figure 17-1 Proposed Sample Map_Combined.mxd

Unsaturated soil samples will be collected for OVA screening and laboratory analysis from each of ten borings as follows: from ground surface to 0.5 feet bls, 0.5 to 2 feet bls, from 2 to 4 feet bls, and every two feet below that, to the two foot interval just above the water table. The water table is likely to be encountered at depths of around 8 feet bls. It is anticipated that up to five samples from each of the 10 boring locations will be submitted to the laboratory for the analysis specified in Worksheet #18. Soil samples for chemical analysis will be selected based on OVA results, visual observations, and/or lithological variations.

The unsaturated soil samples collected from each boring will be visually screened for the presence of staining and potential petrochemical impacts using an FID equipped OVA. The OVA readings will used to identify the presence of "Excessively contaminated soil" as outlined in Chapter 62-780, F.A.C. (soil saturated with petroleum or petroleum products or soil that causes a total corrected hydrocarbon measurement of 50 ppm or higher for Kerosene Analytical Group).

Soil samples below the water table will be collected only for lithological characterization using a DPT rig operated by a licensed drilling contractor. The borings will be completed in the same borehole where the unsaturated soil samples were collected. Lithological characterization samples will be obtained by advancing a pre-cleaned 5-foot stainless steel sampler equipped with a new acetate sample liner. It is anticipated that the lithologic characterization will extend to depths between 18 and 20 feet bls.

The locations of the four step-out (discretionary) samples are shown on Figure 17-1. The location of these samples will be selected based on the field data acquired, conditions observed, and input from the Resolutions Consultants TOM, the Navy, and FDEP RPM. If delineation samples are not necessary then the sampling points will be used to confirm the results of historical investigations at the locations shown on Figure 17-1.

Analytical results will be compared to industrial direct exposure SCTLs and leachability-to-groundwater values.

17.3 Well Installation

Ten temporary wells (to be designated as TW01 through TW010) will be installed throughout the site. Each temporary well point will be collocated with one soil boring location as shown on Figure 17-1. The rationale for each proposed temporary well point is described in Worksheet #18.

17.4 Groundwater Level and Free Product Measurement

Water level measurements will be performed no sooner than 24 hours after well development. A synoptic round of water level monitoring will be performed prior to initiating purging and sampling activities. Water levels will be measured using an oil-water interface probe to evaluate the presence of free product at each newly installed temporary well point and accessible historical monitoring wells. The water level measurements will be used to evaluate the top of the water table underlying the site and the direction of groundwater flow.

17.5 Groundwater Sampling Program

It is anticipated that groundwater samples will be collected from each of the 10 temporary well locations. Any wells where free product is present will not be sampled. Purging at each well will be accomplished via the low-flow quiescent purging techniques. The sample analyses to be performed for each target analyte or analytical group are identified in Worksheet #18. Worksheet #19 provides a summary of the sample analyses, container types and volumes, preservation requirements, and holding times for the samples to be collected. Samples will be collected using the field SOPs identified in Worksheet #21 and will be submitted to GCAL for analysis. The analytical methods and laboratory SOPs used by GCAL are identified in Worksheet #23. Field QC samples will be collected as part of the investigation, including but not limited to field duplicates and equipment rinsate blanks. Proposed field QC samples are specified in Worksheet #12 and Worksheet #20. The required laboratory QC samples are specified in Worksheet #28.

17.6 Temporary Well Point Survey

Following sampling activities, and prior to well abandonment, all soil boring and monitoring well locations will be surveyed by a professional surveyor licensed in the State of Florida. The surveyor will establish the horizontal location and vertical elevation (TOC and ground) for all monitoring wells as detailed in Worksheet #14.

17.7 Temporary Well Point Abandonment

All temporary well points installed as part of this SAP will be abandoned by a licensed well drilling contractor in accordance with Chapter 62-532, F.A.C. and St. Johns River Water Management District Chapter 40C-3.

SAP WORKSHEET #18: LOCATION-SPECIFIC SAMPLING METHODS/SOP REQUIREMENTS TABLE

(UFP-QAPP Manual Section 3.1.1)

Sample Matrix: **Unsaturated Soil**
Location: **UST 26 Kemen Test Cell Building 873**

Sample Location	Sample Identification	Sampling Interval Depth (feet bls)	Sampling Standard Operating Procedures[1]	PAHs [2]	TRPH
JAX873-SB01	JAX873SSB01-01	0-0.5	See Worksheet #21	X	X
JAX873-SB01	JAX873SSB01-02	0.5-2	See Worksheet #21	X	X
JAX873-SB01	JAX873SB01-04	2-4	See Worksheet #21	X	X
JAX873-SB01	JAX873SSB01-06	4-6	See Worksheet #21	X	X
JAX873-SB01	JAX873SSB01-08	6-8	See Worksheet #21	X	X
JAX873-SB02	JAX873SSB02-01	0-0.5	See Worksheet #21	X	X
JAX873-SB02	JAX873SSB02-02	0.5-2	See Worksheet #21	X	X
JAX873-SB02	JAX873SSB02-04	2-4	See Worksheet #21	X	X
JAX873-SB02	JAX873SSB02-06	4-6	See Worksheet #21	X	X
JAX873-SB02	JAX873SSB02-08	6-8	See Worksheet #21	X	X
JAX873-SB03	JAX873SSB03-01	0-0.5	See Worksheet #21	X	X
JAX873-SB03	JAX873SSB03-02	0.5-2	See Worksheet #21	X	X
JAX873-SB03	JAX873SSB03-04	2-4	See Worksheet #21	X	X
JAX873-SB03	JAX873SSB03-06	4-6	See Worksheet #21	X	X
JAX873-SB03	JAX873SSB03-08	6-8	See Worksheet #21	X	X
JAX873-SB04	JAX873SSB04-01	0-0.5	See Worksheet #21	X	X
JAX873-SB04	JAX873SSB04-02	0.5-2	See Worksheet #21	X	X
JAX873-SB04	JAX873SSB04-04	2-4	See Worksheet #21	X	X
JAX873-SB04	JAX873SSB04-06	4-6	See Worksheet #21	X	X
JAX873-SB04	JAX873SSB04-08	6-8	See Worksheet #21	X	X
JAX873-SB05	JAX873SSB05-01	0-0.5	See Worksheet #21	X	X
JAX873-SB05	JAX873SSB05-02	0.5-2	See Worksheet #21	X	X
JAX873-SB05	JAX873SSB05-04	2-4	See Worksheet #21	X	X
JAX873-SB05	JAX873SSB05-06	4-6	See Worksheet #21	X	X
JAX873-SB05	JAX873SSB05-08	6-8	See Worksheet #21	X	X
JAX873-SB06	JAX873SSB06-01	0-0.5	See Worksheet #21	X	X
JAX873-SB06	JAX873SSB06-02	0.5-2	See Worksheet #21	X	X
JAX873-SB06	JAX873SSB06-04	2-4	See Worksheet #21	X	X
JAX873-SB06	JAX873SSB06-06	4-6	See Worksheet #21	X	X
JAX873-SB06	JAX873SSB06-08	6-8	See Worksheet #21	X	X
JAX873-SB07	JAX873SSB07-01	0-0.5	See Worksheet #21	X	X
JAX873-SB07	JAX873SSB07-02	0.5-2	See Worksheet #21	X	X
JAX873-SB07	JAX873SSB07-04	2-4	See Worksheet #21	X	X
JAX873-SB07	JAX873SSB07-06	4-6	See Worksheet #21	X	X
JAX873-SB07	JAX873SSB07-08	6-8	See Worksheet #21	X	X
JAX873-SB08	JAX873SSB08-01	0-0.5	See Worksheet #21	X	X
JAX873-SB08	JAX873SSB08-02	0.5-2	See Worksheet #21	X	X
JAX873-SB08	JAX873SSB08-04	2-4	See Worksheet #21	X	X

Sample Matrix: **Unsaturated Soil**
Location: **UST 26 Kemen Test Cell Building 873**

Sample Location	Sample Identification	Sampling Interval Depth (feet bls)	Sampling Standard Operating Procedures[1]	PAHs [2]	TRPH
JAX873-SB08	JAX873SSB08-06	4-6	See Worksheet #21	X	X
JAX873-SB08	JAX873SSB08-08	6-8	See Worksheet #21	X	X
JAX873-SB09	JAX873SSB09-01	0-0.5	See Worksheet #21	X	X
JAX873-SB09	JAX873SSB09-02	0.5-2	See Worksheet #21	X	X
JAX873-SB09	JAX873SSB09-04	2-4	See Worksheet #21	X	X
JAX873-SB09	JAX873SSB09-06	4-6	See Worksheet #21	X	X
JAX873-SB09	JAX873SSB09-08	6-8	See Worksheet #21	X	X
JAX873-SB10	JAX873SSB10-01	0-0.5	See Worksheet #21	X	X
JAX873-SB10	JAX873SSB10-02	0.5-2	See Worksheet #21	X	X
JAX873-SB10	JAX873SSB10-04	2-4	See Worksheet #21	X	X
JAX873-SB10	JAX873SSB10-06	4-6	See Worksheet #21	X	X
JAX873-SB10	JAX873SSB10-08	6-8	See Worksheet #21	X	X
Field Duplicate	TBD	TBD	See Worksheet #21	3	3
Equipment Blank	TBD	TBD	See Worksheet #21	3	3
MS/MSD	TBD	TBD	See Worksheet #21	3/3	3/3
			Total Number of Samples to the Laboratory (Minus MS/MSD):	56	56

Notes:
[1] Standard operating procedure or worksheet that describes the sample collection procedures.
[2] The select PAH analytical suite is listed in Worksheet #15.

The water table is anticipated between 5.5 and 8 feet bls. Unsaturated soil samples from each borehole will be collected continuously from ground surface to just above the water table.

Actual sampling depths to be determined in the field based on the encountered depth to groundwater.

Each sampling point will be located with reference to latitude, longitude and elevation by a professional land surveyor.

Sampling Depths: 01 = (0-0.5) or 02 = (0.5-2.0) or 04 = (2.0-4.0) or 06 = (4.0-6.0) or 08 = (6.0-8.0)

UST = Underground storage tank
bls = Below land surface
PAH = Polynuclear aromatic hydrocarbons
TRPH = Total recoverable petroleum hydrocarbons
TBD = To be determined in the field
MS/MSD = Matrix spike/matrix spike duplicate

Frequency of quality control sample collection:
Field Duplicate = One per 20 field samples, to be determined in the field. See Worksheet #12.
MS/MSD = One MS and one MSD per 20 field samples (including field quality control samples) to be determined in the field. See Worksheet #12.
Equipment Blank = One per event on non-dedicated equipment. See Worksheet #12.

Sample Matrix: **Groundwater (Temporary Well Points)**
Location: **UST 26 Kemen Test Cell Building 873**

Sample Location	Sample Identification (Well ID – MMYY)	Screen Interval Depth (feet bls) [1]	Sampling Standard Operating Procedures [2]			PAHs [3]		Field Analysis [4]
JAX873-TW01	JAX873GTW01-MMYY	TBD	See Worksheet #21			X		X
JAX873-TW02	JAX873GTW02-MMYY	TBD	See Worksheet #21			X		X
JAX873-TW03	JAX873GTW03-MMYY	TBD	See Worksheet #21			X		X
JAX873-TW04	JAX873GTW04-MMYY	TBD	See Worksheet #21			X		X
JAX873-TW05	JAX873GTW05-MMYY	TBD	See Worksheet #21			X		X
JAX873-TW06	JAX873GTW06-MMYY	TBD	See Worksheet #21			X		X
JAX873-TW07	JAX873GTW07-MMYY	TBD	See Worksheet #21			X		X
JAX873-TW08	JAX873GTW08-MMYY	TBD	See Worksheet #21			X		X
JAX873-TW09	JAX873GTW09-MMYY	TBD	See Worksheet #21			X		X
JAX873-TW010	JAX873GTW010-MMYY	TBD	See Worksheet #21			X		X
Field Duplicate	TBD	TBD	See Worksheet #21			1		NA
MS/MSD	TBD	TBD	See Worksheet #21			1		NA
			Total Number of Samples to the Laboratory (Minus MS/MSD):			11		NA

Notes:
[1] Screen interval depths for proposed Temporary Wells (TW) will be selected based on field conditions. The screen intervals will be determined based the depth to the water table encountered during drilling activities (anticipated 5.5 to 8 feet bls).
[2] Standard operating procedure or worksheet that describes the sample collection procedures.
[3] The select PAHs are listed in Worksheet #15.
[4] Field Analysis: pH, temperature, specific conductance, dissolved oxygen, salinity, oxidation-reduction potential, and turbidity.

MMYY = Month and Year of sample collection, added to sample identification (ID) to create unique identifier
bls = Below land surface
PAH = Polynuclear aromatic hydrocarbons
TBD = To be determined in the field based on the top of the water table
NA = Not applicable
MS/MSD = Matrix spike/matrix spike duplicate

Frequency of quality control sample collection:
Field Duplicate = One per 20 field samples, to be determined in the field. See Worksheet #12.

Newly installed temporary wells will be located with reference to latitude, longitude, and elevation by a professional land surveyor before they are abandoned.

SAP WORKSHEET #19: FIELD SAMPLING 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[1] (preparation/ analysis)
Soil	PAHs	SW-846 8270D modified *EXT-001/GCMSSV-004*	(1) — 4 oz widemouth with Teflon-Lined lid, amber glass	(1) 4 oz	Cool to ≤ 6° Celsius	14 days to extraction, 40 days from extraction to analysis
Soil	TRPH	FDEP FL-PRO *GC-031*	(1) — 4 oz widemouth with Teflon-Lined lid, glass	(1) 4-oz.	Cool to ≤ 6° Celsius	14 days to extraction, 40 days from extraction to analysis
Groundwater	PAHs	SW-846 8270D modified *EXT-003/GCMSSV-004*	(2) 1 Liter amber glass bottles	(2) 1,000 mL	Cool 0-6° Celsius, Protect from light	7 days to extraction, 40 days from extraction to analysis

Notes:
Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

SOP = Standard operating procedures
PAHs = Polynuclear aromatic hydrocarbons
oz = Ounce
TRPH = Total recoverable petroleum hydrocarbons
FL-PRO = Florida Petroleum Residual Organics
mL = Milliliter

SAP WORKSHEET #20: FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Number of Sampling Locations	Number of Samples Per Location	Number of Field Duplicates	Number of Equipment Blanks	Number of Trip Blanks	Number of Matrix Spike/Matrix Spike Duplicate Pairs	Total Number of Samples to Laboratory
Soil	PAHs	10	5	3	3	0	3	59
Soil	TRPH	10	5	3	3	0	3	59
Groundwater	PAHs	10	1	1	0	0	1	12

Notes:
PAH = Polynuclear aromatic hydrocarbons
TRPH = Total recoverable petroleum hydrocarbons

It is anticipated that all soil samples can be collected in one day and that all groundwater samples will be collected in one day a minimum of 24-hrs after completion of well development.

SAP WORKSHEET #21: PROJECT SAMPLING SOP REFERENCE TABLE

(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title/Author	Revision Date or Version Number	Location of SOP	Modified for Project Work? (Yes/No)	Comments
FC 1000	*Cleaning/Decontamination Procedures*/FDEP	Revised 1 March 2014	Appendix A	No	
FD 1000	*Documentation Procedures*/FDEP	Revised 1 March 2014	Appendix A	No	
FM 1000	*Field Planning and Mobilization*/FDEP	Revised 1 March 2014	Appendix A	No	
FQ 1000	*Field Quality Control Requirements*/FDEP	Revised 1 March 2014	Appendix A	No	
FS 1000	*General Sampling Procedures*/FDEP	Revised 1 March 2014	Appendix A	No	
FS 2000	*General Water Sampling*/FDEP	Revised 1 March 2014	Appendix A	No	
FS 2200	*Groundwater Sampling*/FDEP	Revised 1 March 2014	Appendix A	No	
FS 3000	*Soil Sampling/* FDEP	Revised 1 March 2014	Appendix A	No	
FT 1000	*General Field Testing and Measurement*/FDEP	Revised 1 March 2014	Appendix A	No	
FT 1100	*Field Measurement of Hydrogen Ion Activity (pH)*/FDEP	Revised 1 March 2014	Appendix A	No	
FT 1200	*Field Measurement of Specific Conductance (Conductivity)*/FDEP	Revised 1 March 2014	Appendix A	No	
FT 1300	*Field Measurement of Salinity*	Revised 1 March 2014	Appendix A	No	
FT 1400	*Field Measurement of Temperature*/FDEP	Revised 1 March 2014	Appendix A	No	
FT 1500	*Field Measurement of DO*/FDEP	Revised 1 March 2014	Appendix A	No	
FT 1600	*Field Turbidity*/FDEP	Revised 1 March 2014	Appendix A	No	
SOP 3-01	*Utility Clearance*	Revision 0; June2012	Appendix A	No	To be used in conjunction with Florida Statute 556 and coordinated with the NAS Jacksonville Public Works Department

Reference Number	Title/Author	Revision Date or Version Number	Location of SOP	Modified for Project Work? (Yes/No)	Comments
SOP 3-03A	*Record Keeping, Sampling Labeling, and Chain-of-Custody*/ Resolution Consultants	Revision 0; May 2012	Appendix A	No	To be used in conjunction with FDEP SOP FS 1000
SOP 3-04A	*Sample Handling, Storage, and Shipping*/Resolution Consultants	Revision 0; May 2012	Appendix A	No	To be used in conjunction with FDEP SOP FD 1000
SOP 3-05	*Investigation Derived Waste Management*/Resolution Consultants	Revision 0; May 2012	Appendix A	No	To be coordinated with NAS Jacksonville Public Works Department
SOP 3-06	*Equipment Decontamination/*Resolution Consultants	Revision 0; May 2012	Appendix A	No	To be used in conjunction with FDEP SOP FC 1000
SOP 3-07	*Land Surveying/Resolution Consultants*	Revision 0; August 2012	Appendix A	No	
SOP 3-12	*Monitoring Well Installation*/Resolution Consultants	Revision 0; May 2012	Appendix A	No	To be used in conjunction with Chapter 62-532 F.A.C. and SJRWMD Chapter 40C-3
SOP 3-13	*Monitoring Well Development*/Resolution Consultants	Revision 0; June 2012	Appendix A	No	
SOP 3-15	*Monitoring Well Abandonment*/Resolution Consultants	Revision 0; June 2012	Appendix A	No	To be used in conjunction with Chapter 62-532 F.A.C. and SJRWMD Chapter 40C-3
SOP 3-19	*Headspace Screening for Total VOCs*	Revision 0; May 2012	Appendix A	No	To be used in conjunction with the Instrument Calibration Manual
SOP 3-24	*Water Quality Parameter Testing for Groundwater Sampling*	Revision 0; May 2012	Appendix A	No	To be used with applicable FDEP SOPs

Notes:

SOP = Standard operating procedure
FDEP = Florida Department of Environmental Protection
DO = Dissolved oxygen
NAS = Naval Air Station
F.A.C. = Florida Administrative Code
SJRWMD = St. Johns River Water Management District
VOCs = Volatile Organic Compounds

SAP WORKSHEET #22: FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Activity [1]	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
OVA with FID	Calibration	Daily Beginning of each day	Within ±0.5 ppm or ± 10% of actual methane concentration (0.5 to 2000 ppm range)	Operator correction or replacement	Resolution Consultants FTL	Resolution Consultants SOP 3-19 and the Instrument Calibration Manual	None
Electronic Oil/Water Interphase Probe	Visual Inspection Field checks as per manufacturer	Daily Once upon receiving from vendor or company stock	100th of a foot per 100 feet	Operator correction or replacement	Resolution Consultants FTL	FS 2200 and the Instrument Calibration Manual	None
YSI 556 Series (or similar) Multi-Parameter Water Quality Meter	Visual Inspection Calibration/Verification	Daily Beginning of each day	pH ± 0.2 standard units Specific Conductance ± 5% Dissolved oxygen ± 0.03 mg/L Temperature ±0.2 degree Celsius Oxygen reduction potential ± 10 mV Salinity ± 0.1 ppt	Operator correction or replacement	Resolution Consultants FTL	FT 1100 FT 1200 FT 1300 FT 1400 FT 1500 and the Instrument Calibration Manuals	None
LaMotte Model 2020e (or similar) Turbidity Meter	Visual Inspection Calibration/Verification	Daily Beginning of each day	The acceptance criterion for the initial calibration verification depends on the range of turbidity of the standard value: 0.1-10 NTU: within 10% of the standard 11-40 NTU: within 8% of the standard 41-100 NTU: within 6.5% of the standard >100 NTU: within 5% of the standard	Operator correction or replacement	Resolution Consultants FTL	FT 1600 and the Instrument Calibration Manual	None

Notes:
[1] Activities may include: calibration, verification, testing, maintenance, and /or inspection.

OVA = Organic Vapor Analyzer
FID = Flame Ionization Detector
ppm = parts per million
FTL = Field Team Leader
SOP = Standard operating procedure
mg/L = milligrams per liter
mV = millivolts
ppt = part per thousand
NTU = Nephelometric Turbidity Units

SAP WORKSHEET #23: ANALYTICAL SOP REFERENCE TABLE

(UFP-QAPP Manual Section 3.2.1)

Laboratory Name and Address: Gulf Coast Analytical Laboratories LLC, 7979 Innovation Park Drive, Baton Rouge, Louisiana 70820
Laboratory Point of Contact/Project Manager: Anna Kinchen, 225-214-7052

Laboratory SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group and Matrix	Instrument	Variance to Quality Systems Manual	Modified for Project Work? (Yes/No)
GCMSSV-004	*Analysis of Semi-Volatile Organic Compounds (SVOCs) by GC/MS, EPA 8270D,* Revision 11, 14 April 2015	Definitive	Low level PAHs; Soil and Groundwater	Gas Chromatograph/ Mass Spectrometer	None	No
GC-031	*Determination of Petroleum Range Organics (PRO) — FL-PRO,* Revision 10, 03 July 2014	Definitive	TRPH; Soil	Gas Chromatograph/ Flame Ionization Detector	None	No

Notes:
[1] Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (DoD 2013).
SOP = Standard operating procedure
SVOCs = Semi-volatile organic compounds
GC/MS = Gas Chromatograph/Mass Spectrometer
EPA = Environmental Protection Agency
PAHs = Polynuclear aromatic hydrocarbons
FL-PRO = Florida Petroleum Range Organics
TRPH = Total Recoverable Petroleum Hydrocarbons

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 Low level PAHs	Tuning	Prior to ICAL and at the beginning of each 12-hour period.	Refer to method for specific ion criteria.	Retune instrument and verify.	Analyst, Supervisor	GCMSSV-004
GC/MS Low level PAHs	ICAL Minimum five-point ICAL for all analytes (six-points for quadratic)	ICAL prior to sample analysis	Each analyte must meet one of the following: Option 1: %RSD for each analyte ≤ 15%. Option 2: linear least squares regression for each analyte: $r^2 \geq 0.99$. Option 3: non-linear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$.	Repeat calibration if criterion is not met.	Analyst, Supervisor	GCMSSV-004
GC/MS Low level PAHs	Second source ICV	Once after each ICAL	All analytes within ± 20% of expected value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Analyst, Supervisor	GCMSSV-004
GC/MS Low level PAHs	CCV	CV daily, before sample analysis, and every 12 hours of analysis time.	All reported analytes and surrogates within ±20% of true value. All reported analytes and surrogates within ±50% for end of analytical batch CCV.	Repeat ICAL and reanalyze all samples analyzed since the last successful CCV.	Analyst, Supervisor	GCMSSV-004
GC/MS Low level PAHs	Breakdown (DDT)	At the beginning of each 12 hour period, prior to analysis of samples	Degradation ≤20% for DDT, Benzidine and pentachlorophenol should be present at their normal responses, and should not exceed a tailing factor of 2.	Correct problem, then repeat performance checks.	Analyst, Supervisor	GCMSSV-004
GC/MS Low level PAHs	RRT Evaluation	Prior to sample analysis	RRT of each target analyte within ± 0.06 RRT units of the RRT standard.	Correct problem, then rerun ICAL.	Analyst, Supervisor	GCMSSV-004
GC/FID TRPH	ICAL Minimum five-point ICAL for all analytes (six-points for quadratic)	ICAL prior to sample analysis	%RSD for each analyte ≤20%	Correct problem, then repeat ICAL.	Analyst, Supervisor	GC-031
GC/FID TRPH	Second source ICV	Once after each ICAL	All analytes within ±20% of expected value.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Analyst, Supervisor	GC-031
GC/FID TRPH	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	Analyst, Supervisor	GC-031

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
				concentrations to ensure that there is no carryover.		
GC/FID TRPH	CCV	CCV after every 10 samples and at the end of the analytical sequence	%D or Drift < 25% for all analytes.	If CCV fails, repeat injection of standard. If CCV fails again, correct problem. If criteria cannot be met, rerun ICAL.	Analyst, Supervisor	GC-031

Notes:

SOP	=	Standard operating procedure
GC/MS	=	Gas chromatograph/mass spectrometer
PAH	=	Polynuclear aromatic hydrocarbons
ICAL	=	Initial calibration
%RSD	=	Relative standard deviation
r^2	=	Least squares regression coefficient/coefficient of determination
ICV	=	Initial calibration verification
CCV	=	Continuing calibration verification
CV	=	Calibration verification
DDT	=	4,4'-dichlorodiphenyltrichloroethane
RRT	=	Relative retention times
GC/FID	=	Gas chromatograph/Flame Ionization Detector
LOQ	=	Limit of quantitation
TRPH	=	Total recoverable petroleum hydrocarbons
%D	=	Percent difference

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	SOP Reference
GC/MS	Clean source, replace vacuum pump oil, replace filament, replace inlet liner, replace septa, and bake out instrument.	PAHs	Inspect vacuum pressure	Clean source and replace vacuum pump oil annually or as needed. Routine maintenance as necessary. Tune instrument after major maintenance. Inspect vacuum pressure daily.	Bromofluorobenzene and decafluorotriphenylphosphine tunes must meet the criteria listed in the method. Per instrument manufacturer's instructions.	Inspect system and correct problem; Re-tune instrument if necessary. Perform new ICAL	Analyst, Department Manager	GCMSV-003 and GCMSSV-004
GC/FID	Replace septa, replace inlet liner, clip column, clean or replace FID jet, bake out detector, recondition column.	TRPH	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. Clean or replace FID jet. Bake out detector and columns if signal elevated.	Per instrument manufacturer's instructions.	Inspect system; correct problem; perform new ICAL and affected samples	Analyst, Department Manager	GC-031

Notes:

SOP = Standard operating procedure
GC/MS = Gas chromatograph/mass spectrometer
PAHs = Polynuclear aromatic hydrocarbons
ICAL = Initial calibration
GC/FID = Gas chromatography/flame ionization detector
TRPH = Total recoverable petroleum hydrocarbon

SAP WORKSHEET #26: SAMPLE HANDLING SYSTEM

(UFP-QAPP Manual Appendix A)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT	
Sample Collection (Personnel/Organization):	Field Team Leader/Resolution Consultants
Sample Packaging (Personnel/Organization):	Field Team Leader/Resolution Consultants
Coordination of Shipment (Personnel/Organization):	Field Team Leader/Resolution Consultants
Type of Shipment/Carrier:	Overnight via Federal Express
SAMPLE RECEIPT AND ANALYSIS	
Sample Receipt (Personnel/Organization):	Sample Receiving Group/Gulf Coast Analytical Laboratories, LLC
Sample Custody and Storage (Personnel/Organization):	Sample Receiving Group/Gulf Coast Analytical Laboratories, LLC
Sample Preparation (Personnel/Organization):	Organic Preparation Personnel/Gulf Coast Analytical Laboratories, LLC
Sample Determinative Analysis (Personnel/Organization):	Organic Preparation Personnel/Gulf Coast Analytical Laboratories, LLC
SAMPLE ARCHIVING	
Field Sample Storage (No. of days from sample collection):	180 Days from Receipt of Samples
Sample Extract/Digestate Storage (No. of days from extraction/digestion):	180 Days from Receipt of Samples
SAMPLE DISPOSAL	
Personnel/Organization:	Waste Compliance Manager/Gulf Coast Analytical Laboratories, LLC
Number of Days from Analysis:	180 Days from Receipt of Samples

SAP WORKSHEET #27: SAMPLE CUSTODY REQUIREMENTS

(UFP-QAPP Manual Section 3.3.3)

The following sections outline the procedures that will be used to document project activities and sample collection, handling, tracking, and custody procedures during the investigation. All forms must be filled in as completely as possible.

Sample Nomenclature

Sample labeling will be conducted in general accordance with the procedures outlined in Resolution Consultants SOP 3-03A. The sample nomenclature for soil includes the site name (JAX873), followed by the matrix identifier "S" for soil, then the sample name (SB03), and depth of collection (i.e., JAX873SSB03-02). The 02 corresponds to sample collection depth of 0.5 to 2 feet bls. Worksheet #18 shows the proposed sample names and collection depths for each sample. The sample nomenclature for groundwater is similar but includes a "G" as the matrix identifier, followed by the temporary well name (TW02), and the month and year the well was sampled (i.e., JAX873GTW02-MMYY).

Sample type codes planned for this event will include D for field duplicates, and EB for equipment blanks. Field duplicates will be labeled similar to parent samples followed by a "D." For example, a groundwater duplicate of JAX873GTW03-MMYY would be indicated using JAX873GTW03-MMYYD. Equipment blanks and trip blanks will be labeled sequentially followed by the date (i.e., EBMMYY and TBMMYY). Samples to be used for MS/MSD will be labeled MS/MSD on the container label and noted on the chain-of-custody; however, "MS/MSD" will not be part of the unique sample identifier in order to maintain consistency with the project database.

Sample Collection Documentation

Documentation of field observations will be recorded in a field logbook and/or field log sheets including sample collection logs, boring logs, and monitoring well construction logs. Field logbooks utilized on this project will consist of a bound, water-resistant logbook. All pages of the logbook will be numbered sequentially and observations will be recorded with indelible ink.

Field sample log sheets will be used to document sample collection details and other observations and activities will be recorded in the field logbook. Instrument calibration logs will be used to record the daily instrument calibration.

For sampling and field activities, the following types of information will be recorded in the field logbook as appropriate:

- Site name and location
- Date and time of logbook entries
- Personnel and their affiliations
- Weather conditions
- Activities involved with the sampling
- Subcontractor activity summary
- Site observations including site entry and exit times
- Site sketches made onsite
- Visitor names, affiliations, arrival and departure times
- Health and safety issues, including personal protective equipment

Sample Handling and Tracking System

Following collection, all samples will be immediately placed on ice in a cooler. The glass sample containers will be enclosed in bubble-wrap for protection during shipment. The cooler will be secured using strapping tape along with a signed custody seal. Sample coolers will be delivered to a local courier location for priority overnight delivery to the selected laboratory for analysis. Samples will be preserved as appropriate based on the analytical method. The laboratories will provide pre-preserved sample containers for sample collection. Samples will be maintained at 2 to 6 degrees Celsius until delivery to the laboratory. Proper custody procedures will be followed throughout all phases of sample collection and handling.

After collection, each sample will be maintained in the sampler's custody until formally transferred to another party (e.g., FedEx). For all samples collected, chain-of-custody forms will document the date and time of sample collection, the sampler's name, and the names of all others who subsequently held custody of the sample. Specifications for chemical analyses will also be documented on the chain-of-custody form. Resolution Consultants SOP 3-03A provides further details on the chain-of-custody procedure.

These subsections outline the procedures that will be used by field and laboratory personnel to document project activities and sample collection procedures. All forms must be filled in as completely as possible.

Resolution Consultants personnel will collect the samples. The samplers will take care not to contaminate samples through improper handling. Samples will be sealed in appropriate containers, packaged by Resolution Consultants' personnel and placed into sealed coolers under chain-of-custody in accordance with the applicable SOP. All coolers will contain a temperature blank. Samples will be transferred under chain-of-custody to a courier as described below. Once received by the laboratory, receipt will be documented on the chain-of-custody form and the samples will be checked in. The samples will remain under chain-of-custody throughout the analysis period to ensure their integrity is preserved. Details are provided below.

Samples to be delivered to the laboratory(s) will be made by a public courier (e.g., FedEx). After samples have been collected, they will be sent to the laboratory(s) within 24 hours.

Field Sample Custody Procedures

Chain-of-custody protocols will be used throughout sample handling to establish the evidentiary integrity of sample containers. These protocols will be used to demonstrate that the samples were handled and transferred in a manner that would eliminate possible tampering. Samples for the laboratory will be packaged and shipped in accordance with Resolution Consultants SOP-3-04A.

A sample is under custody if:

- The sample is in the physical possession of an authorized person.
- The sample is in view of an authorized person after being in his/her possession.
- The sample is placed in a secure area by an authorized person after being in his/her possession.
- The sample is in a secure area, restricted to authorized personnel only.

Custody documentation is designed to provide documentation of preparation, handling, storage, and shipping of all samples collected. A multi-part 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 form each time a sample transfer occurs.

Integrity of the samples collected 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.

The Resolution Consultants FTL 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 record documents the sample custody transfer from the sampler to the laboratory, often through another person or agency (common carrier). Upon arrival at the laboratory, internal sample custody procedures will be followed as defined in the Laboratory SOPs.

Laboratory Chain of Custody

Laboratory sample custody procedures (receipt of samples, archiving, and disposal) will be used according to Gulf Coast Analytical Laboratory SOPs. Coolers are 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 form will be checked against the sample containers for accuracy. Samples will be logged into the laboratory information management system and given a unique log number which can be tracked through processing. The laboratory project manager will notify the Resolution Consultants FTL verbally or via e-mail immediately if any problems are identified. Discrepancies and resolutions will be documented on the sample receiving checklist.

SAP WORKSHEET #28: LABORATORY QC SAMPLES TABLE

(UFP-QAPP Manual Section 3.4)

Matrix:	Soil/Groundwater
Analytical Group:	Semi-volatile Organic Compounds (PAHs via SIM)
Analytical Method/SOP Reference:	SW-846 8270D/8270D SIM/GCAL SOP GCMSSV-004

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicators	Measurement Performance Criteria
Method Blank	One per batch of 20 or fewer samples per matrix	No analytes detected >½ LOQ and >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Common laboratory contaminants must not be detected >LOQ.	Correct problem; if required reprepare and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Analyst, Supervisor, QA Manager	Bias Contamination	See Method/SOP QC Acceptance Limit Column.
Surrogates	All field and QC samples	QC acceptance criteria specified in DoD QSM Version 5.0.[1]	Correct the problem, then reprepare and reanalyze all failed samples in the associated batch for failed analytes, if sufficient sample material is available. If obvious chromatographic interference with the surrogate is present, reanalysis may not be necessary. If acceptance criteria cannot be met, data must be qualified and explained in the case narrative.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Method/SOP QC Acceptance Limit Column.
LCS	One LCS per batch of 20 or fewer samples per matrix	QC acceptance criteria specified in DoD QSM Version 5.0.[1]	Correct the problem. If the LCS recoveries are high but the sample results are <LOQ narrate. If not, then reprepare and reanalyze the LCS and all samples in the associated batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Method/SOP QC Acceptance Limit Column.
Internal Standards	In all field samples and standards	Retention time ±10 seconds from retention time of the midpoint standard in the initial calibration; extracted ion current profile area within -50% to +100% of initial calibration midpoint standard.	Inspect instrument for malfunctions and correct problem. Reanalysis of samples analyzed while system was malfunctioning is mandatory. If corrective action fails in field samples, data must be qualified and explained in the case narrative.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Method/SOP QC Acceptance Limit Column.

Matrix:	Soil/Groundwater
Analytical Group:	Semi-volatile Organic Compounds (PAHs via SIM)
Analytical Method/SOP Reference:	SW-846 8270D/8270D SIM/GCAL SOP GCMSSV-004

QC Sample:	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicators	Measurement Performance Criteria
MS	One per batch of 20 or fewer samples per matrix	QC acceptance criteria specified in DoD QSM Version 5.0.[1]	Contact the client to determine if additional measures are required. If acceptance criteria cannot be met, data must be qualified and explained in the case narrative.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Method/SOP QC Acceptance Limit Column.
MS/MSD	One per batch of 20 or fewer samples per matrix	For matrix evaluation, use LCS recovery criteria; RPD $\leq$20%.	Contact the client to determine if additional measures are required. If acceptance criteria cannot be met, data must be qualified and explained in the case narrative.	Analyst, Supervisor, QA Manager	Accuracy Bias Precision	See Method/SOP QC Acceptance Limit Column.

Notes:
[1] Department of Defense Quality Systems Manual Version 5.0 (DoD 2013).

PAHs = Polynuclear aromatic hydrocarbons
SIM = Selective ion monitoring
GCAL = Gulf Coast Analytical Laboratories
SOP = Standard operating procedure
QC = Quality control
LOQ = Limit of quantitation
QA = Quality assurance
DoD QSM = Department of Defense Quality Systems Manual
LCS = Laboratory control sample
MS/MSD = Matrix spike/matrix spike duplicate
RPD = Relative percent difference

Matrix:	Soil
Analytical Group:	Total Recoverable Petroleum Hydrocarbons
Analytical Method/ SOP Reference:	FDEP FL-PRO/GCAL SOP GC-031

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicators	Measurement Performance Criteria
Method Blank	One per batch of 20 or fewer samples per matrix	No analytes detected >½ LOQ and either >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct problem; Re-prepare and/or reanalyze any sample associated with a blank that fails criteria. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Analyst, Supervisor, QA Manager	Bias Contamination	See Method/SOP QC Acceptance Limit Column.
Surrogates	All field and QC samples	**Surrogate** — **Soil %R** o-Terphenyl — 51-133 Nonatriacontane — 38-114	Correct problem; Re-prepare and/or reanalyze if sufficient sample is available, if sufficient sample material is available. If obvious chromatographic interference with the surrogate is present, reanalysis may not be necessary. If reanalysis confirms failing recoveries, report and narrate. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Method/SOP QC Acceptance Limit Column.
LCS	One per batch of 20 or fewer samples per matrix	Soil %R — 63-153%; RPD — ≤25	Correct problem. If the LCS recoveries are high but the sample results are <LOQ narrate. If not, then reprepare and/or reanalyze all associated samples, if sufficient sample material is available. If reanalysis cannot be performed or analysis is performed outside of holding times, data must be qualified and explained in the case narrative.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Method/SOP QC Acceptance Limit Column.
MS	One per batch of 20 or fewer samples per matrix	Soil %R — 63-153%; RPD — ≤25	If MS recovery is outside of control limits and LCS is within control limits, matrix interference is indicated. Report with case narrative.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Method/SOP QC Acceptance Limit Column.
LCS/LCSD	One per batch of 20 or fewer samples per matrix	For matrix evaluation, use LCS recovery criteria.	If RPD is outside control limits, assess source of precision error. If lab error is suspected, repeat analysis. If matrix issue is indicated, explain in the case narrative.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Method/SOP QC Acceptance Limit Column.
MS/MSD	One per batch of 20 or fewer samples per matrix	For matrix evaluation, use LCS recovery criteria.	If RPD is outside control limits, assess source of precision error. If lab error is suspected, repeat analysis. If matrix issue is indicated, explain in the case narrative.	Analyst, Supervisor, QA Manager	Accuracy Bias Precision	See Method/SOP QC Acceptance Limit Column.

Notes:

SOP	=	Standard operating procedure
FDEP	=	Florida Department of Environmental Protection
FL-PRO	=	Florida Petroleum Residual Organics
GCAL	=	Gulf Coast Analytical Laboratories
LOQ	=	Limit of quantitation
QA	=	Quality assurance
QC	=	Quality control
%R	=	Percent recovery
RPD	=	Relative percent difference
LCS/LCSD	=	Laboratory control sample/laboratory control sample duplicate
MS/MSD	=	Matrix spike/matrix spike duplicate

SAP WORKSHEET #29: PROJECT DOCUMENTS AND RECORDS TABLE

(UFP-QAPP Manual Section 3.5.1)

Document	Where Maintained
Sample Collection Documents and Records Project personnel sign-off record Field logbook (and sampling notes) Field sample forms (e.g., sample log sheets, drilling logs, etc.) Chain-of-custody records Sample shipment air bills Equipment calibration logs Photographs Sampling and Analysis Plans including field sampling standard operating procedures Safe work permit forms	Sample collection documents and records (may include printed copy as well as electronic information) will be maintained at the Resolution Consultants office 7775 Baymeadows Way, Suite 104, Jacksonville, Florida 32256. These files will be retained for 50 years after the last decision document is signed for Naval Air Station (NAS) Jacksonville.
Analytical Results Documents and Records Sample receipt/log-in forms FRC Sample preparation logs Equipment calibration logs Sample analysis run logs Reported field sample results Reported results for standards, quality control checks Reported results for standards, quality control samples Data completeness checklists Data validation memoranda	Analytical results, documents and records will be provided by the laboratory in printed and electronic formats. Although available in the Administrative Record file, laboratory reports are typically filed at a separate location and are available upon request. Printed copies of laboratory data will be stored at a third-party secure professional document storage firm until transfer to the Federal Records Center (FRC). The records will be transferred to FRC 3 years after completion of a response action. These files will be retained for 50 years after the last decision document is signed for NAS Jacksonville. Electronic analytical results will also be verified, entered, and maintained in a database on a password protected Structured Query Language server. Data qualifiers will be added to the database during data validation. After validation, the validated data files will be transferred to the Navy's Naval Installation Restoration Information Solution (NIRIS) data management system.
Other Documents Personnel training records Health and Safety certifications Health and Safety Plan Field Sampling Audit Checklist Letter reports, technical memos, etc. Analytical Audit Checklist	Personnel training records and health and safety certificates will be stored in personnel records and electronically in the Resolution Consultants' training database in the project file at 5724 Summer Trees Drive, Memphis, Tennessee 38134. Plans and reports will be stored in printed version and electronically in the Administrative Record file. Printed copies will be stored at a third-party secure professional document storage firm until transfer to the FRC. The records will be transferred to FRC 3 years after completion of a response action. These files will be retained for 50 years after the last decision document is signed for NAS Jacksonville. Field Audit Checklists are not considered part of the Administrative Record file and will be stored in the Resolution Consultants project file at 7775 Baymeadows Way, Suite 104, Jacksonville, Florida 32256, and electronically in the server library. Analytical Audit Checklists will be retained by the respective accreditation authorities.
Final Document/Records Repository Administrative Record files Site files Post decision files Analytical data Spatial data Maps	All final documents/Records repositories will be stored in accordance with in the Naval Facilities Engineering Command Environmental Restoration Recordkeeping Manual. Printed copies will be stored at a third-party secure professional document storage firm until transfer to the FRC, and electronic copies will be maintained, verified, and stored on the Navy's NIRIS data management system. The records will be transferred to FRC 3 years after completion of a response action. These files will be retained for 50 years after the last decision document is signed for NAS Jacksonville.

Notes:

NAS	=	Naval Air Station
FRC	=	Federal Records Center
NIRIS	=	Naval Installation Restoration Information Solution

SAP WORKSHEET #30: ANALYTICAL SERVICES TABLE

(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Locations/ ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization[1] (name and address, contact person and telephone number)	Backup Laboratory/Organization (name and address, contact person and telephone number)
Soil/Groundwater	Low Level PAHs via SIM	See Worksheet #18	GCAL SOP GCMSSV-004	21 Days	Gulf Coast Analytical Laboratories 7979 Innovation Park Road Baton Rouge, Louisiana 70820 Contact: Anna Kinchen	None
Soil	TRPH	See Worksheet #18	GCAL SOP GC-031	21 Days	Gulf Coast Analytical Laboratories 7979 Innovation Park Road Baton Rouge, Louisiana 70820 Contact: Anna Kinchen	None

Notes:
[1] Laboratory meets accreditation requirements to support project needs.
SOP = Standard operating procedure
PAHs = Polynuclear aromatic hydrocarbons
SIM = Selective ion monitoring
GCAL = Gulf Coast Analytical Laboratories, LLC
TRPH = Total recoverable petroleum hydrocarbons

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 CA (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Onsite Laboratory Systems Audit	Every 18 months	External	DoD ELAP	DoD ELAP Auditor	Anna Kinchen (QAO, Gulf Coast Analytical Laboratories, LLC)	Anna Kinchen (QAO, Gulf Coast Analytical Laboratories, LLC)	Anna Kinchen (QAO, Gulf Coast Analytical Laboratories, LLC)
Onsite Field Sampling Systems Audit	Randomly selected program-wide[1]	Internal	Resolution Consultants	Tina Cantwell, QAO (or designee), Resolution Consultants	Anthony Wagner (TOM, Resolution Consultants)	Tina Cantwell, (QAO, Resolution Consultants) and Anthony Wagner (TOM, Resolution Consultants)	
Work Product Peer Review	Draft, Draft Final and Final Documents	Internal	Resolution Consultants	Technical Experts and Technical Editors	Report Authors	Anthony Wagner (TOM, Resolution Consultants)	Anthony Wagner (TOM, Resolution Consultants)

Notes:

[1] Field Audits are randomly selected at the Resolution Consultants program level and may or may not include this project.

CA = Corrective action
DoD ELAP = Department of Defense Environmental Laboratory Accreditation Program
QAO = Quality assurance officer
TOM = Task order manager

SAP WORKSHEET #32: ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES TABLE

(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
Laboratory Systems Audit	Verbal debriefing, Written audit report	QAO Anna Kinchen Laboratory Manager	Not specified by DoD ELAP	Corrective action plan, Letter	DoD ELAP Accrediting Bodies	Specified by DoD ELAP Accrediting Bodies
Field Sampling Systems Audit[1]	Audit checklist and written audit finding summary	TOM, Resolution Consultants; FTL, Resolution Consultants	Dependent on findings; if major, a stop work may be issued immediately; however, if minor, within 1 week of audit	Written memo	Tina Cantwell, QAO, Resolution Consultants	Within 21 days of notification
Field Supervision	Site log book and sample collection logs	TOM, Resolution Consultants; FTL, Resolution Consultants	Immediately, when discovered	Entry in site logbook, potential retraining	TOM, Resolution Consultants; FTL, Resolution Consultants	Within 24 hours

Notes:
[1] Field Audits are randomly selected at the Resolution Consultants program level and may or may not include this project.
Assessment findings will be communicated with appropriate staff during verbal audit debriefings and in the written audit report and will be documented on audit checklists and audit reports.

QAO = Quality assurance officer
DoD ELAP = Department of Defense Environmental Laboratory Accreditation Program
TOM = Task order manager
FTL = Field team leader

SAP WORKSHEET #33: QUALITY ASSURANCE 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)
Data Validation	Report per data package	Within 4 weeks of receipt of laboratory data	Resolution Consultants Project Chemist or designee	TOM, project file, Resolution Consultants
Progress Report	Monthly for duration of the project	Monthly	TOM, Resolution Consultants	Navy RPM, program manager, project file, Resolution Consultants
Laboratory Quality Assurance Report	When significant plan deviations result from unanticipated circumstances	Immediately upon detection of problem (within 1 day)	Laboratory quality assurance manager or project manager	TOM, Project Chemist, project file, Resolution Consultants

Notes:
TOM = Task order manager
RPM = Remedial project manager

SAP WORKSHEETS #34-36: DATA VERIFICATION AND VALIDATION (STEPS I AND IIA/IIB) PROCESS TABLE

(UFP-QAPP Manual Section 5.2.1), (UFP-QAPP Manual Section 5.2.2), (Figure 37 UFP-QAPP Manual), (Table 9 UFP-QAPP Manual)

Data Review Input	Description	Responsible for Verification (name, organization)	Step I/ IIa/IIb[1]	Internal/ External[2]
Verification Chain-of-custody forms Sample Login/Receipt	Review the sample shipment for completeness, integrity, and sign accepting the shipment. All sample labels will be checked against the chain-of-custody form, and any discrepancies will be identified, investigated, and corrected. The samples will be logged in at every storage area and work station required by the designated analyses. Individual analysts will verify the completeness and accuracy of the data recorded on the forms. Verification of sample login/receipt and chain-of-custody forms will be documented on the laboratory sample receipt form.	Laboratory sample custodians and analysts	I	Internal
Verification Chain-of-custody forms	Check that the chain-of-custody form was signed/dated by the sampler relinquishing the samples and by the laboratory sample custodian receiving the samples for analyses. Verification of chain-of-custody forms will be documented in the DVA workbook.	Project Chemist or Data Validators, Resolution Consultants	I	External
Verification SAP sample tables	Verify that all proposed samples listed in the SAP tables have been collected. Sample completeness will be documented in the data validation report.	FTL or designee, Resolution Consultants	I	Internal
Verification Sample log sheets and field notes	Verify that information recorded in the log sheets and field notes are accurate and complete. Sample log sheet verification will be documented by dated signature on the last page or page immediately following the review material.	FTL or designee, Resolution Consultants	I	Internal
Verification Field QC samples	Check that field QC samples, described in Worksheet #12 and listed in Worksheet #20, were collected as required. QC sample completeness will be documented in the data validation report.	FTL or designee, Resolution Consultants	I	Internal
Verification Analytical data package	Verify all analytical data packages will be verified internally for completeness by the laboratory performing the work. The laboratory project manager (or designee) will sign the case narrative for each data package. All laboratory data package reviews will be documented in the laboratory narratives.	Laboratory Project Manager	I	Internal
Verification Analytical data package	Verify the data package for completeness. Missing information will be requested from the laboratory and validation (if performed) will be suspended until missing data are received. Data package completeness will be documented in the DVA workbook.	FTL, Project Chemist, or Data Validators, Resolution Consultants	I	External
Verification Electronic data deliverables	Verify the electronic data against the chain-of-custody and hard copy data package for accuracy and completeness before loading into project database. Electronic data deliverable verification will be documented in the DVA workbook.	Data Manager and/or Validator, Resolution Consultants	I	External
Validation Chain-of-custody	Examine the traceability of the data from time of sample collection until reporting of data. Ensure that the custody and integrity of the samples were maintained from collection to analysis and the custody records are complete and any deviations are recorded. Chain-of-custody verification will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa	External

Data Review Input	Description	Responsible for Verification (name, organization)	Step I/ IIa/IIb[1]	Internal/ External[2]
Validation Holding Times	Review that the samples were shipped and stored 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. If holding times were not met, confirm that deviations were documented. Holding time examination will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa	External
Validation 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. Representativeness will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External
Validation Laboratory data results for accuracy	Ensure that the laboratory QC samples were analyzed and that the measurement performance criteria, listed in Worksheet #28, were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed, as listed in Worksheet #12, and that the analytical QC criteria were met. Accuracy will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External
Validation Field and laboratory duplicate analyses for precision	Check the field sampling precision by calculating the RPD for field duplicate samples. Check the laboratory precision by reviewing the RPD or percent difference values from laboratory duplicate analyses; MS/MSDs; and LCS/LCSD duplicates. Ensure compliance with the precision goals listed in Worksheets #12 and #28. Precision will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External
Validation Project action limits	Assess and document 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 undetected. Project action limit achievement will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External
Validation Data quality assessment report	Summarize deviations from methods, procedures, or contracts. Qualify data results based on method or QC deviation and explain all the data qualifications. Present tabular qualified data and data qualifier codes and summarize data qualification outliers. Determine if the data met the measurement performance criteria and determine the impact of any deviations on the technical usability of the data. Result qualification will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External
Validation SAP QC sample documentation	Ensure that all QC samples specified in the SAP were collected and analyzed and that the associated results were within acceptance limits. QC sample documentation will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External
Validation Analytical data deviations	Determine the impact of any deviation from sampling or analytical methods, and laboratory SOP requirements and matrix interferences effect on the analytical results. Data deviations will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIb	External
Validation PQLs for sensitivity	Ensure that the project detection limits were achieved. PQL achievement will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIb	External

<table>
<tr><th>Data Review Input</th><th>Description</th><th>Responsible for Verification (name, organization)</th><th>Step I/ IIa/IIb[1]</th><th>Internal/ External[2]</th></tr>
<tr><td>Validation
Soil –PAHs, and TRPH
Groundwater - PAHs</td><td>Assess data against MPC identified in Worksheets #12, #19, #24, and #28. U.S. EPA National Functional Guidelines for Superfund Organic Methods Data Review, (August 2014) and U.S. EPA National Functional Guidelines for Inorganic Superfund Data Review, (August 2014) will be used as a guidance on applying qualifiers when MPC identified in Worksheets #12, #19, #24, and #28 are not met, including identifying when samples will be qualified estimated or rejected and when individual or all samples in a batch will be qualified.

Data validation will be performed as described in Worksheet #14 and checklists will not be used because it will be performed using a combination of electronic automated data review and data package review. All findings will be documented on the DVA workbook.</td><td>Project chemist or data validators, Resolution Consultants</td><td>IIa/IIb</td><td>External</td></tr>
<tr><td>Validation
Data qualifiers</td><td>Qualifiers that will be applied during the data validation process are summarized below and, as indicated, results will be considered usable for interpretation. Use of rejected data will be decided by the project team.
<table>
<tr><th>Data Qualifier</th><th>Qualifier Definition</th><th>Interpret Result As a Detection?</th><th>Result Usable?</th><th>Potential Result Bias</th></tr>
<tr><td>no qualifier</td><td>Acceptable</td><td>Yes</td><td>Yes</td><td>None expected</td></tr>
<tr><td>J</td><td>Estimated</td><td>Yes</td><td>Yes</td><td>High or Low</td></tr>
<tr><td>U</td><td>Undetected</td><td>No</td><td>Yes</td><td>None expected</td></tr>
<tr><td>UJ</td><td>Undetected and Estimated</td><td>No</td><td>Yes</td><td>High or Low</td></tr>
<tr><td>UR</td><td>Undetected and Rejected</td><td>No</td><td>No</td><td>Unspecified</td></tr>
<tr><td>R</td><td>Rejected</td><td>No</td><td>No</td><td>Unspecified</td></tr>
</table></td><td>Project chemist or data validators, Resolution Consultants</td><td>IIa/IIb</td><td>External</td></tr>
</table>

Notes:

[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]

[2] Internal or external in relation to the data generator.

DVA = Data Validation Assistant
SAP = Sampling and analysis plan
FTL = Field team leader
QC = Quality control
PQL = Project quantitation limits
SOP = Standard operating procedure
PAHs = Polynuclear aromatic compounds
TRPH = Total recoverable petroleum hydrocarbons
MPC = Measurement performance criteria
U.S. EPA = U.S. Environmental Protection Agency
LCS/LCSD = Laboratory control sample/laboratory control sample
MS/MSD = Matrix spike/matrix spike duplicate
RPD = Relative percent difference

SAP WORKSHEET #37: USABILITY ASSESSMENT

(UFP-QAPP Manual Section 5.2.3)

Data Review

The usability of the data directly affects whether project objectives can be achieved and 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: Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under correct normal conditions. It is expected that 100 percent of the planned sampling points will be collected. The completeness goal for field measurements will be greater than 90 percent. Laboratory analysis for this project will have a completeness goal greater than 95 percent to account for unanticipated results that may be rejected during data validation. Completeness can be calculated using the following equation.

$$\%Completeness = \frac{No.\ of\ Valid\ Tests}{Total\ Tests\ Taken} x100$$

  The FTL, acting on behalf of the Project Team, will determine whether deviations from the scheduled sample collection or analyses occurred. If they have occurred and the Resolution Consultants TOM determines that the deviations compromise the ability to meet project objectives they will consult with the Navy RPM and other project team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions.

- Precision: Precision measures the reproducibility of measurements and methods, and is defined for qualitative data as a group of values' variability compared with its average value. To assess the precision of the measurement systems used in this project, field duplicates will be obtained and analyzed with the samples collected. Precision of laboratory analysis will be assessed by comparing the RPD of analytical results between MS and MSDs (or sample duplicates) and the measurement quality objectives will be those cited in Worksheets #12

and #28. The RPD will be calculated for each pair of duplicate analysis using the following equation:

$$RPD = \frac{(S - D)}{(S + D)/2} x100$$

Where:

S = sample result
D = duplicate result

The project chemist, 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 Worksheets #12 and #28. This will also include a comparison of field and laboratory precision with the expectation that laboratory duplicate results will be no less precise than field 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: Accuracy is the degree to which a given result agrees with the true value. The accuracy of an entire measurement system is an indication of any bias that exists. Spiked sample results provide information needed to assess the accuracy of analyses. Specifically, surrogate spike, MS/MSD, and laboratory control sample (LCS) percent recoveries (%Rs) are used to assess accuracy. Every organic sample is spiked with known quantities of non-target surrogate compounds. Five percent of all samples analyzed are spiked with target chemicals for the MS/MSD (or sample duplicates). If the calculated %Rs for the known spike concentrations are within defined control limits set by each method, the reported sample concentrations are considered accurate. The accuracy measurement quality objectives will be those cited in Worksheets #12 and #28. Accuracy is calculated using the following equation:

$$\%R = \frac{(SSR - SR)}{SA} x100$$

Where:

SSR = spike sample recovery
SR = sample recovery
SA = concentration of spike added

The project chemist, acting on behalf of the Project Team, will determine whether the accuracy/bias goals were met for project data. This assessment will include an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for surrogates, MS, MSD, and LCSs against the goals identified in worksheets #24 and #28. 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 project scientist, identified by the Resolution Consultants TOM and 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 analyzed in accordance with this 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 project chemist, acting on behalf of the Project Team, will determine whether the data generated under this project are sufficiently comparable to historical property data generated by different methods and for samples collected using different procedures and under different property 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 the project chemist indicates that such quantitative analysis is required.

- Sensitivity: The project chemist, 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 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.

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

After completion of the data validation, 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. The 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. The Project Team members, identified by the Resolution Consultants TOM, will assess whether the data collectively support the attainment of project objectives. 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.

Identify the personnel responsible for performing the usability assessment:

The Resolution Consultants TOM, project chemist, and FTL will be responsible for conducting the listed data usability assessments. The data usability assessment will be reviewed with the Project Team. 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). The project report will identify and describe the data usability limitations and suggest re-sampling or other corrective actions, if necessary. Graphical presentations of the data such as concentration tag maps will be generated as part of the overall data evaluation process.

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Appendix A
Field 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. If long-term storage of analyte-free water is necessary, see FC 1002, section 3.3.

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 before beginning a sampling event, unless satisfactory long-term storage of analyte-free water for a specified maximum storage time has been documented for the analytes of interest. The water should be replaced and the maximum storage time shortened if it is determined that the analyte-free water has been contaminated, e.g., by the analysis of field-QC blanks or other QC blanks that have been composed using the water stored in the container.

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. Peristaltic Pump
      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. Other Equipment Types (e.g., pressurized Teflon bailer)
      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.
   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:

Table FC 1000-2
Container Cleaning Procedures

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.

FD 1000. DOCUMENTATION PROCEDURES

1. INTRODUCTION:

   1.1. For the creation of clear, accurate and methodical records to document all field activities affecting sample data, implement the following standard operating procedures for sample collection, sample handling and field-testing activities.

2. SCOPE AND APPLICABILITY

   2.1. This SOP provides a detailed listing of the information required for documentation of specific sampling and field testing procedures found in the DEP SOPs contained in the collection DEP-SOP-001. See the DEP SOPs in collection DEP-SOP-003/11 for additional documentation requirements.

   2.2. Refer to the associated sampling or field testing SOP for any requirements for the chronological or sequential documentation of data.

3. QUALITY ASSURANCE

   3.1. Implement review procedures to monitor and verify accurate manual and automated data entry and recordkeeping for all documentation tasks outlined in this SOP.

FD 1100. Universal Documentation Requirements

Incorporate efficient archival design and concise documentation schemes for all record systems. Ensure that the history of a sample is clearly evident in the retained records and documentation and can be independently reconstructed.

1. CRITERIA FOR ALL DOCUMENTS

   1.1. Keep all applicable documentation available for inspection. Keep records of all original data as well as records of all reduced or manipulated forms of the original data.

      1.1.1. Original records consist of documentation that is produced by the person or organization responsible for the original generation of the documentation. Original records are the source from which copies are made.

      1.1.2. Original data is information generated at the time of or as the result of performing field procedures or tests, e.g., “raw” data automatically reported or logged from field-testing instrumentation, handwritten field notes or drawings, completed field forms or sheets, photographs, etc.

      1.1.3. Manipulated data is information that has been reformatted from original data for the purpose of organizing, analyzing, reporting or presenting the data, e.g., lists or tables of results, reports of field sampling and testing results, analyzed or reduced forms of data that present statistical information, calculations or other evaluations and manipulations of the original data, etc.

   1.2. Specific requirements for documentation for projects may be included in quality assurance plans, sampling and analysis plans, monitoring plans or other planning documents that have been approved by DEP.

   1.3. According to the DEP Quality Assurance rule 62-160.650, F.A.C, authorized representatives of DEP shall inspect and request copies of any records using paper, electronic media, or other media during any DEP audit of physical facilities or on-site sampling events, and for any data validations conducted for applicable project data submitted to DEP (see 62-160.670, F.A.C.), as needed for DEP data usability assessments or other quality assurance purposes.

1.4. Electronic records are acceptable as documentation and are considered to be equivalent in status and function to original records, documents or papers, unless otherwise specified in a DEP contract, order, permit or Title 62 rule.

1.4.1. All documentation requirements in the DEP SOPs (DEP-SOP-001/01, DEP-SOP-002/01 and DEP-SOP-003/11) shall apply equally to paper and electronic records.See part FD 1200, below for additional requirements.

1.4.2. Electronic copies of original records can be designated as master copies for storage purposes. Electronic copies designated as master copies can serve the same function as original records.

1.4.3. Electronic copies intended to replace original records must contain the same information as the original records, regardless of whether the electronic copies are designated as master or duplicate records.

1.5. Governmental agencies should comply with all applicable requirements in the Florida Statutes and the Florida Administrative Code concerning the management, storage and destruction of public records

1.6. Record enough information so that clarifications, interpretations, or explanations of the data are not required from the originator of the documentation.

1.7. Clearly indicate the nature and intent of all documentation and all record entries.

1.8. Link citations to SOPs and other documents by the complete name, reference or publication number, revision number, and revision date for the cited document, when applicable. Also assign this information to internally generated SOPs.

1.9. Retain copies of all revisions of all cited documents as part of the documentation archives.

2. PROCEDURES

2.1. Sign, initial or encode all documentation entries made to paper, electronic or other records with a link indicating the name and responsibility of the author making the data entry, clearly indicating the reason for the signature, initials or code (e.g., “sampled by”; “released by”; “prepared by”; “reviewed by”).

2.2. In order to abbreviate record entries, make references to procedures written in internal SOPs or methodology and procedures promulgated by external sources.

2.2.1. Document the intent to use SOPs other than the DEP SOPs, or to use allowable modifications to the DEP SOPs by recording the effective date of use for all such SOPs or modifications.

2.2.1.1. Retain any correspondence with DEP regarding approval to use alternative procedures for any projects.

2.2.2. Authorize all internal SOPs with the signatures of the quality assurance officer(s) and manager(s) responsible for implementation of the SOPs. Record the dates of signature.

2.3. Employ straightforward procedures for the storage of records to facilitate documentation tracking and retrieval of all current records and archives for purposes of inspection, verification, and historical reconstruction of all procedures and measurement data.

2.4. Keep copies or original records of all documentation, including documentation sent to or received from external parties.

2.5. Use waterproof ink for all paper documentation.

2.5.1. Some situations may require the use of pencil for handwritten records. For example, pencils are often the best choice for writing on waterproof paper in wet conditions. Consider making copies of handwritten records (e.g., scanning or photocopying) as soon as possible to ensure preservation of the original data.

2.6. Do not erase or obliterate entry errors on paper records. Make corrections by marking a line through the error so that it is still legible. Initial or sign the marked error and its correction.

2.7. Maintain electronic audit trails for all edited electronic records, if possible. Utilize software that allows tracking of users and data edits, if available. Software that prompts the user to double-check edits before execution is also preferred. See FD 1200.

2.8. Clearly link all documentation associated with a sample or measurement. Make cross-references to specific documentation when necessary.

2.9. Link final reports, data summaries, or other condensed versions of data to the original sample data, including those prepared by external parties.

3. RETENTION REQUIREMENTS

3.1. Per the DEP QA Rule, 62-160.240 & .340, F.A.C., keep all documentation archives for a minimum of 5 years after the date of generation or completion of the records unless otherwise specified in a Department contract, order, permit, or Title 62 rules.

FD 1200. Electronic Documentation

Handle electronic (digital) data as with any data according to applicable provisions of FD 1100.

1. RETENTION OF AUTOMATIC DATA RECORDING PRODUCTS

1.1. For data not directly read from the instrument display and manually recorded, retain all products or outputs from automatic data recording devices, such as strip chart recorders, integrators, data loggers, field measurement devices, computers, etc. Store records in electronic, magnetic, optical, or paper form, as necessary.

1.1.1. Retain all original, raw output data. Ensure archiving of these data prior to subsequent reduction or other manipulation of the data.

1.2. Identify output records as to purpose, analysis date and time, field sample identification number, etc. Maintain clear linkage with the associated sample, other data source or measured medium and specific instrument used to make the measurement.

2. ELECTRONIC DATA SECURITY

2.1. Control levels of access to electronic data systems as required to maintain system security and to prevent unauthorized editing of data.

2.2. Do not alter raw instrumentation data or original manual data records in any fashion without retention of the original raw data.

2.3. Maintain secure computer networks and appropriate virus protection as warranted for each system design.

3. ELECTRONIC DATA STORAGE AND DOCUMENTATION

3.1. Store all electronic, magnetic, and optical media for easy retrieval of records.

3.1.1. Ensure that all records can be printed to paper if needed for audit or verification purposes.

3.1.2. If it is anticipated that the documentation archive will become unreadable due to obsolescence of a particular storage technology, retain a paper archive of the data or transfer to other suitable media.

3.2. For easy retrieval of records, link all stored data to the associated sample data or other data source.

3.3. Back up all data at a copy rate commensurate with the level of vulnerability of the data. Consider replicating all original data as soon as possible after origination.

4. SOFTWARE VERIFICATION

4.1. Ensure that any software used to perform automatic calculations conforms to required formulas or protocols.

4.2. Document all software problems and their resolution in detail, where these problems have irretrievably affected data records or linkage. Record the calendar date, time, responsible personnel, and relevant technical details of all affected data and software files. Note all software changes, updates, installations, etc. per the above concerns. File and link all associated service records supplied by vendors or other service personnel.

5. PROTECTION OF EQUIPMENT AND STORAGE MEDIA

5.1. Place stationary computers, instrumentation, and peripheral devices in locations of controlled temperature and humidity and away from areas where the potential for fluid leaks, fire, falling objects, or other hazards may exist. In the field, protect portable equipment from weather, excess heat or freezing, storage in closed vehicles, spillage from reagents and samples, etc.

5.2. Protect storage media from deteriorating conditions such as temperature, humidity, magnetic fields, or other environmental hazards as above.

6. ELECTRONIC SIGNATURES – Documents signed with electronic signatures must be consistent with the requirements of 62-160.405, F.A.C.:

6.1. the integrity of the electronic signature can be assured;

6.2. the signature is unique to the individual;

6.3. the organization using electronic signatures has written policies for the generation and use of electronic signatures; and

6.4. the organization using electronic signatures has written procedures for ensuring the security, confidentiality, integrity and auditability of each signature.

FD 1300. Documentation Using Other Media

1. UNIVERSAL REQUIREMENTS

1.1. Handle documentation prepared using other media according to FD 1100.

2. PROTECTION OF STORED MEDIA

2.1. Store media such as photographs, photographic negatives, microfilm, videotape, etc. under conditions generally prescribed for these media by manufacturers and conducive to long-term storage and protection from deterioration. See also FD 1200, section 5, above.

FD 2000. DOCUMENTATION OF CLEANED EQUIPMENT, SAMPLE CONTAINERS, REAGENTS AND SUPPLIES

When providing sample containers, preservation reagents, analyte-free water or sampling equipment, document certain aspects of these preparations.

1. EQUIPMENT CLEANING DOCUMENTATION

1.1. Document all cleaning procedures by stepwise description in an internal SOP if cleaning procedures in the DEP SOP have been modified for use. Alternatively, cite the DEP SOP procedures in the cleaning record for the applicable equipment.

1.2. Record the date of cleaning.

1.2.1. If items are cleaned in the field during sampling activities for a site, document the date and time when the affected equipment was cleaned. Link this information with the site and the cleaning location at the site.

1.3. Retain or make accessible any certificates of cleanliness issued by vendors supplying cleaned equipment or sample containers.

1.3.1. Retain from the vendor or document for internal cleaning the following information for sample containers, as applicable:

- Packing slip and cleanliness certificates from vendors
- Container types and intended uses
- Lot numbers or other designations for groups of containers cleaned together using the same reagents and procedures
- Dates of cleaning
- Cleaning procedures or reference to internal cleaning SOPs or DEP SOPs
- Cleaning personnel names
- Results of quality control analyses associated with container lots
- Comments about problems or other information associated with container lots

2. SAMPLING KIT DOCUMENTATION

If supplied to a party other than internal staff, transmit to the recipient the following information pertaining to sampling equipment or other implements, sample containers, reagent containers, analyte-free water containers, reagents or analyte-free water supplied to the recipient.

- Quantity, description and material composition of all containers, container caps or closures or liners for caps or closures
- Intended application for each sample container type indicated by approved analytical method or analyte group(s)
- Type, lot number, amount and concentration of preservative added to clean sample containers and/or shipped as additional preservative
- Intended use for any additional preservatives or reagents provided
- Description of any analyte-free water (i.e., deionized, organic-free, etc.)
- Date of analyte-free water containerization
- Date of sampling kit preparation
- Description and material composition of all reagent transfer implements (e.g., pipets) shipped in the sampling kit and the analyte groups for which the implements have been cleaned or supplied
- Quantity, description and material composition of all sampling equipment and pump tubing (including equipment supplied for filtration) and the analyte groups for which the equipment has been cleaned or supplied
- Tare weight of VOC vials, as applicable (this item is necessary when EPA Method 5035 VOC sample vials are provided for soil samples)

3. DOCUMENTATION FOR REAGENTS AND OTHER CHEMICALS

3.1. Keep a record of the lot numbers and inclusive dates of use for all reagents, detergents, solvents and other chemicals used for cleaning and sample preservation.

3.1.1. See FD 4000 below for documentation requirements for reagents used for field testing.

FD 3000. DOCUMENTATION OF EQUIPMENT MAINTENANCE

1. Log all maintenance and repair performed for each instrument unit, including routine cleaning procedures, corrective actions performed during calibrations or verifications, and solution or parts replacement for instrument probes.
   1.1. Include the calendar date for the procedures performed.
   1.2. Record names of personnel performing the maintenance or repair tasks.
      1.2.1. Describe any malfunctions necessitating repair or service.
2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit employed. This identifier may include a manufacturer name, model number, serial number, inventory number, or other unique identification.
3. Retain vendor service records for all affected instruments.
4. Record the following for rented equipment:
   - Rental date(s)
   - Equipment type and model or inventory number or other description
5. Retain the manufacturer's operating and maintenance instructions.

FD 4000. DOCUMENTATION FOR CALIBRATION OF FIELD-TESTING INSTRUMENTS AND FIELD ANALYSES

Document acceptable instrument or measuring system calibration for each field test or analysis of a sample or other measurement medium.

FD 4100. General Documentation for all Field Testing

1. STANDARD AND REAGENT DOCUMENTATION: Document information about standards and reagents used for calibrations, verifications, and sample measurements.
   1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.
      1.1.1. Document acceptable verification of any standard used after its expiration date.
   1.2. Record the concentration or other value for the standard in the appropriate measurement units.
      1.2.1. Note vendor catalog number and description for preformulated solutions as well as for neat liquids and powdered standards.
      1.2.2. Retain vendor assay specifications for standards as part of the calibration record.
         1.2.2.1. Record the grade of standard or reagent used.
   1.3. When formulated in-house, document all calculations used to formulate calibration standards.
      1.3.1. Record the date of preparation for all in-house formulations.
   1.4. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).

2. FIELD INSTRUMENT CALIBRATION DOCUMENTATION: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.

2.1. Retain vendor certifications of all factory-calibrated instrumentation.

2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.

2.2.1. Record manufacturer name, model number, and identifying number such as a serial number for each instrument unit.

2.3. Record the time and date of all initial calibrations and all calibration verifications.

2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.

2.5. Record the name of the analyst(s) performing the calibration or verification.

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)
- Link to information recorded according to section 1 above

2.7. Retain manufacturers' instrument specifications.

2.8. Document whether successful initial calibration occurred.

2.9. Document whether each calibration verification passed or failed.

2.10. Document, according to records requirements of FD 3000, any corrective actions taken to modify instrument performance.

2.10.1. Document date and time of any corrective actions.

2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.

2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).

2.12. Document acceptance criteria used for all verifications or cite relevant DEP FT SOP or internal SOP.

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
- "J" data qualifier code for estimated measurement or test sample value
- Reporting units for the measurement
- Initials or name of analyst performing the measurement
- Unique identification of the specific instrument unit used for the test (see 2.2 above)

FD 5000. DOCUMENTATION OF SAMPLE COLLECTION, PRESERVATION AND TRANSPORT

Follow these procedures for all samples. See FD 5100 - FD 5427 below for additional documentation for specific sampling activities. See the list of required and optional Forms in FD 9000 below for documenting specific sampling and testing procedures.

1. SAMPLE IDENTIFICATION REQUIREMENTS

1.1. Ensure that labels are waterproof and will not disintegrate or detach from the sample container when wet, especially under conditions of extended submersion in ice water typically accumulating in ice chests or other transport containers.

1.2. Label or tag each sample container with a unique field identification code that adequately distinguishes each sample according to the following criteria. The code must adequately link the sample container with all of the information about the sample contained in the permanent field record.

1.2.1. Link the unique field identification code to the sample source or sampling point identification, the date of sample collection, the time of sample collection (for maximum holding times equal to or less than 48 hours), the analytes of interest and the preservation technique.

1.2.2. Label or tag each sample container for the following types of samples with a unique field identification code:

- Quality control samples such as duplicate samples, other replicate samples or split samples collected for the same analyte or group of analytes
- Field samples or quality control samples collected using a different sample collection technique for the same analyte or group of analytes (for example, if both a bailer and a pump are used to collect samples for metals analysis, label the bailer sample to distinguish it from the pump sample)

1.2.3. The color, size, shape, or material composition of sample containers and caps cannot substitute for the information required in 1.2.1. – 1.2.2. Above.

1.2.4. The unique field identification code and any other information included on the container label or tag must allow the analyzing laboratory to independently determine the sample collection date, the sample collection time (for maximum holding times $\leq$ 48 hours), the sample preservation and the analytical tests to be performed on each container or group of containers.

1.3. Attach the label or tag so that it does not contact any portion of the sample that is removed or poured from the container.

1.4. Record the unique field identification code on all other documentation associated with the specific sample container or group of containers.

2. GENERAL REQUIREMENTS FOR SAMPLING DOCUMENTATION: Record the following information for all sampling:

2.1. Names of all sampling team personnel on site during sampling

2.2. Date and time of sample collection (indicate hours and minutes)

2.2.1. Use 24-hour clock time or indicate A.M. and P.M.

2.2.2. Note the exact time of collection for individual sample containers for time-sensitive analyses with a maximum holding time of 48 hours of less.

2.3. Ambient field conditions, to include, but not limited to information such as weather, tides, etc.

2.4. Comments about samples or conditions associated with the sample source (e.g., turbidity, sulfide odor, insufficient amount of sample collected)

2.5. Specific description of sample location, including site name and address

2.5.1. Describe the specific sampling point (e.g., monitoring well identification number, outfall number, station number, etc.).

2.5.2. Determine latitude and longitude of sampling source location (if required).

2.5.3. Locate sampling points on scaled maps or drawings where applicable.

2.6. Record the unique field identification code for each sample container and parameters to be analyzed, per section 1 above. The code must adequately link the sample container or group of containers with all of the information about the sample contained in the permanent field record.

2.7. Number of containers collected for each unique field identification code

2.8. Analytes/analyte groups collected

2.9. Matrix sampled

2.10. Type of field sample collected, such as grab, composite or other applicable designation.

2.11. Field-testing measurement data:

2.11.1. See FD 4000 above for specific details.

2.12. Calibration records for field-testing equipment

2.12.1. See FD 4000 above for specific details.

2.13. Preservation for each container

2.13.1. Indicate whether samples are chemically preserved on-site by the sampling team or, alternatively, were collected in prepreserved (predosed) containers.

2.13.2. Indication of any tests performed in the field to determine the presence of analytical interferences in the sample.

2.13.3. Indication of any treatments of samples performed in the field to eliminate or minimize analytical interferences in the sample.

2.13.4. See FD 5100, section 1.

2.14. Purging and sampling equipment used, including the material composition of the equipment and any expendable items such as tubing.

2.15. Types, number, collection location and collection sequence of quality control samples

2.15.1. Include a list of equipment that was rinsed to collect any equipment blanks.

2.16. Use of fuel powered vehicles and equipment

2.17. Number of subsamples and amount of each subsample in any composite samples

2.17.1. Include sufficient location information for the composite subsamples per 2.4 above.

2.18. Depth of all samples or subsamples

2.19. Signature(s) or initials of sampler(s)

3. SAMPLE TRANSMITTAL RECORDS: Transmit the following information to the analytical laboratory or other receiving party. Link transmittal records with a given project and retain all transmittal records.

- Site name and address – Note: Client code is acceptable if samples are considered sensitive information and if the field records clearly trace the code to a specified site and address.
- Date and time of sample collection
- Name of sampler responsible for sample transmittal
- Unique field identification codes for each sample container
- Total number of samples
- Required analyses
- Preservation protocol
- Comments about sample or sample conditions
- Identification of common carrier (if used)

4. SAMPLE TRANSPORT

4.1. If shipping transmittal forms in the transport containers with the samples, place the forms in a waterproof enclosure and seal.

4.2. For common carrier shipping, seal transport containers securely with strapping tape or other means to prevent lids from accidentally opening.

4.2.1. Keep all shipping bills from common carriers with archived transmittal records.

5. ANCILLARY FIELD RECORDS: Link any miscellaneous or ancillary records (photographs, videotapes, maps, etc.) to specific sampling events such that these records are easily traceable in the data archives associated with the project, sampling date and sample source(s).

FD 5100. Documentation Specific To Aqueous Chemistry Sampling

1. SAMPLE PRESERVATION: Document preservation of all samples according to the following instructions.

1.1. List the chemical preservatives added to the sample.

1.2. Record the results of pH verification performed in the field, including the pH value of the sample (if applicable). Note any observations about changes in the sample as a result of adding preservative to the sample or mixing the sample with the preservative.

1.3. Record the amount of preservative added to samples and the amount of any additional preservative added. The amount dosed into sample containers supplied with premeasured preservatives must also be recorded.

1.3.1. For documentation of procedures for preservation for routine samples, cite DEP SOPs or internal SOPs for this information.

1.3.2. Record instances of deviation from preservation protocols found in SOPs when non-routine or problematic samples are collected.

1.4. Record the use of ice or other cooling method, when applicable.

1.5. Record the filtration of the sample, if applicable, and include:

- Design type and material construction of filter
- Filter pore size
- Date and time of filtration of the sample

2. GROUNDWATER SAMPLING

2.1. Record or establish a documentation link to the following information for all samples. See form FD 9000-24 for an example documentation format. See section 3 below for in-place plumbing:

- Well casing composition and diameter of well casing
- 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
- Ambient conditions at the wellhead or sampling point that are potential sources of unrepresentative sample contamination
- Water table depth and well depth
- Calculations used to determine purge volume
- Total amount of water purged
- Date well was purged
- Purging equipment used
- Sampling equipment used
- Well diameter
- Total depth of well
- Depth to groundwater
- Volume of water in the well
- Purging method
- Placement depth of tubing or pump intake
- Depth and length of screened interval
- Times for beginning and ending of purging
- Total volume purged
- Times of stabilization parameter measurements
- Purging rate, including any changes in rate
- Temperature measurements
- pH measurements
- Specific conductance measurements
- Dissolved oxygen measurements
- Turbidity measurements
- Site or monitoring well conditions impacting observed dissolved oxygen and turbidity measurements
- Color of groundwater
- Odor of groundwater

2.2. Record the following for Water Level and Purge Volume Determination (FS 2211):

- Depth to groundwater
- Total depth of well
- Length of water column
- Well diameter
- Volume of water in the well
- Volume of pump
- Tubing diameter
- Length of tubing
- Volume of flow cell
- Volume in the pumping system

2.3. Record the following for Well Purging (FS 2212)

- Calculations for pumping rates, including any changes in rates
- Flow meter readings
- Volume of water purged
- Placement depth of tubing or pump intake
- Depth and length of screened interval
- Time needed to purge one (1) well volume or purging equipment volume
- Well volumes or purging equipment volumes purged
- Temperature measurements
- pH measurements
- Specific conductance measurements
- Dissolved oxygen measurements
- Turbidity measurements
- Purging rate, including any changes in rate
- Drawdown in the well

3. IN-PLACE PLUMBING SOURCES INCLUDING DRINKING WATER SYSTEMS

3.1. Record the following for all samples:

- Plumbing and tap material construction (if known)
- Flow rate at which well was purged
- Amount of time well was allowed to purge
- Flow rate at time of sample collection
- Public water system identification number (if applicable)
- Name and address of water supply system and an emergency phone number for notification of sample results (if applicable)

4. SURFACE WATER SAMPLING

- Sample collection depth
- Beginning and ending times (24 hr) for timed composite sampling
- Type of composite (e.g., flow-proportioned, continuous, etc.)

5. WASTEWATER SAMPLING

- Beginning and ending times (24 hr) for timed composite sampling
- Type of composite (e.g. flow-proportioned, continuous, etc.)

FD 5120. RECORDS FOR NON-AQUEOUS ENVIRONMENTAL SAMPLES

Document the following information for all samples when using the indicated procedures.

FD 5130. DOCUMENTATION SPECIFIC TO SOIL SAMPLING (FS 3000)

1. GENERAL SOIL SAMPLING
   - Sample collection depth
   - Areal location of sample
   - Sample collection device
2. Sampling for Volatile Organic Compounds (VOC) per EPA Method 5035
   - Tare weight of VOC sample vial (if applicable)
   - Weight of sample (if applicable)

FD 5140. DOCUMENTATION SPECIFIC TO SEDIMENT SAMPLING (FS 4000)

1. General Sediment Sampling
   - Sample collection depth
   - Areal location of sample
   - Sample collection device
2. Sampling for Volatile Organic Compounds (VOC) per EPA Method 5035
   - Tare weight of VOC sample vial (if applicable)
   - Weight of sample (if applicable)

FD 5200. Documentation Specific to Waste Sampling (FS 5000)

1. DRUM SAMPLING

   1.1. Record the following information for each drum:
   - Type of drum and description of contents
   - Drum number, if applicable
   - Terrain and drainage condition
   - Shape, size and dimensions of drum
   - Label wording or other markings
   - Dimensional extent of leaks or spills associated with the drum
   - Drum location (or location map)

   1.2. Record the following information for the drum sample(s):
   - Description of phases, colors, crystals, powders, sludges, etc.
   - Stratified layers sampled, including aliquot amounts for composites, if applicable

   1.3. Record the following for field testing results on opened drums and drum samples:
   - Background readings for OVA meters
   - Sample readings for OVA meters
   - Type of OVA probe

- Radiation background reading and sample radiation reading
- Type of radiation monitor used
- Oxygen and LEL readings from container opening
- Water reactivity results
- Specific gravity
- PCB test results
- Water solubility results
- pH of aqueous wastes
- Results of chemical test strips
- Ignitability results
- Results of other chemical hazard test kits
- Miscellaneous comments for any tests

2. Documentation for Tanks

2.1. Record the following information for the tank:

- Type of tank, tank design and material of construction of tank
- Description of tank contents and markings
- Tank number or other designation, if applicable
- Terrain and drainage condition
- Shape, size and dimensions of tank
- Label or placard wording or other markings
- Dimensional extent of leaks or spills associated with the tank
- Tank location (or location map)

2.2. Record the following information for the tank sample(s):

- Description of phases, colors, crystals, powders, sludges, etc.
- Stratified layers sampled, including aliquot amounts for composites, if applicable

2.3. Record the following for field testing results on opened tanks and tank samples:

- Background readings for OVA meters
- Sample readings for OVA meters
- Type of OVA probe
- Radiation background reading and sample radiation reading
- Type of radiation monitor used
- Oxygen and LEL level from container opening
- Water reactivity results
- Specific gravity
- PCB test results
- Water solubility results
- pH of aqueous wastes
- Results of chemical test strips
- Ignitability results

- Results of other chemical hazard test kits
- Miscellaneous comments for any tests

3. DOCUMENTATION FOR WASTE LEACHATE AND WASTE SUMP SAMPLES

   3.1. Document information specific to leachate and sump sampling according to the documentation requirements for the respective DEP SOPs employed to collect samples (FS 2100, FS 2200, FS 4000, FS 5100 and FS 5200).

4. DOCUMENTATION FOR WASTE PILE SAMPLES

   4.1. Document information specific to waste pile sampling according to associated regulatory requirements for the project.

5. DOCUMENTATION FOR WASTE IMPOUNDMENT AND WASTE LAGOON SAMPLES

   5.1. Document information specific to impoundment and lagoon sampling according to the documentation requirements for the respective DEP SOPs employed to collect samples (FS 2100, FS 4000, FS 5100, and FS 5200).

FD 5300. Documentation for Biological Sampling

The following SOP sections list required documentation items for specific biological sampling procedures, as indicated.

FD 5310. DOCUMENTATION FOR BIOLOGICAL AQUATIC HABITAT CHARACTERIZATION

Minimum documentation required for biological habitat characterization and sampling is listed below according to requirements as specified in the indicated sampling and field-testing DEP SOPs.

FD 5311. *Physical/Chemical Characterization for Biological Sampling (FT 3001)*

1. Record the following information or use the optional Physical/Chemical Characterization Field Sheet (Form FD 9000-3). Note that some items may not apply to all water body types:

- Submitting agency code
- Submitting agency name
- STORET station number
- Sample date
- Sample location including county
- Field identification
- Receiving body of water
- Time of sampling
- Percentage of land-use types in the watershed that drain to the site
- Potential for erosion within the portion of the watershed that affects the site
- Local non-point-source pollution potential and obvious sources
- Typical width of 100-meter section of river or stream
- Size of the system or the size of the sample area within the system (lake, wetland, or estuary)
- Three measurements of water depth across the typical width transect
- Three measurements of water velocity, one at each of the locations where water depth was measured

- Vegetated riparian buffer zone width on each side of the stream or river or at the least buffered point of the lake, wetland or estuary
- Presence of artificial channelization in the vicinity of the sampling location (stream or river)
- Description of state of recovery from artificial channelization
- Presence or absence of impoundments in the area of the sampling location
- Vertical distance from the current water level to the peak overflow level
- Distance of the high water mark above the stream bed
- Observed water depth at high water mark location
- Percentage range that best describes the degree of shading in the sampling area
- Any odors associated with the bottom sediments
- Presence or absence of oils in the sediment
- Any deposits in the area, including the degree of smothering by sand or silt
- Depth of each water quality measurement
- Temperature
- pH
- Dissolved oxygen
- Specific conductance
- Salinity
- Secchi depth
- Type of aquatic system sampled
- Stream magnitude (order designation)
- Description of any noticeable water odors
- Term that best describes the relative coverage of any oil on the water surface
- Term that best describes the amount of turbidity in the water
- Term that best describes the color of the water
- Weather conditions during the time of sampling
- Any other conditions/observations that are helpful in characterizing the site
- Note any evidence of recent vegetation management
- Relative abundances of periphyton, fish, aquatic macrophytes and iron/sulfur bacteria
- List and map of dominant vegetation observed
- Sampling team designation
- Signature(s) of sampler(s)
- Signature date

2. For streams and rivers, draw a grid sketch of the site (optionally, use Form FD 9000-4), showing the location and amount of each substrate type (as observed by sight or touch). Using the grid sketch, count the number of grid spaces for each substrate type. Divide each of these numbers by the total number of grid spaces contained within the site sketch. Record this percent coverage value for each substrate type. If the substrates are sampled, record the number of times each substrate is sampled by an indicated method.

3. Photographs of the sampling area are also useful tools for documenting habitat conditions and identifying station location.

FD 5312. *Stream and River Biological Habitat Assessment Records (FT 3100)*

1. Record the following information, using required Form FD 9000-5, Stream/River Habitat Assessment Field Sheet:

- Submitting organization name and/or code
- STORET station number
- Assessment date
- Sampling location including county
- Field identification
- Receiving body of water
- Time of sampling upon arrival at the site

2. Additionally record the following:

- Substrate diversity score
- Substrate availability score
- Water velocity score
- Habitat smothering score
- Artificial channelization score
- Bank stability score for each bank
- Riparian buffer zone width score for each bank
- Riparian zone vegetation quality score for each bank
- Primary habitat components score
- Secondary habitat components score
- Habitat assessment total score
- Additional comments and observations
- Signatures

3. Record the following information or use optional Form FD 9000-4, Stream/River Habitat Sketch Sheet for each 100-meter segment assessed.

- Link to the waterbody name, location of 100-meter segment, analyst name(s) and date of the assessment
- Code, symbol or icon used to map each substrate observed in the segment
- Proportionate sketch or map of the abundance of each habitat (substrate) observed in the 100-meter segment, oriented to the direction of flow
- Location of velocity measurements taken within the segment
- Location of habitats smothered by sand or silt
- Location of unstable, eroding banks
- Locations along the segment where the natural, riparian vegetation is altered or eliminated
- Plant taxa observed
- Additional notes and observations

FD 5313. *Lake Biological Habitat Assessment Records (FT 3200)*

1. Document the following information using required Form FD 9000-6 Lake Habitat Assessment Field Sheet:

- STORET station number
- Sampling date
- Sampling location including lake name
- Eco-region
- Field identification number
- County name
- Lake size
- Features observed
- Description of the hydrology of the system (water residence time)
- Lake water color
- Secchi depth score
- Vegetation quality score
- Stormwater inputs score
- Bottom substrate quality score
- Lakeside adverse human alterations score
- Upland buffer zone score
- Adverse watershed land use score
- Habitat assessment total score
- Additional comments and observations
- Name and Signature of analyst

FD 5320. BIOLOGICAL AQUATIC COMMUNITY SAMPLING RECORDS (FS 7000)

Minimum documentation required for biological sampling for procedures described in FS 7000 is listed below according to requirements as specified in the indicated sampling DEP SOPs.

FD 5321. *Periphyton Sampling Records (FS 7200)*

For each sample, record the following:

- Station sampled
- Date collected

FD 5322. *Qualitative Periphyton Sampling Records (FS 7220)*

Complete the Physical/Chemical Characterization Field Sheet (Form FD 9000-3), Stream/River Habitat Sketch Sheet (Form FD 9000-4) or site map and Stream/River Habitat Assessment Field Sheet (Form FD 9000-5), as appropriate for the water body sampled (see FT 3000 – FT 3100). Other customized formats may be used to record the information prompted on forms FD 9000-3 and FD 9000-4.

FD 5323. *Rapid Periphyton Survey Records (FS 7230)*

For each 100-meter reach surveyed, record the following information or use optional Form FD 9000-25, Rapid Periphyton Survey Field Sheet:

- Site or waterbody name
- Survey date
- Name(s) of analyst(s)
- Transect mark number (10-meter segment within the 100-meter reach, 0-100)
- Transect point (1 – 9)
- Algal thickness rank (per FS 7230 procedure)
- Canopy cover (per FS 7230 procedure)

Indication of whether or not a periphyton sample was collected

- Bottom visibility (Secchi depth)
- Number of points with ranks 4, 5, or 6
- Total number of points assessed (out of 99)
- Percent of points with ranks 4, 5, or 6
- Additional comments or observations

FD 5324. *Lake Vegetation Index Records (FS 7310)* **[moved to LVI 1110]**

FD 5325. *Rapid Bioassessment (Biorecon) Records (FS 7410)* **[moved to BRN 1110]**

FD 5326. *Stream Condition Index (D-frame Dipnet) Sampling Records (FS 7420)* **[moved to SCI 1110]**

FD 5327. *Sediment Core Biological Grab Sampling Records (FS 7440)*

Record the sampling location of site grab core samples.

FD 5328. *Sediment Dredge Biological Grab Sampling Records (FS 7450)*

Record the sampling location of site grab dredge samples.

FD 5329. *Lake Condition Index (Lake Composite) Sediment Dredge Biological Grab Sampling Records (FS 7460)*

Record the following:

- Sampling date
- Lake name
- Sampling equipment used
- Comments and observations
- Dredge drop number (1 – 12)
- Sampling depth for each drop number
- Sampling location of site grab dredge sample for each drop (include lake sector map)
- Sediment type(s) in grab dredge sample for each drop (typical choices are sand, silt/clay, CPOM [course particulate organic matter], muck, SAV [submerged aquatic vegetation])
- Location of any water quality measurements

FD 53210. *Phytoplankton Sampling Records (FS 7100) [NEW]*

For each sample, record the following (on field sheet and sample container):

- Site or waterbody name
- County
- Date and time collected
- Record the method of collection (direct grab versus with an intermediate sampling device)
- Sample depth
- Indicate whether phytoplankton was collected during bloom conditions.
- If bloom scum sample, indicate if a surface scum sample or a scum sample core is collected.
- If bloom sample, indicate analysis to be conducted (algal enumeration, identification, or biomass, or toxin analysis)

FD 53211. *Algal Mat Sampling Records for Taxonomic Identification or Toxin Analysis (FS 7240)*

For each sample, record the following (on field sheet and sample container):

- Site or waterbody name
- County
- Date and time collected
- Thickness of the algal mat from the top of the mat to the surface of the substrate to which it is attached
- Analysis to be conducted (taxonomic identification, toxin analysis, biomass,etc)

FD 53212. *Stream and River Linear Vegetation Survey Sampling Records (FS 7320)*

Record the following or use optional DEP Form FD 9000-32 (Linear Stream Vegetation Survey sheet)

- Sampling date
- Waterbody name
- County
- STORET number
- Name of sampler(s)
- List of the plant species observed in the water for each 10m sampling unit.
- Notation of dominant taxa or lack of dominant for each 10m sampling unit.
- Total macrophyte abundance for each 10m sampling unit, using the following categories: 0-5%, >5≤10%, >10≤25%, >25≤50%, >50%.

FD 53213. *Vegetation Wetland Condition Index Sampling Records (FS 7330)*

Record the information required in FD 5311 and complete a site map/sketch for the wetland sampled.

Record the following or use optional DEP Form FD 9000-33 (Vegetation Wetland Condition Index Field Sheet)

- Sampling date
- Wetland name and wetland type
- Transect name for each transect (direction-N,S, E, or W)
- Geographic coordinates (latitude, longitude) for starting and ending points of the 4 transects
- County
- Name(s) of samplers
- A list of the plant species identified for each 5 m quadrat within each transect
- An indication, included on the list of species, for each plant species for which a specimen was collected.
- A unique code for each unknown, included on the list of species. Fill in the correct name once the plant has been identified.

FD 53214. *Macroinvertebrate Wetland Condition Index Sampling Records (FS 7470)*

Record the information required in FD 5311 and complete a site map/sketch for the wetland sampled. Record the following for each sample:

- Sampling date
- Wetland name and wetland type
- County

- Name(s) of samplers
- Number of sweeps for each major vegetation zone
- Total number of containers per sample

FD 6000. QUALITY CONTROL DOCUMENTATION

1. Document all field quality control samples in the permanent field records.
2. At a minimum, record the following information:
   - The type, time and date that the quality control sample was collected; and
   - The preservative(s) (premeasured or added amount) and preservation checks performed.
3. If blanks are collected/prepared by the field organization, maintain records of the following:
   - Type of analyte-free water used;
   - Source of analyte-free water (include lot number if commercially purchased);
   - A list of the sampling equipment used to prepare the blank.

   If items above are specified in an internal SOP, you may reference the SOP number and revision date in the field notes. Note any deviations to the procedure in the field notes.
4. For trip blanks, record the following:
   - Date and time of preparation
   - Storage conditions prior to release to the sample collecting organization
   - Type of analyte-free water used
   - Source and lot number (if applicable) of analyte-free water

     4.1. Include trip blank information in the sampling kit documentation per FD 2000, section 2.
5. For duplicates, record the technique that was used to collect the sample.
6. For split samples, identify the method used to collect the samples and the source(s) of the sample containers and preservatives.

FD 7000. LEGAL OR EVIDENTIARY DOCUMENTATION

1. Scope: The use of legal or evidentiary Chain-of-Custody (COC) protocols is not usually required by DEP, except for cases involving civil or criminal enforcement. Do not use these procedures for routine sampling for compliance, for example, unless evidentiary custody protocols are specifically mandated in a permit or other legal order or when required for enforcement actions.
2. <u>General Procedural Instructions</u>

   2.1. Follow applicable requirements in FD 1000 – FD 5000 for all evidence samples.

   2.2. Establish and maintain the evidentiary integrity of samples and/or sample containers. Demonstrate that the samples and/or sample containers were handled and transferred in such a manner as to eliminate possible tampering.

   2.2.1. Document and track all time periods and the physical possession and storage of sample containers and samples from point of origin through the final analytical result and sample disposal.

FD 7100. General Requirements for Evidentiary Documentation

1. CHAIN OF CUSTODY RECORDS: Use the Chain-of-Custody (COC) records to establish an intact, contiguous record of the physical possession, storage, and disposal of sample containers, collected samples, sample aliquots, and sample extracts or digestates. For ease of discussion, the above-mentioned items are referred to as "samples".

1.1. Account for all time periods associated with the physical samples.

1.2. Include signatures of all individuals who physically handle the samples.

1.2.1. The signature of any individual on any record that is designated as part of the Chain-of-Custody is their assertion that they personally handled or processed the samples identified on the record.

1.2.2. Denote each signature with a short statement that describes the activity of the signatory (e.g., "sampled by", "received by", "relinquished by", etc.).

1.2.3. In order to simplify recordkeeping, minimize the number of people who physically handle the samples.

2. CONSOLIDATION OF RECORDS: The COC records need not be limited to a single form or document. However, limit the number of documents required to establish COC, where practical, by grouping information for related activities in a single record. For example, a sample transmittal form may contain both certain field information and the necessary transfer information and signatures for establishing delivery and receipt at the laboratory.

3. LIABILITY FOR CUSTODY DOCUMENTATION: Ensure appropriate personnel initiate and maintain sample chain-of-custody at specified times.

3.1. Begin legal chain-of-custody when the precleaned sample containers are dispatched to the field.

3.1.1. Omit the transmittal record for precleaned sample containers if the same party provides the containers and collects the samples.

3.2. Sign the COC record upon relinquishing the prepared sample kits or containers.

3.3. Sign the COC record upon receipt of the sample kits or containers.

3.4. Thereafter, ensure that all parties handling the samples maintain sample custody (i.e., relinquishing and receiving) and documentation until the samples or sampling kits are relinquished to a common carrier.

3.4.1. The common carrier should not sign COC forms.

3.4.2. Indicate the name of the common carrier in the COC record, when used. Retain shipping bills and related documents as part of the record.

3.4.3. Ensure that all other transferors and transferees releasing or accepting materials from the common carrier sign the custody record.

3.5. Chain-of-custody is relinquished by the party who seals the shipping container and is accepted by the party who opens it.

3.5.1. Indicate the date and time of sealing of the transport container for shipment.

3.5.2. See FD 7200, section 3 below regarding the use of custody seals.

4. SAMPLE SHIPPING OR TRANSPORTING

4.1. Affix tamper-indicating custody seals or evidence tape before shipping samples.

4.1.1. Seal sample container caps with tamper-indicating custody seals or evidence tape before packing for shipping or transport.

4.1.2. Seal sample transport or shipping containers with strapping tape and tamper-indicating custody seals or evidence tape.

4.1.3. If the same party collects then possesses (or securely stores), packs and transports the samples from time of collection, omit any use of custody seals or evidence tape.

4.2. Keep the COC forms with the samples during transport or shipment. Place the COC records in a waterproof closure inside the sealed ice chest or shipping container.

FD 7200. Required Documentation for Evidentiary Custody

1. GENERAL CONTENT REQUIREMENTS: Document the following in COC tracking records by direct entry or linkage to other records:

- Time of day and calendar date of each transfer or handling procedure
- Signatures of transferors, transferees and other personnel handling samples
- Location of samples (if stored in a secured area)
- Description of all handling procedures performed on the samples for each time and date entry recorded above
- Storage conditions for the samples, including chemical preservation and refrigeration or other cooling
- Unique identification for all samples
- Final disposition of the physical samples
- Common carrier identity and related shipping documents

2. DOCUMENTATION CONTENT FOR SAMPLE TRANSMITTAL

Provide a Chain-of-Custody record for all evidentiary samples and subsamples that are transmitted or received by any party. Include the following information in the COC record of transmittal:

- Sampling site name and address
- Date and time of sample collection
- Unique field identification code for each sample source and each sample container
- Names of personnel collecting samples
- Signatures of all transferors and transferees
- Time of day and calendar date of all custody transfers
- Clear indication of number of sample containers
- Required analyses by approved method number or other description
- Common carrier usage
- Sample container/preservation kit documentation, if applicable

3. CHAIN-OF-CUSTODY SEALS: If required, affix tamper-indicating evidence tape or seals to all sample, storage and shipping container closures when transferring or shipping sample container kits or samples to another party.

3.1. Place the seal so that the closure cannot be opened without breaking the seal.

3.2. Record the time, calendar date, and signatures of responsible personnel affixing and breaking all seals for each sample container and shipping container.

3.3. Affix new seals every time a seal is broken until continuation of evidentiary custody is no longer required.

FD 7300. Documenting Controlled Access to Evidence Samples

Control and document access to all evidentiary samples and subsamples with adequate tracking. Documentation must include records about each of the activities and situations listed below, when applicable to sample evidence, and must track the location and physical handling of all samples by all persons at all times. See FS 1000 for additional discussion about procedures for handling evidence samples.

1. Limit the number of individuals who physically handle the samples as much as practicable.

2. When storing samples and subsamples, place samples in locked storage (e.g., locked vehicle, locked storeroom, etc.) at all times when not in the possession or view of authorized personnel.

3. Alternatively, maintain restricted access to facilities where samples are stored. Ensure that unauthorized personnel are not able to gain access to the samples at any time.

4. Do not leave samples in unoccupied motel or hotel rooms or other areas where access cannot be controlled by the person(s) responsible for custody without first securing samples and shipping or storage containers with tamper-indicating evidence tape or custody seals.

FD 7400. Documenting Disposal of Evidence Samples

1. Dispose of the physical samples only with the concurrence of the affected legal authority, sample data user, and/or submitter/owner of the samples.

2. Record all conditions of disposal and retain correspondence between all parties concerning the final disposition of the physical samples.

3. Record the date of disposal, the nature of disposal (i.e., sample depleted, sample flushed into sewer, sample returned to client, etc.), and the name of the individual who performed the disposal. If samples are transferred to another party, document custody transfer in the same manner as other transfers (see FD 7000 – FD 7200).

FD 8000. (RESERVED)

FD 9000. FORMS

The following forms to facilitate documentation of sampling and field-testing are incorporated at 62-160.800, F.A.C. These forms are presented in both required and optional, example formats (see below). *The forms do not include all documentation required by FD 1000 or other DEP SOPs. The use of certain forms is required, as indicated below.* Customize the indicated optional forms as needed. These forms are available as separate document files at the DEP website. Instructions for completing forms are found in the DEP SOPs indicated in parentheses after the listed form.

The following required forms must be used to record information associated with specific DEP SOPs:

- Form FD 9000-5 Stream/River Habitat Assessment Field Sheet (FT 3000)
- Form FD 9000-6 Lake Habitat Assessment Field Sheet (FT 3000)
- Form FD 9000-34 Stream Habitat Assessment Training Checklist and Event Log (FA 1000 & FT 3000)
- Form FD 9000-35 Stream Condition Index Training Checklist and Event Log (SCI 1000)

The following forms are not required, but provide example formats that can be used to record information associated with specific DEP SOPs:

- Form FD 9000-1 Biorecon Field Sheet (FS 7000)
- Form FD 9000-3 Physical/Chemical Characterization Field Sheet (FT 3000)
- Form FD 9000-4 Stream/River Habitat Sketch Sheet (FT 3000)
- Form FD 9000-24 Groundwater Sampling Log (FS 2200)
- Form FD 9000-25 Rapid Periphyton Survey Field Sheet (FS 7000)
- Form FD 9000-27 Lake Vegetation Index Data Field Sheet (LVI 1000)
- Form FD 9000-31 Lake Observation Field Sheet (FT 3000)
- Form FD 9000-32 Linear Stream Vegetation Survey Form (FS 7000)
- Form FD 9000-33 Wetland Condition Index Vegetation Field Form (FS 7000)

FM 1000. FIELD PLANNING AND MOBILIZATION

This SOP is advisory; however, the following procedures are designed as best management practices, for use as guidance for designing and implementing a field sampling program and when selecting a laboratory.

FM 2000. LABORATORY SCHEDULING

FM 2100. Selecting a Laboratory

1. CONSUMER RESPONSIBILITIES

Each organization that uses laboratory services has certain responsibilities to ensure that the laboratory has the appropriate credentials and that the data are useable for the intended needs, and acceptable to DEP. A consumer's responsibilities include:

1.1. Evaluating the Laboratory

1.1.1. Ensure that the laboratory has the proper credentials.

1.1.2. Ensure that the laboratory can produce data of a quality that will be acceptable to DEP.

1.2. Thinking in Terms of Quality not Dollars: A laboratory that produces data that are not acceptable to DEP usually means that the laboratory will need to repeat the work. It is more cost effective to select a laboratory that will meet the quality needs of the project even if that laboratory is not the lowest bidder.

1.3. Continuing Evaluation: In order to ensure that the laboratory provides data of a consistent quality, do not rely on just the initial evaluation of a laboratory. Other quality control measures will provide the ability to continuously evaluate the laboratory data quality.

1.4. Evaluating the Reported Data: Review the final laboratory reports against the original expectations and acceptable quality control measures.

1.5. Asking Questions: The consumer has the right to question laboratory results and receive a logical and clear response.

An informed client increases the probability of quality data and data acceptability.

FM 2110. IDENTIFYING LABORATORY NEEDS

The consumer should be able to identify these critical needs before considering any laboratory:

1. The purpose for which the data are needed.

   1.1. The consumer must determine DEP's expectations for data quality in terms of the precision, accuracy, and detection limit (reporting level or criteria) for each reported value.

   1.2. Examples include: permit compliance at some specified concentration levels; compliance monitoring at specified reporting levels; and site cleanup to specified soil and water criteria levels.

2. The benefits of using contracted or in-house analytical services.
3. The specific laboratory services that are required:

   3.1. Are sample collection and sample analysis required, or just sample analysis.

   3.2. Types of samples (groundwater, drinking water, soils, sediments, hazardous wastes, etc.).

   3.3. The sample delivery schedule including:

3.3.1. The number of samples to be collected.

3.3.2. The frequency with which samples will be submitted to the laboratory.

3.3.3. The types of matrices to be analyzed.

3.4. The test methods that must be used (normally found in the permit requirements, consent orders, contracts, or relevant rules).

3.5. The expected quality based on DEP's requirements.

3.6. The expected turnaround time for laboratory analysis.

3.7. The deliverables including the report format.

3.8. Field related services such as:

3.8.1. Sample collection

3.8.2. Sample containers

3.8.3. Sample preservation

3.8.4. Equipment rental or cleaning services; or

3.8.5. Instrument calibration services.

4. Any required laboratory credentials such as certification.

5. Identifying key personnel in the consumer's organization that will be interfacing with the laboratory:

5.1. Administrative contact: Usually responsible for obtaining laboratory services.

5.2. Technical contact: Usually a person who will be evaluating the laboratory's performance.

5.3. Sample control contact: Usually a person who will be scheduling services with the laboratory.

6. Have an understanding of the current market price for the tests to be performed.

6.1. Gather information on pricing from several laboratories.

6.2. Request current and historical pricing schedules.

FM 2120. EVALUATING THE LABORATORY

1. LABORATORY CREDENTIALS

1.1. The laboratory must hold National Environmental Laboratory Accreditation Program (NELAP) certification from the Florida Department of Health's Environmental Laboratory Certification Program (DoH ELCP).

1.2. Out-of-state laboratories must be either certified by DoH, or be NELAP-certified by another state **with secondary accreditation** by DoH.

1.3. The laboratory must be certified for the test technology, analyte, and matrices that will be requested. This does not apply to analysis being done for drinking water.

1.4. Request a copy of the Current Certification and Analyte Sheets (must be for the current fiscal year which runs July 1 to June 30).

1.5. Verify the certification through the DEP Web Site, or the DoH offices.

2. ON-SITE VISIT

Conduct an on-site visit to verify the laboratory's capabilities and to determine if the laboratory has the equipment and personnel resources necessary for proposed services.

2.1. The laboratory must show a willingness to meet the client's needs.

2.2. The laboratory (both the analytical and administrative areas) should appear organized.

2.3. The analytical staff must be knowledgeable about the services to be provided.

2.3.1. At least one person (supervisor or analyst) must be experienced in performing all activities on the proposed scope of work.

2.4. The administrative staff must appear organized.

2.5. The laboratory must have the capacity to accommodate the proposed scope of work in terms of personnel and equipment.

3. LABORATORY PERFORMANCE EVALUATION

3.1. Blind Check Samples: Prior to contract signing or any agreement, submit a set of blind check samples to the laboratory.

3.1.1. A blind check sample is a sample in a real matrix (water, soil, sediment, etc.) that appears to be a real sample, except that the submitter has a list of the components and their known concentration values.

3.1.2. Submit the sample(s) to the laboratory as a routine sample(s).

3.1.3. Evaluate the results of the reported values against the certified values in the sample(s).

3.1.4. The values must be within the laboratory's stated precision for the measurement.

4. CUSTOMER SATISFACTION

4.1. Obtain a list of current and previous clients.

4.2. Call several of the clients to determine:

- Satisfaction with laboratory
- Were problems resolved satisfactorily?
- Reasons for not using the laboratory (if applicable)
- Reasons for using the laboratory

5. FISCAL STABILITY

5.1. Request a copy of the current financial statement.

FM 2130. CONTRACTING

1. PURPOSE

1.1. Provide a detailed list of the scope of services to be contracted.

1.2. Include the purpose for which the data are to be used (permit, compliance, etc.).

2. KEY CONTACTS: Identify key contacts for both laboratory and client:

2.1. Administrative: Dealing with billing, contract writing, invoicing, etc.

2.2. Technical: Dealing with data, and quality control issues and problems.

2.3. Sample Control: Dealing with scheduling, shipping supplies, sample receipt.

3. ANTICIPATED NEEDS: Specify:

3.1. The schedule of activities;

3.2. The expected number of samples, analytes, matrices and tests; and

3.3. Field support services, including containers, preservatives, cleaning and calibration services.

4. EXPECTATIONS

4.1. Certification

4.1.1. The laboratory must maintain certification for the analyte, technology, and matrices to be performed.

4.1.2. The laboratory must immediately notify its clients if the certification status for any analyte changes.

4.1.3. The laboratory must state that is will generate all results in strict compliance with the National Environmental Laboratory Accreditation Conference (NELAC) Standards.

4.1.4. The laboratory must flag and justify any results that were not generated in accordance with NELAC.

4.2. Analytical Expectations

4.2.1. Provide a list of analytical methods to be performed and the matrices for each method.

4.2.2. Provide a copy of the permit, QAPP, Sampling Plan or other document that outlines DEP's requirements.

4.2.3. Specify the expected turn-around time for the analyses.

4.2.4. Specify the shipping schedule if sample containers or supplies are to be provided.

4.3. Container/Equipment Services: State the scope of container and equipment services:

4.3.1. Precleaned Containers: Types and Numbers

4.3.1.1. Must be cleaned according to DEP SOP procedures (see FC 1000) or purchased precleaned from a vendor.

4.3.1.2. Provide copy of procedures, if the laboratory does not follow the DEP SOP procedures.

4.3.1.3. Determine if containers must be certified clean by either the laboratory or the vendor.

4.3.2. Preservatives

4.3.2.1. Premeasured into containers, where appropriate.

4.3.2.2. Provided in appropriate containers with dispensing implement.

4.3.3. Equipment

4.3.3.1. Type and numbers.

4.3.3.2. Condition of equipment (precleaned, etc.).

4.3.3.3. Equipment must be cleaned according to DEP SOP procedures (see FC 1000). Obtain a copy of the laboratory procedures if the laboratory does not follow the DEP SOP procedures.

4.3.3.4. Determine if equipment must be certified clean by the laboratory.

4.3.4. Equipment Calibration

4.3.4.1. The calibration method;

4.3.4.2. The frequency of calibration;

4.3.4.3. Preventative maintenance on instrument;

4.3.4.4. Certification statement verifying the calibration; and

4.3.4.5. Documentation of all maintenance and calibrations in laboratory records.

4.4. Quality Control

4.4.1. State adherence to NELAC quality control requirements.

4.4.2. Specify any additional quality control measures that are required but are different from NELAC.

4.4.3. Specify acceptable ranges for spikes, duplicates, surrogates, and other QC measures if appropriate.

4.5. Custody/Sample Tracking

4.5.1. Specify adherence to NELAP documentation and record keeping requirements.

4.5.2. State a time-period for retaining all records if greater than 5 years.

4.5.3. Make arrangement for transfer of records should the laboratory go out of business or transfer ownership before the records retention time period has lapsed.

4.5.4. Specify the level of custody (routine, legal, etc.).

4.6. Minimum Reporting Levels

4.6.1. Provide the laboratory with the minimum acceptable values to be reported (method detection limit, etc.).

4.6.2. Describe contingencies if these levels cannot be met.

4.7. Reporting Format

4.7.1. All analytical reports issued by the laboratory must comply with DEP and NELAP reporting requirements.

4.7.2. Specify whether the information must be provided as hardcopy, electronic or both.

4.7.2.1. If electronic, specify the format for submission.

4.7.3. The use of appropriate DEP data qualifiers (see Table FM 1000-1) should be specified.

4.8. Deliverables: In addition to the NELAP-compliant report, specify any other deliverables that must be provided with the laboratory report such as:

- Laboratory Quality Control results;
- Field Quality Control results;
- Performance Test results;
- Copies of all raw data and associated records;
- Written narrative of the analytical event; and/or
- Description of any modifications to methods.

4.9. Subcontracting

4.9.1. The laboratory must inform the client **before** any analytical services are subcontracted to another laboratory.

4.9.2. The laboratory must ensure that the subcontracted laboratory meets the same qualifications and requirements as the primary laboratory.

4.9.3. If the results from subcontracted laboratories are incorporated into the final laboratory report, the subcontracted results must be clearly identified.

4.10. Method Modifications

4.10.1. The laboratory must identify any modifications that have been made to the requested analytical methods.

4.10.2. The client must be notified of any method modifications prior to use in the laboratory, and must provide written consent.

4.11. Dilutions

4.11.1. Negotiate how multiple dilutions will be handled. They may be considered a separate analysis and therefore an additional cost.

4.11.2. Agree to pay for the analysis of dilutions only if:

4.11.2.1. The sample concentration exceeds the calibration range and the laboratory was not aware of the expected sample concentration; or

4.11.2.2. A dilution is required to quantitate all required components.

5. PENALTIES AND CONSEQUENCES

5.1. Negotiate penalties or other consequences (no payment) for these problems:

- Failure to provide data or associated (expected) information;
- Failure to meet deadlines;
- Failure to provide acceptable data; and
- Failure to meet contract requirements.

5.2. Consider these consequences:

- Costs of resampling;
- Fines incurred because of unacceptable data;
- Costs associated with having evaluated and/or processed unacceptable data; and
- Reanalysis costs (if reanalysis is due to laboratory error or failed QC).

5.3. Reserve the right to reject data. If any data are used, laboratory should be paid according to negotiated terms.

FM 2140. ON-GOING EVALUATION

1. Monitor laboratory's performance against the specific contract requirements.
2. Continue to use blind QC samples as a measure of routine performance.

2.1. Vendor supplied samples;

2.2. Samples prepared to a known concentration; or

2.3. Split samples with another laboratory.

FM 2150. DATA REVIEW

1. Review the data for logical trends:

1.1. Are the reported concentrations different from the routine (expected) levels?

1.2. Is the same value reported for the same analyte (except non detects) in the same set of samples or over a historical period of time?

1.3. Do the parts add up to the total?

1.3.1. Ortho phosphate must be less than total phosphate.

1.3.2. Total nitrate-nitrite must be equal to nitrate plus nitrite.

1.3.3. Total values must be greater than or equal to dissolved values.

1.4. Are different but related analyses consistent?

1.4.1. High turbidity and high total suspended solids.

1.4.2. High turbidity and increased method detection limits for other tests.

1.5. Do results indicate a sample collection problem?

1.5.1. High dissolved oxygen in groundwater.

1.5.2. High turbidity and elevated metals results.

1.6. Are the QC check samples within acceptable ranges?

1.6.1. Are the ranges reasonable?

1.7. Are non-detects reported correctly (should be a value with a "U")?

1.8. Over the history of laboratory use, were any QC problems reported?

1.9. Is there any laboratory or field blank contamination?

1.10. Do the reports contain all required information?

FM 2160. ASK QUESTIONS

Ask questions if:

- There are problems associated with the data review.
- The QC check sample data are not acceptable.
- The laboratory consistently reports the same QC failure.
- The laboratory uses different methods than requested.
- The laboratory subcontracts analyses without notifying the client.
- The laboratory does not meet contract requirements.
- The laboratory misses holding times.
- The laboratory fails to provide requested resource(s) (containers, calibration, etc.) in a timely manner.
- There any doubts about the acceptability of the data.
- Detection limits are above the expected values and the laboratory provides no reasonable explanation.

FM 2200. Scheduling Services

1. Notify the laboratory about the analytical and equipment needs at least a week in advance of the actual sampling trip.

2. Even if the trip is routine (monthly, weekly, quarterly compliance sampling), provide the laboratory with a written request. Include:

- Number and types of samples to be collected;
- Test methods to be performed;
- Expectations for quality control acceptance criteria (if not already listed in a contract);
- Estimated numbers of each type of container;
- Required preservatives, including whether the laboratory will dispense premeasured quantities into the sample containers;
- Preservation supplies such as graduated, disposable pipets;
- Additional preservatives (even if the containers are prepreserved);
- Sampling equipment including material construction;
- Shipping containers;
- Forms (both courier and transmittal/custody forms);
- Any calibration services;
- Estimated time of delivery;
- Expected turn-around time;
- Special needs such as "requires legal chain of custody" or "requires 24-hour turn-around time";

- Data processing services (such as completing regulatory forms); and
- Expected contamination levels. This is important if a highly contaminated site is sampled.

FM 3000. TRIP PLANNING

1. Ensure that everyone involved with the event understands the purpose of the trip:
   1.1. Review the associated sampling plan, quality assurance project plan or permit requirements.
   1.2. Review the applicable safety plans and site files.
2. Determine the number of people that will be required to complete the sampling activities within the allotted time frame. For safety and efficiency, a field team should consist of at least two people.
3. Identify sampling team member(s) and schedule a meeting of the sampling team.
   3.1. Develop a detailed itinerary and schedule.
      3.1.1. Plan to sample from the least contaminated to the most contaminated sampling point.
      3.1.2. Plan to work upstream in flowing water.
   3.2. Review personnel training and make assignments based on experience.
      3.2.1. Ensure that at least one trained, experienced individual is part of the team.
   3.3. Review the SOPs and any associated documents (sampling plan, quality assurance project plan, permit, etc.).
   3.4. Review project/site files for unusual procedures or site peculiarities.
   3.5. Review the safety plan and discuss contingencies (weather, broken equipment, site access, etc.).
      3.5.1. If the sampling event is more than 3 - 5 days, a written contingency plan is recommended.
      3.5.2. If a boat will be used, a float plan is highly recommended.
      3.5.3. At a minimum discuss and have available:
         3.5.3.1. Phone and directions to nearest emergency facility;
         3.5.3.2. Phone number(s) of supervisor and/or project manager;
         3.5.3.3. Locations of power lines and underground utilities; and
         3.5.3.4. Expected environmental hazards.
4. Schedule the date for deployment and the duration of the sampling event.
   4.1. Obtain the necessary entry permits, keys, etc.
   4.2. Identify name(s) and phone number(s) of landowner, tenant or other responsible party.
5. Assemble any needed maps, directions and site descriptions. Include information on:
   5.1. Traffic conditions and/or traffic patterns; and
   5.2. Parking areas.
6. Identify the number of sampling points, and for each sampling point:
   6.1. Determine the matrices that will be sampled;
   6.2. Identify the specific analyses to be performed per matrix;

6.3. Identify the sampling equipment needs based on the matrix and analytes to be collected. Include tubing, mixing implements and other support equipment;

6.4. Based on the analytical tests and the matrices, determine the number and types of sample containers;

6.5. Based on the analytical tests and the matrices, determine the types of preservatives that will be needed;

6.6. Determine what field measurements must be made; and

6.7. Identify transportation mode to reach the location (boat, truck, etc.).

7. Calculate the total number of each container types (both preserved and unpreserved).

8. Determine the total number of sampling equipment sets (tubing, mixing trays, coring devices, etc.) that will be needed for the sampling event.

9. Notify the laboratory of the trip and arrange for necessary containers, preservatives and other supplies (see FM 2200).

10. Reserve appropriate vehicles.

11. Assemble all field records (notebooks, forms, transmittal forms, etc.).

FM 4000. EQUIPMENT AND SUPPLY PREPARATION

1. SAMPLING EQUIPMENT: Assemble all equipment identified in FM 3000, section 8.

1.1. Inspect equipment for cracks, breaks, and other signs of wear.

1.2. If necessary, repair any equipment and document the repairs in appropriate maintenance logs.

1.3. Reclean any equipment that was cleaned but not protected from the environment (stored on dusty shelves).

1.3.1. If not already clean, decontaminate equipment according to FC 1000.

1.3.2. Clean all transport ice chests and water transport containers (see FC 1190 and FC 1180, respectively).

1.4. Check to make sure fuel and battery powered pumps are working.

1.5. See "Field Sample Collection Equipment Checklist".

2. FIELD MEASUREMENTS: Assemble field instruments to make the measurements identified in FM 3000, section 6.6.

2.1. Inspect instruments for damage.

2.1.1. Repair and/or replace parts as necessary, and document in appropriate maintenance logs.

2.1.2. Assemble the appropriate calibration standards and supplies.

2.1.3. Determine the accuracy of the instruments by either performing an initial calibration or checking the calibration before leaving the base of operations. Document the calibration check.

2.2. See "General Field Support Equipment Checklist”, item 7.

3. DOCUMENTATION: Assemble field record supplies:

- Notebooks, and/or forms
- Indelible/waterproof pens
- Clipboards
- Cameras
- GPS unit, if needed
- See "General Field Support Equipment Checklist ".

4. SAMPLE CONTAINERS: Assemble the appropriate types of sample containers or obtain them from the contracted laboratory. See "General Field Support Equipment Checklist", item 8.
5. PRESERVATIVES: Assemble preservation supplies if not provided by the laboratory.
   5.1. Discard any old solutions; clean containers; and prepare fresh solutions.
   5.2. See "General Field Support Equipment Checklist", item 2.
6. FIELD DECONTAMINATION SUPPLIES: Assemble field decontamination supplies.
   6.1. Discard any old solutions; clean containers; and prepare fresh solutions.
   6.2. Discard analyte-free water and obtain fresh water.
   6.3. See "General Field Support Equipment Checklist", item 1.
7. SHIPPING SUPPLIES: Assemble shipping supplies:
   7.1. Determine nearest point to obtain ice;
   7.2. Marking pens, shipping labels, tape, custody seals (if required);
   7.3. See "General Field Support Equipment Checklist", item 3.
8. VEHICLES:
   8.1. Make sure vehicle maintenance is up-to-date.
   8.2. Check fluids.
   8.3. Check tire pressure.
   8.4. Check fuel and fuel supply.
   8.5. See "General Field Support Equipment Checklist", item 10.
9. SAFETY EQUIPMENT: Assemble any needed safety equipment:
   - Protective gloves.
   - Protective clothing including boots.
   - SCUBA gear or other supplied air supply.
   - First aid kit.
   - Drinking water.
   - Float plan.
   - Address and phone numbers for nearest emergency room.
   - See "General Field Support Equipment Checklist", item 6.

Appendix FM 1000

Tables, Figures and Checklists

Table FM 1000-1 Data Qualifier Codes
General Field Support Equipment Checklist
Field Sample Collection Equipment Checklist

Table FM 1000-1
DATA QUALIFIER CODES

Table FM 1000-1 is provided here for convenience. This table is a reproduction of Table 1 in the QA Rule. Requirements for the use of Table 1 are specified in 62-160.700, F.A.C., including the requirements specified in the title header of Table 1.

Symbol	Meaning
A	Value reported is the arithmetic mean (average) of two or more determinations. This code shall be used if the reported value is the average of results for two or more discrete and separate samples. These samples shall have been processed and analyzed independently. Do not use this code if the data are the result of replicate analysis on the same sample aliquot, extract or digestate.
B	Results based upon colony counts outside the acceptable range. This code applies to microbiological tests and specifically to membrane filter colony counts. The code is to be used if the colony count is generated from a plate in which the total number of coliform colonies is outside the method indicated ideal range. This code is not to be used if a 100 mL sample has been filtered and the colony count is less than the lower value of the ideal range.
F	When reporting species: F indicates the female sex.
H	Value based on field kit determination; results may not be accurate. This code shall be used if a field screening test (i.e., field gas chromatograph data, immunoassay, vendor-supplied field kit, etc.) was used to generate the value and the field kit or method has not been recognized by the Department as equivalent to laboratory methods.
I	The reported value is greater than or equal to the laboratory method detection limit but less than the laboratory practical quantitation limit.
J	Estimated value. A “J”-qualified sample value shall be accompanied by a detailed explanation to justify the reason(s) for designating the value as estimated. Where possible, the organization shall report whether the actual sample value is estimated to be less than or greater than the reported value, to assist data users in any evaluation of the usability of the sample value . A “J” data qualifier code shall not be used as a substitute for K, L, M, G, S, T, V, or Y, however, if additional reasons exist for identifying the value as an estimate (e.g., laboratory control spike or matrix spiked failed to meet acceptance criteria), the “J” code may be added to a K, L, M, G, S, T, U, V, or Y qualifier. Examples of situations in which a “J” code must be reported include: instances where a quality control item associated with the reported value failed to meet the established quality

Table FM 1000-1
DATA QUALIFIER CODES

Symbol	Meaning
	control criteria (the specific failure must be identified); instances when the sample matrix interfered with the ability to make any accurate determination; instances when data are questionable because of improper laboratory or field protocols (e.g., composite sample was collected instead of a grab sample); instances when the analyte was detected at or above the method detection limit in an analytical laboratory blank other than the method blank (such as a calibration blank and the value of the blank is greater than 10% of the associated sample value); or, instances when the field or laboratory calibrations or calibration verifications did not meet calibration acceptance criteria, including quantitative or chronological bracketing requirements for field testing data.
K	Off-scale low. Actual value is known to be less than the value given. This code shall not be used for microbiological tests or for biochemical oxygen demand. This code shall not be used for field-testing measurements where quantitative bracketing is required. This code shall be used if:
	1. The value is less than the lowest calibration standard and the calibration curve is known to be non-linear; or
	2. The value is known to be less than the reported value based on sample size, dilution.
	This code shall not be used to report values that are less than the laboratory practical quantitation limit or laboratory method detection limit.
L	Off-scale high. Actual value is known to be greater than value given. This code shall not be used for microbiological tests or biochemical oxygen demand. This code shall not be used for field-testing measurements where quantitative bracketing is required.To be used when the concentration of the analyte is above the acceptable level for quantitation (exceeds the linear range or highest calibration standard) and the calibration curve is known to exhibit a negative deflection.
M	When reporting chemical analyses: presence of material is verified but not quantified; the actual value is less than the value given. The reported value shall be the laboratory practical quantitation limit. This code shall be used if the level is too low to permit accurate quantification, but the estimated concentration is greater than or equal to the method detection limit. If the value is less than the method detection limit use “T” below.
N	Presumptive evidence of presence of material. This qualifier shall be used if:
	1. The component has been tentatively identified based on mass spectral library search; or

Table FM 1000-1
DATA QUALIFIER CODES

Symbol	Meaning
	2. There is an indication that the analyte is present, but quality control requirements for confirmation were not met (i.e., presence of analyte was not confirmed by alternative procedures).
O	Sampled, but analysis lost or not performed.
Q	Sample held beyond the accepted holding time. This code shall be used if the value is derived from a sample that was prepared or analyzed after the approved holding time restrictions for sample preparation or analysis.
T	Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only and shall not be used in statistical analysis.
U	Indicates that the compound was analyzed for but not detected. This symbol shall be used to indicate that the specified component **was not** detected. The value associated with the qualifier shall be the laboratory method detection limit. Unless requested by the client, less than the method detection limit values shall not be reported (see “T” above).
V	A “V”-qualified sample value indicates that the analyte was detected at or above the method detection limit in both the sample and the associated method blank and the blank value was greater than 10% of the associated sample value. The 10% criterion shall not apply to blank results for biochemical oxygen demand (BOD) or microbiological tests. For BOD tests, the “V” code shall be used for all sample results where the associated method blank result exceeds the maximum blank DO depletion specified in the analytical method. For microbiological tests, the “V” code shall be used for all samples where the associated method blank indicates growth of the target organism. Note: unless specified by the method, the value in the blank shall not be subtracted from associated samples.
X	Indicates, when reporting results from a Stream Condition Index Analysis (SCI 1000), that insufficient individuals were present in the sample to achieve a minimum of 280 organisms for identification (the method calls for two aliquots of 140-160 organisms), suggesting either extreme environmental stress or a sampling error.
Y	The laboratory analysis was from an improperly preserved sample. The data may not be accurate.
Z	Too many colonies were present for accurate counting. Historically, this condition has been reported as “too numerous to count” (TNTC). The “Z” qualifier code shall be reported when the total number of colonies of all

Table FM 1000-1
DATA QUALIFIER CODES

Symbol	Meaning
	types is more than 200 in all dilutions of the sample. When applicable to the observed test results, a numeric value for the colony count for the microorganism tested shall be estimated from the highest dilution factor (smallest sample volume) used for the test and reported with the qualifier code. Atypical, non-target, spreading colonies or other interferences may prevent estimation of typical target organism counts.
?	Data are rejected and should not be used. Some or all of the quality control data for the analyte were outside criteria, and the presence or absence of the analyte cannot be determined from the data.
*	Not reported due to interference.

The following codes deal with certain aspects of field activities. The codes shall be used if the laboratory has knowledge of the specific sampling event. The codes shall be added by the organization collecting samples if they apply:

Symbol	Meaning
D	Measurement was made in the field (i.e., in situ). This code applies to any value (**except** field measurements of pH, specific conductance, dissolved oxygen, temperature, total residual chlorine, transparency, turbidity or salinity) that was obtained under field conditions using approved analytical methods. If the parameter code specifies a field measurement (e.g., “Field pH”), this code is not required.
E	Indicates that extra samples were taken at composite stations.
G	A “G”-qualified sample value indicates that the analyte was detected at or above the method detection limit in both the sample and the associated field blank, equipment blank, or trip blank, and the value of the blank is greater than 10% of the associated sample value. The value in the blank shall not be subtracted from associated samples.
R	Significant rain in the past 48 hours. (Significant rain typically involves rain in excess of 1/2 inch within the past 48 hours.) This code shall be used when the rainfall might contribute to a lower or higher than normal value.
S	Secchi disk visible to bottom of waterbody. The value reported is the depth of the waterbody at the location of the Secchi disk measurement.

Table FM 1000-1
DATA QUALIFIER CODES

Symbol	Meaning
!	Data deviate from historically established concentration ranges.

General Field Support Equipment Checklist

Date: _____ Project/Site: _____

DECONTAMINATION SUPPLIES

- ☐ Basins, buckets or bowls to hold wash water and various rinse waters
- ☐ Brushes or other implements to clean equipment
- ☐ Detergents
  - ☐ Liqui-Nox or equivalent
  - ☐ Alconox or equivalent
- ☐ Acids
  - ☐ Nitric
  - ☐ Hydrochloric
- ☐ Solvents
- ☐ Pesticide grade isopropanol
  - ☐ Other: _____
- ☐ Protective wrapping
  - ☐ Foil
  - ☐ Untreated Plastic bags
  - ☐ Bubble wrap
- ☐ Analyte-free water
  - ☐ Distilled in HDPE
  - ☐ Deionized in HDPE
- ☐ Organic-free in HDPE, Teflon or glass
- ☐ Dispensing bottles
- ☐ HDPE for acids and detergents
- ☐ Teflon for solvents and organic-free water
- ☐ Paper towels or other absorbent material
- ☐ Containers for IDW

PRESERVATION SUPPLIES

- ☐ Acids
  - ☐ Nitric
  - ☐ Hydrochloric
  - ☐ Sulfuric
- ☐ Dechlorination reagents
  - ☐ Sodium thiosulfate
  - ☐ Ascorbic acid
- ☐ Sodium hydroxide
- ☐ Dispensing devices
- ☐ Graduated disposable plastic pipets
- ☐ Glass Pasteur pipets
- ☐ Bulbs
- ☐ Premeasured reagents in vials
- ☐ Narrow range pH paper (range of no more than 3 pH units)
  - ☐ pH range of 1 – 3
  - ☐ pH range of 11 – 14
  - ☐ pH range of 6 – 8
- ☐ Cyanide processing
  - ☐ Sulfide test paper
  - ☐ Precipitating Chemical
  - ☐ Cadmium nitrate or
  - ☐ Cadmium carbonate or
  - ☐ Lead nitrate or
  - ☐ Lead carbonate
  - ☐ KI starch paper
  - ☐ Ascorbic acid
  - ☐ Filter paper

SAMPLE TRANSPORTATION SUPPLIES

- ☐ Ice chests
- ☐ Wet ice
- ☐ Sealing tape
- ☐ Shipping labels
- ☐ Shipping forms
- ☐ Bubble wrap
- ☐ Plastic bags
- ☐ Vermiculite
- ☐ Custody seals

DOCUMENTATION SUPPLIES

- ☐ Notebooks/logs/field forms
- ☐ Pens and markers (waterproof)
- ☐ Sample container labels/tags
- ☐ Custody tags
- ☐ Custody/transmittal forms
- ☐ Clipboard
- ☐ Camera
  - ☐ Film
- ☐ GPS equipment
- ☐ Calculator

REFERENCE MATERIALS

- ☐ Site maps and directions
- ☐ QAPP
- ☐ Sampling plan
- ☐ SOPs
- ☐ Itinerary
- ☐ Float plan
- ☐ Contingency plan

HEALTH & SAFETY SUPPLIES

- ☐ Cell phone
- ☐ First aid kit
- ☐ Drinking water
- ☐ Protective gloves
- ☐ Insect repellent
- ☐ Sunscreen
- ☐ Numbers for nearest emergency facilities
- ☐ Safety goggles
- ☐ Applicable MSDS sheets
- ☐ Respirators
- ☐ Fire extinguisher
- ☐ Hard hats
- ☐ Flotation jackets
- ☐ Cable cutters
- ☐ Traffic cones
- ☐ SCUBA gear
- ☐ SCBA gear
- ☐ Other personal protection gear

FIELD MEASUREMENT EQUIPMENT

- ☐ Lint-free tissues
- ☐ Flow-through cells
- ☐ pH meter
  - ☐ 4, 7 & 10 buffers
- ☐ Conductivity meter
  - ☐ Solution at expected conductivity
- ☐ DO meter
- ☐ Turbidimeter
  - ☐ Gel or Formazin standards

General Field Support Equipment Checklist

Date: _____ Project/Site: _____

- ☐ Residual chlorine
  - ☐ Secondary or primary standards
- ☐ Secchi disk
- ☐ MultiProbe

SAMPLE CONTAINERS

- ☐ Extractable Organics
- ☐ Volatile Organics
- ☐ Nutrients
  - ☐ Glass
  - ☐ Plastic
- ☐ Inorganic Non-metallics
  - ☐ Glass
  - ☐ Plastic
- ☐ Physical Parameters
  - ☐ Glass
  - ☐ Plastic
- ☐ Metals
  - ☐ Glass
  - ☐ Plastic
- ☐ Microbiology
  - ☐ Glass
  - ☐ Plastic
- ☐ Whole Effluent Toxicity
- ☐ Tissues
- ☐ Macrobenthic invertebrates
- ☐ Periphyton
- ☐ Sediment/Soil volatiles
- ☐ Sediment/Soil

Remember:

- ☐ Extra containers
- ☐ Extra VOC septa

FILTRATION EQUIPMENT

- ☐ 1 µm filter units
- ☐ 0.45 µm filters
- ☐ Peristaltic pump
- ☐ Pressurized bailers
- ☐ Syringe with Luer-Lok fitting
- ☐ Tripod filter with pressure/vacuum source
- ☐ Forceps for handling filters

VEHICLES

- ☐ Truck
- ☐ Fuel
- ☐ Boat
- ☐ Fuel
- ☐ Motor
- ☐ Paddles/oars
- ☐ Safety vests

MISCELLANEOUS SUPPLIES

- ☐ Hip boots
- ☐ Chest waders
- ☐ Rain gear
- ☐ Tool kit
- ☐ Extra batteries
- ☐ Stopwatch

Field Sample Collection Equipment Checklist

Date: _____ Project/Site: _____

GROUNDWATER

Pumps
- ☐ Peristaltic
- ☐ Centrifugal
- ☐ Variable speed submersible
- ☐ Submersible
- ☐ Variable speed bladder
- ☐ Bladder

Tubing
- ☐ Teflon ___Sets
- ☐ Polyethylene Sets
- ☐ Polypropylene ___Sets
- ☐ Vinyl ___Sets
- ☐ Rubber ___Sets
- ☐ Tygon ___Sets

Bailers
- ☐ Teflon
- ☐ Stainless steel
- ☐ Polyethylene
- ☐ Acrylic
- ☐ PVC

Support Equipment
- ☐ Graduated containers for measuring purge water
- ☐ Containers for holding purge waters
- ☐ Water level measuring device
- ☐ Plastic sheeting
- ☐ Lanyard material
- ☐ Reels
- ☐ Energy source for pumps

SURFACE WATER

Pumps:
- ☐ Peristaltic
- ☐ Automatic composite sampler
- ☐ Other

Tubing
- ☐ Teflon™ ___Sets
- ☐ Polyethylene ___Sets
- ☐ Polypropylene ___Sets
- ☐ Vinyl ___Sets
- ☐ Rubber ___Sets
- ☐ Tygon ___Sets

Bailers
- ☐ Teflon
- ☐ Stainless Steel
- ☐ Polyethylene
- ☐ Acrylic
- ☐ PVC

Grab Sampling Devices:
- ☐ Dipper
- ☐ Kemmerer
- ☐ Alpha water sampler
- ☐ Niskin
- ☐ Beta sampler
- ☐ Retrieval lines

Mixing Implements
- ☐ Churn splitter

WASTEWATER
- ☐ Pond sampler
- ☐ Dippers
- ☐ Peristaltic pump

Tubing
- ☐ Teflon ___Sets
- ☐ Polyethylene ___Sets
- ☐ Polypropylene ___Sets
- ☐ Vinyl ___Sets
- ☐ Rubber ___Sets
- ☐ Tygon ___Sets
- ☐ Kemmerer
- ☐ Van Dorn
- ☐ Nansen
- ☐ Alpha bottle
- ☐ Beta bottle
- ☐ Niskin
- ☐ DO dunker
- ☐ Automatic composite sampler

Tubing
- ☐ Teflon ___Sets
- ☐ Polyethylene ___Sets
- ☐ Polypropylene ___Sets
- ☐ Vinyl ___Sets
- ☐ Rubber ___Sets
- ☐ Tygon ___Sets

Bailers
- ☐ Plastic
- ☐ Teflon
- ☐ Stainless steel

Scoops
- ☐ Plastic
- ☐ Teflon
- ☐ Stainless steel

Beakers
- ☐ Plastic
- ☐ Teflon
- ☐ Stainless steel

Buckets
- ☐ Plastic
- ☐ Stainless steel

SEDIMENTS

Dredges
- ☐ Petersen
- ☐ Ponar
- ☐ Ekman
- ☐ Young Grab
- ☐ Van Veen
- ☐ Shipek
- ☐ Orange-peel grab
- ☐ Smith-McIntyre grab
- ☐ Drag buckets
- ☐ Winch
- ☐ Cable/line
- ☐ Messenger

Coring Devices
- ☐ Stainless steel
- ☐ Glass
- ☐ Plastic
- ☐ Teflon-lined

SOIL
- ☐ Bucket auger
- ☐ Split spoon sampler
- ☐ Stainless steel shovel
- ☐ Garden shovel
- ☐ Stainless steel trowel or scoop
- ☐ Plastic trowel or scoop
- ☐ Trenching device
- ☐ Coring Devices
- ☐ Stainless steel
- ☐ Glass
- ☐ Plastic
- ☐ Teflon-lined
- ☐ Shelby tube
- ☐ EnCore

Field Sample Collection Equipment Checklist

Date: _____ Project/Site: _____

WASTE

- ☐ Stainless steel scoop
- ☐ Stainless steel spoons or spatulas
- ☐ Stainless steel push tubes
- ☐ Stainless steel auger
- ☐ Stainless steel Ponar dredge
- ☐ Glass coliwasa
- ☐ Drum thief
- ☐ Mucksucker
- ☐ Dipstick
- ☐ Stainless steel bacon bomb
- ☐ Stainless steel bailer
- ☐ Teflon bailer
- ☐ Peristaltic pump
- ☐ Stainless steel split spoon
- ☐ Roto-hammer
- ☐ Glass tubing

SHELLFISH

- ☐ Seine
- ☐ Trawl
- ☐ Bucket type/double pole
- ☐ Tong/Double handed grab
- ☐ Line or cable operated grab bucket
- ☐ Petersen
- ☐ Ponar
- ☐ Ekman
- ☐ Orange-peel grab
- ☐ Biological or hydraulic dredge
- ☐ Scoops/shovels
- ☐ Scrapers
- ☐ Rakes
- ☐ D-traps

Processing Equipment

- ☐ Holding trays
- ☐ Stainless steel shucking knife
- ☐ Calipers or ruler
- ☐ Aluminum foil
- ☐ Plastic bags

FINFISH

- ☐ Electrofishing devices
- ☐ Seines
- ☐ Trawls
- ☐ Angling
- ☐ Gill net
- ☐ Trammel net
- ☐ Hoop, fyke & pound nets
- ☐ D-traps

Processing Equipment

- ☐ Holding trays
- ☐ Measuring board or ruler
- ☐ Stainless steel descaler
- ☐ Stainless steel scalpel
- ☐ Balance
- ☐ Aluminum foil
- ☐ Plastic bags

BIOLOGICAL COMMUNITY SAMPLING

Phytoplankton

- ☐ Van Dorn
- ☐ Alpha bottle
- ☐ Logol's solution

Periphyton

- ☐ Periphytometer
- ☐ Microscope slides
- ☐ 100% buffered formalin
- ☐ Nylon twine

Qualitative Periphyton Sampling

- ☐ Stainless steel spatula/spool
- ☐ Stainless steel forceps
- ☐ Suction bulb
- ☐ Preservative
  - ☐ Buffered formalin
  - ☐ Lugol's solution
- ☐ M3
- ☐ Resealable plastic bags
- ☐ White picking pan

Benthic Macroinvertebrates

- ☐ Forceps
- ☐ Transfer pipettes
- ☐ White picking pans
- ☐ 10X hand lens
- ☐ Alcohol-filled jars
- ☐ Dip net (30 mesh)
- ☐ Hester-Dendy
- ☐ Coring device
- ☐ Dredge
  - ☐ Ekman
  - ☐ Petite ponar
- ☐ 30 mesh box sieve

FQ 1000. FIELD QUALITY CONTROL REQUIREMENTS

Field quality control measures monitor the sampling event to ensure that the collected samples are representative of the sample source.

Field-collected blanks must demonstrate that the collected samples have not been contaminated by:

- The sampling environment
- The sampling equipment
- The sample container
- The sampling preservatives
- Sample transport
- Sample storage

FQ 1100. Sample Containers

Sample containers must be free from contamination by the analytes of interest or any interfering constituents and must be compatible with the sample type.

FQ 1200. Sampling Operations

1. When collected, analyze all quality control samples for the same parameters as the associated samples.

1.1. When collected, collect blanks for the following parameter groups and tests:

- Volatile Organics
- Extractable Organics
- Metals
- Ultratrace Metals
- Inorganic Nonmetallics
- Radionuclides
- Petroleum Hydrocarbons and Oil & Grease
- Volatile Inorganics
- Aggregate Organics except Biochemical Oxygen Demand

1.2. Blanks are not required for:

- Microbiological (all types)
- Toxicity
- Field parameters such as pH, Specific Conductance, Residual Chlorine, Temperature, Light Penetration, Dissolved Oxygen, ORP and Salinity
- Radon
- Algal Growth Potential
- Biological Community
- Physical and Aggregate Properties
- Biochemical Oxygen Demand

2. Preserve, transport, document and handle all quality control samples as if they were samples. Once collected, they must remain with the sample set until the laboratory has received them.

3. Except for trip blanks, prepare all quality control samples **on-site in the field**.

   3.1. Do not prepare precleaned equipment blanks in advance at the base of operations.

   3.2. Do not prepare field-cleaned equipment blanks after leaving the sampling site.

4. Perform and document any field QC measures specified by the analytical method (such as trip blanks for volatile organics).

FQ 1210. QUALITY CONTROL BLANKS

Collect field quality control blanks to monitor the sample collection process, decontamination procedures, quality of sample preservatives and sample storage and transport conditions, to help ensure that samples are representative of the sampling source and have not been artificially contaminated by the sample collection process.

FQ 1211. *Precleaned Equipment Blanks*

1. USE: Monitors on-site sampling environment, sampling equipment decontamination, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions for water, waste, soil, or sediment samples.

2. Collect these blanks using sampling equipment that has been brought to the site precleaned and ready for use. The cleaning procedures used for the blank collection must be identical to those used for the field sample collection.

3. Collect these blanks before the equipment set has been used.

4. Prepare equipment blanks by rinsing the sampling equipment set with the appropriate type of analyte-free water and collecting the rinse water in appropriate sample containers (see FQ 1100).

FQ 1212. *Field-Cleaned Equipment Blanks*

1. USE: Monitors on-site sampling environment, sampling equipment decontamination, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions.

2. Collect these blanks using sampling equipment that has been cleaned in the field (i.e., between sampling points). The cleaning procedures used for the blank collection must be identical to those used for the field sample collection.

3. Prepare field-cleaned equipment blanks immediately after the equipment is cleaned in the field and before leaving the sampling site.

4. Prepare equipment blanks by rinsing the sampling equipment set with the appropriate type of analyte-free water and collecting the rinse water in appropriate sample containers (see FQ 1100).

   4.1. For intermediate sampling devices or equipment, site-water rinsing is defined as the decontamination step, if this is the only cleaning that will be performed on the equipment prior to collecting the sample.

      4.1.1. In this case, collect the equipment blank after rinsing the intermediate device 3 times with site water

      4.1.2. Follow the site-water rinses with 3 rinses using analyte-free water.

      4.1.3. Collect the equipment blank with a subsequent rinse of the device using additional analyte-free water to collect sufficient blank volume.

FQ 1213. *Trip Blanks*

1. USE: Monitors sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions.

2. The organization that is providing the VOC vials must provide the trip blanks by filling two or more VOC vials with analyte-free water and preservatives (if needed).

   2.1. To prevent degradation of the trip blank, long-term storage of prepared trip blanks is not recommended.

3. These blanks are applicable if samples are to be analyzed for volatile constituents (volatile organics, methyl mercury, etc.) in water, waste, soils, or sediments.

4. Place a set of trip blanks in each transport container used to ship/store empty VOC vials. They must remain with the VOC vials during the sampling episode and must be transported to the analyzing laboratory in the same shipping or transport container(s) as the VOC samples.

   4.1 When samples from more than one site are transported in the same ice chest, the same trip blank may be used for all of the samples, provided all samples and the trip blank are analyzed at the same lab.

5. Trip blanks must be opened **only** by the laboratory after the blank and associated samples have been received for analysis. The trip blank must be analyzed by the method(s) used to analyze the associated samples.

FQ 1214. *Field Blanks*

1. USE: Monitors on-site sampling environment, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions for water, waste, soil or sediment samples.

2. Prepare field blanks by pouring analyte-free water into sample containers for each parameter set to be collected.

3. Field blanks are not required if equipment blanks (FQ 1211 or FQ 1212) are collected.

FQ 1220. FIELD DUPLICATES

1. USE: Designed to measure the variability in the sampling process.

2. GENERAL CONSIDERATIONS:

   2.1. Collect duplicates by **repeating** (simultaneously or in rapid succession) the entire sample acquisition technique that was used to obtain the first sample.

      2.1.1. Collect, preserve, transport and document duplicates in the same manner as the samples. **These samples are not considered laboratory duplicates**.

   2.2. When collected, analyze field duplicates for the same parameters as the associated samples.

   2.3. If possible, collect duplicate samples from sampling locations where contamination is present.

   2.4. Field duplicates must be collected if required by the analytical method and as required by a DEP program.

FQ 1221. *Water Duplicates*

Collect water duplicates by sampling from successively collected volumes (i.e., samples from the next volume of sample water).

FQ 1222. *Soil Duplicates*

Collect soil duplicates from the same sample source (i.e., soil from the same soil sampling device).

FQ 1230. MANDATORY FIELD QUALITY CONTROLS

1. The respondent, permittee or contractor and the sampling organization are responsible for ensuring that blanks (excluding trip blanks) are collected at a minimum of 5% of each reported test result/matrix combination for the life of a project.

   1.1. Collect at least one blank for each reported test result/matrix combination each year for each project.

   1.2. If a party wishes to claim that a positive result is due to external contamination sources during sample collection, transport or analysis, then at least one field collected blank (excludes trip blanks) must have been collected at the same time the samples were collected and analyzed with the same sample set.

   1.3. A project will be defined by the organization responsible for collecting the samples for the project.

      1.3.1. When applicable, define the scope of the project in conjunction with the appropriate DEP authority.

2. When collecting a set of blanks, use the following criteria:

   2.1. Equipment Blanks:

      2.1.1. Collect field-cleaned equipment blanks if any sample equipment decontamination is performed in the field.

      2.1.2. If no decontamination is performed in the field, collect precleaned equipment blanks if the equipment is not certified clean by the vendor or the laboratory providing the equipment.

      2.1.3. Equipment blanks are not required for volatile organic compounds.

   2.2. Field Blanks:

      2.2.1. Collect field blanks if no equipment except the sample container is used to collect the samples or if the sampling equipment is certified clean by the vendor or the laboratory providing the equipment.

         2.2.1.1. If a sample container is used as an intermediate sample collection device, collect an equipment blank by rinsing the decontaminated collection container as the substitute for the field blank.

      2.2.2. Field blanks are not required for volatile organic compounds.

   2.3. Trip Blanks:

      2.3.1. These blanks are applicable if samples are to be analyzed for volatile organic compounds. See FQ 1213 for frequency, preparation and handling requirements.

3. OPTIONAL QUALITY CONTROL MEASURES

   3.1. The method or project may require collection of additional quality control measures as outlined in FQ 1210 (Blanks), FQ 1220 (Duplicates) and FQ 1240 (Split Samples).

FQ 1240. SPLIT SAMPLES

The DEP or the client may require split samples as a means of determining compliance or as an added measure of quality control. Unlike duplicate samples that measure the variability of both the sample collection and laboratory procedures, split samples measure only the variability

between laboratories. Therefore, the laboratory samples must be subsamples of the same parent sample and every attempt must be made to ensure sample homogeneity.

Collect, preserve, transport and document split samples using the same protocols as the related samples. In addition, attempt to use the same preservatives (if required).

If split samples are incorporated as an added quality control measure, the DEP recommends that all involved parties agree on the logistics of collecting the samples, the supplier(s) of the preservatives and containers, the analytical method(s), and the statistics that will be used to evaluate the data.

FQ 1241. *Soils, Sediments, Chemical Wastes and Sludges*

Collecting split samples for these matrices is not recommended because a true split sample in these matrices is not possible.

FQ 1242. *Water*

Collect split samples for water in one of two ways:

1. Mix the sample in a large, appropriately precleaned, intermediate vessel (a churn splitter is recommended). This method shall not be used if volatile or extractable organics, oil and grease or total petroleum hydrocarbons are of interest. While continuing to thoroughly mix the sample, pour aliquots of the sample into the appropriate sample containers. Alternatively:

2. Fill the sample containers from consecutive sample volumes **from the same sampling device**. If the sampling device does not hold enough sample to fill the sample containers, use the following procedure:

   2.1. Fill the first container with half of the sample, and pour the remaining sample into the second container.

   2.2. Obtain an additional sample, pour the first half into the **second** container, and pour the remaining portion into the first container.

   2.3. Continue with steps described in sections 2.1 and 2.2 above until both containers are filled.

FQ 1250. QUALITY CONTROL DOCUMENTATION

1. Document all field quality control samples in the permanent field records.
2. At a minimum, record the following information:
   - The type, time, date and location that the quality control sample was collected; and
   - The preservative(s) (premeasured or added amount) and preservation checks performed.
3. If blanks are collected/prepared by the field organization, maintain records of the following:
   - Type of analyte-free water used;
   - Source of analyte-free water (include lot number if commercially purchased);
   - A list of the sampling equipment used to prepare the blank.

   If items above are specified in an internal SOP, you may reference the SOP number and revision date in the field notes. Note any deviations to the procedure in the field notes.
4. For trip blanks, record the following:
   - Date and time of preparation
   - Storage conditions prior to release to the sample collecting organization
   - Type of analyte-free water used

- Source and lot number (if applicable) of analyte-free water

  4.1. Include trip blank information in the sampling kit documentation per FD 2000, section 2.

5. For duplicates, record the technique that was used to collect the sample.

6. For split samples, identify the method used to collect the samples and the source(s) of the sample containers and preservatives.

FS 1000. GENERAL SAMPLING PROCEDURES

See also the following Standard Operating Procedures:

- FA 1000 and 2000 Administrative Procedures
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000-9000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FQ 1000 Field Quality Control Requirements

FS 1001. *Preliminary Activities*

1. Begin each sampling trip with some planning and coordination. Refer to FM 1000 for recommendations and suggestions on laboratory selection and communication, and field mobilization.

   1.1. DEP recommends that a minimum of two people be assigned to a field team. In addition to safety concerns, the process of collecting the samples, labeling the containers and completing the field records is much easier if more than one person is present.

   1.2. If responding to incidents involving hazardous substances, DEP recommends that four or five people be assigned to the team.

2. EQUIPMENT

   2.1. Select appropriate equipment based on the sampling source (see FS 2000 to FS 8200), the analytes of interest and the sampling procedure.

      2.1.1. If properly cleaned, sample containers may be used as collection devices or intermediate containers.

   2.2. The equipment construction must be consistent with the analytes or analyte groups to be collected (see Tables FS 1000-1 through FS 1000-3).

   2.3. Bring precleaned equipment to the field or use equipment that has been certified clean by the vendor or laboratory.

3. DEDICATED EQUIPMENT STORAGE

   3.1. Store all dedicated equipment (except dedicated pump systems or dedicated drop pipes) in a controlled environment.

   3.2. If possible, store equipment in an area that is located away from the sampling site. If equipment other than dedicated pumps or dedicated drop pipes is stored in monitoring wells, suspend the equipment above the formation water.

   3.3. Securely seal the monitoring well in order to prevent tampering between sampling events.

   3.4. Decontaminate all equipment (except dedicated pumps or drop pipes) before use according to the applicable procedures in FC 1000.

4. SAMPLE CONTAINERS

   4.1. The analyses to be performed on the sample determine the construction of sample containers.

   4.2. Inspect all containers and lids for flaws (cracks, chips, etc.) before use. Do not use any container with visible defects or discoloration.

FS 1002. *Contamination Prevention*

1. CONTAMINATION PREVENTION

1.1. Take special effort to prevent cross contamination and contamination of the environment when collecting samples. Protect equipment, sample containers and supplies from accidental contamination.

1.1.1. Do not insert pump tubing, measurement probes, other implements, fingers, etc. into sample containers or into samples that have been collected for laboratory analysis.

1.1.1.1. If it is necessary to insert an item into the container or sample, ensure that the item is adequately decontaminated for the analytes of interest to be analyzed in the sample.

1.1.2. If possible, collect samples from the least contaminated sampling location (or background sampling location) to the most contaminated sampling location.

1.1.2.1. Collect the ambient or background samples first and store them in separate ice chests or shipping containers.

1.1.3. Collect samples in flowing water from downstream to upstream.

1.1.4. Do not store or ship highly contaminated samples (concentrated wastes, free product, etc.) or samples suspected of containing high concentrations of contaminants in the same ice chest or shipping container with other environmental samples.

1.1.4.1. Isolate these sample containers by sealing them in separate, untreated plastic bags immediately after collecting, preserving, labeling, etc.

1.1.4.2. Use a clean, untreated plastic bag to line the ice chest or shipping container.

1.1.5. Segregate reagents such as preservation acids during storage and transport as necessary to prevent cross-contamination of samples or other reagents.

2. COMPOSITE SAMPLES

2.1. Do not collect composite samples unless required by permit or DEP program.

2.2. If compositing is required, use the following procedure:

2.2.1. Select sampling points from which to collect each aliquot.

2.2.2. Using the appropriate sampling technique, collect equal aliquots (same sample size) from each location and place in a properly cleaned container.

2.2.3. Record the approximate amount of each aliquot (volume or weight).

2.2.4. Add preservative(s), if required.

2.2.5. Label container and make appropriate field notes (see FD 1000-9000).

2.2.6. Notify the laboratory that the sample is a composite sample.

2.2.7. When collecting soil or sediment samples, combine the aliquots of the sample directly in the sample container with no pre-mixing. Notify the laboratory that the sample is an unmixed composite sample, and request that the laboratory thoroughly mix the sample before sample preparation or analysis.

2.2.8. When collecting water composites see FS 2000, section 1.3 or pertinent sections of other water matrix SOPs for specific details on collection.

FS 1003. *Protective Gloves*

1. Gloves serve a dual purpose to:

- Protect the sample collector from potential exposure to sample constituents
- Minimize accidental contamination of samples by the collector

2. The DEP recommends wearing protective gloves when conducting all sampling activities. They must be worn except when:
    - The sample source is considered to be non-hazardous
    - The samples will not be analyzed for trace constituents
    - The part of the sampling equipment that is handled without gloves does not contact the sample source
3. Do not let gloves come into contact with the sample or with the interior or lip of the sample container.
4. Use clean, new, unpowdered and disposable gloves.

    4.1. DEP recommends latex gloves, however, other types of gloves may be used as long as the construction materials do not contaminate the sample or if internal safety protocols require greater protection.

    4.2. Note that certain materials (as might be potentially present in concentrated effluent) may pass through certain glove types and be absorbed in the skin. Many vendor catalogs provide information about the permeability of different gloves and the circumstances under which the glove material might be applicable.

    4.3. The powder in powdered gloves can contribute significant contamination and DEP does not recommend wearing powdered gloves unless it can be demonstrated that the powder does not interfere with the sample analysis.
5. If gloves are used, change:
    - After preliminary activities such as pump placement;
    - After collecting all the samples at a single sampling point; or
    - If torn, or used to handle extremely dirty or highly contaminated surfaces.
6. Properly dispose of all used gloves.

FS 1004. *Container and Equipment Rinsing*

When collecting aqueous samples, rinse the sample collection equipment with a portion of the sample water before taking the actual sample. Sample containers do not need to be rinsed. In the case of petroleum hydrocarbons, oil & grease or containers with premeasured preservatives, the sample containers cannot be rinsed.

FS 1005. *Fuel-Powered Equipment and Related Activities*

1. Place all fuel-powered equipment away from, and downwind of, any site activities (e.g., purging, sampling, decontamination). If field conditions preclude such placement (i.e., the wind is from the upstream direction in a boat), place the fuel source(s) as far away as possible from the sampling activities and describe the conditions in the field notes.
2. Handle fuel (i.e., filling vehicles and equipment) prior to the sampling day. If such activities must be performed during sampling, the personnel must wear disposable gloves. Dispense all fuels, dispose of gloves downwind, and well away from the sampling activities.
3. If sampling at active gas stations, stop sample collection activities during fuel deliveries.

FS 1006. *Preservation, Holding Times and Container Types*

1. Preserve all samples according to the requirements specified in Tables FS 1000-4 through FS 1000-11.

1.1. The information listed in the above-referenced tables supersedes any preservation techniques, holding time or container type that might be discussed in individual analytical methods.

1.2. If samples are collected only for total phosphorus and are not for NPDES compliance, thermal preservation (ice) is not required if the sample containers are pre-preserved with acid.

2. The preservation procedures in the referenced tables specify immediate preservation. "Immediate" is defined as "within 15 minutes of sample collection." Perform all preservation on-site (in the field).

2.1. Preservation is not required if samples can be transported back to the laboratory within 15 minutes of collecting the sample and

2.1.1. The laboratory begins sample analysis within the 15-minute window and documents the exact time the analysis began, or

2.1.2. The laboratory adds the appropriate preservatives (including thermal preservation) within 15 minutes of sample collection and documents the exact time that the preservation was done.

3. PRESERVING COMPOSITE WATER SAMPLES

3.1. If the sample preservation requires thermal preservation (e.g., <6°C), the samples must be cooled to the specified temperature.

3.1.1. Manually collected samples to be composited must be refrigerated at a temperature equal to or less than the required temperature.

3.1.2. Automatic samplers must be able to maintain the required temperature by packed ice or refrigeration.

3.2. When chemical preservation is also required, begin the preservation process within 15 minutes of the last collected sample.

3.3. Holding Times for Automatic Samplers:

3.3.1. If the collection period is 24 hours or less, the holding time begins at the last scheduled sample collection;

3.3.2. If the collection period exceeds 24 hours, the holding time begins with the time that the first sample is collected.

4. pH ADJUSTED PRESERVATION - Check the pH of pH-adjusted samples according to these frequencies:

4.1. During the first sampling event at a particular site, check **all** samples (includes each groundwater monitoring well, surface water location, or influent/effluent sampling location) that are pH-adjusted except volatile organics.

4.2. During subsequent visits to a particular site, check at least one sample per parameter group that must be pH-adjusted.

4.3. If the frequency of sample collection at a specified location is greater than once per month (i.e., weekly or daily), check the pH of at least one sample per parameter group (except volatile organics) according to the following schedule:

4.3.1. Weekly sampling: 1 pH check per month

4.3.2. Daily sampling: 1 pH check per week

4.4. If the frequency of sample collection at a specified location is once per month, check the pH of at least one sample per parameter group (except volatile organics) quarterly.

4.5. If site conditions vary from sampling event to sampling event, perform pH checks at increased intervals.

5. THERMAL PRESERVATION

5.1. When preservation requirements indicate cooling to a specific temperature, samples must be placed in wet ice within 15 minutes of sample collection (see 1006, section 2 above). Unless specified, do not freeze samples.

5.2. All supplies (ice, dry ice, etc.) necessary to meet a thermal preservation requirement must be onsite for immediate use.

5.3. Ship samples in wet ice. If samples are cooled to the required temperature before shipment, samples may be shipped with frozen ice packs if the specified temperature is maintained during shipment. The sample temperature must not exceed the specified temperature.

5.4. If immediate freezing is required, dry ice must be available in the field to begin the freezing process.

FS 1007. *Preventive and Routine Maintenance*

Preventive maintenance activities are necessary to ensure that the equipment can be used to obtain the expected results and to avoid unusable or broken equipment while in the field. Equipment is properly maintained when:

- It functions as expected during mobilization; and
- It is not a source of sample contamination (e.g., dust).

1. Follow the manufacturer's suggested maintenance activities and document all maintenance. At a minimum, DEP recommends the activities listed on Table FS 1000-12.

2. Maintain documentation for the following information for each piece of equipment or instrumentation. See FD 3000 also.

2.1. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit employed. This identifier may include a manufacturer name, model number, serial number, inventory number or other unique identification.

2.2. Log all maintenance and repair performed for each instrument unit, including routine cleaning procedures and solution or parts replacement for instrument probes.

2.3. Include the calendar date for the procedures performed.

2.4. Record names of personnel performing the maintenance or repair tasks.

2.5. Describe any malfunctions necessitating repair or service.

2.6. Retain vendor service records for all affected instruments.

2.7. Record the following for rented equipment:

- Rental date(s)
- Equipment type and model or inventory number or other description

2.8. Retain the manufacturer’s operating and maintenance instructions.

FS 1008. *Documentation and References*

1. REFERENCES: All sampling references must be available for consultation in the field. These include:

- DEP SOPs;
- Internal SOPs;
- Sampling and analysis plans; and/or
- Quality Assurance Project Plans.

2. DOCUMENTATION: Complete and sign all documentation (see FD 1000).

FS 1009. *Sample Documentation and Evidentiary Custody*

1. SAMPLE DOCUMENTATION

1.1. Document all activities related to a sampling event, including sample collection, equipment calibration, equipment cleaning and sample transport.

1.2. The required documentation related to each sampling or other field activity is specified in the associated SOPs; i.e., FQ 1000, FC 1000, the FS series, and the FT series.

1.3. The documentation requirements are also summarized in FD 1000, Field Documentation. FD 1000 additionally contains a list of example forms published with the SOPs that may be used to document various activities or as templates for creating customized forms.

2. LEGAL CHAIN OF CUSTODY (COC)

The use of legal or evidentiary Chain-of-Custody (COC) protocols is not usually required by DEP, except for cases involving civil or criminal enforcement. Do not use these procedures for routine sampling for compliance unless evidentiary custody protocols are specifically mandated in a permit or other legal order or when required for enforcement actions.

Evidentiary sample custody protocols are used to demonstrate that the samples and/or sample containers were handled and transferred in such a manner as to eliminate possible tampering.

When a client or situation requires legal COC, use the procedures in FD 7000 to document and track all time periods associated with the physical possession and storage of sample containers, samples, and subsamples from point of origin through the final analytical result and sample disposal.

When legal or evidentiary COC is required, samples must be:

- In the actual possession of a person who is authorized to handle the samples (e.g., sample collector, laboratory technician);
- In the view of the same person after being in their physical possession;
- Secured by the same person to prevent tampering; or
- Stored in a designated secure area.

2.1. Control and document access to all evidentiary samples and subsamples with adequate tracking. Documentation must include records about each of the activities and situations listed below, when applicable to sample evidence, and must track the location and physical handling of all samples by all persons at all times.

2.1.1. Limit the number of individuals who physically handle the samples as much as practicable.

2.1.2. When storing samples and subsamples, place samples in locked storage (e.g., locked vehicle, locked storeroom, etc.) at all times when not in the possession or view of authorized personnel.

2.1.3. Alternatively, maintain restricted access to facilities where samples are stored. Ensure that unauthorized personnel are not able to gain access to the samples at any time.

2.1.4. Do not leave samples in unoccupied motel or hotel rooms or other areas where access cannot be controlled by the person(s) responsible for custody without first securing samples and shipping or storage containers with tamper-indicating evidence tape or custody seals. Ice chests or other storage containers used to store sample containers in hotel rooms may be sealed instead of sealing each sample container stored within.

2.2. Use a Chain of Custody form or other transmittal record to document sample transfers to other parties. Other records and forms may be used to document internal activities if they meet the requirements for legal chain of custody.

2.3. Legal COC begins when the precleaned sample containers are dispatched to the field.

2.3.1. The person who relinquishes the prepared sample kits or containers and the individual who receives the sample kits or containers must sign the COC form unless the same party provides the containers <u>and</u> collects the samples.

2.3.2. All parties handling the empty sample containers and samples are responsible for documenting sample custody, including relinquishing and receiving samples, except commercial common carriers.

2.4. <u>Shipping Samples under Legal COC</u>

2.4.1. Complete all relevant information on the COC transmittal form or record (see FD 7200, section 2).

2.4.2. Internal records must document the handling of the samples and shipping containers in preparation for shipment. The names of all persons who have prepared the shipment must be recorded. All time intervals associated with handling and preparation must be accounted for.

2.4.3. Place the forms in a sealed waterproof bag and place in the shipping container with the samples.

2.4.4. Seal the shipping container with tamper-proof seals (see 2.6 below) so that any tampering can be clearly seen by the individual who receives the samples.

2.4.5. Note: The common carrier does not sign COC records. However, the common carrier (when used) must be identified.

2.5. <u>Delivering Samples to the Laboratory</u>

2.5.1. All individuals who handle and relinquish the sample containers must sign the transmittal form. The legal custody responsibilities of the field operations end when the samples are relinquished to the laboratory.

2.6. <u>Chain of Custody Seals</u>: If required, affix tamper-indicating evidence tape or seals to all sample, storage and shipping container closures when transferring or shipping sample container kits or samples to another party.

2.6.1. Place the seal so that the closure cannot be opened without breaking the seal.

2.6.2. Record the time, calendar date and signatures of responsible personnel affixing and breaking all seals for each sample container and shipping container.

2.6.3. Affix new seals every time a seal is broken until continuation of evidentiary custody is no longer required.

FS 1010. *Health and Safety*

Implement all local, state and federal requirements relating to health and safety.

FS 1011. *Hazardous Wastes*

Investigators and sampling personnel should attempt to follow all local, state and federal requirements pertaining to the storage and disposal of any hazardous or investigation-derived wastes (IDW). The discussion below is not intended to describe these requirements and is provided for informational purposes only.

1. All IDW should be properly managed so that contamination is not spread into previously uncontaminated areas.

1.1. IDW typically includes all water, soil, drilling mud, decontamination wastes, discarded personal protective equipment (PPE), etc. from site investigations, exploratory borings, piezometer and monitoring well installation, refurbishment, and abandonment, and other investigative activities. IDW should be containerized at the time it is generated.

1.2. Investigators and sampling personnel should determine if the IDW must be managed as Resource Conservation and Recovery Act (RCRA) regulated hazardous waste through appropriate testing or generator knowledge. IDW that is determined to be RCRA regulated hazardous waste should be managed according to the applicable local, state and federal requirements.

1.3. IDW that is not a RCRA regulated hazardous waste but is contaminated above the Department's Soil Cleanup Target Levels or the state standards and/or minimum criteria for ground water quality should be properly disposed of according to the applicable local, state and federal requirements.

1.4. IDW that is not contaminated or contains contaminants below the Department's Soil Cleanup Target Levels or the state standards and/or minimum criteria for ground water quality may be disposed of onsite if the IDW will not cause a surface water violation. However, investigators and sampling personnel should first verify that all applicable regulations have been met before disposal of the IDW.

1.5. All containers holding IDW should be maintained in good condition:

1.5.1. Containers should be periodically inspected for damage

1.5.2. Personnel should ensure that all required labeling (DOT, RCRA, etc.) is clearly visible.

Appendix FS 1000
Tables, Figures and Forms

Table FS 1000-1 Equipment Construction Materials
Table FS 1000-2 Construction Material Selection for Equipment and Sample Containers
Table FS 1000-3 Equipment Use and Construction
Table FS 1000-4 40 CFR Part 136 Table II: Required Containers, Preservation Techniques, and Holding Times (Water/Wastewater Samples)
Table FS 1000-5 Approved Water and Wastewater Procedures, Containers, Preservation and Holding Times for Analytes not found in 40 CFR Part 136
Table FS 1000-6 Recommended Sample Containers, Sample Volumes, Preservation Techniques and Holding Times for Residuals, Soil and Sediment Samples.
Table FS 1000-7 Sample Handling, Preservation and Holding Time Table for SW 846 Method 5035
Table FS 1000-8 Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II
Table FS 1000-9 Containers, Preservation and Holding Times for Biosolids Samples and Protozoans
Table FS 1000-10 Container Materials, Preservation, and Holding Times for Fish and Shellfish
Table FS 1000-11 Holding Times for SPLP or TCLP Extraction, Sample Preparation and Determinative Analysis
Table FS 1000-12 Preventive Maintenance Tasks
Figure FS 1000-1 Organic Trap Configuration for Collecting Extractable Organics with a Peristaltic Pump

Table FS 1000-1
Equipment Construction Materials

Construction Material[1]	Acceptable Analyte Groups	Precautions
Metals		
316 Stainless Steel	All analyte groups. Recommended for inorganic nonmetallics, metals, volatile and extractable organics.	Do not use if weathered, corroded or pitted.[2]
300-Series Stainless Steel (304, 303, 302)	Suitable for all analyte groups (if used, check for corrosion before use). Recommended for inorganic nonmetallics, metals, volatile and extractable organics.	Do not use if weathered, corroded or pitted.[2] If corroded, there is a potential for samples to be contaminated with iron, chromium, copper or nickel. Check for compatibility with water chemistry for dedicated applications. Do not use in low pH, high chloride, or high TDS waters.
Low Carbon Steel Galvanized Steel Carbon Steel	Inorganic nonmetallics only.	Coring devices are acceptable for all analyte groups **if** appropriate liners are used. Use Teflon liners for organics. Use plastic or Teflon liners for metals. Do not use if weathered, corroded or pitted.[2] If corroded, there is a potential for samples to be contaminated with iron and manganese. Galvanized equipment will also contaminate with zinc and cadmium. If used to collect large samples (e.g., dredges), collect organic and metal samples may be collected from portions of the interior of the collected material.
Brass	Inorganic nonmetallics only.	Do not use if weathered, corroded or pitted.[2]
Plastics[3]		
Teflon and other fluorocarbon polymers	All analyte groups. Especially recommended for trace metals and organics.	Easily scratched. Do not use if scratched or discolored.
Polypropylene Polyethylene (All Types)	All analyte groups.	LDPE may not be used for pump tubing when collecting for VOCs. Easily scratched. Do not use if scratched or discolored.
Polyvinyl chloride (PVC)	All analyte groups except extractable and volatile organics.	Do not use when collecting extractable or volatile organics samples.

Table FS 1000-1
Equipment Construction Materials

Construction Material[1]	Acceptable Analyte Groups	Precautions
Tygon, Silicone, Neoprene	All analyte groups except extractable and volatile organics.	Do not use when collecting extractable or volatile organic samples (see Table FS 1000-3 for silicone tubing exceptions). Do not use silicone if sampling for silica.
Viton	All analyte groups except extractable and volatile organics.[4]	Minimize contact with sample. Use only if no alternative material exists.
Glass		
Glass, borosilicate	All analyte groups except silica and boron.	

Adapted from USGS Field Manual, Chapter 2, January 2000.

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[1] Refers to construction material of the portions of the sampling equipment that come in contact with the sample (e.g., housing of variable speed submersible pump must be stainless steel if extractable organics are sampled; the housing of a variable speed submersible pump used to sample metals may be plastic.)

[2] Corroded/weathered surfaces are active sorption sites for organic compounds.

[3] Plastics used in connection with inorganic trace element samples (including metals) must be uncolored or white.

[4] May be allowable for specialized parts where no alternative material exists (e.g., Viton seals are the best available seal for some dedicated pump systems), however, contact with the sample must be minimized.

Table FS 1000-2
Construction Material Selection for Equipment and Sample Containers

Analyte Group	Acceptable Materials
Extractable Organics (see Table FS 1000-3 for silicone tubing exceptions)	Teflon Stainless steel Glass Polypropylene (All types) Polyethylene (All types) All parts of the system including connectors and gaskets must be considered – Viton may be used if no other material is acceptable.
Volatile Organics (see Table FS 1000-3 for silicone tubing exceptions)	Teflon Stainless steel Glass Polypropylene (All types) Polyethylene (All types excluding LDPE) All parts of the system including connectors and gaskets must be considered – Viton may be used if no other material is acceptable.
Metals	Teflon Stainless steel Polyethylene (All types) Polypropylene (All types) Tygon, Viton, Silicone, Neoprene PVC Glass (except silica and boron)
Ultratrace Metals	Teflon Polyethylene (All types) Polypropylene (All types) Polycarbonate Mercury must be in glass or Teflon
Inorganic Nonmetallics	Teflon Stainless steel Low carbon, Galvanized or Carbon steel Polyethylene (All types) Polypropylene (All types) Tygon, Viton, Silicone, Neoprene PVC Glass Brass

Table FS 1000-2
Construction Material Selection for Equipment and Sample Containers

Analyte Group	Acceptable Materials
Microbiological samples	Teflon Stainless steel Polyethylene (All types) Polypropylene (All types) Tygon, Viton, Silicone, Neoprene PVC Glass Sterilize all **sample** containers. Thoroughly clean **sampling equipment** and rinse several times with sample water before collection. Sampling equipment **does not require** sterilization **Do not rinse sample containers**

Table FS 1000-3
Equipment Use and Construction

EQUIPMENT	CONSTRUCTION: HOUSING[1]	CONSTRUCTION: TUBING	USE	PERMISSIBLE ANALYTE GROUPS	RESTRICTIONS AND PRECAUTIONS
WATER SAMPLING					
GROUNDWATER					
1 Positive displacement pumps[2]					
a. Submersible (turbine, helical rotor, gear driven)	SS, Teflon	SS, Teflon, PE[14], PP	Purging	All analyte groups	[3,4,5]; must be variable speed
			Sampling	All analyte groups	[3,4,5] must be variable speed
	SS, Teflon	Non-inert[6]	Purging	All analyte groups	[3,4,5] must be variable speed; polishing required[7]
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	Must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
	Non-inert[6]	Non-inert[6]	Purging	All analyte groups	[3,4,5] must be variable speed; polishing required[7]
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	Must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
b. Bladder pump (no gas contact)	SS, Teflon, PE, PP or PVC if permanently installed	SS, Teflon, PE[14], PP	Purging	All analyte groups	[3,4,5] must be variable speed
			Sampling	All analyte groups	[3,4] must be variable speed Bladder must be Teflon if sampling for volatile or extractable organics or PE or PP if used in portable pumps
	SS, Teflon, PE, PP	Non-inert[6]	Purging	All analyte groups	[3,4] must be variable speed; polishing required[7] **This configuration <u>is</u> <u>not</u> recommended**
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	[3,4] must be variable speed If sampling for metals, the tubing must be non-metallic if not SS
	Non-inert[6]	Non-inert[6]	Purging	All analyte groups	[3,4] must be variable speed; polishing required[7]
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	[3,4] must be variable speed; polishing required[7] If sampling for metals, the tubing must be non-metallic if not SS

Table FS 1000-3
Equipment Use and Construction

EQUIPMENT	CONSTRUCTION: HOUSING[1]	CONSTRUCTION: TUBING	USE	PERMISSIBLE ANALYTE GROUPS	RESTRICTIONS AND PRECAUTIONS
2. Suction lift pumps					
a. Centrifugal	N/A	SS, Teflon, PE[14], PP	Purging	All analyte groups	[4] foot-valve required Must be variable speed
	N/A	Non-inert[6]	Purging	All analyte groups	[4] foot-valve required; polishing required[7] Must be variable speed
b. Peristaltic	N/A	SS, Teflon, PE[14], PP	Purging	All analyte groups	[4] foot-valve required; polishing required[7] or continuous pumping required Must be variable speed
			Sampling	All analyte groups	[4] Silicone tubing in pump head Must be variable speed
	N/A	Non-inert[6]	Purging	All analyte groups	[4] foot-valve required Must be variable speed
			Sampling	All analyte groups <u>except</u> <u>volatile and extractable organics</u>	[4] Silicone tubing in pump head Must be variable speed
3. Bailers	SS, Teflon, PE, PP	N/A	Purging	All analyte groups	None; **<u>not recommended</u>**
		N/A	Sampling	All analyte groups	None; **<u>not recommended</u>**
	Non-inert[6]	N/A	Purging	All analyte groups <u>except</u> volatile and extractable organics	None; **<u>not recommended</u>** If sampling for metals, the tubing must be non-metallic if not SS
			Sampling	All analyte groups <u>except</u> volatile and extractable organics	None; **<u>not recommended</u>** If sampling for metals, the tubing must be non-metallic if not SS
<u>SURFACE WATER</u>					
1. Intermediate containers such as pond sampler, scoops, beakers, buckets, and dippers	SS, Teflon, Teflon-coated, PE, PP	N/A	Grab sampling	All analyte groups	None
	Glass	N/A		All analyte groups except boron and fluoride	None
	Non-inert[6]	N/A		All analyte groups <u>except</u> volatile and extractable organics	None

Table FS 1000-3
Equipment Use and Construction

EQUIPMENT	CONSTRUCTION		USE	PERMISSIBLE ANALYTE GROUPS	RESTRICTIONS AND PRECAUTIONS
	HOUSING[1]	TUBING			
2. Nansen, Kemmerer, Van Dorn, Alpha and Beta Samplers, Niskin (or equivalent)	SS, Teflon, Teflon-coated, PE, PP	N/A	Specific depth grab sampling	All analyte groups	None
	Non-inert[6]	N/A		All analyte groups <u>except</u> volatile and extractable organics	None
3. DO Dunker	SS, Teflon, glass, PE, PP	N/A	Water column composite sampling	All analyte groups	None
4 Bailers – double valve	SS, Teflon, PE, PP	N/A	Grab sampling	All analyte groups	None
	Non-inert[6]	N/A	Grab sampling	All analyte groups <u>except</u> volatile and extractable organics	None If sampling for metals, the tubing must be non-metallic if not SS
5. Peristaltic pump	N/A	SS, Teflon, PE[14], PP	Specific depth sampling	All analyte groups	Silicone tubing in pump head Must be variable speed
	N/A	Non-inert[6]		All analyte groups <u>except</u> volatile and extractable organics	Silicone tubing in pump head Must be variable speed
<u>FIELD FILTRATION UNITS</u>	N/A		Dissolved constituents	Inorganic nonmetallics and metals in surface water	Must use a 0.45 μm filter
				Inorganic nonmetallics in groundwater	Must use a 0.45 μm filter
				Metals in groundwater and static wastewater and surface water	Must use in-line, high capacity, one-piece molded filter that is connected to the outlet of a pump; no intermediate vessels; positive pressure PE, PP & Teflon bailers acceptable Must use a 1 μm filter in groundwater, a 0.45 μm filter in surface water
				Metals in moving surface water (i.e., river/stream)	Must use positive pressure device, but an intermediate vessel may be used. Use a 0.45 μm filter

Table FS 1000-3
Equipment Use and Construction

EQUIPMENT	CONSTRUCTION: HOUSING[1]	CONSTRUCTION: TUBING	USE	PERMISSIBLE ANALYTE GROUPS	RESTRICTIONS AND PRECAUTIONS
SOLID SAMPLING					
SOILS					
1. Core barrel (or liner)	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	N/A	Sampling	All analyte groups[8]	[9, 10, 11]
	Non-inert[6] nonmetallics	N/A	Sampling	All analyte groups	[12]
	Non-inert[6] metals	N/A	Sampling	All analyte groups	[12]
2. Trowel, scoop, spoon or spatula	SS, Teflon, Teflon-coated, PE, PP	N/A	Sampling	All analyte groups[8]	
			Compositing	All analyte groups except volatile organics	Samples for volatile organics must be grab samples
	Plastic	N/A	Sampling and compositing	All analyte groups <u>except</u> volatile and extractable organics	None Must be nonmetallic if not SS
3. Mixing tray (pan)	SS, Teflon, glass, Teflon-coated, aluminum , PE, PP	N/A	Sampling	All analyte groups[8]	[11]
			Compositing or homogenizing	All analyte groups except volatile organics	[11]
	Non-inert[6]	N/A	Compositing or homogenizing	All analyte groups	[10,11,12] must be nonmetallic if not SS
4. Shovel, bucket auger	SS	N/A	Sampling	All analyte groups[8]	None
	Non-SS	N/A	Sampling	All analyte groups[8]	[10,11,12]
5. Split spoon	SS or carbon steel w/ Teflon insert	N/A	Sampling	All analyte groups[8]	[10,11,12]
6. Shelby tube	SS	N/A	Sampling	All analyte groups[8]	[9]
	Carbon steel	N/A	Sampling	All analyte groups	[9,10,12]
SEDIMENT					
1. Coring devices	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	N/A	Sampling	All analyte groups[8]	[9,10,11]

Table FS 1000-3
Equipment Use and Construction

EQUIPMENT	CONSTRUCTION		USE	PERMISSIBLE ANALYTE GROUPS	RESTRICTIONS AND PRECAUTIONS
	HOUSING[1]	TUBING			
	Non-inert[6] nonmetallics	N/A	Sampling	All analyte groups	[12]
	Non-inert[6] metals	N/A	Sampling	All analyte groups	[9,10,11]
2. Grab – Young, Petersen, Shipek	Teflon, Teflon-lined, SS	N/A	Sampling	All analyte groups[8]	None
	Carbon steel	N/A	Sampling	All analyte groups	[10,11]
3. Dredges – Eckman, Ponar, Petit Ponar Van Veen	SS	N/A	Sampling	All analyte groups[8]	None
	Carbon steel, brass	N/A	Sampling	All analyte groups	[10,11]
4. Trowel, scoop, spoon or spatula	SS, Teflon, Teflon-coated, PE, PP	N/A	Sampling	All analyte groups[8]	
			Compositing	All analyte groups except volatile organics	Samples for volatile organics must be grab samples
	Plastic	N/A	Sampling and compositing	All analyte groups <u>except</u> volatile and extractable organics	None must be nonmetallic if not SS
5. Mixing tray (pan)	SS, Teflon, glass, Teflon-coated, aluminum, PE, PP	N/A	Sampling	All analyte groups[8]	[11]
			Compositing or homogenizing	All analyte groups except volatile organics	[11]
	Non-inert[6]	N/A	Compositing or homogenizing	All analyte groups <u>except</u> volatile and extractable organics	none [11] must be nonmetallic if not SS
WASTE[13]					
Scoop	SS	N/A	Liquids, solids & sludges	All analyte groups[8]	Cannot collect deeper phases
Spoon	SS	N/A	Solids, sludges	All analyte groups[8]	Cannot collect deeper phases
Push tube	SS	N/A	Solids, sludges	All analyte groups[8]	Cannot collect deeper phases
Auger	SS	N/A	Solids	All analyte groups[8]	None

Table FS 1000-3
Equipment Use and Construction

EQUIPMENT	CONSTRUCTION		USE	PERMISSIBLE ANALYTE GROUPS	RESTRICTIONS AND PRECAUTIONS
	HOUSING[1]	TUBING			
Sediment sampler	SS	N/A	Impoundments, piles	All analyte groups[8]	None
Ponar dredge	SS	N/A	Solids, sludges & sediments	All analyte groups[8]	None
Coliwasa, Drum thief	Glass	N/A	Liquids, sludges	All analyte groups	None
Mucksucker, Dipstick	Teflon		Liquids, sludges	All analyte groups	Not recommended for tanks > 11 feet deep
Bacon bomb	SS	N/A	Liquids	All analyte groups[8]	Not recommended for viscous wastes
Bailer	SS, Teflon	N/A	Liquids	All analyte groups[8]	Do not use with heterogeneous wastes Not recommended for viscous wastes
Peristaltic pump	N/A	Teflon, Glass	Liquids	All analyte groups except volatile organics	Do not use in flammable atmosphere Not recommended for viscous wastes
Backhoe bucket	Steel	N/A	Solids, Sludges		Difficult to clean Volatiles and metals must be taken from the interior part of the sample
Split spoon	SS	N/A	Solids	All analyte groups[8]	
Roto-Hammer	Steel	N/A	Solids	All analyte groups[8]	Physically breaks up sample Not for flammable atmospheres

Acronyms:

N/A	not applicable
SS	stainless steel
HDPE	high-density polyethylene
PE	polyethylene
PVC	polyvinyl chloride
PP	polypropylene
LDPE	low density polyethylene[14]

Table FS 1000-3
Equipment Use and Construction

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[1] Refers to tubing and pump housings/internal parts that are in contact with purged or sampled water (interior and exterior of delivery tube, inner lining of the discharge tube, etc.).

[2] If used to collect volatile or extractable organics, all power cords and other tubing must be encased in Teflon, PE or PP.

[3] If used as a non-dedicated system, pump must be completely disassembled, if practical, and cleaned between wells.

[4] Delivery tubing must be precleaned and precut at the base of operations or laboratory. If the same tubing is used during the sampling event, it must be cleaned and decontaminated between uses.

[5] In-line check valve required.

[6] "Non-inert" pertains to materials that are reactive (adsorb, absorb, etc.) to the analytes being sampled. For organics, materials include rubber, plastics (except PE and PP), and PVC. For metals, materials include brass, galvanized, and carbon steel.

[7] "Polishing": When purging for volatile or extractable organics, the entire length of tubing or the portion which comes in contact with the formation water must be constructed of Teflon, SS, PE or PP. If other materials (e.g., PVC, garden hoses, etc.) are used, the following protocols must be followed: 1) slowly withdraw the pump from the water column during the last phase of purging, to remove any water from the well that may have contacted the exterior of the pump and/or tubing; 2) remove a single well volume with the sampling device before sampling begins. **Do not use Tygon** for purging if purgeable or extractable organics are of interest. Polishing **is not recommended;** use of sampling equipment constructed of appropriate materials is preferred.

[8] Do not use if collecting for hexavalent chromium (Chromium^{+6})

[9] If samples are sealed in the liner for transport to the laboratory, the sample for VOC analysis must be taken from the interior part of the core.

[10] If a non-stainless steel (carbon steel, aluminum) liner, core barrel or implement is used, take the samples for metals, purgeable organics and organics from the interior part of the core sample.

[11] Aluminum foil, trays or liners may be used only if aluminum is not an analyte of interest.

[12] If non-inert-liner, core barrel or implement is used, take samples from the interior part of the collected sample.

[13] If disposable equipment of alternative construction materials is used, the construction material must be compatible with the chemical composition of the waste, cannot alter the characteristics of the waste sample in any way, and cannot contribute analytes of interest or any interfering components.

[14] LDPE may not be used for pump tubing when collecting VOCs.

Table FS1000-4
40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times*
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container[1]	Preservation[2, 3]	Maximum holding time[4]
Table IA—Bacterial Tests:			
1–5. Coliform, total, fecal, and *E. coli*	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$[5]	8 hours [22, 23]
6. Fecal streptococci	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$[5]	8 hours [22]
7. Enterococci	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$[5]	8 hours [22]
8. Salmonella	PA, G	Cool, <10 °C, 0.0008% $Na_2S_2O_3$[5]	8 hours [22]
Table IA— Aquatic Toxicity Tests:			
9–12. Toxicity, acute and chronic	P, FP, G	Cool, ≤6 °C [16]	36 hours
Table IB—Inorganic Tests:			
1. Acidity	P, FP, G	Cool, ≤6 °C[18]	14 days
2. Alkalinity	P, FP, G	Cool, ≤6 °C[18]	14 days
4. Ammonia	P, FP, G	Cool, ≤6 °C[18], H_2SO_4 to pH<2	28 days
9. Biochemical oxygen demand	P, FP, G	Cool, ≤6 °C[18]	48 hours
10. Boron	P, FP, or Quartz	HNO_3 to pH<2	6 months
11. Bromide	P, FP, G	None required	28 days
14. Biochemical oxygen demand, carbonaceous	P, FP G	Cool, ≤6 °C[18]	48 hours
15. Chemical oxygen demand	P, FP, G	Cool, ≤6 °C[18], H_2SO_4 to pH<2	28 days
16. Chloride	P, FP, G	None required	28 days
17. Chlorine, total residual	P, G	None required	Analyze within 15 minutes
21. Color	P, FP, G	Cool, ≤6 °C[18]	48 hours
23–24. Cyanide, total or available (or CATC)and free	P, FP, G	Cool, ≤6 °C[18], NaOH to pH>10 reducing agent if oxidizer is present[5, 6]	14 days
25. Fluoride	P	None required	28 days
27. Hardness	P, FP, G	HNO_3 or H_2SO_4 to pH<2	6 months
28. Hydrogen ion (pH)	P, FP, G	None required	Analyze within 15 minutes
31, 43. Kjeldahl and organic N	P, FP, G	Cool, ≤6 °C[18], H_2SO_4 to pH<2	28 days
Table IB—Metals[7]:			
7 18. Chromium VI	P, FP, G	Cool, ≤6 °C[18], pH = 9.3–9.7[20]	28 days

Table FS1000-4
40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times*
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container[1]	Preservation[2, 3]	Maximum holding time[4]
35. Mercury (CVAA)	P, FP, G	HNO_3 to pH<2	28 days
35. Mercury (CVAFS)	FP, G; and FP-lined cap	5 mL/L 12N HCl or 5 mL/L BrCl[17]	90 days [17]
3, 5–8, 12, 13, 19, 20, 22, 26, 29, 30, 32–34, 36, 37, 45, 47, 51, 52, 58–60, 62, 63, 70– 72, 74, 75. Metals, except boron, chromium VI, and mercury.	P, FP, G	HNO_3 to pH<2, or at least 24 hours prior to analysis[19]	6 months
Table IB—Inorganic Tests (continued):			
38. Nitrate	P, FP, G	Cool, ≤6 °C[18]	48 hours
39. Nitrate-nitrite	P, FP, G	Cool, ≤6 °C[18], H_2SO_4 to pH<2	28 days
40. Nitrite	P, FP, G	Cool, ≤6 °C[18]	48 hours
41. Oil and grease	G	Cool, ≤6 °C[18], HCl or H2SO4 to pH<2	28 days
42. Organic Carbon	P, FP, G	Cool, ≤6 °C[18]HCl, H_2SO_4, or H_3PO_4 to pH<2.	28 days
44. Orthophosphate	P, FP, G	Cool, ≤6 °C[18], [24]	Filter within 15 minutes; Analyze within 48 hours
46. Oxygen, Dissolved Probe	G, Bottle and top	None required	Analyze within 15 minutes
47. Winkler	G, Bottle and top	Fix on site and store in dark	8 hours
48. Phenols	G	Cool, ≤6 °C[18], H_2SO_4 to pH<2	28 days
49. Phosphorous (elemental)	G	Cool, ≤6 °C[18]	48 hours
50. Phosphorous, total	P, FP, G	Cool, ≤6 °C[18], H_2SO_4 to pH<2	28 days
53. Residue, total	P, FP, G	Cool, ≤6 °C[18]	7 days
54. Residue, Filterable	P, FP, G	Cool, ≤6 °C[18]	7 days
55. Residue, Nonfilterable (TSS)	P, FP, G	Cool, ≤6 °C[18]	7 days
56. Residue, Settleable	P, FP, G	Cool, ≤6 °C[18]	48 hours
57. Residue, Volatile	P, FP, G	Cool, ≤6 °C[18]	7 days
61. Silica	P or Quartz	Cool, ≤6 °C[18]	28 days
64. Specific conductance	P, FP, G	Cool, ≤6 °C[18]	28 days
65. Sulfate	P, FP, G	Cool, ≤6 °C[18]	28 days
66. Sulfide	P, FP, G	Cool, ≤6 °C[18], add zinc acetate plus sodium hydroxide to pH>9	7 days

Table FS1000-4
40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times*
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container[1]	Preservation[2, 3]	Maximum holding time[4]
67. Sulfite	P, FP, G	None required	Analyze within 15 minutes
68. Surfactants	P, FP, G	Cool, ≤6 °C[18]	48 hours
69. Temperature	P, FP, G	None required	Analyze
73. Turbidity	P, FP, G	Cool, ≤6 °C[18]	48 hours
Table IC—Organic Tests[8]			
13, 18–20, 22, 24–28, 34–37, 39–43, 45–47, 56, 76, 104, 105, 108–111, 113. Purgeable Halocarbons	G, FP-lined septum	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$[5]	14 days
6, 57, 106. Purgeable aromatic hydrocarbons	G, FP-lined septum	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$[5], HCl to pH 2	14 days[9]
3, 4. Acrolein and acrylonitrile	G, FP-lined septum	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$, pH to 4–5	14 days[10]
23, 30, 44, 49, 53, 77, 80, 81, 98, 100, 112. Phenols[11]	G, FP-lined cap	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$	7 days until extraction, 40 days after extraction
7, 38. Benzidines[11 , 12]	G, FP-lined cap	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$[5]	7 days until extraction [13]
14, 17, 48, 50–52. Phthalate esters [11]	G, FP-lined cap	Cool, ≤6 °C[18]	7 days until extraction, 40 days after extraction
82–84. Nitrosamines[11 , 14]	G, FP-lined cap	Cool, ≤6 °C[18], store in dark, 0.008% $Na_2S_2O_3$[5]	7 days until extraction, 40 days after extraction
88–94. PCBs[11]	G, FP-lined cap	Cool, ≤6 °C[18]	1 year until extraction, 1 year after extraction
54, 55, 75, 79. Nitroaromatics and isophorone [11]	G, FP-lined cap	Cool, ≤6 °C[18], store in dark, 0.008% $Na_2S_2O_3$[5]	7 days until extraction, 40 days after extraction
1, 2, 5, 8–12, 32, 33, 58, 59, 74, 78, 99, 101. Polynuclear aromatic hydrocarbons[11]	G, FP-lined cap	Cool, ≤6 °C[18]store in dark, 0.008% $Na_2S_2O_3$[5]	7 days until extraction, 40 days after extraction
15, 16, 21, 31, 87. Haloethers[11]	G, FP-lined cap	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$[5]	7 days until extraction, 40 days after extraction
29, 35–37, 63–65, 107. Chlorinated hydrocarbons [11]	G, FP-lined cap	Cool, ≤6 °C[18]	7 days until extraction, 40 days after extraction

Table FS1000-4
40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times*
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container[1]	Preservation[2, 3]	Maximum holding time[4]
60–62, 66–72, 85, 86, 95–97, 102, 103. CDDs/CDFs [11]			
Aqueous Samples: Field and Lab Preservation	G	Cool, ≤6 °C[18], 0.008% $Na_2S_2O_3$[5] , pH<9	1 year
Solids and Mixed-Phase Samples: Field Preservation	G	Cool, ≤6 °C[18]	7 days
Tissue Samples: Field Preservation	G	Cool, ≤6 °C[18]	24 hours
Solids, Mixed-Phase, and Tissue Samples: Lab Preservation	G	Freeze, ≤-10 °C	1 year
114-118. Alkylated phenols	G	Cool, <6 °C, H_2SO_4 to pH<2	28 days until extraction, 40 days after extraction
119. Adsorbable Organic Halides (AOX)	G	Cool, <6 °C[18], 0.008% $Na_2S_2O_3$ HNO3 to pH<2	Hold at least 3 days, but not more than 6 months
120. Chlorinated Phenolics		Cool,<6 °C[18], 0.008% $Na_2S_2O_3$ H_2SO_4 to pH<2	30 days until acetylation, 30 days after acetylation.
Table ID—Pesticides			
Tests: 1–70. Pesticides[11]	G, FP-lined cap	Cool, ≤6 °C[18], pH 5–9 [15]	7 days until extraction, 40 days after extraction
Table IE—Radiological Tests:			
1–5. Alpha, beta, and radium	P, FP, G	HNO_3 to pH<2	6 months
Table IH—Bacterial Tests:			
1. *E. coli*	PA, G, G	Cool, <10 °C, 0.008% $Na_2S_2O_3$ $Na_2S_2O_3$[5]Cool, <10 °C, 0.008% $Na_2S_2O_3$ [5]	8 hours [22] hours[6]
2. Enterococci	PA, G	Cool, <10 °C, 0.008% $Na_2S_2O_3$ $Na_2S_2O_3$[5]	8 hours [22]
Table IH—Protozoan Tests:			
8. Cryptosporidium	LDPE; field filtration	0–10 °C	96 hours.[21]
9. Giardia	LDPE; field filtration	0–10 °C	96 hours[21]

[16], [17], [18] [19] [20] [21] [22] [23] [24]

*Reference: This table is adapted from Table II, 40 CFR, Ch.I, Part 136.3, *Identification of Test Procedures,* 7-1-13 Edition, including all footnotes listed below.

Table FS1000-4
40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times*
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

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[1] ‘‘P’’ is polyethylene; ‘‘FP’’ is fluoropolymer (polytetrafluoroethylene (PTFE; Teflon®), or other fluoropolymer, unless stated otherwise in this Table II; ‘‘G’’ is glass; ‘‘PA’’ is any plastic that is made of a sterlizable material (polypropylene or other autoclavable plastic); ‘‘LDPE’’ is low density polyethylene.

[2] Except where noted in this Table II and the method for the parameter, preserve each grab sample within 15 minutes of collection. For a composite sample collected with an automated sampler (e.g., using a 24-hour composite sampler; see 40 CFR 122.21(g)(7)(i) or 40 CFR Part 403, Appendix E), refrigerate the sample at ≤6 °C during collection unless specified otherwise in this Table II or in the method(s). For a composite sample to be split into separate aliquots for preservation and/or analysis, maintain the sample at ≤6 °C, unless specified otherwise in this Table II or in the method(s), until collection, splitting, and preservation is completed. Add the preservative to the sample container prior to sample collection when the preservative will not compromise the integrity of a grab sample, a composite sample, or an aliquot split from a composite sample; otherwise, preserve the grab sample, composite sample, or aliquot split from a composite sample within 15 minutes of collection. If a composite measurement is required but a composite sample would compromise sample integrity, individual grab samples must be collected at prescribed time intervals (e.g., 4 samples over the course of a day, at 6-hour intervals). Grab samples must be analyzed separately and the concentrations averaged. Alternatively, grab samples may be collected in the field and composited in the laboratory if the compositing procedure produces results equivalent to results produced by arithmetic averaging of the results of analysis of individual grab samples. For examples of laboratory compositing procedures, see EPA Method 1664A (oil and grease) and the procedures at 40 CFR 141.34(f)(14)(iv) and (v) (volatile organics).

[3] When any sample is to be shipped by common carrier or sent via the U.S. Postal Service, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H2SO4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

[4]Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before the start of analysis and still be considered valid. Samples may be held for longer periods only if the permittee or monitoring laboratory has data on file to show that, for the specific types of samples under study, the analytes are stable for the longer time, and has received a variance from the Regional Administrator under Sec. 136.3(e). For a grab sample, the holding

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time begins at the time of collection. For a composite sample collected with an automated sampler (e.g., using a 24-hour composite sampler; see 40 CFR 22.21(g)(7)(i) or 40 CFR part 403, Appendix E), the holding time begins at the time of the end of collection of the composite sample. For a set of grab samples composited in the field or laboratory, the holding time begins at the time of collection of the last grab sample in the set. Some samples may not be stable for the maximum time period given in the table. A permittee or monitoring laboratory is obligated to hold the sample for a shorter time if it knows that a shorter time is necessary to maintain sample stability. See 136.3(e) for details. The date and time of collection of an individual grab sample is the date and time at which the sample is collected. For a set of grab samples to be composited, and that are all collected on the same calendar date, the date of collection is the date on which the samples are collected. For a set of grab samples to be composited, and that are collected across two calendar dates, the date of collection is the dates of the two days; e.g., November 14 – 15. For a composite sample collected automatically on a given date, the date of collection is the date on which the sample is collected. For a composite sample collected automatically, and that is collected across two calendar dates, the date of collection is the dates of the two days; e.g., November 14 - 15. For static-renewal toxicity tests, each grab or composite sample may also be used to prepare test solutions for renewal at 24 h, 48 h, and/or 72 h after first use, if stored at 0 –6 °C, with minimum headspace.

[5] ASTM D7365-09a specifies treatment options for samples containing oxidants (e.g., chlorine). Also, Section 9060A of Standard Methods for the Examination of Water and Wastewater (20th and 21st editions) addresses dechlorination procedures.

[6] Sampling, preservation and mitigating interferences in water samples for analysis of cyanide are described in ASTM D7365-09a. There may be interferences that are not mitigated by the analytical test methods or D7365-09a. Any technique for removal or suppression of interference may be employed, provided the laboratory demonstrates that it more accurately measures cyanide through quality control measures described in the analytical test method. Any removal or suppression technique not described in D7365-09a or the analytical test method must be documented along with supporting data.

[7] For dissolved metals, filter grab samples within 15 minutes of collection and before adding preservatives. For a composite sample collected with an automated sampler (e.g., using a 24-hour composite sampler; see 40 CFR 122.21(g)(7)(i) or 40 CFR Part 403, Appendix E), filter the sample within 15 minutes after completion of collection and before adding preservatives. If it is known or suspected that dissolved sample integrity will be compromised during collection of a composite sample collected automatically over time (e.g., by interchange of a metal between dissolved and suspended forms), collect and filter grab samples to be composited (footnote 2) in place of a composite sample collected automatically.

[8] Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

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[9] If the sample is not adjusted to pH 2, then the sample must be analyzed within seven days of sampling.

[10] The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

[11] When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity (i.e., use all necessary preservatives and hold for the shortest time listed). When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to ≤6 °C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6–9; samples preserved in this manner may be held for seven days before extraction and for forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (regarding the requirement for thiosulfate reduction), and footnotes 19, 20 (regarding the analysis of benzidine).

[12] If 1, 2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 ± 0.2 to prevent rearrangement to benzidine.

[13] Extracts may be stored up to 30 days at <0º C.

[14] For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7–10 with NaOH within 24 hours of sampling

[15] The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

[16] Place sufficient ice with the samples in the shipping container to ensure that ice is still present when the samples arrive at the laboratory. However, even if ice is present when the samples arrive, immediately measure the temperature of the samples and confirm that the preservation temperature maximum has not been exceeded. In the isolated cases where it can be documented that this holding temperature cannot be met, the permittee can be given the option of on-site testing or can request a variance. The request for a variance should include supportive data which show that the toxicity of the effluent samples is not reduced because of

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the increased holding temperature. Aqueous samples must not be frozen. Hand-delivered samples used on the day of collection do not need to be cooled to 0 to 6ºC prior to test initiation.

[17] Samples collected for the determination of trace level mercury (<100 ng/L) using EPA Method 1631 must be collected in tightly-capped fluoropolymer or glass bottles and preserved with BrCl or HCl solution within 48 hours of sample collection. The time to preservation may be extended to 28 days if a sample is oxidized in the sample bottle. A sample collected for dissolved trace level mercury should be filtered in the laboratory within 24 hours of the time of collection. However, if circumstances preclude overnight shipment, the sample should be filtered in a designated clean area in the field in accordance with procedures given in Method 1669. If sample integrity will not be maintained by shipment to and filtration in the laboratory, the sample must be filtered in a designated clean area in the field within the time period necessary to maintain sample integrity. A sample that has been collected for determination of total or dissolved trace level mercury must be analyzed within 90 days of sample collection.

[18] Aqueous samples must be preserved at ≤6 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. Also, for purposes of NPDES monitoring, the specification of ‘‘≤°C’’ is used in place of the ‘‘4 °C’’ and ‘‘< 4 °C’’ sample temperature requirements listed in some methods. It is not necessary to measure the sample temperature to three significant figures (1/100th of 1 degree); rather, three significant figures are specified so that rounding down to 6 °C may not be used to meet the ≤6 °C requirement. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

[19] An aqueous sample may be collected and shipped without acid preservation. However, acid must be added at least 24 hours before analysis to dissolve any metals that adsorb to the container walls. If the sample must be analyzed within 24 hours of collection, add the acid immediately (see footnote 2). Soil and sediment samples do not need to be preserved with acid. The allowances in this footnote supersede the preservation and holding time requirements in the approved metals methods.

[20] To achieve the 28-day holding time, use the ammonium sulfate buffer solution specified in EPA Method 218.6. The allowance in this footnote supersedes preservation and holding time requirements in the approved hexavalent chromium methods, unless this supersession would compromise the measurement, in which case requirements in the method must be followed.

[21] Holding time is calculated from time of sample collection to elution for samples shipped to the laboratory in bulk and calculated from the time of sample filtration to elution for samples filtered in the field.

Table FS1000-4
40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times*
Applicable to **all** Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

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[22] Sample analysis should begin as soon as possible after receipt; sample incubation must be started no later than 8 hours from time of collection.

[23] For fecal coliform samples for sewage sludge (biosolids) only, the holding time is extended to 24 hours for the following sample types using either EPA Method 1680 (LTB-EC) or 1681 (A-1): Class A composted, Class B aerobically digested, and Class B anaerobically digested.

[24] The immediate filtration requirement in orthophosphate measurement is to assess the dissolved or bio-available form of orthophosphorus (i.e., that which passes through a 0.45-micron filter), hence the requirement to filter the sample immediately upon collection (i.e., within 15 minutes of collection).

Table FS 1000-5
Approved Water and Wastewater Procedures, Containers, Preservation and Holding Times
• For Analytes not Found in 40 CFR 136*

Analyte	Methods	Reference [1]	Container[2]	Preservation[3]	Maximum Holding Time[4]
Bromine	DPD Colorimetric[5]	SM 4500-Cl-G	P, G	None required	Analyze immediately
Bromates	Ion Chromatography	EPA 300.0 [6]	P, G	Cool 4°C	30 days
Chlorophylls	Spectrophotometric	SM 10200 H	P, G[7]	Dark 4°C Filtered, dark, ˜20°C	48 hours chilled until filtration[8], and analyze immediately or 48 hours chilled until filtration[8],and 28 days (frozen)after filtration
Corrosivity	Calculated ($CaCO_3$ Stability, Langelier Index)	SM 2330 ASTM D513-92	P, G	Cool 4°C[9]	7 days[9]
Cyanotoxin	ELISA and LC/MSMS		FP, G	Cool 6°C[16]	7 days until extraction, 40 days after extraction
FL-PRO	Gas Chromatography	DEP (11/1/95)[18]	G, PTFE lined cap only	Cool 4°C, H_2SO_4 or HCl to pH<2	7 days until extraction, 40 days after extraction
Odor	Human Panel	SM 2150	G only	Cool 4°C	6 hours
Salinity	Electrometric [10] Hydrometric[10]	SM 2520 B SM 2520 C	G, wax seal	Analyze immediately or use wax seal	30 days[10]
Taste	Human Panel	SM 2160 B, C, D ASTM E679-91	G only	Cool 4°C	24 hours
Total Dissolved Gases	Direct-sensing Membrane-diffusion	SM 2810	_____	_____	Analyze in-situ
Total Petroleum Hydrocarbons	Gravimetry	EPA 1664[17]	G only	Cool 4°C, H_2SO_4 or HCl to pH<2	28 days
Transparency	Irradiometric[11]	62-302.200(6), FAC	_____	_____	Analyze in-situ
Un-ionized Ammonia	Calculated[12]	DEP-SOP[13]	P, G	Cool 4°C $Na_2S_2O_3$ [12]	8 hours unpreserved 28 days preserved [12]
Organic Pesticides[14]	GC and HPLC	EPA (600-series) [14]	[15]	[15]	[15] [16]

*40 CFR, Ch. I, Part 136.3, *Identification of Test Procedures,* 7-1-13 Edition. Reference provided for informational purposes only.

Table FS 1000-5
Approved Water and Wastewater Procedures, Containers, Preservation and Holding Times
• For Analytes not Found in 40 CFR 136*

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[1] SM XXXX = procedures from "Standard Methods for the Examination of Water and Wastewater"; see Standard Methods Online (http://www.standardmethods.org/store/). Reference methods are listed for informational purposes only.

ASTM XXXX-YY = procedure from "Annual Book of ASTM Standards", Water and Environmental Technology, Volumes 11.01 and 11.02 (Water I and II). See American Society for Testing and Materials (ASTM International), http://www.astm.org/Standard/index.shtml. Reference methods are listed for informational purposes only.

[2] P = plastic, G = glass.

[3] When specified, sample preservation should be performed immediately upon sample collection.

[4] The times listed are the maximum times that samples may be held before analysis and still be considered valid.

[5] The approved procedure is for residual chlorine. However, in the absence of chlorine, the DPD colorimetric procedure can be adapted to measure bromine content of the sample. In such case, the validity of this assumption must be verified by using another procedure for chlorine which is not affected by the presence of bromine (i.e., negligible interference).

[6] "The Determination of Inorganic Anions in Water by Ion Chromatography", EPA Method 300.0, Revision 2.1,, Revised August 1993, by John D. Pfaff, U. S. EPA Cincinnati, Ohio 45268. Reference methods are listed for informational purposes only.

[7] Collect samples in opaque bottles and process under reduced light. A secondary device, such as a Van Dorn/Niskin or bucket, may be used to collect the sample and then expeditiously transfer into an opaque bottle.

[8] Samples must be filtered within 48 hours of collection. Add magnesium carbonate to the filter while the last of the sample passes through the filter.

[9] Temperature and pH must be measured on site at the time of sample collection. 7 days is the maximum time for laboratory analysis of total alkalinity, calcium ion and total solids.

[10] The electrometric and hydrometric analytical methods are suited for field use. The argentometric method is suited for laboratory use. Samples collected for laboratory analysis, when properly sealed with paraffin waxed stopper, may be held indefinitely. The maximum holding time of 30 days is recommended as a practical regulatory limit.

[11] Transparency in surface waters is defined as a compensation point for photosynthetic activity, i.e., the depth at which one percent of the light intensity entering at the water surface remains unabsorbed. The DEP Chapter 62-302, FAC requires that the light intensities at the surface and subsurface be measured simultaneously by irradiance meters such as the Kahlsico Underwater Irradiometer, Model No. 268 WA 310, or an equivalent device having a comparable spectral response.

[12] The results of the measurements of pH, temperature, salinity (if applicable) and the ammonium ion concentration in the sample are used to calculate the concentration of ammonia in the unionized state. Temperature, pH and salinity must be measured on-site at the time of sample collection. Laboratory analysis of the ammonium ion concentration should be conducted within eight hours of sample collection. If prompt analysis of ammonia is impossible, preserve samples with H_2SO_4 to pH between 1.5 and 2. Acid-preserved samples, stored at 4°C, may be held up to 28 days for ammonia determination. Sodium thiosulfate should only be used if fresh samples contain residual chlorine.

[13] Calculation of Un-ionized Ammonia in Fresh Water, Chemistry Laboratory Methods Manual, Florida Department of Environmental Protection, Revision 2, 2/12/2001. The document is available from the DEP Standards & Assessment Section. Reference method listed for informational purposes only.

[14] Other pesticides listed in approved EPA methods (608.1, 608.2, 614, 614.1, 615, 617, 618, 619, 622, 622.1, 627, 629, 631, 632, 632.1, 633, 642, 643, 644 and 645) that are not included in Table ID of 40 CFR Part 136.3 (7-1-13 Edition). Reference methods and CFR citation listed for informational purposes only.

Table FS 1000-5
Approved Water and Wastewater Procedures, Containers, Preservation and Holding Times
- **For Analytes not Found in 40 CFR 136***

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[15] Container, preservation and holding time as specified in each individual method must be followed.

[16] Sample preservation procedures, container material and maximum allowable holding times for analytes not specified in DEP-SOP-001/01 (March 1, 2014) shall follow the preservation, container and holding time requirements specified in the selected analytical method. If no method-specified requirements exist, the best available scientific knowledge shall be used as guidance for determining the appropriate procedures for use, per 62-160.400(2), F.A.C.

[17] Method 1664, n-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry. Revision A, February 1999. EPA-821-R-98-002, and, Revision B, February 2010. EPA-821-R-10-001. Reference methods listed for informational purposes only.

[18] FL-PRO - Method for Determination of Petroleum Range Organics, Revision 1, November 1, 1995, Florida Department of Environmental Protection

Table FS 1000-6
Recommended Sample Containers, Sample Volumes, Preservation Techniques and Holding Times for Residuals, Soil and Sediment Samples

Analyte	Methods	References*	Container	Preservation	Maximum Holding Times
Volatile Organics	Purge-and-Trap GC and GC-MS	8015, 8260, 8021, 5035	See Table 1000-7		
Semivolatile Organics	GC, HPLC, and GC-MS	8041, 8061, 8070, 8081, 8082, 8091, 8111, 8121, 8131, 8141, 8151, 8270, 8275, 8280, 8290, 8310, 8315, 8316, 8318, 8321, 8325, 8330, 8331, 8332, 8410, 8430, 8440, FL-PRO, MADEP, TPHWG	Glass, 8 oz widemouth with Teflon® -Lined lid	Cool ≤6°C [1]	14 days until extraction, 40 days after extraction
Dioxins		8290	Amber Glass, 8 oz widemouth with Teflon® -Lined lid	Cool ≤6°C[1] in dark	30 days until extraction, 45 days after extraction
Total Metals-except mercury and chromium VI methods	Flame AA, Furnace AA, Hydride and ICP	All 7000-series (except 7195, 7196, 7197, 7198, 7470 and 7471), 6010 (ICP) and 6020 (ICP)	Glass or plastic 8 oz widemouth (200 grams sample)	None	6 months
Chromium VI	Colorimetric, Chelation with Flame AA (200 gram sample)	7196 and 7197 (prep 3060)	Glass or plastic, 8 oz widemouth (200 gram sample)	Cool 4°± 2°C[1]	1 month until extraction, 4 days after extraction [2]
Mercury	Manual Cold Vapor AA	7471	Glass or plastic 8 oz widemouth (200 grams sample)	Cool 4°± 2°C[1]	28 days
Microbiology (MPN)		MPN	Sterile glass or plastic	Cool ≤6°C[1]	24 hours
Aggregate Properties			Glass or plastic	Cool ≤6°C[1]	14 days
Inorganic nonmetallics all except:			Glass or plastic	Cool ≤6°C[1]	28 days
Cyanide			Glass or plastic		14 days
Sulfite, Nitrate, Nitrite & o-phosphate			Glass or plastic		48 hours
Elemental Phosphorus			Glass		48 hours

Table FS 1000-6
Recommended Sample Containers, Sample Volumes, Preservation Techniques and Holding Times for Residuals, Soil and Sediment Samples

The term "residuals" include: (1) sludges of domestic origin having no specific requirements in Tables FS-1000-4 or FS-1000-9; (2) sludges of industrial origin; and (3) concentrated waste samples.

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[1] Keep soils, sediments and sludges cool at ≤6°C from collection time until analysis. No preservation is required for concentrated waste samples.

[2] Storage Temperature is 4°C, ±2°C

* Reference method numbers are listed for informational purposes only and are found in SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (http://www.epa.gov/epawaste/hazard/testmethods/sw846/online/index.htm), except for the additional informational method sources listed below:

FL-PRO - Method for Determination of Petroleum Range Organics, Revision 1, November 1, 1995, Florida Department of Environmental Protection

MADEP – Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), Revision 1.1, May 2004, Massachusetts Department of Environmental Protection

MPN – Microbiological test methods utilizing Most Probable Number procedures

TPHWG - TPH Working Group Series

Table FS 1000-7

Sample Handling, Preservation and Holding Time Table for SW 846 Method 5035*

			Sample Container					
Conc. Level	Sampling Device	Collection Procedure*	Type	Vial Preparation*	Preservation	Sample Preparation*	Max HT①	Determinative Procedure^
≤200 ug/kg	Coring Device	5035 - Section 6.2.1	Glass Vial w/ PTFE-silicone Septum	5035 - 6.1.1	$NaHSO_4$ / 4ºC (see 5035 – 6.4.3)	5035 - Section 7.2.3	14 D	Any recognized VOC Method (see 5035 – 7.2)
≤200 ug/kg	Coring Device	5035 - Section 6.2.1	Glass Vial w/ PTFE-silicone Septum	5035 - 6.1.1②	4ºC	5035 - Section 7.2.3	48 H	Any recognized VOC Method (see 5035 – 7.2)
≤200 ug/kg	Coring Device	5035 - Section 6.2.1	Glass Vial w/ PTFE-silicone Septum	5035 - 6.1.1②	4ºC / -10ºC③,④	5035 - Section 7.2.3	48 H / 14 D⑤	Any recognized VOC Method (see 5035 – 7.2)
≤200 ug/kg	EnCore or equivalent	5035 - Section 6.2.1	EnCore or equivalent	5035 - 6.1.1②,⑥,⑦	4ºC	5035 - Section 7.2.3	48 H	Any recognized VOC Method (see 5035 – 7.2)
≤200 ug/kg	EnCore or equivalent	5035 - Section 6.2.1	EnCore or equivalent	5035 - 6.1.1⑥,⑦	$NaHSO_4$ / 4ºC (see 5035 – 6.4.3)	5035 - Section 7.2.3⑤	48 H / 14 D⑤	Any recognized VOC Method (see 5035 – 7.2)
≤200 ug/kg	EnCore or equivalent	5035 - Section 6.2.1	EnCore or equivalent	5035-6.1.1②⑥⑦	4ºC / -10ºC③,④	5035 - Section 7.2⑤	48 H / 14 D⑤	Any recognized VOC Method (see 5035 – 7.2)
>200 ug/kg	EnCore or equivalent	5035 - Section 6.2.2.3⑥	EnCore or equivalent	5035 - 6.1.3⑥,⑦	4ºC	5035 - Sections 7.3.2 & 7.3.3⑤	48 H / 14 D⑤	Any recognized VOC Method (see 5035 – 7.3)
>200 ug/kg⑧	Coring Device	5035 - Section 6.2.2.3⑨	Glass Vial w/ PTFE-silicone Septum	5035 - 6.1.3⑨	Methanol/PEG + 4ºC	5035 - Section 7.3.4	14 D	Any recognized VOC Method (see 5035 – 7.3)
>200 ug/kg[8]	Conventional Devices	DEP SOP - Section 5.	Glass w/ PTFE-silicone Septum	5035 - 6.1.2	4ºC	5035 - Sections 7.3.1 - 7.3.3	14 D	Any recognized VOC Method (see 5035 – 7.3)
Oily Waste	Conventional Devices	5035 - Section 6.2.4.2	Glass w/ PTFE-silicone Septum	5035 - 6.1.4	4ºC	5035 - Sections 7.4.1 - 7.4.2	14 D	Any recognized VOC Method (see 5035 – 7.4)
Oily Waste	Conventional Devices	5035 - Section 6.2.4.1	Glass w/ PTFE-silicone Septum	5035 - 6.1.4	Methanol/PEG + 4ºC	5035 - Sections 7.4.3	14 D	Any recognized VOC Method (see 5035 – 7.4)

Table FS 1000-7

Sample Handling, Preservation and Holding Time Table for SW 846 Method 5035*

Dry Wt.	Conventional Devices	5035 - Sections 6.2.1.6, 6.2.2.7, 6.2.3	Glass with Teflon liner	5035 – 4.4.1	4ºC	5035 - Section 7.5	Not applicable	5035 - Section 7.5
Soil Screen	Conventional Devices	5035 - Sections 6.2.1.6, 6.2.3	Glass w/ PTFE-silicone Septum	5035 – 4.4.1	4ºC	5035 - Section 7.1	14 D	Any recognized VOC Method (see 5035 – 7.1)

[1]Maximum time allowable from time/date of collection to sample analysis.

[2]Eliminate 6.1.1.2; use only organic-free water.

[3]Contents of sampling device must be transported to the laboratory at 4ºC and stored at -10ºC.

[4]In order to ensure that vials do not break during freezing, they should be stored on their side or at a slanted angle to maximize surface area.

[5]Maximum allowable time at 4ºC is 48 hours; maximum allowable time to sample analysis is 14 days (from time of sample collection).

[6]Conducted in the laboratory.

[7]Entire contents of sampling device are extruded into the sample analysis vial containing the appropriate solvent.

[8]Procedures are limited only to those situations or programs in which the maximum contamination level does not exceed 200 ug/kg.

[9]Methanolic preservation in the field is not recommended, but may be used if approved by DEP for a project.

*See method 5035 in SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (http://www.epa.gov/epawaste/hazard/testmethods/sw846/online/index.htm) and DEP SOP FS 3000, Soil, in DEP-SOP-001/01, 9/19/12.

^See 62-160.320, F.A.C., Approved Laboratory Methods

FS 1000-8
Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

Analyte or EPA Method Number*	Preservation[1]	Holding Time[2]	Holding Time for Extract[3]	Container[4]
MICROBIOLOGICAL-BACTERIA	Cool < 10°C, $Na_2S_2O_3$[5]			P or G
Total Coliforms, fecal coliforms & *E. coli* in drinking water	Cool < 10°C[6], $Na_2S_2O_3$[5]	30 Hours[7]		P or G
Total coliforms and fecal coliforms in source water Heterotrophic bacteria in drinking water	Cool < 10°C, $Na_2S_2O_3$[5]	8 hours		P or G
Gross Alpha	Conc. HCl or HNO_3 to pH <2 [8,9]	6 mo		P or G
Gross beta	Conc. HCl or HNO to pH <2[8,9]	6 mo		P or G
Strontium-89	Conc. HCl or HNO to pH <2[8,9]	6 mo		P or G
Strontium-90	Conc. HCl or HNO to pH <2[8,9]	6 mo		P or G
Radium-226	Conc. HCl or HNO to pH <2[8,9]	6 mo		P or G
Radium-228	Conc. HCl or HNO to pH <2[8,9]	6 mo		P or G
Cesium-134	Concentrated HCl to pH <<2[8,9]	6 mo		P or G
Iodine-131	None	8 days		P or G
Tritium	None	6 months		G
Uranium	Conc. HCl or HNO_3 to pH <2[8,9]	6 mo		P or G
Photon emitters	Conc. HCl or HNO_3 to pH <2[8,9]	6 mo		P or G
Asbestos	Cool 4°C	48 hours		P or G
Bromate	Ethylenediamine (50mg/L)	28 days		P or G
Cyanide	Cool, 4C, Ascorbic acid (if chlorinated), NaOH pH>12	14 days		P or G
Nitrate	Cool, 4°C	48 hours		P or G
Nitrate (chlorinated source)	Cool, 4°C	14 days		P or G
Odor	Cool 4°C	24 hours		G
502.2	Sodium Thiosulfate or Ascorbic Acid, 4°C HCl pH<2 if Ascorbic Acid is used	14 days		Glass with PFTE Lined Septum

FS 1000-8
Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

Analyte or EPA Method Number*	Preservation[1]	Holding Time[2]	Holding Time for Extract[3]	Container[4]
504.1	Sodium Thiosulfate Cool, 4°C,	14 days	4°C, 24 hours	Glass with PFTE-Lined Septum
505	Sodium Thiosulfate Cool, 4°C	14 days (7 days for Heptachlor)	4°C, 24 hours	Glass with PFTE-Lined Septum
506	Sodium Thiosulfate Cool, 4°C, Dark	14 days	4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
507	Sodium Thiosulfate Cool, 4°C, Dark	14 days (see method for exceptions)	4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
508	Sodium Thiosulfate Cool, 4°C, Dark	7 days (see method for exceptions)	4°C, dark, 14 days	Glass with PFTE-lined Cap
508A	Cool, 4°C	14 days	30 days	Glass with PFTE-lined Cap
508.1	Sodium Sulfite, HCl pH<2, Cool, 4°C	14 days (see method for exceptions)	30 days	Glass with PFTE-lined Cap
515.1	Sodium Thiosulfate Cool, 4°C, Dark	14 days	4°C, dark, 28 days	Amber Glass with PFTE-lined Cap
515.2	Sodium Thiosulfate HCl pH<2, Cool, 4°C, Dark	14 days	≤ 4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
515.3	Sodium Thiosulfate HCl pH<2, Cool, 4°C, Dark	14 days	≤ 4°C, dark, 14 days	Amber Glass with PFTE-lined Cap
515.4	Sodium Sulfite, HCl pH<2, Cool, ≤10°C for first 48 hours ≤6°C thereafter, Dark	14 days	≤0°C, 21 days	
524.2	Ascorbic Acid, HCl pH<2, Cool 4°C	14 days		Glass with PFTE-lined Septum
525.2	Sodium Sulfite, Dark, Cool, 4°C, HCl pH<2	14 days (see method for exceptions)	≤ 4°C, 30 days from collection	Amber Glass with PFTE-lined Cap
531.1, 6610	Sodium Thiosulfate Monochloroacetic acid, pH<3, Cool, 4°C	Cool 4°C, 28 days		Glass with PFTE-lined Septum
531.2	Sodium Thiosulfate, Potassium Dihydrogen Citrate buffer to pH 4,	28 days		

FS 1000-8
Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

Analyte or EPA Method Number*	Preservation[1]	Holding Time[2]	Holding Time for Extract[3]	Container[4]
	dark, ≤10°C for first 48 hr, ≤6°C thereafter			
547	Sodium Thiosulfate Cool, 4°C	14 days (18 mo. frozen)		Glass with PFTE-lined Septum
548.1	Sodium Thiosulfate (HCl pH 1.5-2 if high biological activity), Cool, 4°C, Dark	7 days	≤4°C 14 days	Amber Glass with PFTE-lined Septum
549.2	Sodium Thiosulfate (H_2SO_4 pH<2 if biologically active), Cool, 4°C, Dark	7 days	21 days	High Density Amber Plastic or Silanized Amber Glass
550, 550.1	Sodium Thiosulfate Cool, 4°C, HCl pH<2	7 days	550, 30 days 550.1, 40 days Dark, 4°C	Amber Glass with PFTE-lined Cap
551.1	Sodium Thiosulfate, Sodium Sulfite, Ammonium Chloride, pH 4.5-5.0 with phosphate buffer, Cool, 4°C	14 days		Glass with PFTE-lined Septum
552.1	Ammonium chloride, Cool, 4°C, Dark	14 days	≤4°C, dark 48 hours	Amber Glass with PFTE-lined cap
552.2	Ammonium chloride, Cool, 4°C, Dark	14 days	≤4°C, dark 7 days ≤-10°C 14 days	Amber Glass with PFTE-lined cap
555	Sodium Sulfite, HCl, pH ≤ 2, Dark, Cool 4°C	14 days		Glass with PFTE-lined cap
1613B	Sodium Thiosulfate, Cool, 0-4°C, Dark		Recommend 40 days	Amber Glass with PFTE-lined Cap

[1] Preservation, when required, must be done immediately upon sample collection.
[2] Stated values are the maximum regulatory holding times. Sample processing must begin by the stated time.
[3] Stated time is the maximum time a prepared sample extract may be held before analysis.
[4] (P) polyethylene or (G) or glass. For microbiology, plastic sample containers must be made of sterilizable materials (poly-propylene or other autoclavable plastic).
[5] Addition of sodium thiosulfate is only required if the sample has a detectable amount of residual chlorine, as indicated by a field test using EPA Method 330.4 or 330.2 or equivalent.

FS 1000-8
Preservation Methods and Holding Times for Drinking Water Samples that Differ from 40 CFR Part 136, Table II

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[6] Temperature requirement applies only to source water samples, however once received by the laboratory, if sample processing does not begin on the same working day, samples must be refrigerated.

[7] If samples are analyzed after 30 hours, but within 48 hours of collection, the laboratory is to indicate in the analytical report that the data may be invalid because of excessive delay in sample processing. No samples received after 48 hours are to be accepted or analyzed for compliance with the regulations of the Department of Environmental Protection or the Department of Health.

[8] It is recommended that the preservative be added at the time of collection unless suspended solids activity is to be measured. It is also recommended that samples be filtered, if suspended or settleable solids are present, prior to adding preservative, at the time of collection. However, if the sample has to be shipped to a laboratory or storage area, acidification of the sample (in its original container) may be delayed for a period not to exceed 5 days. A minimum of 16 hours must elapse between acidification and analysis.

[9] If HCl is used to acidify samples, which are to be analyzed for gross alpha or gross beta activities, the acid salts must be converted to nitrate salts before transfer of the samples to planchets.

*EPA method numbers are provided as informational references only.

Table FS 1000-9
Containers, Preservation and Holding Times for Biosolids Samples and Protozoans

ANALYTE NAME	***CONTAINER***	***PRESERVATION***	***MAX HOLDING TIME***
Fecal Coliform	Plastic or Glass	Cool 4°C	24 hours
Salmonella	Plastic or Glass	< 10°C	24 hours
Enteric Viruses	Plastic or Glass	Up to 25°C	2 hours
Enteric Viruses	Plastic or Glass	2 to 10°C	48 hours
Specific Oxygen Uptake Rate	Plastic or Glass	None	As Soon As Possible
Helminth OVA	Plastic or Glass	< 4°C (Do not Freeze)	24 hours
Cryptosporidium/Giardia	Plastic or Glass	0 - 10°C (Do not Freeze)*	96 Hours
Total Solids	Plastic or Glass	≤6°C (Do not Freeze)	7 days
Metallics	Plastic or Glass	See Tables FS 1000-4, FS 1000-5 and FS 1000-6	
Other Inorganic Pollutants	Plastic or Glass	See Tables FS 1000-4, FS 1000-5 and FS 1000-6	

***Dechlorinate bulk samples when applicable**

Table FS 1000-10
Container Materials, Preservation, and Holding Times for Fish and Shellfish

Analyte	Matrix	Sample Container	Field (Transport to Lab)		Laboratory	
			Preservation	Maximum Shipping Time	Storage	Holding Time
	Whole Organism (Fish, shellfish, etc.	Foil-wrap each organism (or composite for shellfish) and transport in waterproof plastic bag	Cool in wet ice or: ---------- Freeze on dry ice	24 hours ---------- 48 hours		
Mercury	Tissue (fillets and edible portions, homogenates)	Plastic, borosilicate glass, quartz, PTFE			Freeze at <-20°C	1 year
Other metals	Tissue (fillets and edible portions, homogenates)	Plastic, borosilicate glass, quartz, PTFE			Freeze at <-20°C	6 months
Organics	Tissue (fillets and edible portions, homogenates)	Borosilicate glass, PTFE, quartz, aluminum foil			Freeze at <-20°C	1 year
Dioxin	Tissue (fillets and edible portions, homogenates)	Amber containers: Borosilicate glass, PTFE, quartz, aluminum foil			Freeze at <-20°C	30 days until extraction, 15 days after extraction
Lipids	Tissue (fillets and edible portions, homogenates)	Plastic, borosilicate glass, quartz, PTFE			Freeze at <-20°C	1 year

PTFE = Polytetrafluoroethylene (Teflon)

Table FS 1000-11
Holding Times for SPLP or TCLP Extraction, Sample Preparation and Determinative Analysis

Holding Time (Days)				
	From: Field Collection To: SPLP or TCLP Extraction	From: SPLP or TCLP Extraction To: Preparative Extraction	From: Preparative Extraction To: Determinative Analysis	Total Elapsed Time
Volatiles	14	NA	14	28
Semi-Volatiles	14	7	40	61
Mercury	28	NA	28	56
Metals, except Mercury	180	NA	180	360

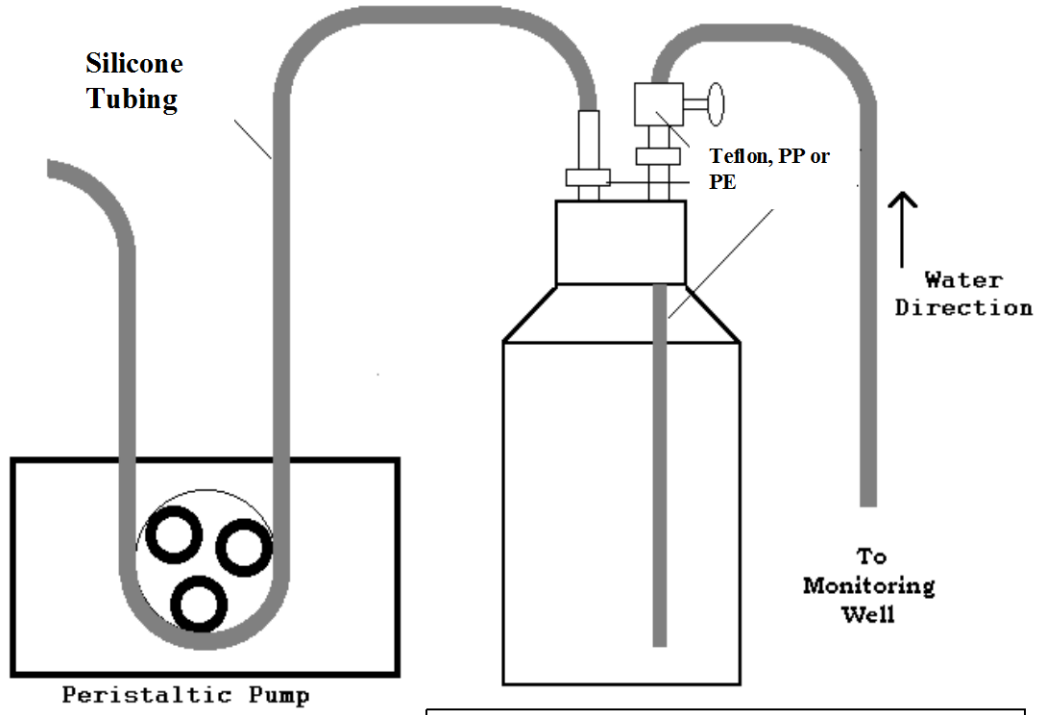
NA – Not Applicable

Table FS 1000-12
Preventive Maintenance Tasks

INSTRUMENT/ACTIVITY	FREQUENCY
REFRIGERATORS, INCUBATORS, OVENS	
Clean interior	Monthly
Check thermometer temperature against certified thermometer or equivalent	Annually
ANYTICAL BALANCES	
Clean pan and compartment	Daily[1]
Check with Class S weights	Monthly
Manufacturer cleaning and calibration	Annually
pH AND ION SELECTIVE ELECTRODES	
PROBE	
Check probe for cracks and proper levels of filling solution; check reference junction; clean electrode	Daily, Replace as necessary
Check response time	Daily[1]
METER	
Check batteries and electronics for loose connections and cracked leads	Daily[1], Replace as necessary
TURBIDIMETER	
Clean instrument housing	Monthly
Clean cells	Daily[1]
CONDUCTIVITY METER	
Check batteries and probe cables	Daily[1]
Replatinize Probe	Per manufacturer's recommendations
DISSOLVED OXYGEN METERS	
PROBE	
Check membrane for deterioration; check filling solution	Daily[1], Replace as necessary
METER	
Battery level and electronics checked	Daily[1], Replace as necessary
THERMOMETERS	
Check for cracks and gaps in the mercury	Daily[1], Replace as necessary
TEMPERATURE PROBE	
Check connections, cables	Daily[1]
Check against calibrated thermometer	Daily[1]
AUTOMATIC SAMPLE COLLECTION SYSTEMS (e.g., ISCO, Sigma)	
Check sampler operation (forward, reverse, automatic through three cycles of the purge-pump-purge cycle)	Daily[1]Prior to Sampling Event
Check purge-pump-purge cycle when sampler is installed	Daily[1]Prior to Sampling Event
Check the flow pacer that activates the sampler to assure proper operation	Daily[1]Prior to Sampling Event
Check desiccant	Daily[1], Replace as Necessary
Check batteries	Daily[1], Replace as Necessary
Check pumping rate against manufacturer's specifications	Daily[1], Replace as Necessary

[1]Daily is defined as prior to use or a 12-hour period if equipment is run continuously

Figure FS 1000-1
Organic Trap Configuration for Collecting Extractable Organics with a Peristaltic Pump



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.

FS 2000. GENERAL AQUEOUS SAMPLING

See also the following Standard Operating Procedures:

- FA 1000 Administrative Procedures
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000-9000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FQ 1000 Field Quality Control Requirements

1. COMMON PROCEDURES

The following procedures are applicable to the collection of all water samples.

1.1. Refer to FS 1000 for procedures that are common to all types of sample collection including general preservation and thermal preservation procedures.

1.2. Grab Samples

1.2.1.1. This is an individual sample collected over a period of time, usually all in one motion, generally not exceeding 15 minutes. The 15-minute time limit applies to aqueous samples only. No time limit applies to the collection of solid samples (e.g., residuals).

1.2.1.2. Grab samples represent the conditions that exist at the moment the sample is collected and do not necessarily represent conditions at any other time. Grab sampling is the preferred method of sampling under the following conditions:

- A snapshot of the water quality at a particular instant in time is desired.
- The water or wastewater stream is not continuous (e.g., batch discharges or intermittent flow).
- The characteristics of the water or waste stream are known to be constant or nearly so.
- When conditions are relatively constant over the period of discharge. In lieu of complex sampling activities, a grab sample provides a simple and accurate method of establishing waste characteristics.
- The sample is to be analyzed for analytes whose characteristics are likely to change significantly with time (e.g., dissolved gases, microbiological tests, pH).
- The sample is to be collected for analytes such as Oil and Grease, bacteriological tests or other parameters listed in number 3 of this section where the compositing process could significantly affect the actual concentration.
- Data on maximum/minimum concentrations are desired for a continuous water or wastewater stream.
- When identifying and tracking slug loads and spills.

1.2.1.3. If required, measure the following parameters on grab samples or in-situ.

NOTE: If the permit specifies a composite sample for any of the parameters mentioned below, **FOLLOW THE PERMIT CONDITIONS**

Cyanide	Oil and Grease
Residual Chlorine	pH
Dissolved constituents in field-filtered samples (ortho-phosphorus, metals, etc.)	Specific Conductance
Dissolved Oxygen and other dissolved gases	Un-ionized Ammonia
Microbiological Parameters	Volatile Organic Compounds
TRPHs	Temperature
Total Phenols	

1.3. Composite Samples

1.3.1. A composite sample is a sample collected over time, formed either by continuous sampling or by mixing discrete samples. Composite samples reflect the average characteristics during the compositing period.

1.3.2. Composite samples are used when stipulated in a permit or when:

- The water or wastewater stream is continuous;
- Analytical capabilities are limited;
- Determining average pollutant concentration during the compositing period;
- Calculating mass/unit time loadings; or
- Associating average flow data to parameter concentrations

1.3.3. Composite samples may be collected individually at equal time intervals if the flow rate of the sample stream does not vary more than plus or minus ten percent of the average flow rate or they may be collected proportional to the flow rate. The permit or work plan will specify which composite sample type to use, either time composites or flow proportional composites. The compositing methods, all of which depend on either continuous or periodic sampling, are described in the following discussions.

1.3.3.1. Time Composite Sample: Time composite samples are based on a constant time interval between samples. A time composite sample can be collected manually or with an automatic sampler. This type of composite is composed of discrete sample aliquots collected in one container at constant time intervals. This method provides representative samples when the flow of the sampled wastewater stream is constant. This type of sample is similar to a sequential composite sample described in number 3.3 of this section.

1.3.3.2. Flow Proportional Composite Sample: Flow proportional samples can be collected automatically with an automatic sampler and a compatible pacing flow measuring device, semi-automatically with a flow chart and an automatic sampler capable of collecting discrete samples, or manually. There are two methods used to collect this type of sample:

- Method 1: Collect a constant sample volume per stream flow (e.g., a 200 mL sample collected for every 5,000 gallons of stream flow) at time intervals proportional to stream flow. This method provides representative samples of all waste streams when the flow is measured accurately.
- Method 2: Collect a sample by increasing the volume of each aliquot as the flow increases, while maintaining a constant time interval between the aliquots (e.g., hourly samples are taken with the sample volume being proportional to the flow at the time the sample is taken).

1.3.3.3. Sequential Composite Sample: Sequential composite samples are composed of discrete samples taken into individual containers at constant time intervals or constant discharge increments. For example, samples collected every 15 minutes are composited for each hour.

- The 24-hour composite is made up from the individual one-hour composites. Each of the 24 individual samples is manually flow-proportioned according to the flow recorded for the hour that the sample represents. Each flow-proportioned sample is then added to the composite samples. The actual compositing of the samples is done by hand and may be done in the field or the laboratory. In most cases, compositing in the field is preferable since only one sample container must be cooled, and then transported to, and handled, in the laboratory. A 24-hour composite is frequently used since an automatic sampler can easily collect the individual samples.
- A variation of the 24-hour composite is to collect a constant volume of sample taken at constant discharge increments, which are measured with a totalizer. For example, one aliquot is collected for every 10,000 gallons of flow
- Sequential sampling is useful to characterize the waste stream because you can determine the variability of the wastewater constituents over a daily period. For example, for pretreatment studies you can visually determine when high strength wastes are being discharged from a facility or when heavy solid loads are being discharged during a 24-hour cycle. You can measure the pH throughout the day. The value of this type of sampling must be weighed against the manpower constraints and sampling goals

1.3.3.4. Continuous Composite Sample: Collected continuously from the stream. The sample may be a constant volume that is similar to the time composite, or the volume may vary in proportion to the flow rate of the waste stream, in which case the sample is similar to the flow proportional composite.

1.3.3.5. Areal Composite: A sample composited from individual grab samples collected on an areal or cross-sectional basis. Areal composites must be made up of equal volumes of grab samples; each grab sample must be collected in an identical manner. Examples include residual samples from grid system points on a land application site, water samples collected at various depths at the same point or from quarter points in a stream, etc. Sample is similar to the flow proportional composite.

1.4. Collection Techniques

1.4.1. When filling a sample container that already contains premeasured preservative, slowly pour the sample down the side of the container so that the preservative does not splatter. If the preservative is concentrated acid, and the sample water is added too

quickly, the reaction between the water and the acid can generate enough heat to burn unprotected skin or could splatter and cause acid burning.

1.4.2. Collect grab samples (single, discrete samples) unless directed by permit, program, or approved sampling plan or work plan to collect composite samples.

1.4.3. Except for volatile organic compounds and sulfide, leave ample headspace in the sample bottle to allow for expansion, effervescence and proper mixing at the laboratory.

1.5. Collecting Filtered/Dissolved Samples

1.5.1. Certain studies or projects require collection of dissolved (i.e., filtered) samples. Identify all analytes in samples that are filtered as “dissolved” or “filtered” in field notes or laboratory transmittal forms and on final reports.

1.5.2. Collect both filtered and unfiltered samples from the same water in a collection device (e.g., bailer, intermediate container) or consecutively if sampling from a pump.

1.5.3. Collect dissolved metals in groundwater according to the procedures discussed in FS 2225. **Do not** collect filtered samples for metals from groundwater sources unless:

1.5.3.1. The DEP has required or approved the protocol and the DEP program allows the use of the procedure; or

1.5.3.2. The organization is documenting that a filtered groundwater sample is as or more representative of the groundwater quality. In this case, collect **both** unfiltered and filtered samples for analysis. Submit the results of both samples the DEP for review.

1.5.4. Filtration, when performed, must be completed within 15 minutes of sample collection.

1.5.5. Collect dissolved groundwater samples for metals with a one-piece molded construction 1 µm filter unless otherwise specified by a DEP program. Use a 0.45 µm filter when filtering all other constituents **including** metals in surface water.

1.5.6. The filter must be compatible with the analyte to be filtered (e.g., zero carbon content for carbon analysis; non-protein binding filters for nitrogen).

1.5.7. Equipment blanks, when collected, must be processed through the filtration apparatus and analyzed for the analytes of interest.

1.5.8. Filters and filtration equipment are intermediate devices and therefore must be adequately rinsed per FS 2110 section 1.1.2.1.

THE FOLLOWING ARE SPECIAL CONSIDERATIONS FOR VARIOUS ANALYTE GROUPS:

FS 2001. *pH-Preserved Samples*

1. SAMPLE CONTAINERS

1.1. Use properly cleaned sample containers (see FC 1300).

1.2. Inspect all containers for visual defects or contamination. Discard if defects are present or containers do not appear clean.

2. SAMPLE COLLECTION PROCEDURES

2.1. Perform any filtration **before** the sample is poured into the container and **before** the sample is preserved.

2.2. Remove the cap from the sample container, and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

2.3. If the preservative is added after the sample is collected, (the container is not prepreserved), do not fill the container to the rim.

3. PRESERVATION

3.1. Preserve the sample within 15 minutes of sample collection or filtration (if applicable) unless collected as a composite sample (see FS 1006, section 3.3) or for analysis of lead and copper for drinking water compliance (see FS 2310, section 2).

3.2. Preserve the sample with the chemical specified by the method or preservation tables (Tables FS 1000-4 to FS 1000-10).

3.2.1. The chemical reagents must be pure enough so that the reagent does not contribute contamination or interferences to the analytes of interest.

3.3. Preserve the sample by adding an accurately measured amount of preservative to the container. Premeasured vials of the preservative, or a graduated container or pipet, may be used.

3.3.1. Tightly cap the sample container and gently tip the container two to three times to distribute the chemical.

3.4. The pH of the preserved sample must meet the pH criterion of the applicable preservation tables (see Tables FS 1000-4 to FS 1000-10). **Do not over preserve the sample.**

3.4.1. Pour an aliquot of the preserved sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH meets the required level. **Do not put the pH paper directly into the sample container.**

3.4.2. If the pH does not meet the required level, add additional measured amounts of preservative and test with narrow range pH paper (see section 3.4.1 above) until the pH meets the pH requirement.

3.4.3. Record the total amount of preservative that was added to the sample. This documentation is necessary for the next site visit, since additional acid may be needed to adequately preserve the sample on subsequent visits.

3.5. Cooling to less than 6°C in wet ice (see FS 1006, section 5) may be required.

3.6. If required, protect from direct sunlight and store in dark (see tables FS 1000-4, FS 1000-5 and FS 1000-8)

3.7. Preserve all field blanks or equipment blanks with the **greatest** amount of preservative that was required in the associated sample set and note the amount in field documentation. However, do not preserve with excess acid where this may interfere with laboratory analysis of the sample.

3.8. After the sample has been preserved, screw the cap on tightly.

4. Verifying pH-Preserved Samples: Verify the pH of all pH-preserved samples (except volatile organics) in the field (see FS 2001, section 3.4). If samples are routinely collected from the same sample location, a pH check is not required each time samples are collected.

4.1. If the frequency of sample collection at a specified location is once per month or greater (e.g., weekly or daily), check the pH of **at least one** sample per parameter group according to the following schedule:

4.1.1. Weekly sampling: 1 pH check per month

4.1.2. Daily sampling: 1 pH check per week

4.2. If the frequency of sample collection at a specified location is once per month, check the pH of at least one sample per parameter group (except volatile organics) quarterly.

4.2.1. If site conditions vary from sampling event to sampling event, perform pH checks at increased intervals.

4.2.2. For all other sample collection frequencies, pH checks may be reduced as follows:

4.2.2.1. During the first sampling event at a particular site, check **all** samples (except volatile organics) that are pH-adjusted, and

4.2.2.2. During subsequent visits to a particular site, check **at least one** sample per parameter group that must be pH-adjusted.

5. DOCUMENTATION

5.1. Complete the sample container label and stick firmly on the container.

5.2. Complete the field notes.

5.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment or preservation problems.

FS 2002. *Metals*

1. SAMPLE CONTAINERS

1.1. Use properly cleaned containers (see FC 1300).

1.2. Inspect the containers and caps for visual defects or contamination. Do not use containers if defects are present or if they do not appear clean.

2. SAMPLE COLLECTION PROCEDURES

2.1. Perform any filtration **before** the sample is poured into the container and **before** the sample is preserved.

2.2. Remove the cap from the sample container and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION - Follow preservation procedures outlined in FS 2001 above.

3.1. Requirements for specific metals:

3.1.1. For boron or cold-vapor atomic absorption Mercury with a grade of nitric acid (HNO_3) that is suitable for use for metals analysis. Use concentrated HNO_3 or 1:1 HNO_3.to lower the pH of less than 2 S.U., but greater than 1.62 S.U.

3.1.2. For Chromium VI add sufficient ammonium sulfate buffer solution specified per Table FS 1000-4 to the sample to raise the pH of the sample to a pH of 9.3 – 9.7 and place in ice (see FS 2002).

3.1.3. <u>Trace Level Mercury</u>

3.1.3.1. Collect samples for trace level mercury (<100 ug/L) in tightly-capped fluoropolymer or glass bottles.

3.1.3.2. If the samples cannot be received by the laboratory within 48 hours of sample collection, preserve the sample with BrCl or HCl solution.

3.1.3.3. For dissolved trace level mercury, samples must be filtered through a 0.45 µm filter within 24 hours of sample collection. If the samples cannot be transported to the laboratory within 24 hours, follow the procedures in FS 8200 for field filtration.

3.1.4. Samples collected for lead and copper for drinking water compliance and metals other than those listed above do not require immediate acid preservation.

3.1.4.1. When samples are not acidified with acid, the transmittal form to the laboratory must:

- Clearly state that the samples are unpreserved; and
- Request that the laboratory preserve the samples.

3.1.4.2. If samples are acidified, use concentrated HNO_3 or 1:1 HNO_3.to lower the pH of less than 2 S.U., but greater than 1.62 S.U.

3.2. After the sample has been preserved, screw the cap on tightly.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

4.4. On the transmittal form, clearly identify samples that must be acidified by the laboratory (FS 2002, 3.1.3 or 3.1.4 above).

FS 2003. *Extractable Organics*

1. SAMPLE CONTAINERS

1.1. Most samples are collected in glass containers with Teflon-lined caps. Note: Teflon containers are also acceptable. There are some exceptions such as collecting samples in amber glass (e.g., nitroamines, nitroaromatics, etc.). If in doubt, verify the proper container type in Tables FS 1000-4 through FS 1000-10.

1.2. Inspect glass bottles to assure that there are no visual glass or liner defects. If defects are present and/or the sample containers do not appear clean, the bottles must be discarded.

1.3. Collect composite samples from automatic sample collection devices in refrigerated glass or Teflon containers through Teflon, polyethylene or polypropylene tubing.

2. SAMPLE COLLECTION PROCEDURES

2.1. Remove the cap from the sample container without touching the interior Teflon liner.

2.2. Carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

2.3. Fill bottle with sample to almost full capacity.

3. PRESERVATION

3.1. In general, these types of samples must be preserved by cooling to 4°C.

3.1.1. Some analyte groups require a chemical preservation. See Tables FS 1000-4 through FS 1000-10 for any additional preservation.

3.1.2. If the samples for pesticides cannot be extracted within 72 hours of collection, the sample pH must be in the range of 5 to 9. If needed, adjust sample to the specified pH range with sodium hydroxide or sulfuric acid.

3.1.3. Add sodium thiosulfate if residual chlorine is present.

3.2. Place samples in **wet** ice within 15 minutes of sample collection (see FS 1006, section 5).

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Document when samples were placed in wet ice immediately (see FS 1006, section 5).

4.3. Complete the field notes.

4.4. Make notes on the lab transmittal form and the field records about any sample that appears highly contaminated or exhibits other abnormal characteristics (i.e., foaming, odor, etc.).

FS 2004. *Volatile Organics*

1. SAMPLE CONTAINERS

1.1. Use a screw cap glass sample vial that is sealed with a Teflon-coated septum.

1.2. Collect **at least two** vials of each sample. Some laboratories may require three or more vials, therefore verify the laboratory's policy on the number of vials they require unless the laboratory provides the sampling kit.

1.3. Inspect the vials for glass or septum defects (e.g., rim must not have nicks or visible depressions and the septum must not be deformed). Do not use containers if defects are present or if they do not appear clean.

2. SAMPLE COLLECTION PROCEDURES

2.1. Special precautions for petroleum sources:

2.1.1. If possible, transport and store fuels in a separate vehicle from sampling equipment, empty vials and collected samples. If these items must be transported in the same vehicle as fuel, store the fuels as far away from the vials as possible.

2.1.2. Place all fuel or exhaust sources downwind of the sampling location.

2.1.3. Position all petroleum-fueled engines (including the vehicle) downwind of the sampling operations.

2.2. Do not allow the sampling equipment or hands to touch the rim of the sample container.

2.3. Do not remove septum caps from VOC vials until just prior to filling. Cap vials immediately after filling with sample.

2.4. **DO NOT PRERINSE VOC VIALS.**

2.5. Do not aerate the sample during sample collection. If collecting from a spigot, reduce the flow rate to less than 100 mL/min. If collecting samples with a pump, maximize the flow rate within the range of 100 mL/min to 400 mL/min, depending on the sample source and pump and tubing configuration. See further discussion about sampling VOCs with pumps in FS 2200.

2.6. If preservation is required, proceed to section 3 below unless the laboratory supplied vials with premeasured quantities of acid, and the sample does not need to be dechlorinated (see 3.2 below).

2.6.1. If no preservation is required or if the vials are prepreserved (see 2.5 above), slowly and carefully allow the sample to flow down the **side** of the vial to minimize turbulence. Fill the vial until the surface tension holds the water in a "convex meniscus".

2.6.2. If a vial overflows during the filling process, document the problem and notify the laboratory that the vial may not contain sufficient acid.

2.6.3. If using a bailer, the bailer must be equipped with a controlled flow bottom assembly.

3. PRESERVATION

3.1. Preserve the sample **during** the sample collection process.

3.2. Dechlorination: Some treated water samples (drinking water and treated wastewater) may contain residual chlorine that must be removed with a declorination agent such as sodium thiosulfate or ascorbic acid. This process must occur **before** any additional preservatives (i.e., acid) are added. The dechlorination agent must be **in the vial** before the sample is added.

3.2.1. Laboratories may supply vials with premeasured quantities of declorination agent. If acid preservation **is not required**, fill the vials (see section 2.5.1 above) and proceed to section 4 below.

3.2.2. For chlorinated drinking water samples, add 3 mg sodium thiosulfate per 40 mL vial.

3.2.3. If the chlorine level is unknown, the concentration must be measured (see FT 2000). For sources other than drinking water (e.g., chlorinated effluent), 10 mg sodium thiosulfate per 40 mL vial will remove up to 5 ppm Cl_2.

3.3. Acid Preservation

3.3.1. Chlorinated Samples

3.3.1.1. If acid preservation is required, carefully fill the vial with sample, but not to a convex meniscus as described in section 2.5.1 above.

3.3.1.2. Add four drops of concentrated HCl (more acid may be needed if the sample is known to contain high levels of bicarbonate or is otherwise buffered).

3.3.1.3. Add additional sample to create a convex meniscus.

NOTE: If the sample reacts with the acid by generating gas, do not submit preserved samples for analysis. Instead, collect unpreserved samples (seven-day holding time must be met).

3.3.2. Unchlorinated Samples

3.3.2.1. The laboratory may supply vials with premeasured quantities of acid. In this case, proceed to section 2.5.1 above. If a vial overflows during the filling process, document the problem and notify the laboratory that the vial may not contain sufficient acid.

3.3.2.2. If the samples are preserved in the field, follow the procedure in section 3.3 above.

4. CAPPING THE VIAL

4.1. Fill the vial so that the sample surface is above the container rim (convex meniscus).

4.1.1. **Do not pour** sample into cap.

4.1.2. Fill vial from the original source (tubing, spigot, etc.) **Do not fill vial from sample collected in the cap**.

4.2. **Immediately** cap the vial with the Teflon seal contacting the sample. Some sample may overflow while tightening the cap.

4.3. If acid has been added to the sample, tip the vial gently two or three times to distribute the preservative.

4.4. Turn the vial over and tap it to check for the presence of bubbles.

4.4.1. If bubbles are present, and the total volume of the bubbles is less than 5 mm in diameter, the sample may be submitted.

4.4.2. If the total volume of the bubbles is greater than 5 mm in diameter, discard the vial and fill a new one.

4.4.3. **Do not reopen a vial to add additional sample.**

5. SAMPLE PACKING

5.1. Label each vial with an appropriate field ID number and preservation (e.g., preserved with acid, sodium thiosulfate/acid, etc.).

5.2. Wrap each vial in a protective material (e.g., bubble wrap).

5.3. Place the set of vials in a small, sealable, untreated plastic bag unless the laboratory supplies an alternate method of packing.

5.4. Place samples in **wet** ice within 15 minutes of sample collection (see FS 1006, section 5).

5.5. Protect samples from environmental contamination during storage and transport to the laboratory.

5.6. As an added measure, DEP recommends wrapping the set of replicate samples in bubble wrap and sealing them in a container. This procedure will add further protection from potential contamination.

6. DOCUMENTATION

6.1. Label all the vials.

6.2. Complete field records.

6.3. Make note in the field records of any samples that appear highly contaminated or appear to effervesce when acid is added.

FS 2005. *Bacteriological Sampling*

1. SAMPLE CONTAINERS

1.1. Collect the samples in properly sterilized containers.

1.1.1. Presterilized Whirl-pak bags (or equivalent) are generally used.

1.1.2. If Whirl-pak bags are not used, the sample container must have a volume of at least 125 mL.

1.1.3. If using bottles, the caps must be sterilized. If the caps are lined, there must be documentation to show that the liner does not produce toxic compounds when sterilized.

1.1.4. Bottles and caps must be sterilized according to procedures in FC 1320 or purchased presterilized from a commercial vendor.

2. SAMPLE COLLECTION PROCEDURES

2.1. Unless a composite is specified by permit, all samples must be grab samples.

2.2. Do not open the container once it has been sealed.

2.3. Do not rinse sample container before collecting the sample.

2.4. Use aseptic techniques to collect the sample:

2.4.1. If an intermediate device is used, thoroughly rinse with sample water. To ensure proper rinsing, DEP recommends that microbiological samples be the last sample collected with the sampling device.

2.4.2. Do not put fingers into the mouth of the container or on the interior of the cap.

2.4.3. Do not disinfect the sample equipment or sampling port.

2.4.3.1. If special sampling requirements suggest disinfection is required because of a questionable condition of the sampling port or spigot, e.g., for drinking water sampling, follow procedures for potable water sampling in Section 9060, *Samples*, subsection 9060 A.3.a., Potable Water, 2006, in Standard Methods for the Examination of Water and Wastewater (see Standard Methods Online, http://www.standardmethods.org/store/).

2.5. Rinse the sampling equipment with sample water before collecting the sample. Therefore, collect microbiological samples at the end of a sampling sequence.

2.6. Wells with In-Place Plumbing, Spigots and/or Faucets

2.6.1. Do not disinfect the spigot with bleach, alcohol or heat. Turn on spigot and flush at maximum velocity (see FS 2310).

2.6.2. After flushing, reduce the water flow to approximately 500 mL/min and allow the water to flow for a few minutes before collecting samples. If other samples (metals, nutrients, etc.) are to be collected, collect these samples first.

2.6.3. **Do not stop the flow before or during the filling process.**

2.7. Direct Grab Sample Collection

2.7.1. Hold a rigid container near the base and plunge neck downward, below the surface. Turn container until the neck points slightly upward with the mouth directed toward the current. Fill to within about 1/2 inch of the top and cap immediately.

2.7.2. Whirl-pak bags (or equivalent)

- Open the bag by zipping off the top and pulling the white tabs to open the bag. Hold the bag behind the wire ties, and plunge neck downward and up in one sweeping arc; or
- Zip off the top of the bag. Hold bag so that the mouth and wire ties are in front of the hands and fingers. Immerse the bag, and open the bag into the current.
- The above procedures may also be accomplished by attaching the bag to a pole.

2.7.2.1. Bring the bag to the surface, and press out excess water.

2.7.2.2. Seal the bag by folding the open ends at least three times and securely twisting the wire ties.

2.8. Intermediate Device Collection

2.8.1. When using an intermediate sampling device (bailer, DO dunker, niskin bottle, etc.), obtain sufficient sample in the sample collection device to completely fill the sample container. Begin pouring sample out of the device BEFORE collecting into the container. Continue to pour sample out of the device, place container under flowing stream, and fill. **Do not stop the flow before or during the filling process.**

3. PRESERVATION

3.1. Preserve samples according to Tables FS 1000-4 through FS 1000-10.

3.2. Place all samples in wet ice immediately after sample collection (see FS 1006, section 5).

3.3. When the sample contains residual chlorine, add a dechlorinating agent such as sodium thiosulfate to the sample container.

3.3.1. The final concentration of sodium thiosulfate must be approximately 100 milligrams per liter (mg/L) in the sample (add 0.1 mL of a 10% solution of thiosulfate to a 125 mL sample).

3.3.2. Some vendors or laboratories provide sterile containers with premeasured amounts of dechlorinating agent. Determine if the source of the field containers already contain a dechlorinating agent.

3.3.3. **Do not use containers with dechlorinating chemicals** when collecting samples from sources that are known to be free from residual chlorine.

4. HOLDING TIME

4.1. The holding time for microbiological samples is very short. Let the laboratory know the approximate time that samples will be collected and when they are expected to be delivered to the laboratory.

4.2. The holding time begins at the time (hours and minutes) the sample is collected and ends at the time that the sample is placed on the applicable growth media.

4.3. Consult Tables FS 1000-4, -6, -8, and -9 for holding times.

5. DOCUMENTATION

5.1. Label each sample container with an appropriate field ID number.

5.2. Place samples in **wet** ice within 15 minutes of sample collection (see FS 1006, section 5).

5.3. Complete field records.

5.4. Make note in the field records of any unusual sample appearances or sampling conditions.

FS 2006. *Oil and Grease (O&G) and Total Recoverable Petroleum Hydrocarbons (TRPHs)*

1. SAMPLE CONTAINERS

1.1. Collect samples for O&G and TRPHs in 1-liter wide mouth amber glass bottles.

1.2. The cap must have a Teflon liner.

1.3. Visually inspect glass bottles and caps for defects. Do not use container if defects are present or if they do not appear clean.

2. SELECTION OF SAMPLING POINTS

2.1. Oil and grease may be present in wastewater as a surface film, an emulsion, a solution, or as a combination of these forms. Since it is very difficult to collect a representative ambient sample for oil and grease analysis, the sampler must carefully evaluate the location of the sampling point.

2.1.1. Select a point of greatest mixing.

2.1.2. For compliance samples at a facility, collect samples from a point that best represents oil and grease concentrations.

3. SAMPLE COLLECTION PROCEDURES

3.1. All samples must be grab samples.

3.1.1. If composite data are required, collect individual grab samples over the specified time period.

3.1.2. Submit all samples for analysis.

3.1.3. Average the concentrations of the results to determine the average concentration over time.

3.2. Do not collect the sample by skimming the surface.

3.3. Collect a discrete sample that will be used for analysis. Do not use this sample for any other test.

3.4. Remove the cap from the glass bottle without touching the interior of the container or lid.

3.5. Do not rinse the sampling device or the sample container with sample water.

3.6. Collect the sample directly into the container.

3.6.1. If intermediate sampling equipment is needed, do not allow the sampling equipment to touch the rim of the sample container.

3.6.2. Do not use automatic samplers to collect these types of samples.

3.6.3. Fill the bottle with the sample water to almost full capacity.

3.6.4. Add preservatives (see section 4 below).

3.6.5. Quickly cap the container and tighten securely.

4. PRESERVATION

4.1. Preserve the sample within 15 minutes of sample collection.

4.2. The pH of the acidified sample must be less than 2. **Do not over acidify the sample.**

4.3. Preserve the sample by adding an accurately measured amount of sulfuric or hydrochloric acid to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.

4.3.1. Tightly cap the sample container and shake to distribute the acid.

4.3.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is less than 2. **Do not put the pH paper directly into the sample container.**

4.3.3. If the pH is greater than 2, add additional measured amounts of acid and test with narrow range pH paper (see section 4.3.2 above) until the pH has been reduced to below 2 pH units.

4.3.4. Record the total amount of acid that was added to the sample.

4.4. Acidify at least one of the equipment blanks with the **greatest** amount of acid that was required in the sample set and note the amount in field documentation.

4.5. After the sample has been preserved, screw the cap on tightly.

4.6. Immediately place the sample in **wet** ice after preserving with acid (see FS 1006, section 5).

5. DOCUMENTATION

5.1. Label each vial with an appropriate field ID number.

5.2. Protect glass container from breakage ("bubble wrap" is recommended).

5.3. Complete field records.

5.4. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2007. *Radiological Sampling (Excludes Radon)*

1. SAMPLE CONTAINERS

1.1. Use polyethylene, polyvinyl chloride (PVC), or Teflon containers.

1.2. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.

2. SAMPLE COLLECTION PROCEDURES

2.1. On unknown sites, survey the area with a beta-gamma survey instrument, such as a Geiger-Müller meter.

2.1.1. If radiation levels are above instrument background, consult a radiation safety specialist to determine appropriate safety procedures.

2.2. Remove the cap from the sample container and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION

3.1. Preserve the sample with a suitable grade of nitric acid (HNO_3).

3.2. Preserve the sample within 15 minutes of sample collection.

3.3. The pH of the acidified sample must be less than 2. **Do not over acidify the sample.**

3.4. If the preservative is added after the sample is collected (the container is not prepreserved), do not fill the container to the rim.

3.5. Preserve the sample by adding an accurately measured volume of concentrated HNO_3 or 1:1 HNO_3 to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.

3.5.1. Tightly cap the sample container and shake to distribute the acid.

3.5.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is less than 2. **Do not put the pH paper directly into the sample container.**

3.5.3. If the pH is greater than 2, add additional measured amounts of acid and test with narrow range pH paper (see section 3.5.2 above) until the pH has been reduced to just below 2 pH units.

3.5.4. Record the total amount of acid that was added to the sample.

3.5.5. Cooling to 4°C is not required.

3.6. Acidify at least one of the equipment blanks with the **greatest** amount of acid that was required in the sample set and note the amount in field documentation.

3.7. After the sample has been preserved, screw the cap on tightly.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2008. *Radon Sampling*

Radon is a gas and is easily removed from water sources. Therefore, follow the same precautions and care used to collect volatile organic samples. Minimize contact with air during sample collection. Other sample collection techniques may be appropriate, depending on the analytical method or as specified in the project data quality objectives.

1. SAMPLE CONTAINERS

1.1. Use glass sample vials containing a premeasured portion of the scintillation “cocktail.”

1.2. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.

1.3. Collect at least two samples.

2. PRESERVATION: The scintillation cocktail is the only required preservative.

3. SAMPLE COLLECTION PROCEDURES Obtain specific sample collection instructions from the laboratory that will analyze the samples. These instructions must include proper handling as

well as sample size and packing instructions. The following are general instructions for collecting the samples:

3.1. Carefully fill a syringe (usually 10 mL) with sample water so that air bubbles are not pulled in with the sample before, during or after filling.

3.2. Place the tip of the syringe BELOW the scintillation cocktail and slowly dispense the sample BENEATH the cocktail surface.

3.3. Replace the lid and cap tightly.

3.4. Generally, the vial is used in the laboratory analytical instrument and labels or ID numbers on the sides of the containers may interfere with the analysis. Check with the laboratory for proper placement of labels or field ID numbers.

3.5. Ship in an upright position in the shipping containers that have been provided by the laboratory. If none are provided, protect vials from breakage ("bubble wrap" is recommended), segregate replicate samples in separate plastic bags, and ship to the laboratory in an upright position.

4. DOCUMENTATION

4.1. Complete the field notes.

4.2. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2009. *Cyanide Sampling*

Cyanide is a very reactive and unstable species and is highly toxic. Samples suspected of containing cyanide must be handled very carefully.

1. SAMPLE CONTAINERS

1.1. Use polyethylene or glass sample containers.

1.2. Use properly cleaned containers (see FC 1300).

1.3. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.

2. SAMPLE COLLECTION PROCEDURES

2.1. Remove the cap from the sample container, and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION

3.1. Many different analytes interfere with the cyanide analysis (e.g., sulfides). If any interferences are known to be present, pretreat the sample for interferences by following the applicable footnotes in Table FS 1000-4.

3.2. Preserve the sample within 15 minutes of sample collection.

3.3. Preserve samples with sodium hydroxide to a pH greater than 10.

3.4. Preserve the sample by adding an accurately measured amount of a sodium hydroxide solution or sodium hydroxide pellets to the container. Use a graduated container or pipet to add the solution.

3.4.1. Tightly cap the sample container and shake to distribute the preservative.

3.4.2. Pour an aliquot of the preserved sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is greater than 10. **Do not put the pH paper directly into the sample container.**

3.4.3. If the pH is less than 10, add additional measured amounts of the preservative and test with narrow range pH paper (see section 3.4.2 above) until the pH has been raised to above 10 pH units.

3.4.4. Record the total amount of preservative that was added to the sample.

3.5. After the sample has been preserved, screw the cap on tightly.

3.6. Immediately put the sample in **wet** ice (see FS 1006, section 5).

3.7. Preserve at least one of the equipment blanks with all the reagents and the **greatest** amount of sodium hydroxide that was required in the sample set and note the amount in field documentation.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

4.4. Ensure that all preservation measures are part of the field notes.

FS 2010 *Sulfide Sampling*

1. Analyze samples within 15 minutes of collection, or the preserve the sample within 15 minutes for later analysis. If preservation is required add the zinc acetate and sodium hydroxide to the container **before** filling with sample.

2. Avoid aerating the sample during collection. Pour the sample slowly and carefully allow the sample to flow down the **side** of the container to minimize turbulence.

3. Check the pH (if necessary) before completing the filling process.

4. Complete the filling process. **Do not leave a head space.**

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 tubing. Do not use low-density polyethylene for the collection of samples for analysis of volatile organic compounds (VOCs).
- The electrical cord must be sealed in Teflon, Polyethylene or Polypropylene and any cabling must be sealed in Teflon, Polyethylene or Polypropylene, 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, 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 Polypropylene.
- The entire length of the delivery tube must be Teflon, Polyethylene or Polypropylene. Do not use low-density polyethylene for VOCs.
- Any cabling must be sealed in Teflon, Polyethylene or Polypropylene, 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 Polypropylene bailers may be used to sample all analytes. Low-density polyethylene is not suitable for the collection of VOCs.

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 Polypropylene.

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 Polypropylene 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 <u>Electronic Probe</u>

3.2.1 Follow the manufacturer's instructions for use.

3.2.2 Record the measurement.

3.3 <u>Chalked Line Method</u>: 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 Wells with Fully Submerged Screen and Pump or Intake Tubing Placed at the Top of the Water Column (conventional purge): 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 Wells with Fully Submerged Screen and Pump or Intake Tubing Placed Within the Screened Interval (minimizing purge volume): 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 Polypropylene tubing and the smallest possible pump chamber volume to minimize the total volume of

water pumped from the well and to reduce drawdown. If samples will be collected for VOCs, do not use low-density polyethylene tubing.

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. GENERAL CONSIDERATIONS FOR SAMPLING EQUIPMENT AND PROCEDURES

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 samples for the analysis of volatile organic compounds (VOCs) through the pump without additional restrictions are stainless steel and Teflon variable speed submersible pumps; stainless steel and Teflon or Polyethylene variable speed bladder pumps; and, permanently installed variable speed bladder or submersible pumps with PVC bodies, as long as the PVC pump remains in contact with the water in the well at all times. Peristaltic pumps may be used for VOC sample collection only according to the requirements in this SOP.

3.1 Collect the sample into the sample container to be sent to the laboratory directly from the sampling tap or spigot, the pump delivery tubing or other sampling device. **Do not** use intermediate containers.

3.2 In order to avoid contaminating the sample or loss of analytes from the sample:

3.2.1 Handle the sampling equipment as little as possible.

3.2.2 Minimize the amount of equipment that is exposed to the sample, where possible.

3.2.3 Employ precautions and procedures specific to the collection of samples for VOC analysis.

3.2.3.1 Minimize aeration of samples collected for VOC analysis.

3.2.3.2 Reduce flow rates to 100 - 400 mL/minute when using a pump to collect VOC samples. Attempt to maximize the flow rate within this range. Do not sample at flow rates lower than 100 mL/minute or higher than 400 mL/minute.

3.2.3.3 See subpart FS 2221, section 1, including subsections 1.1 – 1.1.3.9, 1.2 – 1.2.3.3, 1.3.2 – 1.3.3.1, 1.3.4 – 1.3.4.2 and 1.4 for additional VOC sampling instructions, restrictions, precautions and criteria.

3.3 Dedicated Sampling Equipment

3.3.1 Whenever possible, use dedicated equipment because it significantly reduces the chance of cross-contamination.

3.3.2 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).

3.3.3 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.

3.4 Cleaning/Decontamination

3.4.1 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.

3.4.2 Clean or make sure any permanently mounted tubing is clean before installation.

3.4.3 Change or clean tubing when the pump is withdrawn for servicing.

3.4.4 Clean any replaceable or temporary parts as specified in FC 1000.

3.4.5 Collect equipment blanks on dedicated pumping systems when the tubing is cleaned or replaced.

3.4.6 Clean or ensure dedicated bailers are clean before placing them into the well.

3.4.7 Collect an equipment blank on dedicated bailers before introducing them into the water column.

3.4.8 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; stainless steel, Teflon or Polyethylene bladder pumps; and, permanently installed variable speed submersible or bladder pumps with PVC bodies (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 pump tubing must be Teflon, polyethylene or polypropylene. Do not use low-density polyethylene (LDPE) bladders or tubing to collect samples for volatile organic compounds (VOCs). **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). Samples for **volatile organic compounds** (VOCs) may be collected through the peristaltic pump roller tubing if ≤ 1 foot of silicone tubing is used in the pump roller head, according to the instructions and restrictions listed in section 1.1.1, below. 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 Collected Through the Pump Roller Tubing: Ensure that no more than a maximum length of one foot of new silicone tubing is installed in the peristaltic pump roller head assembly before the well is purged, if the same pump and tubing assembly is used to purge and sample the well. Otherwise, install a new length of silicone roller tubing as described above before beginning to sample (see NOTE below). If the pump will be used to sample more than one well, replace the silicone roller tubing before purging and sampling each new well. Use Teflon, Kynar, high-density polyethylene (HDPE) or similarly inert material for the drop (down-hole) and delivery tubing. Do not use low-density polyethylene (LDPE) tubing. Minimize aeration of the sample during collection. If samples for additional analytes other than VOCs will be collected, fill the VOC sample containers last, if possible. For low-recharge wells, collect VOCs first after purging is completed, where excessive drawdown or dry purging occurs. NOTE: Depending on the recharge characteristics of the well and sampler skill, attempt to maximize the flow rate for VOC sample collection within the range stipulated below in sections 1.1.1.1 and 1.1.1.2. Collect the VOC sample directly into the sample container from the discharge flow exiting from the pump delivery tubing. Disconnect flow-through containers, manifolds, valves or other devices from the delivery tubing before collecting the VOC samples, if applicable. If the tubing assembly intended for VOC sample collection was not used to purge the well, begin pumping using the new sampling tubing assembly, adjust the pumping rate for the maximum possible flow rate for VOC sampling and pump a minimum of 3 equipment volumes (pump and tubing volume) through the entire tubing assembly before collecting the VOC samples. If the pump tubing is placed within the screened interval, new tubing cannot be reinserted into the well and the same tubing must be used for purging and sampling.

1.1.1.1 For wells with sufficient recharge where the pumping rate can be matched with the recharge rate, use tubing with the smallest practical inside diameter and collect VOC samples with a pumping rate in the range of 100 mL/minute – 400 mL/minute. Attempt to maximize the flow rate within this range. Do not reduce the flow rate below 100 mL/minute or exceed 400 mL/minute while sampling. Minimize aeration of the sample during collection, and observe all other precautions as indicated in FS 2000, subpart FS 2004. If samples for additional analytes other than VOCs will be collected, fill the VOC sample containers last, if possible.

1.1.1.2 For low-recharge wells, use tubing with the smallest practical inside diameter and collect VOC samples with a pumping rate in the range of 100 mL/minute – 400 mL/minute. Attempt to maximize the flow rate within this range. Do not reduce the flow rate below 100 mL/minute (if possible) or exceed 400 mL/minute while sampling. Minimize aeration of the sample during collection, and observe all other precautions as indicated in FS 2000, subpart FS 2004. If samples for additional analytes other than VOCs will be collected, fill the VOC sample containers last, if possible. Collect VOCs first after purging is completed, where excessive drawdown or dry purging occurs. See subpart FS 2212, section 3.7 for wells that purge dry.

1.1.2 Volatile Organics Using Manual Fill and Drain Method: This method is also denoted as the “straw” method (with gravity drain). Collect volatile organics last. If the pump tubing is placed within the screened interval, do not reinsert the tubing into the well after withdrawing, and do not repeat steps 1.1.2.3 through 1.1.2.6.

1.1.2.1 Insert sufficient length of drop tubing to provide enough sample volume to fill all necessary VOC sample containers, if possible.

1.1.2.2 Remove the drop tubing from the inlet side of the pump.

1.1.2.3 Submerse the drop tubing into the water column and allow it fill.

1.1.2.4 Remove the drop tubing from the well.

1.1.2.5 Prevent the water in the tubing from flowing back into the well.

1.1.2.6 Carefully allow the groundwater to drain by gravity into the VOC sample containers. Avoid turbulence. Do not aerate the sample.

1.1.2.7 Repeat steps 1.1.2.3 - 1.1.2.6 until enough sample containers are filled.

1.1.3 Volatile Organics Using the Pump to Fill and Drain the Tubing: This method is also denoted as the "straw" method with reverse-flow. Collect volatile organics last. If the pump tubing is placed within the screened interval, do not reinsert the tubing into the well after withdrawing, and do not repeat steps 1.1.3.2 through 1.1.3.8, below. Do not reduce the flow rate below 100 mL/minute or exceed 400 mL/minute while pumping. Do not collect sample that has passed through the pump roller head silicone tubing.

1.1.3.1 Insert sufficient length of drop tubing to provide enough sample volume to fill all necessary VOC sample containers, if possible.

1.1.3.2 Submerse the drop tubing into the water column.

1.1.3.3 Use the pump to fill the drop tubing.

1.1.3.4 Quickly remove the tubing from inlet side of the pump.

1.1.3.5 Prevent the water in the tubing from flowing back into the well.

1.1.3.6 Remove the drop tubing from the well and fill the VOC sample containers using the reverse-flow or gravity-drain methods in steps 1.1.3.7 or 1.1.3.8 below.

1.1.3.7 Reverse the flow on the peristaltic pump to deliver the sample into the VOC sample containers at a slow, steady rate. Avoid turbulence. Do not aerate the sample.

1.1.3.8 Or, remove the drop tubing from the inlet side of the pump and carefully allow the groundwater to drain into the VOC sample containers. Avoid turbulence. Do not aerate the sample.

1.1.3.9 Repeat steps 1.1.3.2 - 1.1.3.8 until enough VOC sample containers are filled.

1.1.4 Extractable Organics Collected Through Silicone Pump-Head Tubing:

1.1.4.1 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.

1.1.4.2 Collect extractable organic samples directly from the effluent delivery tubing (attached to discharge side of the silicone pump head tubing) into the sample container.

1.1.4.3 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.

1.1.5 Extractable Organics Using an Optional Organic Trap Assembly

1.1.5.1 Assemble the components of the pump and trap according to Figure FS 2200-1.

1.1.5.2 The sample container should be the trap bottle.

1.1.5.3 All equipment that contacts the groundwater **before** the sample container must be constructed of Teflon, Polyethylene, Polypropylene, 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.**

1.1.5.4 Connect the outflow tubing from the container to the influent side of the peristaltic pump.

1.1.5.5 Prevent the water in the down-hole delivery tubing from flowing back into the well while performing this connection.

1.1.5.6 Turn the pump on and reduce the flow rate to a smooth and even flow.

1.1.5.7 Discard a small portion of the sample to allow an air space.

1.1.5.8 Preserve (if required), label and complete the field notes.

1.1.6 Inorganics

1.1.6.1 Inorganic samples may be collected from the effluent tubing.

1.1.6.2 If samples are collected from the pump, decontaminate all tubing (including the tubing in the head) or change it between wells.

1.1.6.3 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, polyethylene or polypropylene. All tubing must be Teflon, Polyethylene, or Polypropylene and any cabling must be sealed in Teflon, Polyethylene or Polypropylene, or made of stainless steel. Do not use low-density polyethylene (LDPE) tubing or bladders for the collection of VOC samples.

1.2.2 After purging to a smooth even flow, reduce the flow rate.

1.2.2.1 When sampling for volatile organic compounds, reduce the flow rate to 100 – 400 mL/minute, if possible. Attempt to maximize the flow rate within this range.

1.2.3 Sampling for Volatile Organic Compounds (VOCs)

1.2.3.1 Use Teflon, Kynar, HDPE or similarly inert material for the bladder or tubing. Do not use LDPE bladders or tubing. Minimize aeration of the sample during collection. If samples for additional analytes other than VOCs will be collected, fill the VOC sample containers last, if possible. For low-recharge wells, collect VOCs first after purging is completed, where excessive drawdown or dry purging occurs. Depending on the recharge characteristics of the well and sampler skill, attempt to maximize the flow rate for VOC sample collection within the range stipulated above in section 1.2.3. Collect the VOC sample directly into the sample container from the discharge flow exiting from the pump delivery tubing. Disconnect flow-through containers, manifolds, valves or other devices from the delivery tubing before collecting the VOC samples, if applicable.

1.2.3.2 If the pump and/or tubing assembly intended for VOC sample collection was not used to purge the well, begin pumping using the sampling pump and/or tubing assembly, adjust the pumping rate for the maximum possible flow rate for VOC sampling and pump a minimum of 3 equipment volumes (pump and tubing volume) through the entire tubing assembly before collecting the VOC samples.

1.2.3.3 If the pump is placed within the screened interval, use the same pump and tubing assembly for both purging and sampling.

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 Polypropylene. The delivery tubing must be Teflon, Polyethylene or Polypropylene. Do not use low-density polyethylene (LDPE) for the collection of VOC samples. The electrical cord must be sealed in Teflon, Polyethylene or Polypropylene, and any cabling must be sealed in Teflon, Polyethylene or Polypropylene, or constructed of stainless steel.

1.3.3 After purging to a smooth even flow, reduce the flow rate.

1.3.3.1 When sampling for volatile organic compounds, reduce the flow rate to 100 – 400 mL/minute, if possible. Attempt to maximize the flow rate within this range.

1.3.4 Sampling for Volatile Organic Compounds (VOCs)

1.3.4.1 Use Teflon, Kynar, HDPE or similarly inert material for the pump tubing. Do not use LDPE tubing. Minimize aeration of the sample during collection. If samples for additional analytes other than VOCs will be collected, fill the VOC sample containers last, if possible. For low-recharge wells, collect VOCs first after purging is completed, where excessive drawdown or dry purging occurs. Depending on the recharge characteristics of the well and sampler skill, attempt to maximize the flow rate for VOC sample collection within the range stipulated above in section 1.3.4. Collect the VOC sample directly into the sample container from the discharge flow exiting from the pump delivery tubing. Disconnect flow-through containers, manifolds, valves or other devices from the delivery tubing before collecting the VOC samples, if applicable.

1.3.4.2 If the pump and/or tubing assembly intended for VOC sample collection was not used to purge the well, begin pumping using the sampling pump and/or tubing assembly, adjust the pumping rate for the maximum possible flow rate for VOC sampling and pump a minimum of 3 equipment volumes (pump and tubing volume) through the entire tubing assembly before collecting the VOC samples.

1.4 For all analytes, if the pump is placed within the screened interval, use the same pump and tubing assembly for both purging and sampling.

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 Polypropylene 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 DEP recommends following 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. If samples for additional analytes other than VOCs will be collected, fill the VOC sample containers last, if possible. However, collect VOCs first after purging is completed, where excessive drawdown or dry purging occurs.

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 **<u>Do not</u>** pour the sample into any intermediate vessel for subsequent filtration.

1.6.1.3 Collect the sample in a Polyethylene, Teflon or Polypropylene 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 Procedures

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

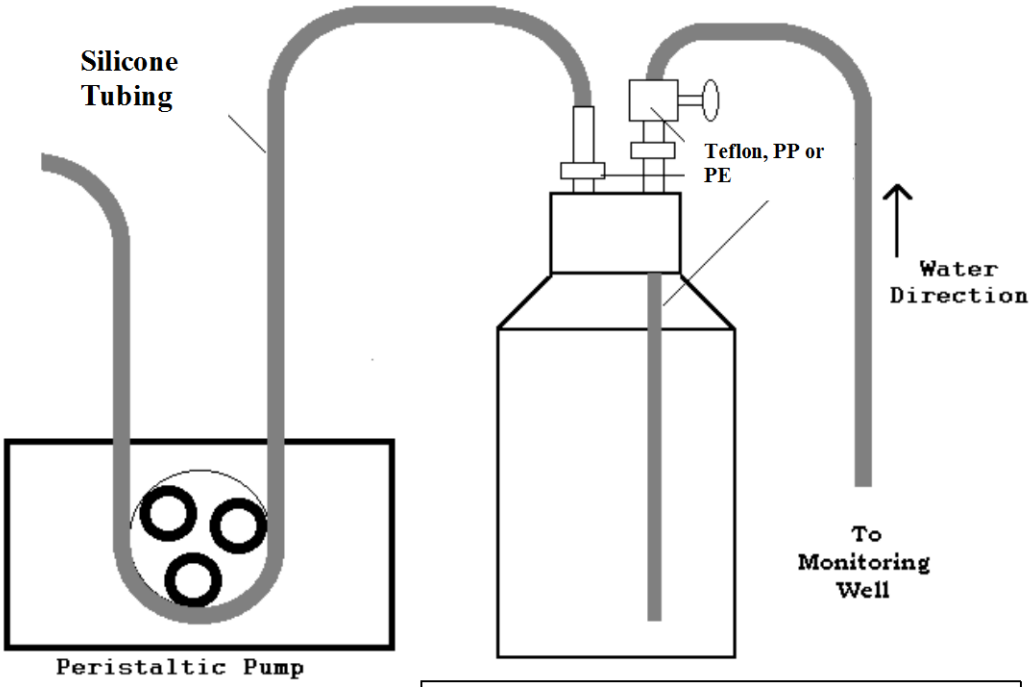
Derived using the formula in Standard Methods for the Examination of Water and Wastewater, Page 4-101, 18th Edition, 1992

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 FS 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.

Groundwater Purging Procedures

Figure FS 2200-2

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.

FS 3000. SOIL

See also the following Standard Operating Procedures:

- FA 1000 Administrative Procedures
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000 Documentation Procedures
- FM 1000 Field Planning and Mobilization
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FT 1000 – FT 2000 Field Testing and Calibration

1. Introduction and Scope

1.1. Use these SOPs during field investigations to collect soil samples that are representative of current site conditions. It is very important to ensure that the collected samples are neither altered nor contaminated by sampling and handling techniques.

1.2. The following topics include: equipment choice, equipment construction materials, grab and areal or depth composite sampling techniques. Sample collection methods fall into three general depth classifications: surface, shallow subsurface, and deep subsurface. Once the samples are acquired, the handling procedures are very similar and are described below.

2. GENERAL

2.1. Select sampling equipment based on the type of sample to be collected and the analytes of interest. Choose soil sampling locations such that a representative portion of the soil is collected with minimal disturbance. Locations where natural vegetation is stressed or dead and/or areas that have surficial soil staining may be indicative of improper waste disposal practices.

2.2. If background and/or quality control sampling is warranted and feasible as determined in the site's work plan or by the project manager, select an up gradient, undisturbed location for obtaining the background and/or quality control samples. Be aware that differences in soil types may affect these background samples (e.g., sands vs. clays).

2.3. **Do not collect** samples for chemical analysis from auger flights or cuttings from hollow stem auger flights, except for waste characterization purposes for disposal.

2.4. Do not use samples that are collected for geological/lithological or vapor meter determinations for chemical analyses.

3. EQUIPMENT AND SUPPLIES

3.1. All equipment must be constructed of materials consistent with the analytes of interest. Refer to FS 1000, Tables FS 1000-1, FS 1000-2 and FS 1000-3 for selection of appropriate equipment and materials.

3.2. For information on sample container size and construction, see FS 1000, Table FS 1000-6.

3.3. For information on sampling equipment cleaning requirements, see FC 1000.

3.4. For information on preservation and holding time requirements, see FS 1000, Table FS 1000-6.

3.5. For information on documentation requirements, see FD 1000.

4. PROCEDURES FOR COMPOSITING

4.1. The following is not a complete discussion regarding all available sampling protocols nor the appropriateness or inappropriateness of compositing soil samples. The appropriateness of compositing soil samples will depend on the data quality objectives of the project. However, it is sometimes advantageous to composite soil samples to minimize the number of samples to be analyzed when sampling highly contaminated areas. Obtain permission from the DEP program.

4.1.1. Select sampling points from which to collect each aliquot.

4.1.2. Using the appropriate sampling technique, collect equal aliquots (same sample size) from each location and place in a properly cleaned container.

4.1.3. **Combine the aliquots of the sample directly in the sample container with no pre-mixing**.

4.1.4. Record the amount of each aliquot (volume or weight).

4.1.5. Label container, preserve on wet ice to 4°C and complete field notes.

4.1.6. Notify the laboratory that the sample is an unmixed composite sample, and request that the sample be thoroughly mixed before sample preparation or analysis.

5. Specific Procedures for Volatile Organic Compounds

Follow the procedures specified for sample collection and sample preparation in EPA Method 5035, Revision 0, December,1996 (in SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods). The protocols listed below **do not replace Method 5035** but clarify and/or modify certain method procedures. Therefore, it is essential that all organizations have a copy of Method 5035 as a reference document.

5.1. Container Preparation

5.1.1. All containers must be cleaned according to the FC 1000 sample container cleaning procedures for volatile organics.

5.1.2. Sample Vials: If sample vials are filled in the field, they must be provided with all reagents, stirring devices, label **and vial cap** to be used during sample analysis. These vials must be preweighed by the laboratory and records must be maintained so that there is an unambiguous link between the tare weight and the filled sample vial.

5.2. Collection Procedure

5.2.1. The sample vials (when used) will contain a premeasured amount of liquid. The laboratory must weigh the vials before sending into the field, and must weigh them again after receipt. Therefore:

- Do not lose any of the liquid either through evaporation or spillage
- Do not use a vial if some of the contents has spilled, or if it appears that some has leaked during transport
- Use the laboratory-supplied container label for identification information. **DO NOT apply any additional labels to the container**
- Do not interchange vial caps or septa

5.2.2. Minimize exposure to air by obtaining the sample directly from the sample source, using a coring device or a commercially designed sampling tool.

5.2.2.1. The sample collection device must be designed to fit tightly against the mouth of the vial or be small enough to be inserted into the vial. Use:

- EnCore or equivalent sampling devices or
- Disposable plastic syringes with the syringe end cut off prior to sampling (use **once** per sampling location).

5.2.2.2. Extrude the sample directly into the sample container.

5.2.3. Follow the method procedures for field transfer into the vial.

5.2.4. Procedures for determining the sample weight in the field are not required unless the project manager requires an accurate determination of the 5-gram sample size.

5.2.4.1. If the vials are returned to the laboratory for weighing, the sampler must be proficient in estimating the requisite 5-gram weight necessary for each sample.

5.2.4.2. If an accurate estimate of the 5-gram sample size is desired prior to starting sample collection activities, use a balance with a sensitivity of 0.1 gram. Check the balance calibration before each day's use with a set of weights that have been calibrated against NIST-traceable weights at least annually.

5.2.5. If the sampling device is transported to the laboratory with a sample, make sure the seals are intact, especially if collecting samples from sandy soils.

5.2.6. Collect at least two replicate samples from the same soil stratum and within close proximity to the original sample location.

5.2.7. Collect an additional aliquot of sample for screening and dry weight determinations.

5.3. <u>Preservation (see FS 1000, Table FS 1000-7)</u>

5.3.1. <u>Low Level (≤ 200 µg/kg volatile organics)</u>

5.3.1.1. Method 5035 discusses the use of sodium bisulfate, which is an acid. Since Florida soils contain significant amounts of calcium carbonate that reacts with acids, DEP does not recommend using this preservative.

5.3.1.2. Properly pack the samples (see FS 2004, section 5), and place all samples on wet ice.

5.3.1.3. Analyze unpreserved samples (no acid) within 48 hours.

5.3.1.4. Analyze acid-preserved samples within the specified 14-day holding time.

5.3.1.5. Analyze unpreserved samples that have been collected in a septum vial with premeasured analyte-free water within 48 hours.

5.3.1.6. If unpreserved samples collected in a septum vial with premeasured analyte-free water are frozen to -10°C at the laboratory within 48 hours of sample collection, analyze the samples within 14 days.

5.3.1.7. Analyze samples that have been collected with and transported in a sealed coring device within 48 hours.

5.3.1.8. If unpreserved samples collected in a sealed coring device are extruded from the corer into an appropriate liquid and frozen to -10°C at the laboratory within 48 hours of sample collection, analyze the samples within 14 days.

5.3.2. <u>High Level (> 200 µg/kg volatile organics)</u>

5.3.2.1. Properly pack the samples (see FS 2004, section 5), and place all samples on wet ice.

5.3.2.2. Analyze samples that have been collected with and transported in a sealed coring device within 48 hours.

5.3.2.3. If unpreserved samples collected in a sealed coring device are extruded from the corer into an appropriate liquid and stored at 4°C at the laboratory within 48 hours of sample collection, analyze the samples within 14 days.

5.3.2.4. Analyze samples that that have been preserved in methanol in the field within 14-days.

6. BULK SAMPLES: The collection of bulk samples will depend on the data quality objectives of the project.

6.1. Do not composite or mix VOC samples unless required by the DEP program or if mandated by a formal DEP document (permit, order or contract).

6.2. Select sampling points from which to collect each aliquot.

6.3. Using the appropriate sampling technique, collect equal aliquots (same sample size) from each location and place in a properly cleaned container.

6.3.1. **Combine the aliquots of the sample directly in the sample container with no pre-mixing**.

6.3.2. Pack soil tightly minimizing as much headspace as possible in the sample container.

6.3.3. Cap container tightly with Teflon side facing sample.

6.4. Record the amount of each aliquot (volume or weight) in the field notes.

6.5. Label container. Refer to FS 1000, Table FS 1000-7 for preservation and holding time requirements.

6.6. Notify the laboratory that the sample is an unmixed composite sample, and request that the sample be thoroughly mixed before sample preparation or analysis.

FS 3100. Surface Soil Sampling

Surface soil is generally classified as soil between the ground surface and 6-12 inches below ground surface.

1. Remove leaves, grass and surface debris from the area to be sampled.
2. Collect samples for volatile organic analyses as described in FS 3000, section 5.
3. Select an appropriate precleaned sampling device and collect the sample.
4. Transfer the sample to the appropriate sample container.
5. Clean the outside of the sample container to remove excess soil.
6. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

FS 3200. Subsurface Soil Sampling

Interval begins at approximately 12 inches below ground surface.

FS 3210. SAMPLE COLLECTION PROCEDURE

Use the following after the desired depth has been reached by one of the methods outlined in FS 3220.

1. Collect samples for volatile organic analyses as described in FS 3000, section 5.
2. For other analyses, select an appropriate precleaned sampling device and collect the sample.
3. Transfer the sample to the appropriate sample container.
4. Clean the outside of the sample container to remove excess soil.

5. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

FS 3220. REACHING THE APPROPRIATE DEPTH

1. SHOVELS AND DIGGERS: Used for soils from approximately 12 inches to a point when using the implement becomes impractical.

1.1. Dig a hole or trench to the required depth.

1.2. Follow the sample collection procedures outlined in FS 3210.

2. BACKHOE: Used for soils from approximately 12 inches to a point when using the implement becomes impractical.

2.1. Dig a trench to the appropriate depth.

2.2. Expose the sample, in the trench, by using a precleaned spoon, spatula or equivalent to clean away the soil that came in contact with the backhoe bucket.

2.3. Use a **second** precleaned utensil to actually collect the sample from the trench.

2.4. Follow the procedures outlined in FS 3210 to collect the sample.

3. BUCKET AUGERS AND HOLLOW CORERS: Suitable to reach soils from approximately 12 inches to a point when using the implement becomes impractical.

3.1. Push and rotate the auger into the soil until the bucket is filled.

3.2. Addition of a non-contaminating sleeve may allow an undisturbed soil sample to be obtained.

3.2.1. The device consists of a standard auger head with a removable sleeve, which is inserted into the auger barrel. In this case it is the sleeve, which fills with soil.

3.2.2. Remove the sleeve from the auger and cap.

3.3. If the auger hole is prone to collapse due to low cohesion in some soils, DEP recommends inserting a temporary rigid PVC casing into the hole. The casing prevents hole collapse and minimizes cross-contamination between soil zones as the auger is advanced. After collecting the samples, remove the temporary casing (if used) and fill the hole filled with the excavated soil.

3.4. Remove the sample from the sampler by pushing or scraping the soil with an appropriate precleaned utensil into an appropriately precleaned tray or aluminum foil.

3.5. Remove any portion of the sample that has been disturbed and discard.

3.6. Follow the sample collection procedures outlined in FS 3210.

NOTE: If a confining layer has been breached during sampling, grout the hole to land surface with Type-1 Portland cement. This requirement may be different throughout Florida; contact the local Water Management District office for local requirements.

4. SPLIT SPOON SAMPLER: Suitable for reaching soils from approximately 12 inches to depths greater than 10 feet.

4.1. A split spoon sampler, useful for sampling unconsolidated soil, consists of two half cylinders (spoons) that fit together to form a tube approximately two feet in length and two inches in diameter.

4.1.1. The cylindrical arrangement is maintained by a retaining head and bit rings that screw on at each end of the split spoon.

4.1.2. The bit ring has beveled edges to facilitate sampling as the split spoon is forced into the ground.

4.1.3. Advance the sampler using the weight of the drilling stem and rods or a mechanical hammer.

4.1.4. Insert a catcher device in the head ring to prevent loss of unconsolidated sample during recovery.

4.2. After retrieving the split spoon sampler, expose the soil by unscrewing the bit and head rings and splitting the barrel.

4.3. If the recovery is enough to accommodate discarding a portion of the sample, discard the top and bottom two to three inches of the sample.

4.4. For volatile organic compounds collect the sample immediately from the **center portion of the split spoon** using the procedures described in FS 3000, section 5.

4.5. For other analyses, slice the sample from the center portion of the split spoon using a clean, decontaminated utensil.

4.6. Select an appropriate precleaned sampling device and collect the sample.

4.7. Transfer the sample to the appropriate sample container.

4.8. Clean the outside of the sample container to remove excess soil.

4.9. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

5. DIRECT PUSH RIGS: May be used for depths greater than 10 feet below ground surface.

5.1. Liners: The clear liners are used with direct push rigs. This method is appropriate only for unconsolidated materials. The sampling depth that can be achieved varies depending on the rig and the lithologies that are encountered. Typically, the rig operator will:

- Place the liner inside the metal probe rod
- Select a point holder with an opening appropriate for the site lithology and screw it on the probe rod
- Advance the rod a full rod length
- Retrieve the rod
- Remove the point holder
- Remove the liner, and
- Slice the liner to expose the soil.

5.2. After the liner has been sliced, follow the procedures outlined in FS 3210, collecting volatile organic samples (if needed) immediately after the liner is sliced.

5.3. If samples for organic vapor analysis screening are required, collect them by slicing the sample(s) using a clean, decontaminated utensil and place them in 8-ounce (preferred) or 16-ounce jars, immediately cover the opening with aluminum foil and screw on the lid ring. If the contamination is derived from petroleum products, it is acceptable to use a clean gloved hand to transfer the sample(s) to the sample container(s).

5.4. For other analyses, slice the sample from the center portion of the split spoon using a clean, decontaminated utensil.

5.5. Select an appropriate precleaned sampling device and collect the sample.

5.6. Transfer the sample to the appropriate sample container.

5.7. Clean the outside of the sample container to remove excess soil.

5.8. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

6. SHELBY TUBE SAMPLER

6.1. The Shelby tube sampler is used to sample unconsolidated soil and consists of a tube approximately 30 inches long and two inches (or larger) in diameter.

6.2. One end of the tube has edges beveled into a cutting edge. The other end can be mounted to an adapter, which allows attachment to the drilling rig assembly.

6.3. After drilling to the required depth with an auger or rotary drill bit, a soil sample is obtained through the auger or directly in the borehole.

6.4. Push the Shelby tube into the soil using the drilling rig's hydraulic ram or manually with a sledge hammer.

6.5. Remove the tube from the sampler head.

6.6. Extrude the sample from the Shelby tube.

6.7. Use a decontaminated utensil to remove any portion of the sample that has been disturbed.

6.8. Collect samples for volatile organics immediately from the center portion of the Shelby tube using the procedures described in FS 3000, section 5.

6.9. For other analyses, slice the sample from the center portion of the Shelby tube using a clean, decontaminated utensil.

6.10. Transfer the sample to the appropriate sample container.

6.11. Clean the outside of the sample container to remove excess soil.

6.12. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

7. CORE BARREL

7.1. A standard core barrel is utilized when consolidated samples (such as limestone or dolomite) are to be sampled.

7.1.1. The core barrel is a cylinder approximately three feet long and two inches in diameter.

7.1.2. The barrel has a removable head ring with small embedded diamonds which allow the device to cut through rock or consolidated soil as the drilling rods are rotated.

7.2. Retrieve the sample core by unscrewing the head ring and sliding the sample into a precleaned container.

7.3. Use a decontaminated utensil to remove any portion of the sample that has been disturbed.

7.4. Remove the sample from the sampler (corer) with a precleaned tool.

7.5. Transfer the sample to the appropriate sample container.

7.6. Clean the outside of the sample container to remove excess soil.

7.7. Label the sample container, place on wet ice to preserve to 4°C and complete the field notes.

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. . However, the user may set the zero point of the instrument according to the manufacturer's instructions, if applicable.

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.

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 used for continuous monitoring, see FT 1900.

2.2.5.6. For unattended instrument deployment, refer to FT 1000 sections 2.2.5.1-2.2.5.4.

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. Compare the assigned or stated standard value with the reading. This reading must be within the manufacturer's stated tolerance range and the acceptance criterion required in the individual FT-series SOP. If the SOP criterion is not met, assign this reading as the new value of the secondary 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. Field Instrument Calibration Documentation: 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**
Specific Conductance (FT 1200)	**± 5% of standard value**
Temperature (FT 1400)	**± 0.5^{o}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**

FT 1100. Field Measurement of Hydrogen Ion Activity (pH)

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. Equipment and Supplies

1.1. Field Instrument: Use any pH meter consisting of a potentiometer, a glass electrode, a reference electrode, and a temperature-compensating device.

1.1.1. For routine fieldwork use a pH meter accurate and reproducible to at least 0.2-unit in the range of 0.0 to 14.0 units, and equipped with temperature-compensation adjustment. Record the pH value in pH units to one decimal place.

1.1.2. Advanced silicon chip pH sensors (with digital meters) may be used if demonstrated to yield equivalent performance to glass electrode sensors for the intended application.

1.2. Standards: Purchased or laboratory-prepared standard buffer solutions of pH values that bracket the expected sample pH range. Use buffers with nominal values of 4.0, 7.0 and 10.0 units for most situations. If the sample pH is outside the range of 4.0 to 10.0, then use two buffers that bracket the expected range with the pH 7 buffer being one of the two buffers. Alternatively, prepare appropriate standards per Table 4500-H^+:I in method SM4500-H^+-B (see Standard Methods for the Examination of Water and Wastewater (see Standard Methods Online, http://www.standardmethods.org/store/).

1.3. Recordkeeping and Documentation Supplies:

- Field notebook (w/ waterproof paper is recommended) or forms
- Indelible pens

2. Calibration and Use

2.1. General Concerns

2.1.1. The acceptance criterion for the initial calibration or the calibration verification is a reading of the standard within +/- 0.2-unit of the expected value.

2.1.2. On a weekly basis, check the calibration to ensure the % theoretical slope is greater than 90% (if applicable to your instrument type).

2.1.2.1. Note the % slope in the calibration records.

2.1.2.2. A % slope of less than 90% indicates a bad electrode that must be changed or repaired.

2.1.2.3. If % slope cannot be determined on your meter, or the manufacturer's optimum specifications are different, follow the manufacturer's recommendation for maintaining optimum meter performance.

2.2. Interferences

2.2.1. Sodium at pH $\geq$ 10.0 units can be reduced or eliminated by using a low sodium error electrode.

2.2.2. Coatings of oils, greases, and particles may impair the electrode's response. Pat the electrode bulb dry with lint-free paper or cloth and rinse with de-ionized water. For cleaning hard-to-remove films, use acetone very sparingly so that the electronic surface is not damaged.

2.2.3. Temperature effects on the electrometric measurement of pH are controlled by using instruments having temperature compensation or by calibrating the meter at the temperature of the samples.

2.2.4. Poorly buffered solutions with low specific conductance (< 200 μmhos/cm) may cause fluctuations in the pH readings. Equilibrate electrode by immersing in several aliquots of sample before taking pH.

2.2.5. Ensure stable sample and sensor temperature before calibrating or taking sample readings. Drifting sensor or sample temperature may produce erroneous sample measurements, calibrations, or verifications.

2.2.6. Thoroughly rinse the pH sensor with deionized water or fresh buffer standard when calibrating or verifying the calibration or when taking sample measurements. For in-situ measurements, ensure adequate flushing of the sensor with fresh sample water prior to taking measurements. Any residual standard, sample or deionized water remaining on the sensor may affect the measurement of the subsequent standard or sample. This is especially true when samples or standards of widely different pH value are successively measured.

2.2.7. Drifting readings or an inability to calibrate the sensor may also indicate a fouled electrode. Clean the electrode per the manufacturer's instructions or replace.

2.3. Calibration: Follow the manufacturer's calibration instructions specific to your meter. Most instruments allow for a two-point calibration and a few models can perform a three-point calibration. Use the appropriate number of standard buffer solutions for calibration. Do not reuse buffers for initial calibrations.

2.3.1. Rinse the probe with de-ionized water (DI) before and between each standard buffer solution.

2.3.2. Follow the calibration activities specified in FT 1000, section 2.2.

2.3.2.1. Perform an initial calibration using at least two buffers. Always use a pH 7 buffer first.

2.3.2.2. If the pH sample range is expected to be wider than the range established by a two-point calibration (e.g., some samples at pH 4 and others at pH 8), then add a third calibration point. If the instrument cannot be calibrated with three buffers, the third buffer may be used as the initial calibration verification to extend the range.

2.3.2.3. After initial calibration, immediately perform an initial calibration verification (ICV). Read a buffer as a sample. To be acceptable, a calibration verification must be within +/- 0.2 pH units of the stated buffer value. For example, if reading the pH 4.0 buffer, the result must be in the 3.8 to 4.2 range. Certain regulatory programs may have more stringent acceptance criteria.

2.3.2.4. After sample measurement(s), perform a continuing calibration verification (CCV). Read a buffer as a sample. To be acceptable, a calibration verification must be within +/- 0.2 pH units of the stated buffer value. This CCV (if within acceptance criteria) can be used as the beginning of the chronological bracket. Certain regulatory programs may have more stringent acceptance criteria.

2.4. Measuring pH *in situ*: After calibrating the multi-probe sensors as outlined in 2.3 above, follow the meter's instructions to select the display for reading the pH of the

sample. Immerse the probe at the desired depth in the water and wait for stabilization of the reading before recording the measurement.

2.5. Measuring pH in Flow-through Cells: When using a flow-through cell, the procedure described above in section 2.4 is applicable.

2.6. Measuring pH in Samples: After an acceptable initial calibration or calibration verification, follow these procedures to take a pH reading of a freshly collected sample (within 15 minutes of collection).

2.6.1. Pour enough of the fresh sample into a clean cup to take the reading.

2.6.2. Place the pH electrode in the sample (in the cup) and swirl the electrode.

2.6.3. Wait for stabilization, and read the pH value.

2.6.4. Turn the meter off after the last sample reading, rinse the electrode thoroughly with de-ionized water and replace the electrode's cap.

3. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

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 preformulated 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. Field Instrument Calibration Documentation: 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 used.

4.2.2.1. Record 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)
- 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 date and time of any corrective action.

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)

FT 1200. Field Measurement of Specific Conductance (Conductivity)

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling
- FD 1000 Documentation Procedures

1. INTRODUCTION: Specific conductance is a useful method to approximate the total amount of inorganic dissolved solids.

1.1. Conductivity varies with temperature. For example, the conductivity of salt water increases 3%/degree C at 0°C, and only 2%/degree C at 25°C.

1.2. Record the sample temperature or adjust the temperature of the samples prior to measuring specific conductance if the conductivity instrument does not employ automatic temperature compensation and correction of the instrument display value.

2. EQUIPMENT AND SUPPLIES

2.1. Field Instrument: Any self-contained conductivity instrument suitable for field work, accurate and reproducible to 5% or better over the operational range of the instrument, and preferably equipped with temperature-compensation adjustment. See references in FT 1210 below for additional information about instruments.

2.2. Standards: Purchased or laboratory-prepared standard potassium chloride (KCl) solutions with conductivity values that bracket the expected samples' range. In the laboratory, prepare standards of appropriate conductivities per method 2510, *Conductivity*, in *Standard Methods for the Examination of Water and Wastewater, 2011* (see Standard Methods Online, http://www.standardmethods.org/store/). Do not reuse standards for initial calibrations.

2.3. Recordkeeping and Documentation Supplies:

- Field notebook (w/ waterproof paper is recommended) or forms
- Indelible pens

3. CALIBRATION AND USE

3.1. General Concerns

3.1.1. **Follow the instrument manufacturer's instructions for the details of operating the instrument.**

3.1.2. For instruments without automatic temperature compensation, attempt to adjust the temperature of the samples to 25°C. If the temperature cannot be adjusted, measure the temperature with a calibrated device (see FT 1400), record the temperature, correct for temperature (per section 3.4 below) and report the results corrected to 25°C. See references in FT 1210 below for further information about temperature correction.

3.1.3. Ensure stable sample and sensor temperature before calibrating or taking sample readings. Drifting sensor or sample temperature may produce erroneous sample measurements, calibrations or verifications.

3.1.4. Thoroughly rinse the conductivity sensor with deionized water and fresh standard when calibrating or verifying the calibration or when taking sample measurements. For in-situ measurements, ensure adequate flushing of the sensor with fresh sample water

prior to taking measurements. Any residual standard, sample or deionized water remaining on the sensor may affect the measurement of the subsequent standard or sample. This is especially true when samples or low-concentration standards are measured subsequent to measuring high-concentration standards.

3.1.5. Drifting readings or an inability to calibrate the sensor may also indicate a fouled electrode. Clean the electrodes per the manufacturer's instructions.

3.1.6. When successful calibration and verification cannot be achieved after ensuring that temperatures have stabilized and the sensor electrodes are clean and free of residual sample or standard from the previous measurement, suspect opened containers of standards, especially after repeated openings, when near the manufacturer's expiration date or when little standard volume remains in the container. Low-concentration conductivity standards are seldom stable for an extended period after opening.

3.2. Calibration and Calibration Verification:

3.2.1. Follow the calibration activities specified in FT 1000, section 2.2.1 – 2.2.7.

3.2.2. Initial Calibration: Calibrate the meter prior to use according to the following steps:

3.2.2.1. **Calibrate according to the manufacturers recommendations.**

3.2.2.2. When the sample measurements are expected to be 100 μmhos/cm or greater, use two standard potassium chloride solutions that bracket the range of expected sample conductivities. A single standard at 100 μmhos/cm standard potassium chloride solution is acceptable for situations in which all sample measurements are expected to be less than 100 μmhos/cm. See also FT 1000 section 1.3.3.2.

3.2.2.3. Calibrate the instrument with one of the two standards to create an upper or lower boundary for the quantitative bracket.

3.2.2.4. Verify the calibration of the instrument with the second standard, quantitatively bracketing the range of expected sample values.

3.2.2.5. If the instrument can be calibrated with more than one standard, choose additional calibration standards within the range of expected sample values. The second standard in section 3.2.2.3 above may be used as an additional calibration standard.

3.2.2.6. Note: If all samples are expected to be less than 100 μmhos/cm, only one standard at 100 μmhos/cm standard potassium chloride solution is required.

3.2.3. Acceptability: Accept the calibration if the meter reads within +/- 5% of the value of any calibration standard used to verify the calibration. For example, the acceptance range for a 100 μmhos/cm standard is 95 to 105 μmhos/cm. If the meter does not read within +/- 5% of each calibration verification standard, determine the cause of the problem and correct before proceeding.

3.2.4. Temperature Correction: Most field instruments read conductivity directly. If the meter does not automatically correct values to 25°C, calculate correction factors using the procedure in section 3.4 below. Record all readings and calculations in the calibration records.

3.2.5. Continuing Calibration Verification: Check the meter in read mode with at least one KCl standard with a specific conductance that quantitatively brackets the conductivity measured in environmental samples. The reading for the calibration verification must also be within +/- 5% of the standard value (see 3.2.3 above).

3.2.5.1. If new environmental samples are encountered outside the range of the initial calibration in 3.2.2 above, verify the instrument calibration with an additional standard that brackets the range of new sample values. If these calibration verifications fail, recalibrate the instrument as in 3.2.2.

3.2.5.2. **More frequent calibration verifications may be required for discharge permit compliance measurements or other regulatory requirements.**

3.3. Measuring Specific Conductance of Samples:

3.3.1. Follow manufacturer's instructions for sample measurement.

3.3.2. Immerse or place the conductivity probe or sensor in situ at a measuring location representative of the sampling source.

3.3.3. Allow the conductivity instrument to stabilize.

3.3.4. Measure the water temperature (if necessary for manual temperature compensation) and record the temperature. See FT 1400 for temperature measurement procedures.

3.3.5. If the meter is equipped with manual temperature compensation, adjust the conductivity meter to the water temperature per manufacturer's instructions.

3.3.6. If the conductivity meter has a set of positions that multiply the reading by powers of ten in order to measure the full range of potential conductivities, set this dial to the correct range in order to take a reading.

3.3.7. Record the sample conductivity measurement reading within 15 minutes of water sample collection.

3.3.8. Rinse off the probe with de-ionized water. Follow manufacturer's instructions for probe storage between use.

3.4 Calculations for Temperature Compensation

If the meter does not automatically correct for temperature (manual or automatic adjustment), or if a probe with a cell constant other than 1 is used, the following formula must be used to normalize the data to 25°C:

$$K = \frac{(K_m)(C)}{1 + 0.0191(T-25)}.$$

Where: K = conductivity in μmhos/cm at 25°C

K_m = measured conductivity in μmhos/cm at T degrees C

C = cell constant

T = measured temperature of the sample in degrees C

If the cell constant is 1, the formula for determining conductivity becomes:

$$K = \frac{(K_m)}{1 + 0.0191(T-25)}.$$

Refer to SM2510B, 20th edition, if other calculations (i.e., determining cell constant, etc.) are required. See FT 1210 below.

3.5 *In situ* Measurements at Depth or With Flow-through Cells: After calibrating the instrument as outlined in 3.2 above, **follow the manufacturer's instructions** to measure the conductivity of the sample.

3.5.1. For *in situ* measurements immerse the probe at the desired depth and wait for stabilization of the reading and record its value. Follow a similar procedure when using a flow-through cell.

3.5.1.1 Preferably measure groundwater sample conductivity *in situ* with a downhole probe or in a flow-through system.

4. PREVENTATIVE MAINTENANCE: Refer to FT 1000, section 3.

5. DOCUMENTATION

5.1. Standard and Reagent Documentation: Document information about standards and reagents used for calibrations, verifications and sample measurements.

5.1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.

5.1.1.1. Document acceptable verification of any standard used after its expiration date.

5.1.2. Record the concentration or other value for the standard in the appropriate measurement units.

5.1.2.1. Note vendor catalog number and description for preformulated solutions as well as for neat liquids and powdered standards.

5.1.2.2. Retain vendor assay specifications for standards as part of the calibration record.

5.1.3. Record the grade of standard or reagent used.

5.1.4. When formulated in-house, document all calculations used to formulate calibration standards.

5.1.4.1. Record the date of preparation for all in-house formulations.

5.1.5. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).

5.2. Field Instrument Calibration Documentation: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.

5.2.1. Retain vendor certifications of all factory-calibrated instrumentation.

5.2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.

5.2.2.1. Record manufacturer name, model number, and identifying number such as a serial number for each instrument unit.

5.2.3. Record the time and date of all initial calibrations and all calibration verifications.

5.2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.

5.2.5. Record the name of the analyst(s) performing the calibration.

5.2.6. 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., conductivity standard)
- Value of standard, including correct units (e.g., conductivity = 100 µmhos/cm)
- Link to information recorded according to section 5.1 above

5.2.7. Retain manufacturers' instrument specifications.

5.2.8. Document whether successful initial calibration occurred.

5.2.9. Document whether each calibration verification passed or failed.

5.2.10. Document any corrective actions taken to correct instrument performance according to records requirements of FD 3000.

5.2.10.1. Document date and time of any corrective action.

5.2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.

5.2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).

5.3. 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)

FT 1300. Field Measurement of Salinity

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. INTRODUCTION: Salinity is an important property of industrial and natural waters. This field parameter is also important for assessing the source or origin of effluents and of the mixing between fresh and marine waters in coastal regions, in both surface water and groundwater.

1.1. Salinity is a unit-less parameter since by definition it is the ratio of the mass of dissolved salts to the total mass of a given volume of water. Thus, salinity values are commonly expressed as "grams of salt/kilograms of water" or $^{o}/_{oo}$.

1.2. Salinity is determined by using indirect methods involving the measurement of a related physical property such as conductivity, density, sound speed, or refractive index. The commonly used procedures in the field are determination of <u>conductivity</u> or <u>density</u> of the sample.

1.3. The sample salinity is calculated from an empirical relationship between salinity and the physical property as determined from a standard solution. Refer to the referenced method SM 2520 (2011) for further discussions on these topics.

1.4. Because of its high sensitivity and easy of measurement, the conductivity method is most often used to determine the salinity. (Note – using a hydrometer to measure the density or the specific gravity to obtain an approximate salinity value is not recommended for reporting purposes.)

2. EQUIPMENT AND SUPPLIES

2.1. <u>Field Instrument</u>: Depending on the chosen method, use:

2.1.1. Any self-contained conductivity instrument with a platinum or graphite electrode type cell, and a temperature sensor. Some conductivity instruments have meter scales pre-calibrated for salinity and are sometimes referred to as Salinometers. For routine fieldwork use a conductivity meter accurate and reproducible to at least 5% or 1 μmho/cm (whichever is greater), and equipped with temperature-compensation adjustment; <u>or</u>

2.1.2. A precision "vibrating flow densimeter" and a field thermometer. For informational purposes, see Millero & Poisson, 1981a, International one-atmosphere equation of state of seawater. *Deep-Sea Research* 28:625–629.

2.2. <u>Standards</u>:

2.2.1. Purchased or laboratory-prepared Standard Seawater and/or potassium chloride (KCl) standards of appropriate equivalent salinities.

2.2.1.1. See methods 2510, *Conductivity*, and 2520, *Salinity* (2011 versions), in Standard Methods for the Examination of Water and Wastewater (see Standard Methods Online, http://www.standardmethods.org/store/).

2.2.2. De-ionized water for calibration of the densimeter (if used).

2.3. Recordkeeping and Documentation Supplies:

- Field logbook (w/ waterproof paper is recommended) or field forms
- Indelible pens

3. CALIBRATION AND USE

3.1. Conductivity Method

3.1.1. Calibration: - Calibrate the instrument per manufacturer's instructions using one calibration standard, either standard seawater or a KCl solution, as applicable, or follow the manufacturer's specific instructions. The acceptance criterion for initial calibration or a calibration verification is that the instrument reading is within +/- 5% of the standard value. For example, when calibrating with standard seawater, S = 35, the meter must read in the 34 to 36 range in order to be acceptable.

3.1.1.1. Use standard seawater (S = 35) when measuring salinity in the open ocean or estuaries with a predominance of seawater.

3.1.1.2. KCl may be used in estuarine waters with low salinity (S = 0 – 40).

3.1.1.3. If verifying or calibrating with a "zero" standard, do not use analyte-free water or air check (dry electrode) as the blank. However, the user may set the zero point of the instrument according to the manufacturer's instructions, if applicable.

3.1.1.4. If the meter does not provide a direct reading of salinity, use the equation found in SM 2520B (2011) to convert the readings to salinity.

3.1.1.5. Follow the calibration activities in FT 1000, section 2.2.

3.1.1.6. Do not reuse standards for initial calibrations.

3.1.2. Field Use: - Rinse the probe with DI water after calibration, verification and before each sample measurements. Follow the manufacturer's instructions for temperature compensation, if needed. Report salinities with only one decimal figure.

3.1.3. General Concerns for Conductivity Method

3.1.3.1. Ensure stable sample and sensor temperature before calibrating or taking sample readings. Drifting sensor or sample temperature may produce erroneous sample measurements, calibrations, or verifications.

3.1.3.2. Thoroughly rinse the conductivity (salinity) sensor with deionized water and fresh standard when calibrating or verifying the calibration or when taking sample measurements. For in-situ measurements, ensure adequate flushing of the sensor with fresh sample water prior to taking measurements. Any residual standard, sample, or deionized water remaining on the sensor may affect the measurement of the subsequent standard or sample. This is especially true when samples or low-concentration standards are measured subsequent to measuring high-concentration standards.

3.1.3.3. Drifting readings or an inability to calibrate the sensor may also indicate a fouled electrode. Clean the electrodes per the manufacturer's instructions.

3.1.3.4. When successful calibration and verification cannot be achieved after ensuring that temperatures have stabilized and the sensor electrodes are clean and free of residual sample or standard from the previous measurement, suspect opened containers of standards, especially after repeated openings, when near the manufacturer's expiration date or when little standard volume remains in the container. Low-concentration conductivity standards are seldom stable for an extended period after opening.

3.2. Density Method

The vibrating flow densimeter is an instrument that allows for precise and rapid measurements of the density of a liquid, such as water. The principle of operation is the effect of the density of the sample on the frequency of a vibrating tube encased in a constant-temperature jacket. The measurement is made by passing the water (sample) through the vibrating tube and reading the period of vibration that is electronically sensed and displayed by the densimeter. The sample density (D) is proportional to the square of the period of vibration (T):

$$D = a + bT^2$$

Where a and b are terms determined by calibration, b being determined by calibration of the densimeter with Standard Seawater. The difference between the density of the sample (D) and that of pure water (D_0) is given by:

$$D - D_0 = b\,(T^2 - T_0^2)$$

Where T and T_0 are, respectively, the periods of the sample and that of pure (de-ionized) water. Using this second equation, you only have to deal with the term b for calibration purposes. Hence, the system can be calibrated with two liquids: pure water and Standard Seawater. Follow the manufacturer's instruction for calibration of the densimeter.

The salinity of the sample is determined by the one-atmosphere international equation of state for seawater. This equation relates the difference ($D - D_0$) to the practical salinity as a function of the temperature of the sample (which is also measured by the densimeter or the field thermometer). For further details on this calculation read the referenced method SM 2520C (2011).

4. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

5. DOCUMENTATION

5.1. Standard and Reagent Documentation: Document information about standards and reagents used for calibrations, verifications, and sample measurements.

5.1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.

5.1.1.1. Document acceptable verification of any standard used after its expiration date.

5.1.2. Record the concentration or other value for the standard in the appropriate measurement units.

5.1.2.1. Note vendor catalog number and description for preformulated solutions as well as for neat liquids and powdered standards.

5.1.2.2. Retain vendor assay specifications for standards as part of the calibration record.

5.1.3. Record the grade of standard or reagent used.

5.1.4. When formulated in-house, document all calculations used to formulate calibration standards.

5.1.4.1. Record the date of preparation for all in-house formulations.

5.1.5. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).

5.2. Field Instrument Calibration Documentation: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.

5.2.1. Retain vendor certifications of all factory-calibrated instrumentation.

5.2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.

5.2.2.1. Record manufacturer name, model number, and identifying number such as a serial number for each instrument unit.

5.2.3. Record the time and date of all initial calibrations and all calibration verifications.

5.2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.

5.2.5. Record the name of the analyst(s) performing the calibration.

5.2.6. 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., salinity standard)
- Value of standard, including correct units (e.g., salinity = 20 $^{o}/_{oo}$)
- Link to information recorded according to section 5.1 above

5.2.7. Retain manufacturers' instrument specifications.

5.2.8. Document whether successful initial calibration occurred.

5.2.9. Document whether each calibration verification passed or failed.

5.2.10. Document any corrective actions taken to correct instrument performance according to records requirements of FD 3000.

5.2.10.1. Document date and time of any corrective action.

5.2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.

5.2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).

5.3. 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)

FT 1400. Field Measurement of Temperature

The use of this SOP is not required when using field temperature measurement devices to monitor groundwater stabilization during the purging of groundwater monitoring wells. Field temperature measurement devices installed for automatic temperature compensation (correction) for other measurements such as dissolved oxygen, specific conductance or pH are also exempted from the requirements of this SOP. FT 1400 must be used for all other field temperature measurements required by DEP.

Use this SOP in conjunction with the following DEP SOPs:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. EQUIPMENT AND SUPPLIES

1.1. Field Instruments: Use any of the following instrument types for performing field measurements:

- Digital thermistor (thermocouple type) and meter typical of field instruments
- Glass bulb, mercury-filled thermometer (not recommended for field ruggedness)
- Glass bulb, alcohol-filled thermometer with protective case
- Bi-metal strip/dial-type thermometer
- Advanced silicon chip temperature sensor and digital meter

1.1.1. Field instruments must be capable of measuring temperature in 0.1^{o}C increments.

1.2. Standard Thermometer: NIST-traceable Celsius certified thermometer with scale marks for every 0.1^{o}C increment, a range of 0°C to 100°C (or a range bracketing expected sample temperatures) and correction chart supplied with certification. The standard thermometer must have a valid certification for the period of measurement.

1.3. Recordkeeping and Documentation Supplies:

- Field notebook or forms
- Indelible pens

2. CALIBRATION AND USE

2.1. General Concerns

2.1.1. Select a temperature measuring device meeting the requirements of section 1.1 above.

2.1.2. Dial-type and thermocouple-type devices with meters are preferred over the glass thermometers for fieldwork because of their durability and ease of reading.

2.1.2.1. Transport glass thermometers in protective cases.

2.1.2.2. Inspect glass thermometers for liquid separation. Do not use a thermometer if the liquid has separated.

2.1.2.3. Most instruments with digital display will provide more decimal figures than are significant. Record the temperature reading with only one rounded decimal figure (e.g., 25.9 instead of 25.86^{o}C).

2.2. Calibration

2.2.1. Follow the calibration activities specified in FT 1000, section 2.2.

2.2.2. Verify all thermistor (meter) devices and field thermometers against the NIST-traceable standard thermometer at several temperatures in the expected sample measurement range, using any correction factor indicated by the certificate supplied with the NIST-traceable thermometer.

2.2.2.1. See the US Geological Survey, National Field Manual for the Collection of Water-Quality Data, Book 9, Chapter A6, Field Measurements, Section 6.1, Temperature, Techniques of Water-Resources Investigations, Version 2, 3/2006 for additional guidance about making temperature comparisons with the standard thermometer.

2.2.2.2. Make note of the calibration in the calibration records. See section 4 below.

2.2.2.3. The field measurement device may be used with a linear correction factor provided that the observed temperature difference with the standard thermometer is documented at incremental temperatures over the range of expected sample temperatures.

2.2.2.4. Use the resulting correction factor when making temperature measurements of samples with the field measurement device.

2.2.2.5. Prominently display the correction factor on the field measurement device, with the date last verified. A calibration correction curve or plot may also be used.

2.2.2.6 To be acceptable, a calibration verification must be within +/- 0.5^{o}C of the corrected reading of the NIST-traceable thermometer.

2.2.2.7 Properly dispose of glass-bulb thermometers that do not meet the above calibration acceptance criteria.

2.2.3. Continuing Calibration Verifications:

2.2.3.1. Determine the maximum time between continuing calibration verifications for the specific field temperature measurement device based on instrument stability.

2.2.3.2. Verify the field measurement device against the standard NIST-traceable thermometer as in section 2.2.2 above.

2.2.4. Refer to additional calibration requirements in FT 1000, section 2.2.

2.2.5. **More frequent calibration verifications may be required for discharge permit compliance measurements or other regulatory requirements.**

2.3. Measuring Sample Temperature

2.3.1. Insert or place the thermometer or sensor *in situ* at a measuring location representative of the sampling source.

2.3.2. Allow the thermometer or temperature sensor to equilibrate to ambient *in situ* temperature.

2.3.2.1. Groundwater samples must be measured *in situ* with a downhole probe or in a flow-through container. Do not measure bailed or pumped samples in an intermediate container containing static sample.

2.3.3. Record the temperature to the nearest 0.1^{o}C after the reading stabilizes and remains constant.

3. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

4. DOCUMENTATION

4.1. Standards Documentation: Document information about the NIST-traceable standard thermometer in the calibration record, including:

- Unique identification for the thermometer
- Vendor certificate of calibration, including any correction factor
- Vendor's expiration date for the certificate of calibration

4.2. Field Instrument Calibration Documentation: 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 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 following information about initial calibration and calibration verifications and link to information recorded according to section 4.1 above:

- Details of the method used to compare the field measurement device to the NIST-traceable standard thermometer.
- Results of each calibration verification, including the expected reading (per the NIST-traceable standard thermometer)
- The actual reading of the field measurement device, using any established correction factors and correct units.

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 (such as a new correction factor) according to records requirements of FD 3000.

4.2.10.1. Document date and time of any corrective action.

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)

FT 1500. Field Measurement of Dissolved Oxygen (DO)

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. EQUIPMENT AND SUPPLIES

1.1. Field Instruments

1.1.1. Membrane-type polarographic or galvanic electrode DO sensor with dedicated meter or configured with multi-parameter sonde

1.1.2. Luminescence-based DO sensor with dedicated meter or configured with multi-parameter sonde (see ASTM International, Standard Test Methods for Dissolved Oxygen in Water, Test Method C, Luminescence-based Sensor, D 888-12e1, 2012).

1.1.3. Select instrument assemblies that provide minimum precision of +/- 0.2 mg DO/L and a minimum accuracy of +/- 0.2 mg DO/L.

1.1.4. Compensate for temperature dependence of DO measurements by using instruments employing automatic temperature compensation or by manually correcting measurements in accordance with method 4500-O, Oxygen (Dissolved), 2011, in Standard Methods for the Examination of Water and Wastewater (see Standard Methods Online, http://www.standardmethods.org/store/).

1.1.4.1. Calibrate on-board temperature sensors as described in FT 1400.

1.2. Standards

1.2.1. NIST-traceable Celsius thermometer with a scale marked for every 0.1^{o}C and a range of 0 to 100°C.

1.2.2. Access to an organization with capability to perform the Winkler titration procedure is recommended but not mandatory.

1.2.3. A “zero-DO standard”, prepared on-site with an aliquot of the sample water, is optional. Prepare by adding excess sodium sulfite and a trace of cobalt chloride to bring the DO to zero.

1.3. Recordkeeping and Documentation Supplies:

- Field notebook (w/ waterproof paper is recommended) or forms
- Indelible pens

2. CALIBRATION AND USE: the electrode method is predominantly used *in-situ* for dissolved oxygen determinations.

2.1. General Concerns

2.1.1. Turbulence is necessary to keep a constant flow of water across the membrane-sample interface. Make sure the appropriate mechanism is working before using the probe.

2.1.2. Follow instrument manufacturer’s instructions for probe storage. For example, store the probe with a cover that creates a saturated atmosphere. A cap, with a wet sponge in it, will suffice for single-parameter probes. If the sensor is in a multi-probe device, keep the protective cap chamber moist during storage.

2.1.3. Before mobilizing, check to make sure there are no bubbles beneath the probe membrane, or any wrinkles or tears in the probe membrane. If so, replace the membrane and KCL solution. Follow manufacturers recommendation for conditioning

newly installed membranes in order to ensure stable readings. Check the leads, contacts, etc. for corrosion and/or shorts if meter pointer remains off-scale, does not calibrate, or drifts.

2.1.4. Dissolved inorganic salts interfere with the performance of DO probes. For example, DO readings in salt water are affected by the salinity and must be corrected. The DO meter may adjust automatically based on readings taken from the specific conductivity/salinity probe. If corrections are not automatic the appropriate calculations must be used to correct for salinity. If automatic adjustments are used the specific conductivity/salinity probe calibration must be verified or calibrated in accordance with FT1200.

2.1.5. Reactive gases, which pass through the membrane, may interfere. For example, chlorine will depolarize the cathode and cause a high probe output. Long-term exposures to chlorine will coat the anode with the chloride of the anode metal and eventually desensitize the probe. Sulfide (from H_2S) will undergo oxidation if high enough potential (voltage) is applied, creating current flow, yielding faulty readings. If such interferences are suspected, change the membrane electrode more frequently and calibrate at more frequent intervals.

2.1.6. Ensure that the temperature of the sensor and sample are stable. Unstable temperatures will produce erroneous calibrations, verifications or sample measurements.

2.1.7. Erroneous calibrations or verifications may result if the saturated air chamber is not vented to atmospheric pressure, properly humidified and protected from temperature fluctuations produced by common field conditions such as evaporation or fluctuation in sunlight intensity.

2.2. Follow the quality control requirements for calibration (see activities in FT 1000, section 2.2).

2.3. <u>Initial Calibration and Initial Calibration Verification</u>

2.3.1. <u>Air Calibration and Initial Calibration Verification (ICV)</u>: Calibrate the meter at 100% saturation. Before use, verify the meter calibration in water-saturated air to make sure it is properly calibrated and operating correctly. Make a similar verification at the end of the day, sampling event or at other appropriate intervals. **Follow the manufacturer's instructions for operation of a specific instrument.**

2.3.1.1. Allow an appropriate warm up period before initial calibration or verification.

2.3.1.2. Wet the inside of the calibration chamber with water, pour out the excess water (leave a few drops), wipe any droplets off the membrane/sensor and insert the sensor into the chamber (this ensures 100% humidity).

2.3.1.3. Allow adequate time for the DO sensor and the air inside the calibration chamber to equilibrate.

2.3.1.4. Once the probe/calibration chamber is stable at ambient temperature, check the air temperature and determine, from the DO versus temperature table, what the DO saturation value should be at the observed temperature (see Table FT 1500-1, below). A stable and accurate temperature is required for a valid calibration. The acceptance criterion for DO calibration verification is +/- 0.3 mg DO/L at the observed temperature of the verification.

2.4. <u>Continuous Calibration Verification</u>

2.4.1. <u>Air-Calibration Verification</u>: DO sensor or instrument is calibrated against air that is saturated with water at a known temperature and ambient atmospheric pressure. Use Table FT 1500-1 below to verify calibration at specified temperature.

2.4.1.1. Wet the inside of the calibration chamber with water, pour out the excess water (leave a few drops) and insert the sensor into the chamber (this ensures 100-percent humidity)

2.4.1.2. Allow adequate time for the DO sensor and the air inside the calibration chamber to equilibrate.

2.4.1.3. Measure the temperature in the calibration chamber and observe the readings until the instrument stabilizes.

2.4.1.4. Use the oxygen solubility Table FT 1500-1 below to determine the DO saturation at a measured temperature and atmospheric pressure. Calculate values to the nearest tenth degree by interpolation or use an expanded version of this table found in FS 2200, which provides saturation data in 0.1 ^{o}C increments for a selected temperature range (see Table FS 2200-2).

2.4.1.5. Compare DO meter reading with value obtained from Table FT 1500-1 below to verify continuous calibration.

2.5. Additional Verifications: The following methods may be used as additional checks to verify calibration. These additional checks may be required as part of a specific permit.

2.5.1. Winkler method: This check is useful to assess the condition of the DO sensor (i.e., its degradation with time/use) and that the instrument can still maintain a valid calibration (see method 4500-O C).

2.5.1.1. **Perform the Winkler method when required by permit or other regulation at the required calendar frequency.**

2.5.1.2. For an accuracy calibration verification using the Winkler method, follow method 4500-O C.

2.5.1.3. Fill a clean bucket with uncontaminated or de-ionized water and place the probe into the bucket (with stirrer or equivalent mechanism turned off). Fill at least two biological oxygen demand (BOD) bottles without entraining atmospheric oxygen into the bottles. Carefully submerge the bottom of the bottle (one at a time) into the water and allow the water to fill the bottle. Place the bottle on the bottom of the bucket and carefully place stopper into it without adding atmospheric oxygen. Retrieve the bottles and determine their DO by the Winkler method (see method 4500-O-C for more details). Turn the stirrer or equivalent mechanism on and read the DO of the water in the bucket.

2.5.1.4. Adjust the DO meter according to manufacturer's instructions. Be sure to adjust the meter to the temperature of water in the bucket, and then calibrate the DO meter to read the average DO concentration of the two samples determined by the Winkler test.

2.5.2. Zero-DO Verification: The air calibration and the interfering effects of the sample can be further checked in the field by means of a “zero-DO standard” (see method 4500-O G).

2.5.2.1. Prepare this standard on-site with an aliquot of the sample by adding excess sodium sulfite and a trace of cobalt chloride to bring the DO to zero. Prepare this zero-DO standard in a beaker or a large-mouth sample container of appropriate size to insert the DO probe.

2.5.2.2. After adding the chemicals, gently swirl the water and let it sit for about 30 seconds before inserting the probe.

2.5.2.3. Read the DO of the sample. If the reading is outside the acceptance interval, the instrument must be recalibrated and/or zero-adjusted if the meter allows for this adjustment.

2.5.3. Air-Saturated Water: The DO sensor or instrument system is calibrated against water that is saturated with oxygen at a known temperature and ambient atmospheric pressure.

2.5.3.1. The temperature and conductivity of water used for calibration should be about the same as the temperature and conductivity of the water to be measured.

2.5.3.2. Place DO sensor and calibration water in a large beaker or open-mouth container.

2.5.3.3. Aerate the water for an adequate amount of time.

2.5.3.4. Determine if the water is 100 percent saturated with oxygen, and take a temperature reading. Temperature must be calibrated or verified for accuracy before DO calibration verification.

2.5.3.5. Use Table FT 1500-1 above to determine the DO saturation value at the measured water temperature. Compare DO meter reading with value obtained from Table FT 1500-1 to ensure continuous calibration.

2.6. Measuring DO in Samples:

2.6.1. Insert or place the DO probe *in situ* at a measuring location representative of the sampling source:

2.6.1.1. Take the DO of an effluent just before it enters the receiving water. If the effluent aerated prior to entering the surface water, take the DO reading in the receiving water right where it enters.

2.6.1.2. For well mixed surface waters, e.g., fast flowing streams, take the DO reading at approximately 1-2 feet below the surface or at mid-depth.

2.6.1.3. For still or sluggish surface waters, take a reading at one foot below the surface, one foot above the bottom, and at mid-depth.

2.6.1.4. If it is shallow surface waters, (less than two feet) take the reading at mid-depth.

2.6.1.5. Do not take a reading in frothy or aerated water unless required by the sampling plan.

2.6.1.6. Groundwater samples must be measured *in situ* with a downhole probe or in a flow-through container. Do not measure bailed or pumped samples in an intermediate container containing static sample.

2.6.2. Rinse probe with de-ionized water and keep the probe in the saturated atmosphere (see 2.1.2 above) between sites and events.

2.6.3. If the readings show distinct, unexplainable changes in DO levels, or when the probe has been in waters with high sulfides, recalibrate or perform maintenance per manufacturer's instructions. While taking a reading, if it is very low (e.g., below 1.0 mg/L), allow the meter to stabilize, record it and then, remove and rinse the probe, as the environment is very likely anoxic and may contain hydrogen sulfide, which can damage the probe.

2.6.4. Salinity and Temperature corrections may be necessary. Follow manufacturer instructions for automatic corrections or perform manual calculations (see method 4500-O G).

3. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

4. DOCUMENTATION

4.1. Standard and Reagent Documentation: Document information about standards and reagents used for verifications.

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. Field Instrument Calibration Documentation: 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 temperature associated with all calibration verifications.

4.2.6. Record the name of the analyst(s) performing the calibration.

4.2.7. 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., saturation)
- Value of standard, including correct units (e.g., mg/L at ^{o}C)
- Link to information recorded according to section 4.1 above

4.2.8. Retain manufacturers' instrument specifications.

4.2.9. Document whether successful initial calibration occurred.

4.2.10. Document whether each calibration verification passed or failed.

4.2.11. Document any corrective actions taken to correct instrument performance according to records requirements of FD 3000.

4.2.11.1. Document the date and time of any corrective action.

4.2.11.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.

4.2.12. 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 1500
Tables, Figures and Forms

Table FT 1500-1: Solubility of Oxygen in Water at Atmospheric Pressure [1,2]

Temperature	Oxygen Solubility	Temperature	Oxygen Solubility
ºC	mg/L	ºC	mg/L
0.0	14.621	26.0	8.113
1.0	14.216	27.0	7.968
2.0	13.829	28.0	7.827
3.0	13.460	29.0	7.691
4.0	13.107	30.0	7.559
5.0	12.770	31.0	7.43
6.0	12.447	32.0	7.305
7.0	12.139	33.0	7.183
8.0	11.843	34.0	7.065
9.0	11.559	35.0	9.65
10.0	11.288	36.0	6.837
11.0	11.027	37.0	6.727
12.0	10.777	38.0	6.62
13.0	10.537	39.0	6.515
14.0	10.306	40.0	6.412
15.0	10.084	41.0	6.312
16.0	9.870	42.0	6.213
17.0	9.665	43.0	6.116
18.0	9.467	44.0	6.021
19.0	9.276	45.0	5.927
20.0	9.092	46.0	8.835
21.0	8.915	47.0	5.744
22.0	8.743	48.0	5.654
23.0	8.578	49.0	5.565
24.0	8.418	50.0	5.477
25.0	8.263		

1. The table provides three decimal places to aid interpolation

2. Under equilibrium conditions, the partial pressure of oxygen in air-saturated water is equal to that of the oxygen in water-saturated air.

FT 1600. Field Measurement of Turbidity

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. INTRODUCTION: Turbidity measures the scattering effect that suspended solids have on the propagation of light through a body of water (surface or ground waters). The higher the effect (i.e., intensity of scattered light), the higher the turbidity value. Suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter, and plankton and other microscopic organisms cause turbidity in water.

This SOP describes the use of true nephelometric measurement using instruments meeting the specifications outlined in 2.1.

Exceptions to the requirements specified in 2.1 below include:

1.1. *In situ* probes with turbidity sensors used for screening purposes (e.g., groundwater purge stabilization measurements).

1.2. Non standard light sources, detectors or other turbidity measuring devices may be proposed for use in studies that entail comparison measurements (dredge and fill) or unattended deployment for monitoring purposes.

1.3. **Do not report results from "non standard" sensors or configurations for regulatory purposes such as permit compliance unless the Department has approved the use for the specific project.**

1.4. All "non-standard" instruments must be calibrated and verified according to the requirements in this SOP.

2. EQUIPMENT AND SUPPLIES

2.1. Field Instrument: Use a turbidimeter (nephelometer) or a spectrophotometer consisting of a light source and one or more photoelectric detectors with a readout device to indicate the intensity of light. The instrument must meet these specifications:

2.1.1. The light source must have a tungsten-filament lamp operated at a color temperature between 2000 and 3000 K.

2.1.2. The distance traversed by the incident light and scattered light within the sample tube must not exceed 10 cm.

2.1.3. The light detector, positioned at 90° to the incident light, must have an acceptance angle that does not exceed $\pm$ 30° from 90°.

2.1.4. The detector and any filter system must have a spectral peak response between 400 and 600 nanometers.

2.1.5. The instrument sensitivity must permit detection of a turbidity difference of 0.02 NTU at the 0 – 1.0 NTU scale.

2.1.6. Note: using the appropriate equipment and following the procedures in this SOP, the field accuracy of this measurement is close to %R = 100 $\pm$ 10% for turbidities in the range of 1 to 100 NTU.

2.2. Sample Cells (cuvettes): Use sample cells or tubes of clear, colorless glass or plastic.

2.2.1. Keep cells clean, both inside and out, and discard if scratched or etched.

2.2.1.1. Never handle them where the light beam strikes the sample.

2.2.1.2. Clean sample cells by thorough washing with laboratory soap (inside and out) followed by multiple rinses with distilled or de-ionized water, and let air-dry.

2.2.2. Use a very thin layer of silicone oil on the outside surfaces to mask minor imperfections or scratches in the cells.

2.2.2.1. Use silicone oil with the same refractive index of the glass; making sure the cell appear to be nearly dry with little or no visible signs of oil.

2.2.3. Because small differences between cells significantly impact measurement, use either matched pairs or the same cell for standardization and sample measurement.

2.3. Standards:

2.3.1. Primary standards: Use these standards for initial calibration.

2.3.1.1. Formazin standards can be either obtained commercially or prepared according to method 2130B (2011), section 3. in Standard Methods for the Examination of Water and Wastewater (see Standard Methods Online, http://www.standardmethods.org/store/).

2.3.1.2. Some instruments may require the use of styrene divinylbenzene (SDVB) standards for calibration.

2.3.2. Secondary Standards: Use only those certified by the manufacturer for a specific instrument. Secondary standards must only be used for continuing calibration verifications according to the procedures in section 3.4 below. Determine or verify the values of secondary standards according to the procedure in section 3.3 below.

2.3.3. Turbidity-free water: Use filtered, laboratory reagent water demonstrated to be free of measurable turbidity (<0.01 NTU) or purchase commercially prepared turbidity-free water.

3. CALIBRATION AND USE

3.1. General Concerns

3.1.1. Light absorption by dissolved and suspended matter may cause a negative bias on the turbidity measurement. When present in significant concentrations, particles of light-absorbing materials such as activated carbon will cause a negative interference. Likewise, the presence of dissolved, color-causing substances that absorb light may also cause a negative interference. Some commercial instruments may have the capability of either correcting for slight color interference or optically blanking out the color effect.

3.1.2. Handle samples with natural effervescence as described in 3.5.5.1 below.

3.2. Calibration and Initial Calibration Verification

3.2.1. Follow the calibration activities in FT 1000, section 2.2.

3.2.2. Perform an initial calibration using at least two primary standards.

3.2.2.1. If the instrument cannot be calibrated with two standards, calibrate the instrument with one standard and verify with a second standard per 3.2.3 below.

3.2.2.2. For measurement of samples of very low turbidity, select the lowest standard commercially available for bracketing the lower end of the anticipated sample turbidity range or dilute higher turbidity standards with turbidity-free water.

3.2.2.3. Do not use turbidity-free water as a calibration verification standard.

3.2.3. Perform an initial calibration verification by reading at least one primary standard as a sample. The acceptance criterion for the initial calibration verification depends on the range of turbidity of the standard value:

- Standard Value = 0.1-10 NTU: the response must be within 10% of the standard except specified in 3.2.3.1 below;
- Standard Value = 11-40 NTU: the response must be within 8% of the standard;
- Standard Value = 41-100 NTU: the response must be within 6.5% of the standard; and
- Standard Value > 100 NTU: the response must be within 5% of the standard.

3.2.3.1. Turbidity–free water sold as a standard by a vendor (i.e., a blank) does not have to meet the acceptance requirement of ± 10%, but must meet the vendor's stated value (typically < 0.1 NTU) or be less than the reporting limit. The user may still use this blank to set the zero point according to the instrument manufacturer's manual.

3.3. Determining the Values of Secondary Standards

3.3.1. Use only those standards certified by the manufacturer for a specific instrument.

3.3.2. Use verified secondary standards only for continuing calibration verifications.

3.3.3. Determining the initial value(s) of secondary standard(s):

3.3.3.1. Calibrate or verify the instrument with primary standards. Select primary standards that bracket the range of the secondary standards.

3.3.3.2. Immediately after the an initial calibration with primary standards or verification with a primary standard, read each secondary standard as a sample use the reading from the instrument as the first assigned value.

3.3.4. Verifying Secondary Standards

3.3.4.1. At least once per quarter or at other documented intervals (see 3.3.5 below), determine or verify the values of secondary standards immediately after the instrument has been calibrated or verified with primary standards.

3.3.4.2. Read each secondary standard as a sample. This reading must be within the manufacturer's stated tolerance range and within the acceptance ranges of the assigned standard value as listed in 3.2.3., above. If the criteria in section 3.2.3., above are 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.

3.3.5. **More frequent calibration verifications may be required for discharge permit compliance measurements or other regulatory requirements.**

3.4. Continuing Calibration Verification: Perform a continuing calibration verification using at least one primary or secondary standard. The calibration acceptance criteria are the same as those listed in section 3.2.3 above.

3.5. Measuring Turbidity in Samples

3.5.1. Gently agitate the sample and wait until air bubbles disappear.

3.5.2. Double-rinse the sample cell or cuvette with a small amount of the sample. Discard, and pour an aliquot into the sample cell or cuvette.

3.5.3. Gently dry out its external surface with lint-free paper.

3.5.4. Insert the cell in the instrument and read the turbidity directly from the meter display.

3.5.5. Do not use vacuum degassing, ultrasonic bath or other devices to remove bubbles from the sample. If the sample contains visible bubbles or if it effervesces (as in groundwater, with changes in pressure and temperature), make a note of this in the field records and collect a sample for laboratory measurement.

3.5.5.1. If effervescing samples are collected for laboratory analysis collect the sample without leaving headspace in the container and ship it as soon as possible to the laboratory (the holding time for this measurement is only 48 hrs). Ship this sample in wet ice at 4°C.

3.5.6. Pour out the sample, double-rinse the cuvette with de-ionized water in preparation for the next sample.

4. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

5. DOCUMENTATION

5.1. Standard and Reagent Documentation: Document information about standards and reagents used for calibrations, verifications, and sample measurements.

5.1.1. Note the date of receipt, the expiration date and the date of first use for all standards and reagents.

5.1.1.1. Document acceptable verification of any standard used after its expiration date.

5.1.2. Record the concentration or other value for the standard in the appropriate measurement units.

5.1.2.1. Note vendor catalog number and description for preformulated solutions as well as for neat liquids and powdered standards.

5.1.2.2. Retain vendor assay specifications for standards as part of the calibration record.

5.1.3. Record the grade of standard or reagent used.

5.1.4. When formulated in-house, document all calculations used to formulate calibration standards.

5.1.4.1. Record the date of preparation for all in-house formulations.

5.1.5. Describe or cite the procedure(s) used to prepare any standards in-house (DEP SOP or internal SOP).

5.2. Field Instrument Calibration Documentation: Document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements.

5.2.1. Retain vendor certifications of all factory-calibrated instrumentation.

5.2.2. Designate the identity of specific instrumentation in the documentation with a unique description or code for each instrument unit used.

5.2.2.1. Record manufacturer name, model number, and identifying number (such as a serial number) for each instrument unit.

5.2.3. Record the time and date of all initial calibrations and all calibration verifications.

5.2.4. Record the instrument reading (value in appropriate measurement units) of all calibration verifications.

5.2.5. Record the name of the analyst(s) performing the calibration.

5.2.6. 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., formazin)
- Value of standard, including correct units (e.g., 20 NTU)
- Link to information recorded according to section 5.1 above

5.2.7. Retain manufacturers' instrument specifications.

5.2.8. Document whether successful initial calibration occurred.

5.2.9. Document whether each calibration verification passed or failed.

5.2.10. Document any corrective actions taken to correct instrument performance according to records requirements of FD 3000.

5.2.10.1. Document date and time of any corrective action.

5.2.10.2. Note any incidence of discontinuation of use of the instrument due to calibration failure.

5.2.11. Describe or cite the specific calibration or verification procedure performed (DEP SOP or internal SOP).

5.3. 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)

Utility Clearance

Procedure 3-01

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the process for determining the presence of subsurface utilities and other cultural features at locations where planned site activities involve the physical disturbance of subsurface materials.

1.2 This procedure is the Program-approved professional guidance for work performed by Resolution Consultants under the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract (Contract Number N62470-11-D-8013).

1.3 The procedure applies to the following activities: soil gas surveying, excavating, trenching, drilling of borings and installation of monitoring and extraction wells, use of soil recovery or slide-hammer hand augers, and all other intrusive sampling activities.

1.4 The primary purpose of the procedure is to minimize the potential for damage to underground utilities and other subsurface features, which could result in physical injury, disruption of utility service, or disturbance of other subsurface cultural features.

1.5 If there are procedures, whether it be from Resolution Consultants, state, and/or federal, that are not addressed in this SOP and are applicable to utility clearance, those procedures should be added as an appendix to the project specific SAP.

1.6 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 Field and subcontractor personnel shall adhere to a site-specific health and safety plan (HASP).

3.0 Terms and Definitions

3.1 **Utility**

For the proposes of this SOP, a utility is defined as a manmade underground line or conduit, cable, pipe, vault or tank that is, or was, used for the transmission of material or energy (e.g., gas, electrical, telephone, steam, water or sewage, product transfer lines, or underground storage tanks).

3.2 **As-Built Plans**

As-built plans are plans or blueprints depicting the locations of structures and associated utilities on a property.

3.3 **One-Call**

The Utility Notification Center is the one-call agency for nationwide call before you dig. The Utility Notification Center is open 24 hours a day, and accepts calls from anyone planning to dig. The phone number 811 is the designated call before you dig phone number that directly connects you to your local one-call center. Additional information can be found at www.call811.com.

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Calling before you dig ensures that any publicly owned underground lines will be marked so that you can dig around them safely. Having the utility lines marked not only prevents accidental damage to the lines, but prevents property damage and personal injuries that could result in breaking a line.

The following information will need to be provided when a call is placed to One-Call:

- Your name, phone number, company name (if applicable), and mailing address.
- What type or work is being done.
- Who the work is being done for.
- The county and city the work is taking place in.
- The address or the street where the work is taking place.
- Marking instructions, (specific instructions as to where the work is taking place).

Under normal circumstances it takes between 2 to 5 days from the time you call (not counting weekends or holidays) to have the underground lines marked. Because these laws vary from state to state, exactly how long it will take depends on where your worksite is located. You will be given an exact start time and date when your locate request is completed, which will comply with the laws in your area.

In the event of an emergency (any situation causing damage to life or property, or a service outage), lines can be marked sooner than the original given time if requested.

3.4 **Toning**

Toning is the process of surveying an area utilizing one or more surface geophysical methods to determine the presence or absence of underground utilities. Typically, toning is conducted after identifying the general location of utilities and carefully examining all available site utility plans. Each location is marked according to the type of utility being identified. In addition, areas cleared by toning are flagged or staked to indicate that all identified utilities in a given area have been toned.

4.0 Training and Qualifications

4.1 The **Contract Task Order (CTO) Manager** is responsible for verifying that these utility locating procedures are performed prior to the initiation of active subsurface exploration.

4.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.3 The **Field Manager** is responsible for ensuring that all utility locating activities are performed in accordance with this procedure.

4.4 All **Field Personnel** are responsible for the implementation of this procedure.

5.0 Equipment and Supplies

5.1 Equipment and supplies necessary for locating subsurface utilities will be provided by the subcontractor; however, the project **Field Manager/Field Personnel** will provide any additional equipment and supplies as needed as well as maintain information regarding the utility clearance activities in the field logbook.

6.0 Procedure

Proceed wtih the following steps where subsurface exploration will include excavations, drilling, or any other subsurface investigative method that could damage utilities at a site. In addition to the steps outlined below, always exercise caution while conducting subsurface exploratory work.

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6.1 Prepare Preliminary Site Plan

- Prepare a preliminary, scaled site plan depicting the proposed exploratory locations as part of the project specific Sampling and Analysis Plan (SAP) or Work Plan. Include as many of the cultural and natural features as practical in this plan.

6.2 Review Background Information

- Search existing plan files to review the as-built plans to identify the known location of utilities at the site. Plot the locations of utilities identified onto a preliminary, scaled site plan. Inform the CTO Manager if utilities lie within close proximity to a proposed exploration or excavation location. The CTO Manager will determine if it is necessary to relocate proposed sampling or excavation locations.
- Include the utility location information gathered during previous investigations (e.g., remedial investigation or remedial site evaluation) in the project design documents for removal or remedial actions. In this manner, information regarding utility locations collected during implementation of a CTO can be shared with the subcontractor during implementation of a particular task order. In many instances, this will help to reduce the amount of additional geophysical surveying work the subcontractor may have to perform.
- Conduct interviews with onsite and facility personnel familiar with the site to obtain additional information regarding the known and suspected locations of underground utilities. In addition, if appropriate, contact shall be made with local utility companies to request their help in locating underground lines. Pencil in the dimensions, orientation, and depth of utilities, other than those identified on the as-built plans, at their approximate locations on the preliminary plans. Enter the type of utility, the personnel who provided the information, and the date the information was provided into the field log.
- During the pre-field work interviewing process, the interviewer will determine which site personnel should be notified in the event of an incident involving damage to existing utilities. Record this information in the field logbook with the corresponding telephone numbers and addresses.

6.3 Site Visit/Locate Utilities/Toning

- Prior to the initiation of field activities, the Field Task Manager or similarly qualified field personnel shall visit the site and note existing structures and evidence of associated utilities, such as fire hydrants, irrigation systems, manhole and vault box covers, standpipes, telephone switch boxes, free-standing light poles, gas or electric meters, pavement cuts, and linear depression. Compare notes of the actual site configuration to the preliminary site plan. Note deviations in the field logbook and on the preliminary site plan. Accurately locate or survey and clearly mark with stakes, pins, flags, paint, or other suitable devices all areas where subsurface exploration is proposed. These areas shall correspond with the locations drawn on the preliminary site plan.
- Following the initial site visit by the Field Task Manager, a trained utility locating subcontractor will locate, identify, and tone all utilities depicted on the preliminary site plan. The Field Task Manager or similarly qualified field personnel shall visit the site and identify the areas of subsurface disturbance with white spray paint, chalk, white pin flags or some other easily identifiable marking. The utility locator should utilize appropriate sensing equipment to attempt to locate utilities that might not have appeared on the as-built plans. At a minimum, the utility subcontractor should utilize a metal detector and/or magnetometer; however, it is important to consider the possibility that non-metallic utilities or tanks might be present at the site. Use other appropriate surface geophysical methods such as Ground Penetrating Radar, Radiodetection, etc. as appropriate. Clear proposed exploration areas of all utilities in the immediate area where subsurface exploration is proposed. Clearly tone all anomalous areas. Clearly identify all toned areas on the preliminary site plan. All utilities near the area of subsurface disturbance should also be marked out by the utility subcontractor using the universal colors for subsurface utilities (i.e., red – electric; blue – water; green – sewer; yellow – gas; etc.). After toning the site and plotting all known or suspected buried utilities on the preliminary site plan, the utility locator shall provide the Field Task Manager with a copy of the completed preliminary

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site plan. Alternatively, the Field Task Manager or designee shall document the results of the survey on the preliminary site plan.

- Report to the Field Task Manager anomalous areas detected and toned that are in close proximity to the exploration or excavation areas. The Field Task Manager shall determine the safe distance to maintain from the known or suspected utility. It may be necessary to relocate the proposed exploration or excavation areas. If this is required, the Field Task Manager or designee shall relocate them and clearly mark them using the methods described above. Completely remove the markings at the prior location. Plot the new locations on the site plan and delete the prior locations from the plan. In some instances, such as in areas extremely congested with subsurface utilities, it may be necessary to dig by hand or use techniques such as air knife to determine the location of the utilities.

6.4 **Prepare Site Plan**

- Prior to the initiation of field activities, draft a final site plan that indicates the location of subsurface exploration areas and all known or suspected utilities present at the site. Provide copies of this site plan to the Navy Technical Representative (NTR), the CTO Manager, and the subcontractor who is to conduct the subsurface exploration/excavation work. Review the site plan with the NTR to verify its accuracy prior to initiating subsurface sampling activities.

7.0 Quality Control and Assurance

7.1 Utility locating must incorporate quality control measures to ensure conformance to these and the project requirements.

8.0 Records, Data Analysis, Calculations

8.1 A bound field logbook will be kept detailing all activities conducted during the utility locating procedure.

8.2 The logbook will describe any changes and modifications made to the original exploration plan. The trained utility locator shall prepare a report and keep it in the project file. Also, a copy of the final site plan will be kept in the project file.

9.0 Attachments or References

Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual.* Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.

Author	Reviewer	Revisions (Technical or Editorial)
Caryn DeJesus Senior Scientist	Bob Shoemaker Senior Scientist	Rev 0 – Initial Issue (June 2012)

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Sample Labeling and Chain of Custody Procedures

Procedure 3-03A

1.0 Purpose and Scope

1.1 The purpose of this standard operating procedure is to establish standard protocols for all field personnel for use in maintaining field and sampling activity records, labeling samples, ensuring that proper sample custody procedures are utilized, and completing chain-of-custody/analytical request forms.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

Not applicable

3.0 Definitions

3.1 **Logbook**

A logbook is a bound field notebook with consecutively numbered, water-repellent pages that is clearly identified with the name of the relevant activity, the person responsible for maintenance of the logbook, and the beginning and ending dates of the entries.

3.2 **Chain-of-Custody**

Chain-of-custody (COC) is documentation of the process of custody control. Custody control includes possession of a sample from the time of its collection in the field to its receipt by the analytical laboratory, and through analysis and storage prior to disposal.

4.0 Training and Qualifications

4.1 The **CTO Manager**, or designee, is responsible for determining which team members shall record information in the field logbook and for checking sample logbooks and COC forms to ensure compliance with these procedures. The **CTO Manager**, or designee, shall review COC forms at the completion of each sampling event.

4.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.3 The **Field Manager** is responsible for ensuring that all field equipment is decontaminated according to this procedure.

4.4 The **Project Chemist**, or designee, is responsible for verifying that the COC/analytical request forms have been completed properly and match the sampling and analytical plan. The **Project Chemist**, or designee, is responsible for notifying the laboratory, data managers, and data validators in writing if analytical request changes are required as a corrective action. These small changes are different from change orders, which involve changes to the scope of the subcontract with the laboratory and must be made in accordance with a respective contract.

4.5 All **Field Personnel** are are responsible for recording pertinent data onto the COC forms to satisfy project requirements and for attesting to the accuracy of the entries by dated signature.

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5.0 Procedure

This procedure provides standards for labeling the samples, documenting sample custody, and completing COC/analytical request forms. The standards presented in this section shall be followed to ensure that samples collected are maintained for their intended purpose and that the conditions encountered during field activities are documented.

5.1 Sample Labeling

Affix a waterproof sample label with adhesive backing to each individual sample container. Record the following information with a waterproof marker on each label:

- Project name or number (optional)
- COC sample number
- Date and time of collection
- Sampler's initials
- Matrix (optional)
- Sample preservatives (if applicable)
- Analysis to be performed on sample (This shall be identified by the method number or name identified in the subcontract with the laboratory)

These labels may be obtained from the analytical laboratory or printed from a computer file onto adhesive labels.

5.2 Custody Procedures

For samples intended for chemical analysis, sample custody procedures shall be followed through collection, transfer, analysis, and disposal to ensure that the integrity of the samples is maintained. A description of sample custody procedures is provided below.

Sample Collection Custody Procedures

According to the EPA guidelines, a sample is considered to be in custody if one of the following conditions is met:

- It is in one's actual physical possession or view
- It is in one's physical possession and has not been tampered with (i.e., it is under lock or official seal)
- It is retained in a secured area with restricted access
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal

Place custody seals on shipping coolers (and sample jars, if required) if the cooler/container is to be removed from the sampler's custody. Place a minimum of two custody seals in such a manner that they must be broken to open the containers or coolers. Label the custody seals with the following information:

- Sampler's name or initials
- Date and time that the sample/cooler was sealed

These seals are designed to enable detection of sample tampering. An example of a custody seal is shown in Attachment 1.

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Field personnel shall also log individual samples onto COC forms (carbon copy or computer generated) when a sample is collected. These forms may also serve as the request for analyses. Procedures for completing these forms are discussed in Section 0, indicating sample identification number, matrix, date and time of collection, number of containers, analytical methods to be performed on the sample, and preservatives added (if any). The samplers will also sign the COC form signifying that they were the personnel who collected the samples. The COC form shall accompany the samples from the field to the laboratory. When a cooler is ready for shipment to the analytical laboratory, the person delivering the samples for transport will sign and indicate the date and time on the accompanying COC form. One copy of the COC form will be retained by the sampler and the remaining copies of the COC form shall be placed inside a self-sealing bag and taped to the inside of the cooler. Each cooler must be associated with a unique COC form. Whenever a transfer of custody takes place, both parties shall sign and date the accompanying carbon copy COC forms, and the individual relinquishing the samples shall retain a copy of each form. One exception is when the samples are shipped; the delivery service personnel will not sign or receive a copy because they do not open the coolers. The laboratory shall attach copies of the completed COC forms to the reports containing the results of the analytical tests. An example COC form is provided in Attachment 2.

5.3 Completing COC/Analytical Request Forms

COC form/analytical request form completion procedures are crucial in properly transferring the custody and responsibility of samples from field personnel to the laboratory. This form is important for accurately and concisely requesting analyses for each sample; it is essentially a release order from the analysis subcontract.

Attachment 2 is an example of a completed COC/analytical request form that may be used by field personnel, with box numbers identified and discussed in text below. Multiple copies may be tailored to each project so that much of the information described below need not be handwritten each time. Each record on the form (Attachment 2) is identified with a bold number corresponding to the instructions given below.

1. Record the project name, site location.
2. Record the site location, including the state.
3. Record the Contract Task Order number
4. Record the Resolution Consultants Task Order Manager
5. Record the sampler/site phone or cell number (if applicable).
6. Record the laboratory name where the samples were sent.
7. Record the requested turnaround time, in days. If a specific turnaround time is required to meet project objectives, but was not indicated on the laboratory service request form submitted to the purchasing department, the sampler, project manager, or site manager should contact the purchasing department so the laboratory contract can be modified.
8. Record the COC number that is defined by the sampler and should be unique throughout the project's history. An example would be to use the sampler's initials followed by the data. If multiple custodies are generated on a given day, use a unique sequential identifier. Example: CRC040105A, CRC040105B
9. Record the purchase order number provided by the purchasing department.
10. Record the page and total number of COC forms used in a shipment.
11. Record the project, and phase applicable to the sampling task.
12. Record the two-character code corresponding to the *chemical* preservation type, which is found on the bottom of the COC form. If no chemical preservation was added to the sample, the field should be left blank. Temperature preservation need not be documented at this location, but will be indicated elsewhere on the COC form (see 33).

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13. List the requested analysis. Whenever possible, list the corresponding analytical method. (e.g., VOCs, 8260).

14. For Lab identification use only.

15. Record the full *unique* sample identification as detailed in the Site's Sampling and Analysis Plan.

16. Record the location identification, which is a shortened ID used for presentation and mapping, as detailed in the Site's Sampling and Analysis Plan.

17. Record the sample date using the format mm/dd/yy.

18. Record the sample time using the military format of hhmm.

19. Record the matrix code of the sample, which is located at the bottom of the COC form. The matrix code is a crucial element of the Navy's data management system. For simplicity, only typical matrix codes are listed on the bottom COC form, but below is a complete listing of all applicable Navy matrix codes:

Table 1
Navy Matrix Codes

Matrix Code	Matrix Code Description	Matrix Code	Matrix Code Description
AA	Ambient air	RK	Rock
AC	Composite air sample	SB	Bentonite
AD	Air - Drilling	SBS	Sub-surface soil (> 6")
AIN	Integrated air sample (under sample form of gas)	SC	Cement/Concrete
AQ	Air quality control matrix	SD	Drill cuttings — solid matrix
AQS	Aqueous	SE	Sediment
ASB	Asbestos	SEEP	SEEP
ASBF	Asbestos-Fibrous	SF	Filter sand pack
ASBNF	Asbestos-Non-Fibrous	SJ	Sand
AVE	Air-Vapor extraction, effluent	SK	Asphalt
AX	Air sample from unknown origin	SL	Sludge
BK	Brick	SM	Water filter (solid material used to filter water)
BS	Brackish sediment	SN	Miscellaneous solid/building materials
CA	Cinder ash	SO	Soil
CK	Caulk	SP	Casing (PVC, stainless steel, cast iron, iron pipe
CN	Container	SQ	Soil/Solid quality control matrix
CR	Carbon (usually for a remediation system)	SS	Scrapings
DF	Dust/Fallout	SSD	Subsurface sediment
DR	Debris/rubble	STKG	Stack gas
DS	Storm drain sediment	STPM	Stripper Tower Packing Media
DT	Trapped debris	SU	Surface soil (less than 6 inches)
EF	Emissions flux	SW	Swab or wipe
EW	Elutriate water	SZ	Wood
FB	Fibers	TA	Animal tissue
FL	Forest litter	TP	Plant tissue
GE	Soil gas effluent — stack gas (from system)	TQ	Tissue QC
GI	Soil gas influent (into system)	TX	Tissue
GL	Headspace of liquid sample	UNK	Unknown
GQ	Gaseous or Headspace QC	W	Water (not groundwater, unspecified)
GR	Gravel	WA	Drill cuttings - aqueous mix
GS	Soil gas	WB	Brackish Water

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Table 1
Navy Matrix Codes

Matrix Code	Matrix Code Description	Matrix Code	Matrix Code Description
GT	Grit	WC	Drilling water (used for well construction)
IC	IDW Concrete	WD	Well development water
IDD	IDW Solid	WF	Freshwater (not groundwater)
IDS	IDW soil	WG	Ground water
IDW	IDW Water	WH	Equipment wash water
IW	Interstitial water	WI	Ground water influent (into system)
LA	Aqueous phase of a multiphase liquid/soil	WL	Leachate
LF	Product (floating or free)	WM	Marine water
LQ	Organic liquid quality control matrix	WN	Pore water
MA	Mastic	WO	Ocean water
MO	Mortar	WP	Drinking water
MR	Marine sediment	WQ	Water for QC samples
MS	Metal shavings	WR	Ground water effluent (from system)
NS	Near-surface soil	WS	Surface water
PA	Paper	WT	Composite groundwater sample
PC	Paint Chips	WU	Storm water
PP	Precipitate	WW	Waste water
RE	Residue		

Field QC blanks will require matrix codes that identify the type of blank associated with parent sample. Aqueous field QC blanks are not automatically identified with a matrix code of "WQ," indicating a water quality control blank; they are only identified with a matrix code of "WQ" if the associated samples are also aqueous. Trip blanks, field blanks, and equipment rinsate blanks collected in association with ***soil*** samples will be identified with a matrix code of "SQ," even though the actual matrix is aqueous, because the blanks were collected to assess potential contamination imparted during decontamination activities or transport of ***soil*** samples.

20. Record the sample type code, which is located at the bottom of the COC form. The sample type is a crucial element of the EQuIS data management system. For simplicity, only typical sample type codes are listed on the bottom of the COC form, but below is a list of all applicable Navy field sample type codes:

Table 2
Navy Sample Type Codes

Sample Type Code	Sample Type Code Description
AB	Ambient condition blank
BIOCON	Bioassay control sample
BS	Blank spike
BSD	Blank spike duplicate
EB	Equipment blank
EBD	Equipment blank/rinsate duplicate
FB	Field blank
FD	Field duplicate
FS	Field spike
IDW	Purge and rinsate water
LB	Lab Blank

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Table 2
Navy Sample Type Codes

Sample Type Code	Sample Type Code Description
LR	Lab Replicate
MB	Material blank
MIS	Multi-Incremental Sample
MS	Matrix spike
N	Normal (Regular)
PE	Performance evaluation
PURGE	Purge water sample
RD	Regulatory duplicate
SB	Source blank
SBD	Source blank duplicate
SCREEN	Screening Sample
SD	Matrix spike duplicate
SPLIT	Sample split
SRM	Standard reference material
TB	Trip Blank
TBD	Trip blank duplicate
TBR	Trip blank replicate

Field duplicate samples — Field duplicates will be identified using the format detailed in the Site's Sampling and Analysis Plan. However, field duplicates will also be differentiated from the parent sample on the chain-of-custody form. The parent sample will have a sample type code of "N," for normal environmental sample; while its duplicate will have a sample type code of "FD."

21. Record whether the sample is field filtered with a "Y" or not field filtered with an "N." If a project requires collecting samples for both total and dissolved constituents, the same sample and location ID is used for both (see 15 and 16); however, the sampler will indicate whether the sample is field filtered at this location on the COC form. This field must always be filled out; even when soil samples are collected (where "N" appropriately applies, in most cases).

22. Record the total number of containers that are submitted for all of the tests. This must add up to the total number of containers listed for each individual test in 23.

23. Record the number of containers for each test. Do not use Xs, rather indicate the number of containers submitted for each test listed in 14. For example, Sample 010MW007002 requires analysis for VOCs (8260), and SVOCs (8270). Record 3 under the VOC analysis and 2 under the SVOC (assuming 3 containers were submitted for VOCs and 2 were submitted for SVOCs). The total number of containers in this example is 5, which should be the total number of containers listed in 22. Extra containers submitted for matrix spike/matrix spike duplicates (MS/MSDs) will be appropriately recorded.

24. Indicate if extra sample volume was included for MS/MSD analysis using an "X." Samples to be used for MS/MSDs will use the same sample ID and location ID (see 15 and 16), but will be collected in triplicate, particularly for liquid samples, to ensure the analytical laboratory receives sufficient volume for the analyses.

25. Indicate if the samples should be held by the laboratory for future testing using an "X."

26. Record any field comments.

27. Reserved for laboratory comments.

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28. Indicate the total number of coolers in each shipment. *Note*: When multiple coolers are submitted, each should contain a COC form.

29. Signature(s) of the person(s) relinquishing sample custody.

30. Signature(s) of the person(s) receiving sample custody.

31. Indicate whether the samples are iced, by checking the appropriate response.

32. Indicate the method of shipment (e.g., FedEx, hand-delivered, laboratory courier).

33. Record the airbill number when a commercial courier is used. This is particularly important when multiple coolers are sent in the same shipment or when the laboratory is sent the COC form in advance of receiving samples because it aids in tracking lost coolers.

34. Record the date the coolers were shipped.

COC forms tailored to each CTO can be drafted and printed onto multiple forms. This eliminates the need to rewrite the analytical methods column headers each time. It also eliminates the need to write the project manager, name, and number; QC Level; turnaround time; and the same general comments each time.

Complete one COC form per cooler. Whenever possible, place all volatile organic analyte vials into one cooler in order to reduce the number of trip blanks. Complete all sections and be sure to sign and date the COC form. One copy of the COC form must remain with the field personnel.

6.0 Records

The COC/analytical request form shall be faxed or emailed approximately daily to the Project Chemist, or designee for verification of accuracy. Following the completion of sampling activities, the sample logbook and COC forms will be transmitted to the CTO Manager for storage in project files. The original COC/analytical request form shall be submitted by the laboratory along with the data delivered. Any changes to the analytical requests that are required shall be made in writing to the laboratory. A copy of this written change shall be sent to the data validators and placed in the project files. The reason for the change shall be included in the project files so that recurring problems can be easily identified.

7.0 References and Attachments

Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual*. Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/-fedfac/pdf/ufp_qapp_v1_0305.pdf.

Attachment 1: Chain-of-Custody Seal

Attachment 2: Generic Chain-of-Custody/Analytical Request Form

Author	Reviewer	Revisions (Technical or Editorial)
Tina Cantwell QA Officer	Ben Brantley Project Manager	Rev 0 — Initial Issue

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Attachment 1
Chain-of-Custody Seal

EXAMPLE CHAIN-OF-CUSTODY SEAL

[LABORATORY]	SAMPLE NO.	DATE	SEAL BROKEN BY
	SIGNATURE		DATE
	PRINT NAME AND TITLE *(Inspector, Analyst or Technician*		

Attachment 2
Example Chain-of-Custody / Analytical Request Form

RESOLUTION CONSULTANTS

CHAIN OF CUSTODY AND ANALYTICAL REQUEST RECORD

Project Name: 1	COC No. 7	Page of 9	
Site Location: 2	PO No. 8	Project No. 10	
Contract Task Order No. 3		Lab Name 11	

Sampler/Site Phone# 4

Send Results To: 5

Data Shipping Address: 6

Sample Analysis Requested (Enter number of containers for each test)

Lab ID	Sample ID (sys_samp_code)	Location ID (sys_loc_code)	Date (mm/dd/yy)	Time (Military) (hhmm)	Matrix Code (1)	Sample Type (2)	Field Filtered (Y/N)	Total No. of Containers	12 / 13									Extra Volumen for MS/MSD	HOLD
14	15	16	17	18	19	20	21	22	23									24	25

Turnaround Time(specify): 26 **Final** _____ days **Email** (if applicable) _____ days

Deliverable(check): 27 Level 2_____ Level 3_____ Full/Level 4_____ TX TRRP-13_____

Field **Comments:** 28

Lab **Comments:** 29

Sample Shipment and Delivery Details

Number of coolers in shipment: 30

Relinquished by (signature)	Date	Time	Received by (signature)	Date	Time
1 31			1 32		
2			2		
3			3		

Samples Iced?(check) 33 Yes___ No___

Method of Shipment: 34

Airbill No: 35

Date Shipped: 36

(1) AA=Ambient air, **AQ**=Air quality control, **ASB**=Asbestos, **CK**=Caulk, **DS**=Storm drain sediment, **GS**=Soil gas, **IC**=IDW Concrete, **IDD**=IDW Solid, IDS=IDW soil, **IDW**=IDW Water, **LF**=Free Product, **MA**=Mastic, **PC**=Paint Chips, **SC**=Cement/Concrete, **SE**=Sediment, **SL**=Sludge, **SO**=Soil, **SQ**=Soil/Solid quality control, **SSD**=Subsurface sediment, **SU**=Surface soil (<6 in), **SW**=Swab or wipe, **TA**=Animal tissue, **TP**=Plant tissue, **TQ**=Tissue quality control, **WG**=Ground water, **WL**=Leachate, **WO**=Ocean water, **WP**=Drinking water, **WQ**=Water quality control, **WR**=Ground water effluent, **WS**=Surface water, **WU**=Storm water, **WW**=Waste water

(2) Sample Type: AB=Ambient Blk, **EB**=Equipment Blk, **FB**=Field Blk, **FD**=Field Duplicate Sample, **IDW**=Investigative-Derived Waste, **MIS**=Incremental Sampling Methodology, **N**=Normal Environmental Sample, **PE**=Performance Eval., **TB**=Trip Blk

(3) Preservative added: HA=Hydrochloric Acid, **NI**=Nitric Acid, **SH**=Sodium Hydroxide, **SA**=Sulfuric Acid, **AA**=Ascorbic Acid, **HX**=Hexane, **ME**=Methanol, **SB**=sodium bisulfate, **ST**=Sodium Thiosulfate, If **NO preservative** added leave blank

Sample Handling, Storage, and Shipping of Low Level Environmental Samples

Procedure 3-04A

1.0 Purpose and Scope

1.1 This Standard Operating Procedure (SOP) sets forth the methods for use by personnel engaged in handling, storing, and transporting low level environmental samples.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 To avoid lifting injuries associated with heavy coolers, use the large muscles of the legs, not the back. Use dollies if possible.

2.2 When using tools for cutting purposes, cut away from yourself. The use of appropriate, task specific cutting tools is recommended.

2.3 Wear proper gloves, such as blue nitrile and latex, as defined in the site-specific project health and safety plan, when handling sample containers to avoid contacting any materials that may have spilled out of the sample containers.

3.0 Terms and Definitions

DOT — Department of Transportation

4.0 Training and Qualifications

4.1 The **Contract Task Order** (CTO) **Manager** is responsible for verifying that these procedures are performed prior to the initiation of active subsurface exploration.

4.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.3 The **Field Manager** is responsible for ensuring that sample handling, storage, and shipping are performed in accordance with this procedure.

4.4 All **Field Personnel** are responsible for the implementation of this procedure.

5.0 Procedures

5.1 Handling and Packaging

Environmental samples should be packaged prior to shipment using the following procedures:

1. Allow sufficient headspace in all bottles (except volatile organic analysis containers with a septum seal) to compensate for any pressure and temperature changes (approximately 1 percent of the volume of the container).

2. Ensure that the lids on all bottles are tight (will not leak).

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3. Glass bottles should be wrapped in bubble wrap — preferably sealable bubble wrap sample bags, if available. Place bottles in separate and appropriately-sized polyethylene bags and seal the bags.

4. Select a sturdy cooler in good repair. Secure and tape the drain plug with fiber or duct tape inside and outside. Line the cooler with a large heavy-duty plastic bag.

5. Place cushioning/absorbent material in the bottom of the cooler, if available, and then place the containers in the cooler with sufficient space to allow for the addition of cushioning between the containers.

6. Put "blue ice" (or ice that has been "double bagged" in heavy-duty polyethylene bags and properly sealed) on top of and/or between the containers. Fill all remaining space between the containers with bubble wrap or other suitable absorbent material.

7. Securely fasten the top of the large garbage bag with packaging tape.

8. Place the completed Chain-of-Custody (COC) Record into a sealed plastic bag, and tape the bag to the inner side of the cooler lid.

9. Close the cooler and securely tape (preferably with fiber tape) the top of the cooler shut. COC seals should be affixed to opposing sides of the cooler within the securing tape so that the cooler cannot be opened without breaking the seal.

5.2 Shipping

Follow all appropriate DOT regulations (e.g., 49 Code of Federal Regulations, Parts 171-179) for shipment of air, soil, water, and other samples. Elements of these procedures are summarized in the following subsections.

5.2.1 Non-hazardous Materials Shipment

If the samples are suspected to be non-hazardous based on previous site sample results, field screening results, or visual observations, if applicable, then samples may be shipped as non-hazardous.

When a cooler is ready for shipment to the laboratory, prepare standard air bill paperwork for shipment of the samples to the laboratory. Write the shippers tracking/airbill number on the COC form. Place two copies of the COC form inside a self-sealing bag and tape it to the inside of the cooler. Seal the cooler with waterproof tape and label it with “Fragile,” “This-End-Up” (or directional arrows pointing up), or other appropriate notices. Affix a label stating the destination (laboratory address) to each cooler. Personnel should be aware of carrier weight or other policy restrictions.

5.2.2 Hazardous Materials Shipment

Shipment of Hazardous Material is not covered in this SOP; all samples handled under this SOP are anticipated to be non-hazardous or not dangerous goods. The CTO Manager, or designee, is responsible for determining if samples collected during a specific field investigation meet the definitions for dangerous goods. If a sample is collected of a material that is listed in the Dangerous Goods List, Section 4.2, of International Air Transport Authority (IATA), then that sample must be identified, packaged, marked,

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labeled, and shipped according to the instructions given for that material. If the composition of the collected sample(s) is unknown, and the project leader knows or suspects that it is a regulated material (dangerous goods), the sample may not be offered for air transport. If the composition and properties of a waste sample or a highly contaminated soil, sediment, or water sample are unknown, or only partially known, the sample may not be offered for air transport.

6.0 Records

Maintain all copies of chain of custodies and air bills with the project file. .

7.0 Attachments or References

International Air Transport Authority (IATA). Dangerous Goods Regulations

http://www.iata.org/whatwedo/cargo/dangerous_goods/Documents/DGR52-significant-changes.pdf

Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual*. Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.

Author	Reviewer	Revisions (Technical or Editorial)
Ben Brantley	Tina Cantwell	Rev 0 — Initial Issue
Program Manager	QA Officer	

Investigation Derived Waste Management

Procedure 3-05

1.0 Purpose and Scope

This standard operating procedure (SOP) describes activities and responsibilities of the United States (U.S.) Navy Environmental Restoration (ER) Program, Naval Facilities Engineering Command, Atlantic (NAVFAC Atlantic) with regard to management of investigation-derived waste (IDW). The purpose of this procedure is to provide guidance for the minimization, handling, labelling, temporary storage, inventory, classification, and disposal of IDW generated under the ER Program. This procedure will also apply to personal protective equipment (PPE), sampling equipment, decontamination fluids, non-IDW trash, non-indigenous IDW, and hazardous waste generated during implementation of removal or remedial actions. The information presented will be used to prepare and implement work plans (WPs) for IDW-related field activities. The results from implementation of WPs will then be used to develop and implement final IDW disposal plans.

If there are procedures whether it be from Resolution Consultants, state and/or federal that are not addressed in this SOP and are applicable to IDW then those procedures may be added as an appendix to the project specific SAP.

This procedure applies to all Navy ER projects performed in the NAVFAC Atlantic Area of Responsibility.

This procedure shall serve as management-approved professional guidance for the ER Program and is consistent with protocol in the Uniform Federal Policy-Quality Assurance Project Plan (DoD 2005). As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgment during unforeseen circumstances. Deviations from this procedure while planning or executing planned activities must be approved by both the Contract Task Order (CTO) Manager and the Quality Assurance (QA) Manager or Technical Director, and documented.

This procedure was developed to serve as management-approved professional guidance for the management of IDW generated under the ER Program. It focuses on the requirements for minimizing, segregating, handling, labeling, storing, and inventorying IDW in the field. Certain drum inventory requirements related to the screening, sampling, classification, and disposal of IDW are also noted in this procedure.

2.0 Safety

The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the CTO WP and/or direction from the **Site Safety Officer (SSO)**.

All **Field Personnel** responsible for IDW management must adhere to the HASP and must wear the PPE specified in the site-specific HASP. Generally, this includes, at a minimum, steel-toed boots or steel-toed rubber boots, safety glasses, American National Standards Institute-standard hard hats, and hearing protection (if heavy equipment is in operation). If safe alternatives are not achievable, discontinue site activities immediately.

3.0 Terms and Definitions

None.

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4.0 Training and Qualifications

4.1 The **CTO Manager** is responsible for ensuring that IDW management activities comply with this procedure. The **CTO Manager** is responsible for ensuring that all personnel involved in IDW management shall have the appropriate education, experience, and training to perform their assigned tasks.

4.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.3 The **Field Manager** is responsible for ensuring that all IDW is managed according to this procedure.

4.4 All **Field Personnel** are responsible for the implementation of this procedure.

5.0 Equipment and Supplies

The equipment and supplies required for implementation of this SOP include the following:

- Containers for waste (e.g., [U.S. Department of Transportation] DOT approved 55-gallon open and closed top drums) and material to cover waste to protect from weather (e.g., plastic covering);
- Hazardous /non-hazardous waste drum labels (weatherproof);
- Permanent marking pens;
- Inventory forms for project file;
- Plastic garbage bags, zip lock storage bags, roll of plastic sheeting; and
- Steel-toed boots, chemical resistant gloves, coveralls, safety glasses, and any other PPE required in the HASP.

6.0 Procedure

The following procedures are used to handle the IDW.

6.1 Drum Handling

6.1.1 IDW shall be containerized using DOT approved drums. The drums shall be made of steel or plastic, have a 55-gallon capacity, be completely painted or opaque, and have removable lids (i.e., United Nations Code 1A2 or 1H2). Typically 55-gallon drums are used, however small drums may be used depending on the amount of waste generated. New steel drums are preferred over recycled drums.

6.1.2 Recycled drums should not be used for hazardous waste, PCBs or other regulated shipments. For short-term storage of liquid IDW prior to discharge, double-walled bulk steel or plastic storage tanks may be used. For this scenario, consider the scheduling and cost-effectiveness of this type of bulk storage, treatment, and discharge system versus longer-term drum storage.

6.1.3 For long-term IDW storage at other project locations, the DOT approved drums with removable lids are recommended. Verify the integrity of the foam or rubber sealing ring located on the underside of some drum lids prior to sealing drums containing IDW liquids.

6.1.4 If the ring is only partially attached to the drum lid, or if a portion of the ring is missing, select another drum lid with a sealing ring that is in sound condition.

6.1.5 To prepare IDW drums for labeling, wipe clean the outer wall surfaces and drum lids of all material that might prevent legible and permanent labeling. If potentially contaminated material adheres to the outer surface of a drum, wipe that material from the drum, and segregate the paper towel or rag used to remove the material with visibly soiled PPE and

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disposable sampling equipment. Label all IDW drums and place them on pallets prior to storage.

6.2 Labelling

6.2.1 Containers used to store IDW must be properly labelled. Two general conditions exist: 1) from previous studies or on-site data, waste characteristics are known to be either hazardous or nonhazardous; or 2) waste characteristics are unknown until additional data are obtained.

6.2.2 For situations where the waste characteristics are known, the waste containers should be packaged and labelled in accordance with state regulations and any federal regulations that may govern the labelling of waste.

6.2.3 The following information shall be placed on all non-hazardous waste labels:

- Description of waste (i.e., purge water, soil cuttings);
- Contact information (i.e., contact name and telephone number);
- Date when the waste was first accumulated.

6.2.4 The following information shall be placed on all hazardous waste labels:

- Description of waste (i.e., purge water, soil cuttings);
- Generator information (i.e., name, address, contact telephone number);
- EPA identification number (supplied by on-site client representative);
- Date when the waste was first accumulated.

6.2.5 When the final characterization of a waste is unknown, a notification label should be placed on the drum with the words “waste characterization pending analysis” and the following information included on the label:

- Description of waste (i.e., purge water, soil cuttings);
- Contact information (i.e., contact name and telephone number);
- Date when the waste was first accumulated.

6.2.6 Once the waste has been characterized, the label should be changed as appropriate for a nonhazardous or hazardous waste.

6.2.7 Waste labels should be constructed of a weatherproof material and filled out with a permanent marker to prevent being washed off or becoming faded by sunlight. It is recommended that waste labels be placed on the side of the container, since the top is more subject to weathering. However, when multiple containers are accumulated together, it also may be helpful to include labels on the top of the containers to facilitate organization and disposal.

6.2.8 Each container of waste generated shall be recorded in the field notebook used by the person responsible for labelling the waste. After the waste is disposed of, either by transportation off-site or disposal on-site in an approved disposal area, an appropriate record shall be made in the same field notebook to document proper disposition of IDW.

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6.3 Types of Site Investigation Waste

Several types of waste are generated during site investigations that may require special handling. These include solid, liquid, and used PPE, as discussed further below.

Solid Waste

Soil cuttings from boreholes will typically be placed in containers unless site specific requirements allow for soil cuttings to be placed back into the borehole after drilling is complete. Drilling mud generated during investigation activities shall be collected in containers. Covers should be included on the containers and must be secured at all times and only open during filling activities. The containers shall be labelled in accordance with this SOP. An inventory containing the source, volume, and description of material put in the containers shall be logged on prescribed forms and kept in the project file.

Non-hazardous solid waste can be disposed on-site in the designated site landfill or in a designated evaporation pond if it is liquefied. Hazardous wastes must be disposed off-site at an approved hazardous waste landfill.

Liquid Waste

Groundwater generated during monitoring well development, purging, and sampling can be collected in truck-mounted containers and/or other transportable containers (i.e., 55-gallon drums). Lids or bungs on drums must be secured at all times and only open during filling or pumping activities. The containers shall be labelled in accordance with this SOP. Non-hazardous liquid waste can be disposed of in one of the designated lined evaporation ponds on-site. Hazardous wastes must be handled separately and disposed off-site at an approved hazardous waste facility.

Personal Protective Equipment

PPE that is generated throughout investigation activities shall be placed in plastic garbage bags. If the solid or liquid waste that was being handled is characterized as hazardous waste, then the corresponding PPE should also be disposed as hazardous waste. If not, all PPE should be disposed as non-hazardous waste in the designated on-site landfill. Trash that is generated as part of field activities may be disposed of in the landfill as long as the trash was not exposed to hazardous media.

6.4 Waste Accumulation On-Site

6.4.1 Solid, liquid, or PPE waste generated during investigation activities that are classified as nonhazardous or “characterization pending analysis” should be disposed of as soon as possible. Until disposal, such containers should be inventoried, stored as securely as possible, and inspected regularly, as a general good practice.

6.4.2 Solid, liquid, or PPE waste generated during investigation activities that are classified as hazardous shall not be accumulated on-site longer than 90 days. All hazardous waste containers shall be stored in a secured storage area. The following requirements for the hazardous waste storage area must be implemented:

- Proper hazardous waste signs shall be posted as required by any state or federal statutes that may govern the labelling of waste;
- Secondary containment to contain spills;
- Spill containment equipment must be available;
- Fire extinguisher;
- Adequate aisle space for unobstructed movement of personnel.

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6.4.3 Weekly storage area inspections shall be performed and documented to ensure compliance with these requirements. Throughout the project, an inventory shall be maintained to itemize the type and quantity of the waste generated.

6.5 **Waste Disposal**

6.5.1 Solid, liquid, and PPE waste will be characterized for disposal through the use of client knowledge, laboratory analytical data created from soil or groundwater samples gathered during the field activities, and/or composite samples from individual containers.

6.5.2 All waste generated during field activities will be stored, transported, and disposed of according to applicable state, federal, and local regulations. All wastes classified as hazardous will be disposed of at a licensed treatment storage and disposal facility or managed in other approved manners.

6.5.3 In general, waste disposal should be carefully coordinated with the facility receiving the waste. Facilities receiving waste have specific requirements that vary even for non-hazardous waste, so characterization should be conducted to support both applicable regulations and facility requirements.

6.6 **Regulatory Requirements**

The following federal and state regulations shall be used as resources for determining waste characteristics and requirements for waste storage, transportation, and disposal:

- Code of Federal Regulations (CFR), Title 40, Part 261;
- CFR, Title 49, Parts 172, 173, 178, and 179.

6.7 **Waste Transport**

A state-certified hazardous waste hauler shall transport all wastes classified as hazardous. Typically, the facility receiving any waste can coordinate a hauler to transport the waste. Shipped hazardous waste shall be disposed of in accordance with all RCRA/USEPA requirements. All waste manifests or bills of lading will be signed either by the client or the client's designee.

7.0 Quality Control and Assurance

7.1 Management of IDW must incorporate quality control measures to ensure conformance to these and the project requirements.

8.0 Records, Data Analysis, Calculations

8.1 Maintain records as required by implanting the procedures in this SOP.

8.2 Deviations from this procedure or the sampling and analysis plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

9.0 Attachments or References

Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual.* Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/-fedfac/pdf/ufp_qapp_v1_0305.pdf.

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NAVFAC NW Standard Operating Procedure Number I-D-1, *Drum Sampling.*

NAVFAC NW Standard Operating Procedure Number I-F, *Equipment Decontamination.*

NAVFAC NW Standard Operating Procedure Number III-D, *Logbooks.*

Author	Reviewer	Revisions (Technical or Editorial)
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)

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Equipment Decontamination

Procedure 3-06

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes methods of equipment decontamination, to be used for activities where samples for chemical analysis are collected or where equipment will need to be cleaned before leaving the site or before use in subsequent activities.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

It is the responsibility of the **Site Safety Officer (SSO)** to set up the site zones (i.e., exclusion, transition, and clean) and decontamination areas. Generally the decontamination area is located within the transition zone, upwind of intrusive activities, and serves as the washing area for both personnel and equipment to minimize the spread of contamination into the clean zone. Typically, for equipment, a series of buckets are set up on a visqueen-lined bermed area. Separate spray bottles containing cleaning solvents as described in this procedure or the Contract Task Order (CTO) Work Plan (WP) and distilled water are used for final rinsing of equipment. Depending on the nature of the hazards and the site location, decontamination of heavy equipment, such as augers, pump drop pipe, and vehicles, may be accomplished using a variety of techniques.

All **Field Personnel** responsible for equipment decontamination must adhere to the site-specific health and safety plan (HSP) and must wear the personal protective equipment (PPE) specified in the site-specific HSP. Generally this includes, at a minimum, Tyvek® coveralls, steel-toed boots with boot covers or steel-toed rubber boots, safety glasses, American National Standards Institute-standard hard hats, and hearing protection (if heavy equipment is in operation). Air monitoring by the **SSO** may result in an upgrade to the use of respirators and cartridges in the decontamination area; therefore, this equipment must be available on site. If safe alternatives are not achievable, discontinue site activities immediately.

In addition to the aforementioned precautions, the following sections describe safe work practices that will be employed.

2.1 Chemical Hazards associated with Equipment Decontamination

- Avoid skin contact with and/or incidental ingestion of decontamination solutions and water.
- Utilize PPE as specified in the site-specific HSP to maximize splash protection.
- Refer to material safety data sheets, safety personnel, and/or consult sampling personnel regarding appropriate safety measures (i.e., handling, PPE including skin and respiratory).
- Take the necessary precautions when handling detergents and reagents.

2.2 Physical Hazards associated with Equipment Decontamination

- To avoid possible back strain, it is recommended to raise the decontamination area 1 to 2 feet above ground level.
- To avoid heat stress, over exertion, and exhaustion, it is recommended to rotate equipment decontamination among all site personnel.

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- Take necessary precautions when handling field sampling equipment.

3.0 Terms and Definitions

None.

4.0 Training and Qualifications

4.1 The **CTO Manager** is responsible for ensuring that decontamination activities comply with this procedure. The **CTO Manager** is responsible for ensuring that all personnel involved in equipment decontamination shall have the appropriate education, experience, and training to perform their assigned tasks.

4.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.3 The **Field Manager** is responsible for ensuring that all field equipment is decontaminated according to this procedure.

4.4 All **Field Personnel** are responsible for the implementation of this procedure.

5.0 Procedure

Decontamination of equipment used in soil/sediment sampling, groundwater monitoring, well drilling and well development, as well as equipment used to sample groundwater, surface water, sediment, waste, wipe, asbestos, and unsaturated zone, is necessary to prevent cross-contamination and to maintain the highest integrity possible in collected samples. Planning a decontamination program requires consideration of the following factors:

- Location where the decontamination procedures will be conducted
- Types of equipment requiring decontamination
- Frequency of equipment decontamination
- Cleaning technique and types of cleaning solutions appropriate to the contaminants of concern
- Method for containing the residual contaminants and wash water from the decontamination process
- Use of a quality control measure to determine the effectiveness of the decontamination procedure

The following subsections describe standards for decontamination, including the frequency of decontamination, cleaning solutions and techniques, containment of residual contaminants and cleaning solutions, and effectiveness.

5.1 Decontamination Area

Select an appropriate location for the decontamination area at a site based on the ability to control access to the area, the ability to control residual material removed from equipment, the need to store clean equipment, and the ability to restrict access to the area being investigated. Locate the decontamination area an adequate distance away and upwind from potential contaminant sources to avoid contamination of clean equipment.

5.2 Types of Equipment

Drilling equipment that must be decontaminated includes drill bits, auger sections, drill-string tools, drill rods, split barrel samplers, tremie pipes, clamps, hand tools, and steel cable. Decontamination of monitoring well development and groundwater sampling equipment includes submersible pumps, bailers, interface probes, water level meters, bladder pumps, airlift pumps, peristaltic pumps, and lysimeters. Other sampling equipment that requires decontamination includes, but is not limited to, hand trowels,

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hand augers, slide hammer samplers, shovels, stainless-steel spoons and bowls, soil sample liners and caps, wipe sampling templates, composite liquid waste samplers, and dippers. Equipment with a porous surface, such as rope, cloth hoses, and wooden blocks, cannot be thoroughly decontaminated and shall be properly disposed of after one use.

5.3 Frequency of Equipment Decontamination

Decontaminate down-hole drilling equipment and equipment used in monitoring well development and purging prior to initial use and between each borehole or well. Down-hole drilling equipment, however, may require more frequent cleaning to prevent cross-contamination between vertical zones within a single borehole. When drilling through a shallow contaminated zone and installing a surface casing to seal off the contaminated zone, decontaminate the drilling tools prior to drilling deeper. Initiate groundwater sampling by sampling groundwater from the monitoring well where the least contamination is suspected. Decontaminate groundwater, surface water, and soil sampling devices prior to initial use and between collection of each sample to prevent the possible introduction of contaminants into successive samples.

5.4 Cleaning Solutions and Techniques

Decontamination can be accomplished using a variety of techniques and fluids. The preferred method of decontaminating major equipment, such as drill bits, augers, drill string, and pump drop-pipe, is steam cleaning. To steam clean, use a portable, high-pressure steam cleaner equipped with a pressure hose and fittings. For this method, thoroughly steam wash equipment and rinse it with potable tap water to remove particulates and contaminants.

A rinse decontamination procedure is acceptable for equipment such as bailers, water level meters, new and re-used soil sample liners, and hand tools. The decontamination procedure shall consist of the following: (1) wash with a non-phosphate detergent (Alconox®, Liquinox®, or other suitable detergent) and potable water solution; (2) rinse with potable water; (3) spray with laboratory-grade isopropyl alcohol; (4) rinse with deionized or distilled water; and (5) spray with deionized or distilled water. If possible, disassemble equipment prior to cleaning. Add a second wash at the beginning of the process if equipment is very soiled.

Decontaminating submersible pumps requires additional effort because internal surfaces become contaminated during usage. Decontaminate these pumps by washing and rinsing the outside surfaces using the procedure described for small equipment or by steam cleaning. Decontaminate the internal surfaces by recirculating fluids through the pump while it is operating. This recirculation may be done using a relatively long (typically 4 feet) large-diameter pipe (4-inch or greater) equipped with a bottom cap. Fill the pipe with the decontamination fluids, place the pump within the capped pipe, and operate the pump while recirculating the fluids back into the pipe. The decontamination sequence shall include: (1) detergent and potable water; (2) potable water rinse; (3) potable water rinse; and (4) deionized water rinse. Change the decontamination fluids after each decontamination cycle.

Solvents other than isopropyl alcohol may be used, depending upon the contaminants involved. For example, if polychlorinated biphenyls or chlorinated pesticides are contaminants of concern, hexane may be used as the decontamination solvent; however, if samples are also to be analyzed for volatile organics, hexane shall not be used. In addition, some decontamination solvents have health effects that must be considered. Decontamination water shall consist of distilled or deionized water. Steam-distilled water shall not be used in the decontamination process as this type of water usually contains elevated concentrations of metals. Decontamination solvents to be used during field activities will be specified in the CTO WP.

Rinse equipment used for measuring field parameters, such as pH (indicates the hydrogen ion concentration – acidity or basicity), temperature, specific conductivity, and turbidity with deionized or distilled water after each measurement. Also wash new, unused soil sample liners and caps with a fresh

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detergent solution and rinse them with potable water followed by distilled or deionized water to remove any dirt or cutting oils that might be on them prior to use.

5.5 Containment of Residual Contaminants and Cleaning Solutions

A decontamination program for equipment exposed to potentially hazardous materials requires a provision for catchment and disposal of the contaminated material, cleaning solution, and wash water.

When contaminated material and cleaning fluids must be contained from heavy equipment, such as drill rigs and support vehicles, the area must be properly floored, preferably with a concrete pad that slopes toward a sump pit. If a concrete pad is impractical, planking can be used to construct solid flooring that is then covered by a nonporous surface and sloped toward a collection sump. If the decontamination area lacks a collection sump, use plastic sheeting and blocks or other objects to create a bermed area for collection of equipment decontamination water. Situate items, such as auger flights, which can be placed on metal stands or other similar equipment, on this equipment during decontamination to prevent contact with fluids generated by previous equipment decontamination. Store clean equipment in a separate location to prevent recontamination. Collect decontamination fluids contained within the bermed area and store them in secured containers as described below.

Use wash buckets or tubs to catch fluids from the decontamination of lighter-weight drilling equipment and hand-held sampling devices. Collect the decontamination fluids and store them on site in secured containers, such as U.S. Department of Transportation-approved drums, until their disposition is determined by laboratory analytical results. Label containers in accordance with Procedure 3-05, *IDW Management*.

6.0 Quality Control and Assurance

A decontamination program must incorporate quality control measures to determine the effectiveness of cleaning methods. Quality control measures typically include collection of equipment blank samples or wipe testing. Equipment blanks consist of analyte-free water that has been poured over or through the sample collection equipment after its final decontamination rinse. Wipe testing is performed by wiping a cloth over the surface of the equipment after cleaning. These quality control measures provide "after-the fact" information that may be useful in determining whether or not cleaning methods were effective in removing the contaminants of concern.

7.0 Records, Data Analysis, Calculations

Any project where sampling and analysis is performed shall be executed in accordance with an approved sampling and analysis plan. This procedure may be incorporated by reference or may be incorporated with modifications described in the plan.

Deviations from this procedure or the sampling and analysis plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

8.0 Attachments or References

8.1 ASTM Standard D5088. 2008. *Standard Practice for Decontamination of Field Equipment Used at Waste Sites.* ASTM International, West Conshohocken, PA. 2008. DOI: 10.1520/D5088-02R08. www.astm.org.

8.2 NAVSEA T0300-AZ-PRO-010. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. August 2009.

8.3 Procedure 3-05, *IDW Management*.

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Author	Reviewer	Revisions (Technical or Editorial)
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue

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Land Surveying

Procedure 3-07

1.0 Purpose and Scope

1.1 The purpose of this document is to define the standard operating procedure (SOP) for acquiring land surveying data to facilitate the location and mapping of geologic, hydrologic, geotechnical data, and analytical sampling points and to establish topographic control over project sites.

1.2 This procedure is the Program-approved professional guidance for work performed by Resolution Consultants under the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract (Contract Number N62470-11-D-8013).

1.3 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review. If there are procedures whether it be from Resolution Consultants, state and/or federal that are not addressed in this SOP and are applicable to surface water sampling then those procedures may be added as an appendix to the project specific SAP.

1.4 It is fully expected that the procedures outlined in this SOP will be followed. Procedural modifications may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Program Quality Manager. Deviations to this SOP will be documented in the field records.

1.5 If there are procedures, whether it be from Resolution Consultants, state and/or federal, that are not addressed in this SOP and are applicable to land surveying then those procedures may be added as an appendix to the project specific Sampling and Analysis Plan (SAP).

2.0 Safety

2.1 Depending upon the site-specific contaminants, various protective programs must be implemented prior to conducting fieldwork. All **field sampling personnel** must review the project-specific health and safety plan (HASP) paying particular attention to the control measures planned for the specific field tasks. Conduct preliminary area monitoring to determine the potential hazard to field sampling personnel. If significant contamination is observed, minimize contact with potential contaminants in both the vapor and liquid phase through the use of respirators and disposable clothing.

2.2 In addition, observe standard health and safety practices according to the project-specific HASP. Suggested minimum protection includes inner disposable vinyl gloves, outer chemical-protective nitrile gloves, rubberized steel-toed boots, and an American National Standards Institute-standard hard hat. Half-face respirators and cartridges and Tyvek® suits may be necessary depending on the contaminant concentrations, and shall always be available on site.

2.3 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the **Site Safety Officer (SSO)** or designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. Weather conditions are often part of these discussions. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

2.4 The health and safety considerations for the work associated with land surveying include:

- Slip, trips and falls associated with work in the field;

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- Biological hazards associated with work in the field; and,
- Potential hazards associated with contaminants of concern (COC) that may be located in the survey area,

3.0 Terms and Definitions

3.1 Boundary Survey

Boundary surveys are conducted by Certified Land Surveyors in order to delineate a legal property line for a site or section of a site.

3.2 Global Positioning System (GPS)

A system of satellites, computers, and receivers that is able to determine the latitude and longitude of a receiver on Earth by calculating the time difference for signals from different satellites to reach the receiver.

4.0 Interferences

4.1 Commercially available GPS units typically have a level of precision of (±) 3 to 5 meters. Field corrections can be made as described in Section 8.3 below.

5.0 Training and Qualifications

5.1 Qualifications and Training

5.1.1 The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 Responsibilities

5.2.1 The **Contract Task Order (CTO) Manager** is responsible for ensuring that land surveying activities comply with this procedure. The CTO Manager is responsible for ensuring that all field sampling personnel involved in land surveying shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

5.2.3 The **Field Manager (FM)** is responsible for ensuring that all field personnel follow these procedures. In virtually all cases, subcontractors will conduct these procedures. The FM or designee is responsible for overseeing the activities of the subcontractor and ensuring that sampling points and topographic features are properly surveyed.

6.0 Equipment and Supplies

6.1 The following equipment list contains materials that may be needed in carrying out the procedures outlined in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- Personal protective equipment (PPE) and other safety equipment, as required by the HASP;
- Commercially available GPS unit; and,
- Field Logbook.

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7.0 Calibration or Standardization

7.1 An authorized manufacturer's representative shall inspect and calibrate survey instruments in accordance with the manufacturer's specifications regarding procedures and frequencies. At a minimum, instruments shall be calibrated no more than six months prior to the start of the survey work.

7.2 Standards for all survey work shall be in accordance with National Oceanic and Atmospheric Administration standards and, at a minimum, with accuracy standards set forth below. The horizontal accuracy for the location of all grid intersection and planimetric features shall be (±) 0.1 feet. The horizontal accuracy for boundary surveys shall be 1 in 10,000 feet (1:10,000). The vertical accuracy for ground surface elevations shall be (±) 0.1 feet. Benchmark elevation accuracy and elevation of other permanent features, including monitoring wellheads, shall be (±) 0.01 feet.

8.0 Procedure

8.1 Theodolite/Electronic Distance Measurement (EDM)

Follow the procedures listed below during theodolite/EDM land surveying conducted under the NAVFAC CLEAN Program:

- A land surveyor registered in the state or territory in which the work is being performed shall directly supervise all surveying work.
- Reference surveys to the local established coordinate systems and base all elevations and benchmarks established on U.S. Geological Survey datum, 1929 general adjustment.
- Reference surveyed points to Mean Sea Level (Lower Low Water Level).
- Jointly determine appropriate horizontal and vertical control points prior to the start of survey activities. If discrepancies in the survey (e.g., anomalous water level elevations) are observed, the surveyor may be required to verify the survey by comparison to a known survey mark. If necessary, a verification survey may be conducted by a qualified third party.
- All field notes, sketches, and drawings shall clearly identify the horizontal and vertical control points by number designation, description, coordinates, and elevations. Map all surveyed locations using a base map or other site mapping, as specified by the project Work Plan or SAP.
- Begin and end all surveys at the designated horizontal and vertical control points to determine the degree of accuracy of the surveys.
- Iron pins used to mark control points shall be made of reinforcement steel or an equivalent material and shall be 18 inches long with a minimum diameter of 5/8 inch. Drive pins to a depth of 18 inches into the soil.
- Stakes used to mark survey lines and points shall be made from 3-foot lengths of 2-inch by 2-inch lumber and pointed at one end. Clearly mark them with brightly colored weatherproof flagging and paint.
- Clearly mark the point on a monitoring well casing or well riser that is surveyed by filing grooves into the casing/riser on either side of the surveyed point, or by marking the riser with a permanent ink marker.

8.2 Global Positioning System (GPS) to Conduct Land Survey

Follow the procedures listed below during land surveying using GPS:

- A land surveyor registered in the state or territory in which the work is being performed shall directly supervise all surveying work.
- Reference surveys to the local established coordinate systems and base all elevations and benchmarks established on U.S. Geological Survey datum, 1929 general adjustment.

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- All field notes, sketches, and drawings shall clearly identify the horizontal and vertical control points by number designation, description, coordinates, and elevations. Map all surveyed locations using a base map or other site mapping, as specified in the project Work Plan or SAP.
- Begin and end all surveys at the designated horizontal and vertical control points (as applicable) to determine the degree of accuracy of the surveys.
- Iron pins used to mark control points shall be made of reinforcement steel or an equivalent material and shall be 18 inches long with a minimum diameter of 5/8 inch. Drive pins to a depth of 18 inches into the soil.
- Stakes used to mark survey lines and points shall be made from 3-foot lengths of 2-inch by 2-inch lumber and pointed at one end. Clearly mark them with brightly colored weatherproof flagging and paint.
- Clearly mark the point on a monitoring well casing that is surveyed by filing grooves into the casing on either side of the surveyed point.

8.3 Global Positioning System (GPS) to Position Sample Locations or Locate Site Features

Experienced field personnel may use a GPS system unit to position sample locations (e.g. grid positioned samples, soil boring locations) at a site. The decision to use field personnel or a licensed land surveyor will depend on the objectives of the survey (e.g. vertical elevation is not required) and the levels of precision required. Typically when a level of precision greater than (±) 3 to 5 meters is required, a licensed surveyor will be required. When a level of precision of (±) 3 to 5 meters is sufficient to meet project requirements (i.e. when laying sampling grids, identifying significant site features, or locating features identified in GIS figures) experienced field personnel may use commercially available, consumer-grade GPS units. Follow the procedures listed below to locate samples or site features using GPS:

- A commercially available GPS unit with Wide Angle Averaging System (WAAS), topographic map display, and waypoint storage capabilities should be used.
- If waypoints are to be imported into a GIS database, the same grid projection system should be used.
- If a permanent reference point near the site is available, it is recommended that a waypoint at this location be taken every day waypoints are stored.
- When laying out a sampling grid from a GIS map, upload the coordinates from GIS to the GPS unit, including coordinates for an easily identified, permanent, nearby feature (i.e. building corner, roadway intersection, or USGS benchmark).
- If during the initial site walk, the permanent feature identified does not overlay within (±) 5 meters as identified in the GPS unit, field corrections of the waypoints should be made.
- Field corrections can be made by adding/subtracting the difference in x,y coordinates between the field measurement of the permanent site feature and the anticipated x,y coordinates. This correction should then be applied to the x,y coordinates for each sampling location to be marked. Corrected x,y coordinates can then be uploaded into the GPS unit.
- Sampling points and site features can then be located in the field using the GPS units “Go To” function. When the distance to the sampling point or feature remains close to zero, the location can be marked.
- If no field corrections to the sampling location need to be made, or if sampling locations are to be surveyed by a licensed surveyor at a later date, no additional waypoints need to be taken. If significant changes to the sampling location are made, GPS coordinates at the corrected location shall be stored and labeled.

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- It is recommended that GPS coordinates be uploaded to a storage device such as PC at the end of each day.
- Field logs shall indicate manufacturer and model number for GPS unit used, map datum and projection used, and any field corrections made. If the GPS unit cannot lock onto a WAAS system at the site, this should also be noted.

9.0 Quality Control and Assurance

None.

10.0 Data and Records Management

The surveyor shall record field notes daily using generally accepted practices. The data shall be neat, legible, in indelible ink, and easily reproducible. Copies of the surveyor's field notes and calculation forms generated during the work shall be obtained and placed in the project files.

Surveyor's field notes shall, at a minimum, clearly indicate:

- The date of the survey;
- General weather conditions;
- The name of the surveying firm;
- The names and job titles of personnel performing the survey work;
- Equipment used, including serial numbers; and,
- Field book designations, including page numbers.

A land surveyor registered in the state or territory in which the work was done shall sign, seal, and certify the drawings and calculations submitted by the surveyor.

Dated records of land surveying equipment calibration shall be provided by the surveyor and placed in the project files. Equipment serial numbers shall be provided in the calibration records.

11.0 Attachments or References

Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual*. Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.

Author	*Reviewer*	*Revisions (Technical or Editorial)*
Robert Shoemaker Senior Scientist	Naomi Ouellette, Project Manager	Rev 0 – Initial Issue

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Monitoring Well Installation

Procedure 3-12

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the methods to be used during the installation of groundwater monitoring wells. It describes the components of monitoring well design and installation and sets forth the rationale for use of various well installation techniques in specific situations.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the Contract Task Order (CTO) Work Plan (WP) and/or direction from the **Site Safety Officer (SSO)**.

2.2 Before well installation commences, appropriate entities (e.g. DigSafe, local public works departments, company facilities) must be contacted to assure the anticipated well locations are marked for utilities, including electrical, telecommunications, water, sewer, and gas.

2.3 Physical Hazards Associated with Well Installation

- Stay clear of all moving equipment and avoid wearing loose fitting clothing.
- When using an approved retractable-blade knife, always cut away from one self and make sure there are no other people in the cutting path or the retractable-blade knife.
- To avoid slip/trip/fall conditions during drilling activities, keep the area clear of excess soil cuttings and groundwater. Use textured boots/boot cover bottoms in muddy areas.
- To avoid heat/cold stress as a result of exposure to extreme temperatures and personal protective equipment (PPE), drink electrolyte replacement fluids (1 to 2 cups per hour is recommended) and, in cases of extreme cold, wear fitted insulating clothing.
- To avoid hazards associated with subsurface utilities, ensure all sampling locations have been properly surveyed as described in SOP 3-01, Utility Clearance.
- Be aware of restricted mobility caused by PPE.

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3.0 Terms and Definitions

3.1 **Annulus:** The annulus is the down-hole space between the borehole wall and the well casing and screen.

3.2 **Bridge:** A bridge is an obstruction in the drill hole or annulus. A bridge is usually formed by caving of the wall of the well bore, by the intrusion of a large boulder, or by the placement of filter pack materials during well completion. Bridging can also occur in the formation during well development.

3.3 **Filter Pack:** Filter pack is sand or gravel that is smooth, uniform, clean, well-rounded, and siliceous. It is placed in the annulus of the well between the borehole wall and the well screen to prevent formation materials from entering the well and to stabilize the adjacent formation.

3.4 **Grout:** Grout is a fluid mixture of cement and water that can be forced through a tremie pipe and emplaced in the annular space between the borehole and casing to form an impermeable seal. Various additives, such as sand, bentonite, and polymers, may be included in the mixture to meet certain requirements.

3.5 **Heaving (Running) Sands:** Loose sands in a confined water-bearing zone or aquifer which tend to rise up into the drill stem when the confining unit is breached by the drill bit. Heaving sands occur when the water in the aquifer has a pressure head great enough to cause upward flow into the drill stem with enough velocity to overcome the weight of the sand.

3.6 **Sieve Analysis:** Sieve analysis is the evaluation of the particle-size distribution of a soil, sediment, or rock by measuring the percentage of the particles that will pass through standard sieves of various sizes.

4.0 Interferences

4.1 Heaving sands may be problematic in unconsolidated sands encountered below the water table.

4.2 Rotary drilling methods requiring bentonite-based drilling fluids should be used with caution to drill boreholes that will be used for monitoring well installation. The bentonite mud builds up on the borehole walls as a filter cake and permeates the adjacent formation, potentially reducing the permeability of the material adjacent to the well screen.

4.3 If water or other drilling fluids have been introduced into the boring during drilling or well installation, samples of these fluids should be obtained and analyzed for chemical constituents that may be of interest at the site. In addition, an attempt should be made to recover the quantity of fluid or water that was introduced, either by flushing the borehole prior to well installation and/or by overpumping the well during development.

4.4 Track-mounted drill rigs are suitable for travelling on many types of landscapes that truck-mounted units cannot access, but may have limitations on extremely uneven or soft terrain.

4.5 Care should be taken to prevent cross-contamination between well locations. All drilling equipment coming in contact with potentially contaminated soil and/or groundwater will be decontaminated by the drilling subcontractor prior to initial drilling activities and between drilling locations in accordance with SOP 3-06, Equipment Decontamination.

5.0 Training and Qualifications

5.1 **Qualifications and Training**

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

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5.2 **Responsibilities**

5.2.1 **Contract Task Order (CTO) Managers** are responsible for issuing sampling and analysis plans (SAPs) that reflect the procedures and specifications presented in this procedure. Individual municipalities, county agencies, and possibly state regulatory agencies enforce regulations that may include well construction and installation requirements. The **CTO Manager** shall be familiar with current local and state regulations, and ensure that these regulations are followed. The **CTO Manager** is responsible for ensuring that all personnel involved in monitoring well installation shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

5.2.3 The **Field Manager** is responsible for direct supervision of the installation of monitoring wells and ensuring that procedures and specifications are implemented in the field in accordance with the approved SAP and well installation permits. The qualifications for the **Field Manager** must be in accordance with local jurisdictions with authority over the operations conducted.

5.2.4 All field personnel are responsible for the implementation of this procedure.

5.2.5 The on-site hydrogeologist/engineer is expected to obtain a description of the lithologic samples obtained during the excavation and construction of a monitoring well. These data are often required to provide guidance regarding the installation of specific components of the monitoring well. Guidance for lithologic sample collection and sample description is contained within SOP 3-16, Soil and Rock Classification.

6.0 Equipment and Supplies

6.1 Materials provided by the drilling contractor may include:

- Drill rig, drill rods, hollow stem augers, etc.
- Decontamination equipment (e.g., steam cleaner, high-pressure washer, brushes, etc.)
- Decontamination pad materials
- Well screen/riser pipe with flush-threaded couplings including riser and bottom caps
- Clean, filter sand
- Bentonite chips or pellets
- Cement grout and tremie pipe
- Portland cement for well pad completion
- Steel protective riser covers and locking caps
- Weighted calibrated tape
- Split-spoon samplers
- 55-gallon drums or containers for drill cuttings, decontamination fluids, etc.

6.2 In addition to those materials provided by the drilling contractor, equipment and materials required by the project geologist/engineer may include, but is not limited to, the following:

- Photoionization Detector (PID)
- Spill kit, including at a minimum sorbent pads and shovel (if not provided by subcontractor)

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- Plastic sheeting
- Teaspoon or spatula
- Resealable plastic bags
- Boring Log Records
- Decontamination materials (per SOP No. 3-06 - Equipment Decontamination)
- Weighted measuring tape for depth measurement
- Soil logging materials (e.g. USCS classification field card, millimeter rule, hand lens, etc.)
- Survey lathes or pin flags
- Digital camera
- PPE as required by the HASP
- Planning documents including the site-specific HASP and SAP
- Large indelible ink or paint pen
- Field logbook/field forms/site maps (water proof)

7.0 Procedure

7.1 General Procedures

- Specific drilling, sampling, and installation equipment and methodology will be dictated by the type of well to be installed (e.g., single case (Type II), double case (Type III), bedrock, etc.), geologic characteristics of the site, the type of contaminants being monitored, and local and state regulations.
- For access to locations when travelling over difficult terrain, an appropriate line should be chosen before mobilizing the drill rig or other support vehicles. If clearing of trees or ground cover is required, perform these activities in advance to avoid down time. Avoid wet or soft areas where possible or use ground mats and/or timbers to aid in supporting the rig as it travels. If drilling on soft material, place geomatting and ground mats under the rig tracks or stabilizers prior to drilling.
- A utility locate must be conducted to identify all underground utilities at the site prior to drilling (refer to SOP 3-01, Utility Clearance*)*. Proper clearance procedures for aboveground/overhead utilities must also be followed as specified in the HASP.
- Although new well materials (well screen and riser pipe) generally arrive at the site boxed and sealed within plastic bags, it is sometimes necessary to decontaminate the materials prior to their use. Well materials should be inspected by the project geologist/engineer upon delivery to check for cleanliness. If the well materials appear dirty, or if local or regional regulatory guidance requires decontamination, then well material decontamination should be performed by the drilling subcontractor in accordance with SOP 3-06, Equipment Decontamination.
- The diameter of the borehole must be a minimum of 2 inches greater than the outside diameter of the well screen or riser pipe used to construct the well. This is necessary so that sufficient annular space is available to install filter packs, bentonite seals, and grout seals, and allow the passage of tremie pipe where grouting at depth is required. Bedrock wells may require reaming after coring in order to provide a large enough borehole diameter for well installation.
- When soil sampling is required (refer to the SAP), soil samples will be collected for visual logging by advancing split-spoon samplers through the augers. The soil will be visually logged by a field geologist and include lithologic characteristics (i.e., soil type, color, density, moisture content, etc.) using the the

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methods described in SOP 3-16, Soil and Rock Classification. This information will be recorded on a boring/well log form, along with well construction details.

7.2 Drilling Techniques

Drilling of monitoring well boreholes may be accomplished by a variety of methods as described below. Preferred methods include those that temporarily case the borehole during drilling (i.e., hollow stem auger and sonic methods) using an override system. Other methods can be used where specific subsurface conditions or well design criteria dictate.

- Hollow stem auger (HSA) – Borings are advanced by rotating steel hollow stem augers with an attached cutting head. Soil cuttings are displaced by the cutting head and transported to the surface via continuous spiral flights attached to each auger stem. This method is widely used for unconsolidated soils that have a tendency to collapse within the boring. A bottom plug can be placed in the bottom auger to prevent soils from entering and clogging the auger, especially in the case of heaving sands. However, a bottom plug cannot be used when soil samples are to be collected through the augers. Soil plugs that accumulate in the bottom of the auger must be removed or knocked out prior to sampling or well installation.
- Solid stem auger – This type of drilling method is similar to HSA drilling using a solid stem or sealed hollow stem auger flights to advance the boring. Solid stem, continuous flight auger use is limited to semi-consolidated sediments or to cohesive or semi-cohesive unconsolidated sediments that don't have a tendency to collapse when disturbed.
- Sonic methods – Sonic drilling consists of advancing concentric hollow drill casings (inner and outer) using rotation in conjunction with axial vibration of the drill casing. Once the casings are advanced to the appropriate depth, the inner string is removed with a core of drill cuttings while the outer casing remains in place to keep the borehole open. Cuttings are removed from the inner casing relatively intact for logging or sampling purposes. This drilling method is used for a variety of soil types, from heaving sands to consolidated or indurated formations. Smearing of the formation along the borehole walls is minimal since moderate vibration and rotation techniques are used to advance the casings. Since the total borehole diameter in sonic drilling is only incrementally larger than the inner casing diameter, care should be taken during installation of the monitoring well to ensure the well is centered and adequate space is available for annular materials.
- Rotary methods (water or mud) – Rotary drilling methods consist of drill rods coupled to a drill bit that rotates and cuts through the soils to advance the borehole. Water or drilling fluid ("mud") is forced through the hollow drill rods and drill bit as the rods are rotated. The soil cuttings are forced up the borehole with the drilling fluids to the surface and the fluids recirculated. The drilling fluid provides a hydrostatic pressure that reduces or prevents the borehole from collapsing. Clean, potable water must be used for water-rotary drilling to prevent introducing trace contaminants. A sample of the potable water should be collected during the course of well installation for analysis of the same parameters defined for the groundwater samples. If mud-rotary is used to advance boreholes, potable water and bentonite drilling mud should only be used. No chemical additives shall be mixed in the drilling fluid to alter viscosity or lubricating properties. Adequate well development is essential for removal of drilling mud and fluids from the formation materials and ensure collection of representative groundwater samples.
- Rotary methods (Air) – Air rotary methods are similar to water rotary but use high air velocities in place of drilling fluids to rotate the drill bit and carry the soil cuttings up the borehole to the surface. Care must be taken to ensure that contaminants are not introduced into the air stream from compressor oils, etc. Most compressor systems are compatible with a coalescing filter system. Cuttings exiting the borehole under pressure must be controlled, especially when drilling in a zone of potential contamination. This can be accomplished by using an air diverter with hose or pipe to carry the cuttings to a waste container. Letting the cuttings blow uncontrolled from the borehole is not acceptable.

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7.3 Well Construction and Installation

- If rotary drilling techniques are used, the borehole should be flushed or blown free of material prior to well installation. If hollow stem augers are used, the soil or bottom plug should be removed and the augers raised approximately six inches above the bottom of the borehole, while slowly rotating the augers to remove cuttings from the bottom of the boring. The depth of the borehole should be confirmed with a weighted, calibrated tape.
- The riser pipe and screen should be connected with flush-threaded joints and assembled wearing clean, disposable gloves. No solvent or anti-seize compound should be used on the connections. The full length of the slotted portion of the well screen and unslotted riser pipe should be measured and these measurements recorded on a well construction form (Attachment 1).
- If placed in an open borehole, the assembled well should be carefully lowered and centered in the borehole so that the well is true, straight, and vertical throughout. Centering can also be accomplished with the use of centralizers, if necessary. However, centralizers should be placed so that they do not inhibit the installation of filter sand, bentonite seal, and annular grout. Wells less than 50 deep generally do not require centralizers.
- If hollow stem augers are used, the well should be lowered through the augers and each auger flight removed incrementally as the filter sand, bentonite seal, and grout are tremmied or poured into the annular space of the well. The well should be temporarily capped before filter sand and other annular materials are installed.
- Clean, silica sand should be placed around the well screen to at least 1 foot above the top of the screen. The filter sand should be appropriately graded and compatible with the selected screen size and surrounding formation materials. In general, the filter pack should not extend more than 3 feet above the top of the screen to limit the thickness of the monitoring zone. As the filter pack is placed, a weighted tape should be lowered in the annular space to verify the depth to the top of the layer. This measurement will be recorded on the well construction form (Attachment 1). If necessary, to eliminate possible bridging or creation of voids, placement of the sand pack may require the use of a tremie pipe. Tremie pipe sandpack installations are generally suggested for deeper wells and for wells which are screened some distance beneath the water table.
- A minimum 2-foot thick layer of bentonite pellets or slurry seal will be installed immediately above the filter sand to prevent vertical flow within the boring from affecting the screened interval. Bentonite chips/pellets must be hydrated if place above the water table prior to grouting. If bridging is of concern as in the case of deep wells, powdered bentonite may be mixed with water into a very thick slurry and a tremie pipe used to place the seal to the desired depth. Placement of the bentonite seal in the borehole will be recorded on the well construction form (Attachment 1).
- The remaining annular space around the well will be grouted from the top of the bentonite seal to the surface with a grout composed of neat cement, a bentonite cement mixture, or high solids sodium bentonite grout.
- Each well riser will be secured with an expandable, locking cap (vented if possible). Optionally, a hole can be drilled in the upper portion of the riser to allow venting of the well.
- The well will be completed within a concrete well pad consisting of a Portland cement/sand mixture. Well pads are generally 3 feet by 3 feet square but may be larger or smaller depending on site conditions and state-specific well construction standards. Round concrete well pads are also acceptable. A minimum of 1 inch of the finished pad should be below grade to prevent washing and undermining by soil erosion.
- If completed as a flush-mount well, the well riser will be cut off approximately 4 to 6 inches below ground surface and an expandable, locking cap placed on the well riser. The area around the riser is dug out and a steel well vault or manhole cover placed over the riser and set almost flush to the ground

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to protect the well. The manhole cover should be water-tight and secured with bolts to prevent casual access. The well pad will then be constructed around the well vault and slightly mounded at the center and sloping away to prevent surface water from accumulating in the well vault.

- If completed as a stick-up well, the well riser is cut approximately 2.5 to 3 feet above the ground surface and an expandable, locking cap placed on the well riser. A steel guard pipe with hinged, locking cap is placed over the well riser as a protective casing. The bottom of the guard pipe will be set approximately 2 feet below ground surface and sealed by pouring concrete from the top of the annular grout around the pipe to grade. The concrete well pad should be completed at the same time. Weep holes will be drilled in the base of the guard pipe to facilitate draining of rainwater or purge water from inside the guard pipe.
- Bumper posts or bollards may be necessary for additional well protection, especially in high traffic areas. The bumper posts should be placed around the well pad in a configuration that provides maximum protection to the well and extend a minimum of 3 feet above the ground.

7.4 Double Cased Wells

Under certain site conditions, the use of a double-cased or telescoping (Type III) well may be necessary. Installation of double-cased wells may be required to prevent the interconnection of two separate aquifers, seal off a perched aquifer without creating a vertical hydraulic conduit, prevent cross-contamination during construction of wells in deeper aquifers hydro-stratigraphically below impacted aquifers, or case off highly impacted soils present above the aquifer to prevent potential “dragging down” of contaminants.

Similar to conventional wells, construction of double-cased wells can be accomplished using a varety of drilling methods. Well construction is initiated by “keying” a large diameter, outer casing into a stratigraphic zone of low permeability (clay layer or bedrock). The size of the outer casing should be a minimum of 2 inches greater than the outside diameter of the inner casing to allow installation of annular seal materials during well completion. A pilot borehole should be drilled through the overburden soil and/or contaminated zone into a clay confining layer or bedrock. The borehole for the outer casing should be of sufficient size to contain the outer casing with a minimum of 2 inches around the outside diameter to allow sufficient annular space for tremie or pressure grouting. The boring should extend a minimum of 2 feet into a clay layer and a minimum of 1 foot into bedrock, if possible, to ensure an adequate seal. The boring should never breach a confining layer or keyed zone under any circumstances.

Once the boring is completed, the outer casing can be set in the borehole and sealed with grout. The outer casing can be set two ways, with or without a bottom cap. If no bottom cap is applied, the casing is usually driven approximately 6 inches into the clay confining unit. A grout plug is generally placed in the bottom of the casing and once set, standing water in the casing is evacuated prior to drilling below the casing. As an alternative, a cap can be placed on the bottom of the casing and if set below the water table, the casing can be filled with clean, potable water to hold down the casing in the boring. Grouting should be conducted using tremie-grouting or pressure-grouting methods by pumping grout into the annular space between the outer casing and the borehole wall from the bottom of the casing to the ground surface. Grout around the casing should be allowed to cure at least 24 hours before attempting to drill through the bottom.

Once the grout is cured, a smaller diameter drill pipe/bit is used to bore through the grout plug or bottom cap to the desired well depth. The well is then constructed as described in Section 7.3 above.

7.5 Post Installation Procedures

- Wells should be permanently labelled or marked for identification. Well tags can be used to record the site name, well number, total depth, installation date, etc. At a minimum, the well number will be written in indelible marker or paint on both the outside of the protective casing and inside beneath the casing lid, as well as on the riser pipe.

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- A measuring point will be marked on the top of the riser pipe for taking water level measurements. The measuring point can be notched using a knife or saw or can be marked with a waterproof marker or paint. The measuring point will also be the point which will be surveyed for vertical elevation data.
- Upon completion, the following measurements will be taken by the field geologist/engineer and recorded on the well construction diagram.
    - Depth to static water level
    - Depth of non-aqueous phase liquid (NAPL), if present
    - Total depth of well measured from top of casing (TOC)
    - Height of well casing above ground surface
    - Height of protective casing above ground surface
- All monitoring wells will be surveyed for horizontal and vertical control by a licensed surveyor.
- Investigation-derived waste (IDW) including drill cuttings, spent materials (e.g., PPE), and decontamination water should be properly managed in accordance with SOP 3-05, IDW Management.

8.0 Quality Control and Assurance

8.1 Field personnel will follow specific quality assurance (QA) guidelines as outlined in the SAP. Certain quality control (QC) measures should be taken to ensure proper well installation and construction in accordance with this SOP, project specific SAP, and applicable well standards.

8.2 The borehole will be checked for total open depth, and extended by further drilling or shortened by backfilling, as required before installation of the well materials.

8.3 Water level and NAPL presence will be checked during well installation to ensure that the positions of well screen, filter sand, and seals relative to water level conform to project requirements

8.4 The depth to top of each layer of annular materials (i.e., filter sand, bentonite, grout) will be verified and adjusted as necessary for proper placement.

9.0 Records, Data Analysis, Calculations

All field information will be recorded in the field logbook and/or standardized field forms by field personnel. Field data recorded will include drilling contractor information, drilling methods, well material and construction information provided on the boring logs and well construction forms, observations or problems encountered during drilling, fluid level data, and any deviations from the procedures in this SOP and other project plans. Well Construction Forms (Attachment 1) will provide visual and descriptive information the monitoring well and are often the most critical form of documentation generated during the installation of a monitoring well. The field logbook is kept as a general log of activities and should not be used in place of the boring log.

10.0 Attachments or References

10.1 Attachment 1 – Monitoring Well Construction Form

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10.2 Environmental Protection Agency, United States (EPA). 1987. *A Compendium of Superfund Field Operations Methods*. Office of Solid Waste and Emergency Response. EPA/540/P-87/001.

10.3 EPA. 1990. *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells*. EPA/600/4-89/034. Office of Research and Development, Washington. March.

10.4 EPA. 1992. *RCRA Groundwater Monitoring Draft Technical Guidance*. EPA/530/R-93/001. Office of Solid Waste. November.

10.5 EPA, 2008. SESD Operating Procedure SESDGUID-101-R0: *Design and Installation of Monitoring Wells*. USEPA, Science and Ecosystem Support Division (SESD), Athens, Georgia. Effective Date February 18, 2008.

10.6 U.S. Army Corps of Engineers. 2008. Manual No. EM 385-1-1. *Safety and Health Requirements*. 15 November 2008. http://140.194.76.129/publications/eng-manuals/em385-1-1/2008_English/toc.html.

10.7 SOP 3-01, *Utility Clearance*.

10.8 SOP 3-05, *IDW Management*

10.9 SOP 3-06, *Equipment Decontamination*.

10.10 SOP 3-16, *Soil and Rock Classification.*

Author	*Reviewer*	*Revisions (Technical or Editorial)*
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)

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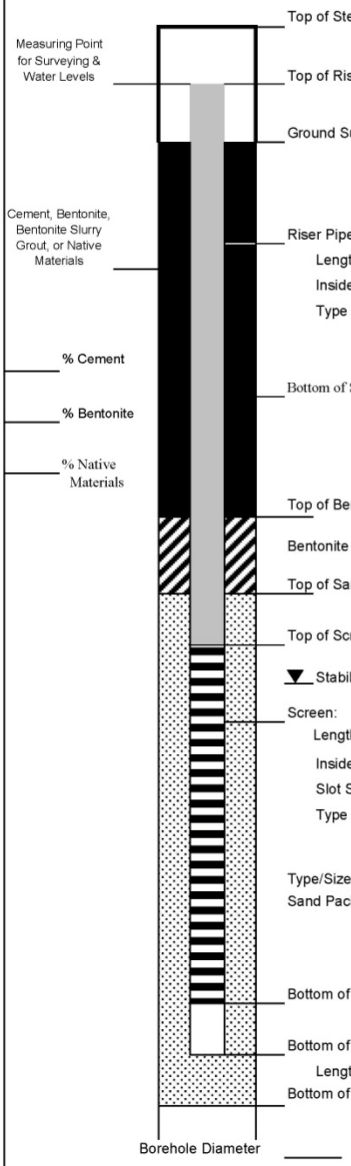
Attachment 1
Monitoring Well Construction Form

RESOLUTION CONSULTANTS	*Client:*	***WELL ID:***
	Project Number:	
	Site Location:	*Date installed:*
	Well Location: *Coords:*	*Inspector:*
	Method:	*Contractor:*

MONITORING WELL CONSTRUCTION DETAIL



	Depth from G.S. (feet)	Elevation(feet) Datum _____
Top of Steel Guard Pipe		
Measuring Point for Surveying & Water Levels — Top of Riser Pipe		
Ground Surface (G.S.)	0.0	
Cement, Bentonite, Bentonite Slurry Grout, or Native Materials — Riser Pipe:		
Length _____		
Inside Diameter (ID) _____		
Type of Material _____		
_____ % Cement		
Bottom of Steel Guard Pipe		
_____ % Bentonite		
_____ % Native Materials		
Top of Bentonite		
Bentonite Seal Thickness _____		
Top of Sand		
Top of Screen		
▼ Stabilized Water Level		
Screen:		
Length _____		
Inside Diameter (ID) _____		
Slot Size _____		
Type of Material _____		
Type/Size of sand _____		
Sand Pack Thickness _____		
Bottom of Screen		
Bottom of Tail Pipe:		
Length _____		
Bottom of Borehole		

Borehole Diameter _____ Approved:

Describe Measuring Point:

_____ Signature _____ Date

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Monitoring Well Development

Procedure 3-13

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the procedures used for developing newly installed monitoring wells and/or redeveloping existing wells.

1.2 The purpose of well development is to remove interferences from a well to provide better connection between the well and the formation, to improve pumping performance of the well, and to be able to collect more representative information from the well (e.g., samples, test results, etc.). Proper well development will:

- Remove drilling residuals (e.g., water, mud) from the borehole and surrounding formations;
- Improve or restore hydraulic conductivity of the surrounding formations which may have been disturbed during the drilling process;
- Remove residual fines from the well screen and sand pack (filter pack) materials, thus reducing turbidity of groundwater and permitting the collection of more representative groundwater samples.

1.3 There may be circumstances where well development is not desirable, for example, in the presence of non-aqueous phase liquids (NAPL) or other significant contamination if development could worsen the contaminant impact. If NAPL begins to intrude during development, the development process will be halted. This situation will be considered a cause for sample modification requiring approval by the CTO Manager and other stakeholders, as applicable.

1.4 The applicable well development procedures for a particular site may be subject to State or local regulatory requirements. In all cases, the project team should consult their local regulatory requirements and document the selected well development procedure in the project-specific Sampling and Analysis Plan (SAP). For project-specific information refer to the SAP, which takes precedence over these procedures.

1.5 This procedure is the Program-approved professional guidance for work performed by Resolution Consultants under the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract (Contract Number N62470-11-D-8013).

1.6 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the Contract Task Order (CTO) SAP and/or direction from the Site Safety Officer (SSO).

2.2 Monitoring well development may involve chemical hazards associated with potential contaminants in the soil or aquifer being characterized and may involve physical hazards associated with use of well development equipment.

3.0 Terms and Definitions

None.

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4.0 Interferences

4.1 Equipment/materials used for development may react with the groundwater during development. Appropriate development equipment has been selected for the anticipated condition of the groundwater.

4.2 Appropriate development methods such as using a surge-block to flush suspended fines in the groundwater in and out of the well screen can improve the yield of wells and improve their potential to be developed successfully. However, the effectiveness of development can be significantly reduced in wells that do not yield sufficient water to allow this flushing to take place.

4.3 For formations with a significant content of fine-grained materials (silts and clays), or wells with improperly sized screens, it may not be possible to reduce turbidity to commonly acceptable levels. Possible solutions may include collecting a sample even if excessively turbid, or installing a replacement well.

4.4 Development itself disturbs the surrounding formation and disrupts equilibrium conditions within the well. Groundwater samples will not be collected until a minimum of 24 hours after a well is developed to allow conditions to stabilize. For sites with fine-grained formations (silts and clays) and highly sorptive contamination, a longer time period between development and sampling should be considered.

5.0 Training and Qualifications

5.1 Qualifications and Training

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 Responsibilities

5.2.1 The **CTO Manager** is responsible for ensuring that well development activities comply with this procedure. The **CTO Manager** is responsible for ensuring that all personnel involved in well development shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

5.2.3 The **Field Manager** is responsible for ensuring that all well development activities are conducted according to the either this procedure or the applicable procedure presented in the project-specific SAP.

5.2.4 **Field sampling personnel** are responsible for the implementation of this procedure.

5.2.5 The field sampler and/or task manager is responsible for directly supervising the well development procedures to ensure that they are conducted according to this procedure and for recording all pertinent data collected during sampling.

6.0 Equipment and Supplies

6.1 This equipment list was developed to aid in field organization and should be used in planning and preparation. Depending on the site-specific requirements and the development method selected, additional or alternative material and equipment may be necessary. In addition, for sites where groundwater is expected to be contaminated, the materials to be placed down the well and in contact with groundwater should be evaluated so that they are compatible with the chemical conditions expected in the well.

6.2 Equipment and materials used for well development may include, but is not limited to:

Well development equipment

- Surge block

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- Disposable Teflon bailers, appropriate to the diameter of the well(s): 1-inch to 1.5-inch for 2-inch inside diameter (ID) monitoring wells.
- Watterra® footvalve
- Electric submersible pump
- 12-volt power source for electric pump
- High density polyethylene (HDPE) tubing appropriately sized for Watterra® footvalve and/or electric submersible pump
- Drums or containers for storage of purge water
- Nephelometer to measure turbidity
- Multi-parameter water quality meter(s) to measure temperature, pH, conductivity, dissolved oxygen (DO), oxidation reduction potential (ORP)
- Instrument calibration solutions
- Water level meter
- Oil/water interface probe

General equipment

- Project-specific plans including the site-specific HASP and SAP
- Field notebook/field forms/site maps
- Indelible markers/pens
- 5-gallon buckets

Equipment decontamination supplies (refer to SOP 3-06, Equipment Decontamination)

- Health and safety supplies, including personal protective equipment (PPE)
- Appropriate hand tools
- Keys or combinations to access monitoring wells
- Distilled/deionized water supply
- Disposable bailer string (polypropylene)
- Plastic trash bags

7.0 Procedure

Development generally consists of removing water and entrained sediment from the well until the water is clear (to the extent feasible) and the turbidity is reduced, which indicates the well is in good hydraulic connection with the surrounding formation. In addition to simply removing water, development can be improved when flushing through the well screen and gravel pack takes place in both directions, that is, both into the well and into the formation. This action breaks down sediment bridges that can occur in the formation or sand pack, which reduce the connection between the well and the formation

7.1 General Preparation

- All down-well equipment should be decontaminated prior to use and between well locations in accordance with SOP 3-06, Equipment Decontamination
- Although equipment is decontaminated between well locations, if wells are known or suspected to be contaminated based on observations during well installation, it is recommended that well development be conducted in order from the least contaminated to the most contaminated well to minimize the chances of cross-contamination.
- Management of investigation-derived waste (IDW), including development purge water and miscellaneous expendable materials generated during the development process, will be conducted in accordance with SOP 3-05, IDW Management.

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- Prior to accessing the well, the wellhead should be cleared of debris and/or standing water. Nothing from the ground surface should be allowed to enter the well.
- The depth to water and total well depth should be measured with a water level meter and recorded in the field logbook or on a Well Development Record (Attachment 1). This information will be used to calculate the volume of standing water (i.e., the well volume) within the well, and plan the specific details of the well development. If wells are suspected to contain NAPL, an oil/water interface probe should be used to measure liquid levels and depth to bottom of the well.
- Permanent monitoring wells will be developed no sooner than 24 hours after well installation is completed in order to allow well completion materials to set properly.

7.2 Monitoring Well Development Procedures

Generally, development will begin by gently surging the well with a surge block or bailer as described in Sections 7.2.1 and 7.2.2, respectively. Surging can become more vigorous as development progresses but initially the well must be gently surged to allow material blocking the screen to become suspended without damaging the well. Next, a bailer can be used to remove the sediment settled at the base of the well. A bailer, Watterra® pump, or electric submersible pump will then be used to purge the well, per Sections 7.2.2, 7.2.3, or 7.2.4, respectively. The well will be purged until the removed water becomes less turbid or per the requirements of the project-specific SAP, or State or local requirements. At this point the well will be surged again with a surge block or bailer. The well can be surged more vigorously at this point. After surging, the well will be purged again until the turbidity once again decreases. The surge/purge cycle should be completed at least three times during the development process. After the last surge, the well will be purged until the development completion criteria outlined in 7.3.2 or per the project-specific SAP are met.

7.2.1 Surge Block

The default method of well development is the use of a surge block in conjunction with pumping or bailing to remove sediment-laden water.

- The construction of the surge block must be appropriate for the diameter of the well. The surge block must be mounted on rods or other stiff materials to extend it to the appropriate depths and to allow for the surge block to be moved up and down in the well.
- Insert the surge block into the well and lower it slowly to the screened or open interval below the static water level. Start the surge action by slowly and gently moving the surge block up and down in the well. A slow initial surging, using plunger strokes of approximately 1 meter or 3 feet, will allow material which is blocking the screen to separate and become suspended.
- After 5 to 10 plunger strokes, remove water from the well using a separate bailer (Section 7.2.2) or pumping techniques (Sections 7.2.3 or 7.2.4). The returned water should be heavily laden with suspended fines. The water will be discharged to 5-gallon buckets or 55-gallon drums to be managed per the requirements presented in the project-specific SAP.
- In some cases, the bailer or Watterra® foot valve can act as a surge block, flushing water in and out of the well screen as groundwater is removed.
- Repeat the process of surging and pumping/bailing. As development continues, slowly increase the depth of surging to the bottom of the well screen. Surging within the riser portion of the well is neither necessary nor effective.

7.2.2 Bailer

- Tie a string or other cable securely to the bailer. Lower it to the screened or open interval of the monitoring well below the static water level.
- The bailer may be raised and lowered repeatedly within the screened interval to attempt to simulate the action of a surge block by pulling fines through the well screen, and pushing water out into the formation to break down bridging.

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- With the bailer full of water, remove it from the well and discharge the water into 5-gallon buckets or 55-gallon drums to be managed per the requirements presented in the project-specific SAP.
- The Watterra® system (Section 7.2.3) or electric submersible pump (Section 7.2.4) may be used as a complementary development method to the bailer, especially when removal of additional water at a faster rate is beneficial.
- Continue alternately surging and bailing, monitoring the purge water periodically (Section 7.3.1) until development completion criteria are met (Section 7.3.2).

7.2.3 Watterra® system

- Attach high-density polyethylene (HDPE) tubing to the decontaminated Watterra® pump foot valve
- Lower the foot valve and tubing assembly near the bottom of the well.
- Lift and lower the tubing to allow water to enter the Watterra® foot valve and travel up the tubing and discharge the water into 5-gallon buckets or 55-gallon drums to be managed per the requirements presented in the project-specific SAP.
- The lifting and lowering action of the Watterra® sysem will cause some surging action to aid in breaking up fine material in the surrounding formation.
- A bailer (Section 7.2.2) may be used as a complementary development method to the Watterra® system, especially during the initial stages of development when a high volume of sediment may be required to be removed.
- An electric submersible pump (Section 7.2.4) may also be used as a complementary development method to the Watterra® system, especially when more volume of water is desired to be pumped or the turbidity criteria cannot be met due to the surging action of the Watterra® system.
- Continue alternately surging and pumping, monitoring the purge water periodically (Section 7.3.1) until well development completion criteria are met (Section 7.3.2).

7.2.4 Electric Submersible Pump

- Attach HDPE tubing to the decontaminated electric submersible pump.
- Lower the pump and tubing assembly near the bottom of the well, at least a few inches above the well total depth.
- Begin pumping, discharging the water into 5-gallon buckets or 55-gallon drums to be managed per the requirements presented in the project-specific SAP.
- Continue alternately surging and pumping, monitoring the purge water discharge periodically (Section 7.3.1) until well development completion criteria are met (Section 7.3.2).

7.3 Discharge Monitoring

7.3.1 Monitoring the Progress of Development

The progress of the development is evaluated through visual observation of the suspended sediment load and measurement of the turbidity and other parameters in the purged diischarge water. As development progresses, the water should become clearer, measured turbidity should decrease, and specific capacity (pumping rate divided by drawdown) should stabilize. Water quality parameters, including DO, conductivity, ORP, pH, temperature, and turbidity may be measured and recorded periodically to determine the progress of development using the criteria outlined in Section 7.3.2 or per the project-specific SAP. Water quality parameters should be measured on each well volume removed.

7.3.2 Completion of Development

The well will be considered developed when the following criteria are met or per the criteria set forth in the project-specific SAP:

- A minimum of three times the standing water volume in a well (to include the well screen and casing plus saturated annulus, assuming 30 percent porosity) is removed.

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- Groundwater parameters for three consecutive standing water volumes are within the following:
    - pH – within ± 0.2 units
    - Specific conductivity – within ± 3%
    - ORP – within ± 10 mV
    - Temperature – within ±1 degree Celsius
    - Turbidity – at or below 10 nephelometric turbidity units (NTU) or within ± 10% if above 10 NTU.
- The sediment thickness remaining within the well is less than 1 percent of the screen length or less than 30 millimeters (0.1 ft) for screens equal to or less than 10 feet long.

Dissolved oxygen (DO) readings may be recorded but DO readings will not be used as development completion criteria because DO may not stabilize.

If the well has slow groundwater recharge and is purged dry, the well will be considered developed when bailed or pumped dry three times in succession and the turbidity has decreased, or per the requirements set forth in the project-specific SAP. Water quality parameters may be recorded if feasible using the flow-through cell.

If any water is added to the well's borehole during development or drilling, three times the volume of water added will also be removed during well development, or per the requirements set forth in the project-specific SAP.

7.4 Development of Wells with Low Yield

Water is the primary mechanism to remove fines and flush water through the gravel pack for effective development. Therefore, development can be a challenge in wells that do not yield sufficient water to recharge when water is removed. However, often these wells are the most in need of development to improve their performance as they are typically installed in low permeability formations with a high content of fines. Development of these wells can improve their yield.

The surging portion of the development can be successfully performed in a well with standing water regardless of its yield. It is the subsequent removal of fine materials that is hindered when insufficient water is recharged to the well. When wells go dry or drawdown significantly during development, development can be performed intermittently, allowing sufficient water to recharge prior conducting the next stage of surging. These intermittent procedures can take place hours or even days apart, depending on project-specific time constraints.

7.5 Wells containing NAPL

Additional care should be taken when planning development of wells that contain NAPL. If the NAPL is flammable, there are health and safety as well as handling issues to consider. If NAPL in excess of a persistent sheen is noted, the recharge rate will be evaluated through hand bailing. In most cases, it is generally preferable to remove NAPL by bailing to the extent practical prior to performing development. Groundwater parameters, excluding turbidity, will not be collected during well development if NAPL or excessive sheen is noticed in the purged water during development to ensure the meter probes are not fouled or destroyed. Well development will be halted.

Development by surging or pumping the well dry can result in the spreading of NAPL vertically in the soil column around the well. These methods can be used, if information exists describing the vertical thickness of the NAPL smear zone around the well, and if the methods do not result in mounding or drawdown that exceeds this thickness. Alternate methods such as bailing may also be used, but any method should not allow the well to be pumped dry or result in significant drawdown that would spread the NAPL vertically.

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7.6 Temporary Well Points

For certain projects, temporary well points (TWPs) may be installed to collect groundwater samples at a site. Since no sand pack, bentonite chips, or bentonite grout are generally used in the construction of the TWPs, development can proceed as soon as sufficient water has entered the well to static conditions. Due to the small diameter of these wells, generally ¾-inch to 1-inch ID, development will be performed using either a small diameter (0.5-inch) bailer and/or a peristaltic pump with dedicated tubing. The TWPs will have minimal water column and may purge dry during development. However, attempts will be made to remove fines from the well prior to sampling. Purging and sampling may occur as soon as approximately 80% of the static water has re-entered the TWP, or per the requirements set forth in the project-specific SAP.

8.0 Quality Control and Assurance

8.1 Field personnel will follow specific quality assurance (QA) guidelines as outlined in the project-specific SAP.

8.2 Quality control (QC) requirements are dependent on project-specific sampling objectives. The project-specific SAP will provide requirements for equipment decontamination (frequency and materials) and IDW handling.

9.0 Records, Data Analysis, Calculations

9.1 All data and information (e.g., development method used) must be documented on field data sheets (Attachment 1) or within site logbooks with permanent ink. Data recorded may include the following:

- Well Location
- Weather conditions
- Date and Time
- Purge Method
- Reading/measurements obtained

10.0 Attachments or References

Attachment 1 – Well Development Record

SOP 3-05, *IDW Management*.

SOP 3-06, *Equipment Decontamination*.

Author	*Reviewer*	*Revisions (Technical or Editorial)*
Shawn Dolan Senior Scientist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (June 2012)

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Attachment 1
Well Development Record

Well/Piezometer Development Record

Well ID:

Client: _____

Project No: _____ Date: _____ Developer: _____

Site Location: _____

Well/Piezometer Data

Well ☐ Piezometer ☐ Diameter _____ Material _____

Measuring Point Description _____

Depth to Top of Screen (ft.) _____

Depth to Bottom of Screen (ft.) _____

Total Well Depth (ft.) _____

Depth to Static Water Level (ft.) _____

Geology at Screen Interval (if known) _____

Time of Water Level Measurement _____

Calculate Purge Volume (gal.) _____

Disposal Method _____

Headspace _____

Original Well Development ☐ Redevelopment ☐ Date of Original Development _____

DEVELOPMENT METHOD _____

PURGE METHOD _____

Time	Total Volume Purged (gal.)	Flow Rate (gpm)	Turbidity (NTU)	Color	pH	Temp	Other

ACCEPTANCE CRITERIA (from workplan)

Minimum Purge Volume Required _____ gallons
Maximum Turbidity Allowed _____ NTUs
Stabilization of parameters _____%

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Has parameters stabilized	☐	☐	☐

If no or N/A explain below:

_____

Signature _____ Date: _____

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Monitoring Well Abandonment

Procedure 3-15

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the methods used for the abandonment of groundwater monitoring wells and peizometers.

1.2 This procedure is the Program-approved professional guidance for work performed by Resolution Consultants under the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract (Contract Number N62470-11-D-8013).

1.3 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the Contract Task Order (CTO) Work Plan (WP) and/or direction from the Site Safety Officer (SSO).

2.2 Physical hazards associated with well installation include:

- To avoid lifting injuries associated with well abandonment practices, use the large muscles of the legs, not the back. The drilling contractor should use the drill rig wenching cables and appropriate heavy equipment to minimize manual lifting.
- Stay clear of all moving equipment and avoid wearing loose fitting clothing.
- When using an approved retractable-blade knife, cut away from one self.
- To avoid slip/trip/fall conditions during site activities, keep the area clear of excess soil cuttings and formation groundwater and use textured boots/boot cover bottoms in muddy areas.
- To avoid heat/cold stress because of exposure to extreme temperatures and PPE, drink electrolyte replacement fluids (1 - 2 cups per hour is recommended) and, in cases of extreme cold, wear fitted insulating clothing.
- Be aware of restricted mobility caused by PPE.

3.0 Terms and Definitions

3.1 **Annulus:** The annulus is the down-hole space between the borehole wall and the well casing and screen.

3.2 **Bridge:** A bridge is an obstruction in the drill hole or annulus. A bridge is usually formed by caving of the wall of the well bore, by the intrusion of a large boulder, or by the placement of filter pack materials during well completion. Bridging can also occur in the formation during well development.

3.3 **Filter Pack:** Filter pack is sand or gravel that is smooth, uniform, clean, well-rounded, and siliceous. It is placed in the annulus of the well between the borehole wall and the well screen to prevent formation materials from entering the well and to stabilize the adjacent formation.

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3.4 **Grout:** Grout is a fluid mixture of cement and water that can be forced through a tremie pipe and emplaced in the annular space between the borehole and casing to form an impermeable seal. Various additives, such as sand, bentonite, and polymers, may be included in the mixture to meet certain requirements.

4.0 Interferences

4.1 The total depth of the monitoring well will be measured and the measurement will be compared to the original well completion log prior to abandonment.

4.2 A map with the location of the well to be abandoned and the surrounding wells, if any, will be utilized in the field to confirm the location of the well to be abandoned.

4.3 Information from the well identification tags/markings will be noted and the information compared to both the well completion log and the total depth measurement obtained in the field to confirm the identity of the well being abandoned.

5.0 Training and Qualifications

5.1 Qualifications and Training

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 Responsibilities

5.2.1 The **CTO Manager** is responsible for ensuring that well abandonment activities comply with this procedure. The **CTO Manager** is responsible for ensuring that all personnel involved in well abandonment shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

5.2.3 The **Field Manager** is responsible for ensuring that all well abandonment activities are conducted according to the either this procedure or the applicable procedure presented in the project-specific SAP.

5.2.4 **Field sampling personnel** are responsible for the implementation of this procedure.

5.2.5 The field sampler and/or task manager is responsible for directly supervising the well abandonment procedures to ensure that they are conducted according to this procedure and for recording all pertinent data collected during sampling.

6.0 Equipment and Supplies

6.1 Equipment and materials used during monitoring well and piezometer abandonment include the following:

- Drill rig or trailer-mounted mixer and grout pump
- Filter pack material
- Pure sodium bentonite with no additives
- Bentonite pellets/chips
- Bentonite grout
- Portland Type II cement
- Water from an approved source

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- Weighted tape measure
- Flexible hose
- Tremie pipe (small-diameter, rigid polyvinyl chloride [PVC] pipe)
- Weatherproof bound field logbook with numbered pages
- Appropriate health and safety equipment

7.0 Procedure

7.1 General Procedures

The following procedure applies to the abandonment of wells aborted prior to completion and existing wells determined to be ineffective or otherwise in need of closure. Prior to abandoning any developed well, you may need to acquire a permit from the State or local governing body in which you are working. The permit application may require a detailed design of the well abandonment. In addition, prior to abandonment, all obstructions (e.g., pumps, lost equipment) must be removed from the well. Some States are strict in requiring the removal of all lost equipment prior to abandonment and will not allow the closure of a well with lost equipment in it. The State may require the removal of all objects to allow a proper seal during abandonment. Great lengths must be taken to reclaim lost items, such as the use of downhole video cameras to inspect and aid in the recovery of items. Prior to abandonment, confirm that the well selected for abandonment is properly located and identified to avoid abandoning the wrong well.

At locations where a well log is not available, the following procedure shall be implemented:

- The casing should be pulled, drilled out, or thoroughly pierced.
- With the use of a tremie pipe, grout should be placed from the bottom of the hole to within 3 feet of the ground surface.
- The material should be allowed to settle for 24 hours.
- The remainder of the hole should be filled with concrete.
- All historical sample data and abandonment procedures should be included in the records of work.

At locations where a well completion log is available, the following procedure shall be implemented:

- With the use of a tremie pipe, grout should be placed from the bottom of the hole to within 3 feet of the ground surface.
- The material should be allowed to settle for 24 hours.
- The remainder of the hole should be filled with concrete.
- All boring logs, historical sample data, completion records, and abandonment procedures should be included in the records of work.

Depending on the regulatory body under which you are working, the procedures listed above may differ. All work shall be performed by a licensed well driller in the State work is being performed. The licensed well driller is responsible for documenting the abandonment of the monitoring well with the appropriate State agency.

7.2 Replacement Wells

Replacement wells (if any) should normally be offset at least 15 feet from any abandoned well in an upgradient or crossgradient groundwater flow direction. Site-specific conditions may necessitate variation of this placement requiring the replacement well to be located either closer or further in proximity to the original well. To avoid potential issues related to grout migration into a well filter pack and/or screen section, replacement wells should be installed after the original/adjacent well is properly abandoned.

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7.3 Grout

Bentonite grout is preferred for the abandonment of monitoring wells. Cement grout, if used for abandonment, should be composed of the following by weight:

- 20 parts cement (Portland cement, Type II or V)
- 0.4 to 1 part (maximum) (2 to 5 percent) bentonite
- 8 gallons (maximum) approved water per 94-pound bag of cement

Neither additives nor borehole cuttings should be mixed with the grout. Bentonite should be added after the required amount of cement has been mixed with the water. All grout material should be combined in an aboveground container and mechanically blended to produce a thick, lump-free mixture. The mixed grout should be recirculated through the grout pump prior to placement. The mixture can be combined and recirculated through a drill rig equipped for mud rotary drilling or through a mixer and grout pump mounted on a trailer.

Grout should be placed with the use of a commercially available grout pump and a rigid tremie pipe. Casing and grouting should be removed in stages, aquifer by aquifer, sealing the boring from the bottom to ground surface. This should be accomplished by placing a tremie pipe to the bottom and pumping grout through the pipe until undiluted grout reaches the bottom of the next higher section of casing or, for the topmost section, until grout flows from the boring at the ground surface.

After 24 hours, the abandoned drilling site should be checked for grout settlement. Any settlement depression should be filled with grout and rechecked 24 hours later. This process should be repeated until firm grout remains at the ground surface.

Be aware that when the drillers are finished, they will need a large supply of water to rinse out their equipment. This wash water must be containerized as IDW in accordance with SOP 3-05, *IDW Management*. Also, any materials (such as the removed protective casing, manhole covers, and concrete collars) shall be disposed of properly, or per the requirements of the project-specific SAP.

8.0 Quality Control and Assurance

8.1 Field personnel will follow specific quality assurance (QA) guidelines as outlined in the project-specific SAP.

8.2 Quality Control (QC) measures should be taken to ensure proper well abandonment in accordance with this SOP, project-specific SAP, and applicable well standards.

9.0 Records, Data Analysis, Calculations

9.1 All field information must be documented in the field logbook and/or on field data sheets with permanent ink. Data recorded may include the following:

- Date/time
- Well/piezometer location
- Personnel/subcontractor on site
- Abandonment method
- Depth of well/piezometer
- Materials used to seal each stratum
- Detailed description of procedure
- Date/time of return visit(s)
- Activities performed on return visit(s)
- Observations or problems encountered during abandonment

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10.0 Attachments or References

Environmental Protection Agency, United States (EPA). 1987. *A Compendium of Superfund Field Operations Methods*. Office of Solid Waste and Emergency Response. EPA/540/P-87/001.

SOP 3-05, *IDW Management*.

Author	*Reviewer*	*Revisions (Technical or Editorial)*
Shawn Dolan Senior Scientist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (June 2012)

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Headspace Screening for Total VOCs

Procedure 3-19

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the basic techniques for using headspace analysis to screen for volatile organics in contaminated soils using a portable Photo Ionization Detector (PID) or Flame Ionization Detector (FID).

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 The health and safety considerations for the work associated with this SOP will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the Contract Task Order (CTO) Work Plan (WP) and/or direction from the **Site Safety Officer (SSO)**. Note that headspace screening usually requires Level D personal protection unless there is a potential for airborne exposure to site contaminants. Under circumstances where potential airborne exposure is possible respiratory protective equipment may be required based on personal air monitoring results. Upgrades to Level C will be coordinated with the Site Safety Officer (SSO) or **CTO Manager**.

2.2 Health and safety hazards and corresponding precautions include, but are not limited to, the following:

2.2.1 Dermal contact with contaminated soil. Personnel should treat all soil as potentially contaminated and wear chemically impervious gloves. Minimize skin contact with soil by using sampling instruments such as stainless steel spades or spoons. Do not touch any exposed skin with contaminated gloves.

2.2.2 Inhalation hazards. Appropriate air monitoring should be conducted to ensure that organic vapor concentrations in the breathing zone do not exceed action levels as specified in the Site-Specific HASP. When ambient temperatures are low enough to require warming samples using the vehicle heater, the vehicle's windows should be opened enough to prevent the build-up of any organic vapors. Use the PID or FID to verify the airborne concentrations in the vehicle remain below applicable action levels. Note that many volatile organic compounds (VOCs) are flammable and all precautions must be observed to eliminate any potential ignition sources.

2.2.3 Shipping limitations. Follow applicable regulations when shipping FID/PID equipment. When shipping an FID by air, the hydrogen tank must be bled dry. Calibration gas canisters are considered dangerous goods and must be shipped according to IATA and DOT regulations. Consult your EHS Coordinator and check with your shipping company to determine the correct shipping procedures

3.0 Terms and Definitions

None.

4.0 Interferences

4.1 Regardless of which gas is used for calibration, the instrument will respond to all analytes present in the sample that can be detected by the type of lamp used in the PID.

4.2 Moisture will generate a positive interference in the concentration measured for a PID and is characterized by a slow increase in the reading as the measurement is made. Care must be taken to

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minimize uptake of moisture to the extent possible. Refer to the manufacturers' instructions for care, cleaning, and maintenance.

4.3 Uptake of soil into the PID must be avoided as it will compromise instrument performance by blocking the probe, causing a positive interference, or dirtying the PID lamp. Refer to the manufacturers' instructions for care, cleaning, and maintenance.

4.4 The user should listen to the pitch of the sampling pump. Any changes in pitch may indicate a blockage and corrective action should be initiated.

5.0 Training and Qualifications

5.1 Qualifications and Training

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 Responsibilities

5.2.1 The CTO Manager is responsible for ensuring that the collection of headspace readings comply with this procedure. The CTO Manager is responsible for ensuring that all personnel involved in the collection of headspace readings shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The Program Quality Manager is responsible for ensuring overall compliance with this procedure.

5.2.3 The Field Manager is responsible for ensuring that all headspace readings are conducted according to this procedure as well as verifying that the PID/FID is in proper operating condition prior to use and for implementing the calibration.

5.2.4 All Field Personnel are responsible for the implementation of this procedure.

6.0 Equipment and Supplies

6.1 The following materials must be on hand in good operating condition and/or in sufficient quantity to ensure that proper field analysis procedures may be followed:

- Calibrated PID/FID instrument;
- Top-sealing "Zip-Loc" type plastic bags – or – 16 ounces of soil or "mason-" type glass jars and aluminum foil;
- Project field book and/or boring logs;
- Personal Protective Equipment (PPE) as specified in the project HASP; and
- Material Safety Data Sheets (MSDSs) for any chemicals or site-specific contaminants.

7.0 Procedure

7.1 Preparation

Review available project information to determine the types of organic vapors that will likely be encountered to select the right instrument. The two basic types of instruments are FIDs and PIDs.

FIDs work well with organic compounds that have relatively lightweight molecules, but may have problems detecting halogenated compounds or heavier organic compounds; FIDs can detect methane for example. Since the FID uses a flame to measure organic compounds, ensure that work is conducted in an atmosphere, which is free of combustible vapors. If ambient temperatures are below 40°F, the flame of the FID may be difficult to light.

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When using a PID, select an instrument that can measure the ionization potential of the anticipated contaminants of concern. PIDs work well with a range of organic compounds and can detect some halogenated hydrocarbons; PIDs cannot detect methane. The correct ultraviolet (UV) light bulb must be selected according to the types of organic vapors that will likely be encountered. The energy of the UV light must equal or exceed the ionization potential of the organic molecules that the PID will measure. The NIOSH Pocket Guide to Chemical Hazards is one source for determining ionization potentials for different chemicals. Bulbs available for PIDs include 9.4 eV, 10.6 (or 10.2) eV, and 11.7 eV bulbs. The 10.6 eV bulb is most commonly used as it detects a fairly large range of organic molecules and does not burn out as easily as the 11.7 eV bulb. The 9.4 eV bulb is the most rugged, but detects only a limited range of compounds. Under very humid or very cold ambient conditions, the window covering the UV light may fog up, causing inaccurate readings. Ask the **SSO** about correction factors when high humidity conditions exist.

After selecting the correct instrument, calibrate the PID/FID according to the manufacturer's instructions. Record background/ambient levels of organic vapors measured on the PID/FID after calibration and make sure to subtract the background concentration (if any) from your readings. Check the PID/FID readings against the calibration standard every 20 readings or at any time when readings are suspected to be inaccurate, and recalibrate, if necessary. Be aware that, after measuring highly contaminated soil samples, the PID/FID may give artificially high readings for a time.

7.2 Top-Sealing Plastic Bag

Place a quantity of soil in a top-sealing plastic bag and seal the bag immediately. The volume of soil to be used should be determined by the **CTO Manager** or **Field Manager**. The volume of soil may vary between projects but should be consistent for all samples collected for one project. Ideally, the bag should be at least 1/10th-filled with soil and no more than half-filled with soil. Once the bag is sealed, shake the bag to distribute the soil evenly. If the soil is hard or clumpy, use your fingers to gently work the soil (through the bag) to break up the clumps. Do not use a sampling instrument or a rock hammer since this may create small holes in the plastic bag and allow organic vapors to escape. Alternatively, the sample may be broken up before it is placed in the bag. Use a permanent marker to record the following information on the outside of the bag:

- Site identification information (i.e., borehole number);
- Depth interval; and
- Time the sample was collected. For example: "SS-12, 2-4 ft, @1425".

Headspace should be allowed to develop before organic vapors are measured with a PID/FID. The amount of time required for sufficient headspace development will be determined by the project-specific sampling plan and the ambient temperature. Equilibration time should be the same for all samples to allow an accurate comparison of organic vapor levels between samples. However, adjustments to equilibration times may be necessary when there are large variations in ambient temperature from day to day. When ambient temperatures are below 32°F, headspace development should be within a heated building or vehicle. When heating samples, be sure there is adequate ventilation to prevent the build-up or organic vapors above action levels.

Following headspace development, open a small opening in the seal of the plastic bag. Insert the probe of a PID/FID and seal the bag back up around the probe as tightly as possible. Alternatively, the probe can be inserted through the bag to avoid loss of volatiles. Since PIDs and FIDs are sensitive to moisture, avoid touching the probe to the soil or any condensation that has accumulated inside of the bag. Since the PID/FID consumes organic vapors, gently agitate the soil sample during the reading to release fresh organic vapors from the sample. Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture, in which case, headspace data should be discounted. Record the highest reading on the field form or in the field notebook as described in Section 9.

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7.3 **Jar and Aluminum Foil (Alternate Method)**

Half-fill a clean glass jar with the soil sample to be screened. Quickly cover the jar's opening with one to two sheets of clean aluminum foil and apply the screw cap to tightly seal the jar. Allow headspace development for at least ten minutes. Vigorously shake the jar for 15 seconds, both at the beginning and at the end of the headspace development period. Where ambient temperatures are below 32°F (0°C), headspace development should be within a heated area. When heating samples, be sure there is adequate ventilation to prevent the build-up of organic vapors above action levels.

Subsequent to headspace development, remove the jar lid and expose the foil seal. Quickly puncture the foil seal with the instrument sampling probe, to a point about one-half of the headspace depth. Exercise care to avoid uptake of water droplets or soil particulates. As an alternative, use a syringe to withdraw a headspace sample, and then inject the sample into the instrument probe or septum-fitted inlet. This method is acceptable contingent upon verification of methodology accuracy using a test gas standard. Following probe insertion through the foil seal or sample injection to probe, record the highest meter response on the field form or in the field notebook. Using foil seal/probe insertion method, maximum response should occur between two and five seconds. Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture, in which case, headspace data should be discounted.

8.0 Quality Control and Assurance

Quality Assurance/Quality Control (QA/QC) will include the collection of duplicate samples. In general, one duplicate will be collected per 20 samples. Organic vapor concentrations measured in the primary and duplicate samples should be similar within plus or minus 20 percent. The frequency of headspace duplicate collection will be determined by the project manager/task manager. The PID/FID instrument must be calibrated according to the manufacturer's instructions before beginning screening, and checked or recalibrated every 20 analyses or when readings are suspected to be inaccurate. Record ambient organic vapor levels in the field notebook and on the field form. Periodically check ambient organic vapor levels. If ambient levels have changed more than 20 percent, recalibrate the PID/FID. Make sure readings are not collected near a vehicle exhaust or downwind of a drill rig exhaust. If grossly contaminated soil is encountered, decontaminate sampling instruments between samples and/or change contaminated gloves to avoid cross contaminating less contaminated samples.

9.0 Records, Data Analysis, Calculations

9.1 All data generated (results and duplicate comparisons) will be recorded in the field notebook and/or on the field form. Any deviation from the outlined procedure will also be noted. Field conditions (ambient temperature, wind, etc.) should also be recorded in the field notebook.

9.2 Readings may be recorded in a field notebook, on a boring log, or on an appropriate form specific to the project. The form should include the following information:

- When the PID/FID was calibrated (date/time) and calibration standard used;
- Background/ambient concentrations measured after PID/FID calibration;
- Location of sample (i.e., bore-hole number);
- Depth interval of sample measured;
- Lithology of material measured; and
- PID/FID reading and units of measure.

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9.3 Note that if PID/FID measurements are recorded on a boring log, it is not necessary to duplicate information in the column where the PID/FID readings are recorded (e.g., borehole number, depth interval, lithology type).

9.4 All documentation will be stored in the project files and retained following completion of the project.

10.0 Attachments or References

SOP 3-20 Operation and Calibration of a Photoionization Detector

Author	Reviewer	Revisions (Technical or Editorial)
Robert Shoemaker Senior Scientist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)

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Standard Operating Procedure SOP-3-24
Water Quality Parameter Testing for Groundwater Sampling

1.0 PURPOSE

This standard operating procedure (SOP) represents minimum standard of practice. State and federal requirements may vary, and this SOP does not replace state and federal requirements that must be consulted before work begins. Further, if a project-specific work plan has been created, the work plan should be considered the ruling document. This SOP may be modified to meet specific regulatory, client, or project specific criteria.

If there are procedures whether it be from Resolution Consultants, state and/or federal that are not addressed in this SOP and are applicable to water quality parameter testing, then those procedures may be added as an appendix to the project-specific Sampling and Analysis Plan (SAP).

2.0 SCOPE

This procedure provides guidance for expected sampling methods and protocols by all personnel related to the measurement of water quality parameters.

Field measurements of water quality parameters are commonly performed to evaluate surface water and groundwater. These tests are often performed to evaluate basic water quality parameters, to evaluate natural attenuation parameters, and to assess the presence of pore water entering a well.

As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgment during unforeseen circumstances. Deviations from this procedure while planning or executing planned activities must be approved by either the Contract Task Order (CTO) Manager or the Quality Assurance (QA) Manager, and documented.

3.0 DEFINITIONS

3.1 Barometric Pressure (BP)

The density of the atmosphere, which varies according to altitude and weather conditions.

3.2 Conductivity/Specific Conductance

A measure of the ability of water to pass electrical current, which increases with the amount of dissolved ionic substances (i.e., salts). Conductivity is inversely related to the resistance of a solution and is measured in units of mhos per centimeter (mhos/cm) (inverse ohms/cm, Siemens/cm). The conductivity of water increases with increasing temperature.

Specific Conductance is corrected for 25 degrees Celsius (°C); for this reason, it is best to record Specific Conductance. If Conductivity is recorded, the temperature of the sample MUST recorded.

3.3 Dissolved Oxygen (DO)

The amount of oxygen present in water and available for respiration. DO is typically measured in milligrams per liter (mg/L). Oxygen is less soluble in warm and salty waters, so the instrument compensates the apparent percent saturation for changes in temperature and conductivity. Most probes measure the current resulting from the electrochemical reduction of oxygen (at a gold cathode) diffusing through a selective membrane. Because oxygen is being removed from the sample to perform the measurement, sample flow is required to prevent false low readings due to depletion of oxygen in the solution in front of the probe. Optical DO probes do not remove oxygen from the sample and are less affected by salts. The common range of DO in groundwater is 0.0 to 3.0 mg/L. Measurements outside of this range suggest that the meter may not be operating correctly.

3.4 Nephelometric Turbidity Unit (NTU)

The measurement of light passing through a sample based on the scattering of light caused by suspended particles.

3.5 pH

A measure of acidity and alkalinity of a solution using a logarithmic scale on which a value of 7 represents neutrality, lower numbers indicate increasing acidity, and higher numbers are increasingly basic.

3.6 Oxidation-Reduction Potential (ORP)

Also known as redox or eH, ORP is a measurement of the potential for a reaction to occur, which generally indicates the oxygen status of a sample. The probe consists of a platinum electrode, the potential of which is measured with respect to a reference electrode that rapidly equilibrates with the potential of the sample solution. A positive value indicates that oxygen is present. A negative value indicates an anaerobic environment or reducing condition. For this reason, negative ORP readings should be associated with DO readings of less than 0.5 mg/l; with negative ORP readings the water may exhibit a sulfur odor or gray color. Positive ORP readings should be associated with DO readings greater than 0.5 mg/L and lack of sulfur odors. Because of the complex relationship between ORP and temperature, no compensation is attempted; it is thus best to report both the ORP and temperature of a water sample.

3.7 Total Dissolved Solids

A measure of the quantity of materials in water that are either dissolved or too small to be filtered.

3.8 Turbidity

Measure of the clarity of water in NTUs. Potable water typically has NTU values between 0.0 and 0.3 NTUs, depending on the state or regulatory program.

4.0 RESPONSIBILITIES

The CTO Manager, or designee, is responsible for ensuring that these standard groundwater sampling activities are followed and shall review all groundwater sampling forms at the conclusion of a sampling event. The CTO Manager is responsible for ensuring that all personnel involved in monitoring well sampling shall have the appropriate education, experience, and training to perform their assigned tasks. The QA Manager or Technical Director is responsible for ensuring overall compliance with this procedure. The Field Manager is responsible for ensuring that all project field staff follows these procedures.

Field sampling personnel are responsible for the implementation of this procedure. Personnel are required to be knowledgeable of the procedures in this SOP. Training and familiarization with this SOP shall be documented in the training file for each employee. The field sampler and/or Field Manager is responsible for directly supervising the calibration procedures to ensure that they are conducted according to this procedure, and for recording all pertinent data. If deviations from the procedure are required because of anomalous field conditions, they must first be approved by the CTO Manager, QA Manager, or Technical Director and then documented in the field logbook and associated report or equivalent document.

5.0 PROCEDURES

5.1 Purpose

The procedures will vary depending on parameters being measured, method of sampling, and the method of measurement used. The information here is a general guidance and the site-specific documents and manufacturer manuals supersede these procedures.

5.2 Cautions

Improper use of water quality testing equipment could result in equipment damage or compromised sampling results. Personnel should be trained to operate the test equipment being used for a field operation and should be trained in the proper techniques for collecting and

logging water quality parameters. Personnel should also be able to recognize problems with test equipment and have someone available for basic troubleshooting and repair.

5.3 Interferences

During field testing, water quality data that is documented from field testing equipment may be influenced by certain outside factors that are unrelated to the actual site water quality. Such parameters and equipment include the following:

pH Meters

- Coatings of oils, greases, and particles may impair the electrode's response. Pat the electrode bulb dry with lint-free paper or cloth and rinse with de-ionized water. For cleaning hard-to-remove films, use isopropyl alcohol very sparingly so that the electronic surface is not damaged.

- Poorly buffered solutions with low specific conductance (less than 200 microsiemens per centimeter) may cause fluctuations in the pH readings. Equilibrate electrode by immersing in several aliquots of sample before taking pH.

Dissolved Oxygen

- Dissolved gases (e.g., hydrogen sulfide, halogens, sulfur dioxide) are a factor with the performance of DO probes. The effect is less pronounced on optical DO meters. Meter type and potential interferences should be considered based on potential sulfate/sulfide or nitrate/nitrite reducing environments.

- Exposure of the sample to the atmosphere will cause elevated DO measurements.

Turbidity Meter

- If the weather is warm and humidity is high, condensation may collect on the cuvet. To avoid this, allow the sample to warm and dry the outside of the cuvet before making the measurement. One method used to accomplish this is to place the cuvet against one's body (armpits work well).

Temperature

- Sample temperature will change rapidly when there are significant differences between the sample and ambient air.

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5.4 Apparatus and Materials

Field personnel shall consult the site work plan and SAP to review the equipment requirements for the sampling procedures to be followed during the sampling effort. The specific apparatus and materials required will depend on the water quality parameters being monitored. Table 1 shows the common equipment used in water quality parameter testing.

Table 1
Water Quality Parameter Testing — Common Equipment

Water Quality Parameter Instrument	Calibration Standards Required	Other Equipment
pH Meter	Yes - 2 or 3 Point Standards depending on groundwater range. Calibration must cover the range to be measured. If samples are above or below typical buffer standards (4, 7 and 10), special order buffers that fall outside groundwater pH range.	Container or flow thru cell for holding sample
Specific Conductance	Yes	Container or flow thru cell for holding sample
ORP Meter	Yes	Container or flow thru cell for holding sample
Turbidity Meter	Yes	Container or flow thru cell for holding sample
DO	No	Container or flow thru cell for holding sample
Thermometer	No	Container or flow thru cell for holding sample
Flow Rate	No	Calibrated Container

Notes:
ORP = Oxidation-Reduction Potential
DO = Dissolved Oxygen

5.5 Instrument or Method Calibration

Most monitoring instruments require calibration before use, and this calibration must be conducted in the field under the ambient climatic conditions that will be present during field sampling. Calibration of monitoring instruments shall be performed in accordance with the manufacturer's specifications and recorded in the provided form in Attachment 1. Site-specific instrument calibration requirements should be specified in the SAP. The following minimum calibration requirements apply to the various types of meters used to gather water quality measurements.

Initial Calibration (IC): Before use, the instrument or meter electronics are adjusted (manually or automatically) to a theoretical value (e.g., DO saturation) or a known value of a

calibration standard. An IC is performed in preparation for the first use of an instrument or if a calibration verification does not meet acceptance criteria.

Initial Calibration Verification (ICV): The instrument or meter calibration is checked or verified directly following IC by measuring a calibration standard of known value as if it were a sample and comparing the measured result to the calibration acceptance criteria for the instrument/parameter. If an ICV fails to meet acceptance criteria, immediately recalibrate the instrument using the applicable initial calibration procedure or remove it from service.

Continuing Calibration Verification (CCV): After use, 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 for the instrument/parameter.

5.5.1 Calibration Checks

Calibration checks are conducted by measuring a known standard. They must be completed after calibration and should be performed at least one other time (i.e., after lunch) and anytime suspect measurements are encountered. Table 2 provides general acceptance ranges to be used during calibration checks. If a meter is found to be outside of the acceptance range, the meter **must** be recalibrated. If the meter remains out of range, the project manager and/or the supplier of the meter should be contacted to determine alternative measures.

Table 2
Calibration Check Acceptance Limits

Parameter	Acceptance Criteria
Dissolved Oxygen	±0.3 mg/L of the theoretical oxygen solubility
Oxidation-Reduction Potential	±10 mv from the theoretical standard value at that temperature
pH	±0.2 Standard pH Units
Specific Conductance	±5% of the standard
Turbidity	0.1 to 10 NTU: ±10% of the standard 11 to 40 NTU: ±8% of the standard 41 to 100 NTU: ±6.5% of the standard

Notes:
mg/L = milligrams per liter
mv = millivolts
NTU = nephelometric turbidity units

5.5.2 Possible and Suspected Ranges

The concentration for each parameter range should be known so that concentrations outside of the range can be noted. Table 3 presents the maximum range of the parameter in groundwater. The table also presents the suspected range. Measurements outside of the maximum/minimum range should be considered in error and the measurement method should be checked. Concentrations outside the normal range should be treated as suspect but may be the result of contaminant impact. For example, a pH of 2.0 would be out of the normally suspected range for groundwater but not at a site impacted with an acid.

Table 3
Minimum and Maximum Result Ranges

Parameter	Units	Possible Min	Possible Max	Normal Min	Normal Max	Notes
Dissolved Oxygen	mg/L	0.0	14.6 (0°C) 10.1 (15°C) 8.3 (2°C)	0.0	5	The colder the sample, the higher the DO reading. DO greater than 1 mg/L, ORP positive should not have sulfur odor, sulfide, ferrous iron and/or gray color. DO less than 1 mg/L, ORP negative, may have sulfur odor, sulfide, ferrous iron and/or gray color.
pH	SU	0	14	5	9	pH values exceeding 10 could indicate grout contamination
ORP	mv					DO greater than 1 mg/L, ORP positive should not have sulfur odor, sulfide, ferrous iron and/or gray color. DO less than 1 mg/L, ORP negative, may have sulfur odor, sulfide, ferrous iron and/or gray color.
Specific Conductance	µS/cm			varies	varies	
Temperature	°C	0	100	5	30	
Turbidity	NTU	0	Greater than 1,000	0	Greater than 1,000	50 NTU or greater suggests cloudiness.

Notes:

mg/L = milligrams per liter
°C = degrees Celsius
DO = dissolved oxygen
SU = standard units
ORP = oxidation reduction potential
mv = millivolts
mS/cm = micro Siemens per cm
NTU = nephelometric turbidity units

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5.5.3 Field Instruments and Calibration Criteria

The calibration acceptance criteria for each instrument are summarized in Table 4 along with special considerations related to each field instrument.

Table 4
Calibration Check Acceptance Limits

Parameter	Acceptance Criteria
Dissolved Oxygen	±0.3 mg/L of the theoretical oxygen solubility.
Oxidation-Reduction Potential	±10 mv from the theoretical standard value at that temperature.
pH	±0.2 Standard pH Units
Specific Conductance	±5% of the standard
Turbidity	0.1 to 10 NTU: ±10% of the standard 11 to 40 NTU: ±8% of the standard 41 to 100 NTU: ±6.5% of the standard

Notes:
mg/L = milligrams per liter
mv = millivolts
NTU = nephelometric turbidity units

pH Meters

- For the most accurate of pH measurements, pH meters should receive a three-point calibration. However, if a two-point calibration will bracket the groundwater pH of the site, a two-point calibration is acceptable. Three-point calibrations typically include calibrating to solutions of pH 7.00, 4.00, and 10.00. If groundwater pH is outside the calibration range of the solution standards, special buffers must be ordered to bracket the pH. Some meters will report the slope of the calibration and this may be used in checking the meter calibration (refer to the meter's manual). When performing an ICV, the result must be within +/- 0.2 pH units of the stated buffer value.

- pH meters should be calibrated across the range of values to be measured. The maximum and minimum calibration solutions shall be outside the range of anticipated values. For example, if the expected range is between 7.50 and 9.00, the 7.00 and the 10.00 standard should be used for calibration. Perform the IC using at least two buffers, and always use the pH 7.00 buffer first. A reading that is above the maximum (or below the minimum) calibration standard is an estimate only and is not valid. This condition requires obtaining a new standard that is above (or below) the reported value, depending on the measurement.

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- A percent slope of less than 90 percent indicates a bad electrode that must be changed or repaired. If percent slope cannot be determined, or the manufacturer's optimum specifications are different, follow the manufacturer's recommendation for maintaining optimum meter performance.

Specific Conductivity Meters

- For IC, when the sample measurements are expected to be 100 microsiemens per centimeter (µS/cm) or greater, use two standard potassium chloride (KCl) solutions that bracket the range of expected sample conductivities. Calibrate the instrument with the first standard. Verify the calibration of the instrument with the second standard, bracketing the range of expected sample values.

- If the instrument can be calibrated with more than one standard, choose additional calibration standards within the range of expected sample values.

- When the sample measurements are expected to be less than 100 µS/cm, a lower bracket is not required, but one standard (KCl) solution that is within the range of expected measurements must be used for the IC and the ICV.

- Accept the calibration if the meter reads within +/- 5 percent of the value of any calibration standard used to verify the calibration.

- Most field instruments read conductivity directly. Record all readings and calculations in the calibration records.

- For CCV, check the meter with at least one KCl standard with a specific conductance in the range of conductivity measured in environmental samples. The reading for the calibration verification must also be within +/- 5 percent of the standard value.

- If new environmental samples are encountered outside the range of the IC, verify the instrument calibration with two standards bracketing the range of sample values. If these calibration verifications fail, recalibrate the instrument.

Dissolved Oxygen Meters

- Before calibrating, check the probe membrane for bubbles, tears, or wrinkles. These conditions require replacement of the membrane in accordance with the manufacturer's directions.

- If the meter provides readings that are off-scale, will not calibrate, or drift, check the leads, contacts, etc., for corrosion and/or short circuits. These conditions require replacement maintenance in accordance with the manufacturer's directions.
- Most DO meters must be calibrated based on an environment of 100 percent humidity and a known elevation and barometric pressure (BP).

- For 100 percent humidity, place the probe in the calibration container with a moist towel and allow the probe to remain, undisturbed, for 10 to 20 minutes.

- The IC is an air calibration at 100% saturation. Before use, verify the meter calibration in water-saturated air to make sure it is properly calibrated and operating correctly. Make a similar verification at the end of the day or sampling event. Follow the manufacturer's instructions for your specific instrument. Allow an appropriate warm up period before IC. Wet the inside of the calibration chamber with water, pour out the excess water (leave a few drops), wipe any droplets off the membrane/sensor and insert the sensor into the chamber (this ensures 100 percent humidity). Allow adequate time for the DO sensor and the air inside the calibration chamber to equilibrate. Once the probe/calibration chamber is stable at ambient temperature, check the air temperature and determine, from the DO versus temperature table (see Attachment 2) what DO should measure. The acceptance criterion for DO ICV is +/- 0.3 mg/L.

- Use the same procedure as above for CCV.

ORP Meters

- Verify electrode response before use in the field.

- Equilibrate the standard solution to the temperature of the sample. The standard solution is based on a 25°C temperature; however, the calibration solution standard's value will require adjustment based on the temperature.

- Immerse the electrodes and gently stir the standard solution in a beaker (or flow cell). Turn the meter on, placing the function switch in the millivolt (mv) mode.

- Let the electrode equilibrate and record the reading to the nearest millivolt. The reading must be within ±10 mv from the theoretical redox standard value at that temperature. If not, determine the problem and correct it before proceeding. Switch to temperature display and read the value.

- Record the mv reading and temperature in the field notebook or in form. Rinse the electrode with distilled water and proceed with the sample measurement, unless using a flow cell. If a flow cell is used, rinse between sample locations.

Turbidity Meters

- Perform an initial calibration using at least two primary standards.

- If the instrument cannot be calibrated with two standards, calibrate the instrument with one standard and verify with a second standard.

- Perform an ICV by reading at least one primary standard as a sample. The acceptance criterion for the ICV depends on the range of turbidity of the standard value:

  1. Standard Value = 0.1 to 10 NTU: the response must be within 10 percent of the standard;

  2. Standard Value = 11 to 40 NTU: the response must be within 8 percent of the standard;

  3. Standard Value = 41 to 100 NTU: the response must be within 6.5 percent of the standard; and

  4. Standard Value greater than 100 NTU: the response must be within 5 percent of the standard.

- Determining the Values of Secondary Standards: Use only those certified by the manufacturer for a specific instrument. Secondary standards may be used for CCVs.

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To initially determine the value of a secondary standard, assign the value that is determined immediately after an ICV or verification with primary standards. This is done by reading the secondary standard as a sample. This result must be within the manufacturer's stated tolerance range and +/- 10 percent of the assigned standard value. If the +/- 10 percent 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.

- CCV: Perform a CCV using at least one primary or secondary standard. The calibration acceptance criteria are the same as those for an ICV.

5.6 Direct Measurements

Direct measurements with meters are the most common methods and can be accomplished by placing a sample in a container with the probe or by allowing the water to flow past the probe in a flow cell. The use of a flow-through cell improves measurement quality by allowing the constant flow of water over the probes and reduces interaction of the sample with the atmosphere. Sample cups should be avoided. The quantity of samples, timing, and methodology should be described in the project SAP.

Following calibration of required probes, connect the bottom flow-cell port to the discharge line of the pump. Connect the top port to a discharge line directed to a bucket to collect the purge water. Allow the flow cell to completely fill. As the water flows over the probe, record the measurements. Continue to record the measurements at regular intervals, as specified in the SAP.

When the ambient air temperatures are much higher or lower than the temperature of the water sample, it is best to keep the length of tubing between the wellhead and the flow cell as short as possible to prevent heating or cooling of the water. Tubing and flow-through cell should not be exposed to direct sunlight, particularly in the summer, if at all possible, to avoid heating of water samples.

5.7 Data Acquisitions, Calculations, and Data Reduction

5.7.1 Specific Conductivity Correction Factions

If the meter does not automatically correct for temperature (i.e., read Specific Conductivity) record Conductivity and adjust for temperature upon returning to the office. The following equation can be used to convert Conductivity to Specific Conductivity.

$$K = \frac{(Km)(C))}{1 + 0.0191(\mathrm{T} - 25)}$$

Where:

K	=	Conductivity in μmhos/cm at 25°C
Km	=	Measured conductivity in μmhos/cm at T degrees Celsius
C	=	Cell constant
T	=	Measured temperature of the sample in degrees Celsius;

If the cell constant is 1, the formula for determining conductivity becomes:

$$K = \frac{(Km)}{1 + 0.0191(\mathrm{T} - 25)}$$

5.7.2 Percentage Difference Calculation

For evaluating slope of readings from either a flow cell or a sample cup.

$$\%Difference = \frac{(Highest\ Value - Lowest\ Value)}{(Highest\ Value)}\ x\ 100$$

5.7.3 Convert mm mercury (mmHG) to inches mercury (inHG)

$$mmHG = inHG\ x\ 25.4$$

5.7.4 True Barometric Pressure

For converting BP obtained from a public domain source that is expressed in BP at sea level to BP at the subject site.

$$TrueBP = (BP) - \frac{(2.5\ x\ [Local\ Altitude])}{100}$$

Where: BP is in mmHG and Local Altitude is in feet

Example: BP at site A is 30.49 inHg and elevation is 544 feet, calculate TrueBP

Convert inHG to mmgHG:

mmHg = 30.49 inHg x 25.4 = 774.4 mmHg

Calculate True BP:

TrueBP = (774.4 mmHg) – [2.5 * (544 /100)] = 774.4-13.6 = 760.8 mmHg

6.0 RECORDS

Data will be recorded promptly, legibly, and in indelible ink on the appropriate logbooks and forms. At the completion of a field effort, all logbooks, field data forms, and calibration logs shall be scanned and made electronically available to the project team. The original field forms, calibrations logs, and log book will be maintained in the project file.

7.0 HEALTH AND SAFETY

Detailed Health and Safety requirements can be found in the site specific Health and Safety Plan. Ensure that a Safe Work Assessment and Permit form is filled out daily prior to any work in the field and reviewed with all project personnel in a daily safety brief.

Safety glasses with side shields or goggles and disposable gloves shall be worn during calibration activities.

8.0 REFERENCES

None

9.0 ATTACHMENTS

Attachment 1: Example Field Instrument Calibration Form
Attachment 2: Solubility of Oxygen at Given Temperatures
Attachment 3: Example Field Data Form

Attachment 1

Example Field Instrument Calibration Form

Field Instrument Calibration Form

Calibrated by: _____ Equipment (Make/Model/Serial#): _____

Date: _____ Equipment (Make/Model/Serial#): _____

pH (su) — Standard: ± 0.2 standard units

Initial Calibration / Initial Calibration Verification

	Hach SL	Reading	Pine SL	Reading
pH7				
pH4				

Continuing Calibration Verification

	Hach SL	Reading	Deviation	Acceptable Variance (Y/N)
pH7				
pH4				

DO (mg/L) — Standard: ± 0.3 mg/L of theoretical*

IC (Temp:)		ICV (Temp:)	
Saturation (%)	Reading (%)	Theoretical (mg/L)	Reading (mg/L)
100			

CCV (Temp:)

Saturation (%)	Reading (%)	Deviation	Acceptable Variance (Y/N)
100			

Theoretical (mg/L)	Reading (mg/L)	Deviation	Acceptable Variance (Y/N)

ORP (mV) — Standard: NA

IC (Zobell SL:)		ICV (Pine SL:)	
TCS (Std/Temp)	Reading	TCS (Std/Temp)	Reading

CCV (Zobell SL:)

TCS (Std/Temp)	Reading	Deviation	Acceptable Variance (Y/N)

Turbidity (ntu) — Standard: ±10% of Standard

Initial Calibration

Standard	Reading

Continuing Calibration Verification

Standard	Reading	Deviation	Acceptable Variance (Y/N)

Conductivity (ms^{C}/cm) — Standard: ± 5% of standard value

IC (YSI SL:)		ICV (Pine SL:)	
Standard	Reading	Standard	Reading

CCV (YSI SL:)

Standard	Reading	Deviation	Acceptable Variance (Y/N)

Comments:

Notes:

SL	solution lot	su	standard units	ntu	Nephelometric Turbidity Units
TCS	temperature corrected standard	mV	millivolts	°C	degrees Celsius
Std	standard	%	percent	ms°/cm	millisiemens per centimeter (temperature corrected)
Temp	temperature	mg/L	milligrams per liter	*	Theoretical value

Attachment 2

Solubility of Oxygen at Given Temperatures

Field Measurement of Dissolved Oxygen

Solubility of Oxygen in Water at Atmospheric Pressure			
Temperature	**Oxygen Solubility**	**Temperature**	**Oxygen Solubility**
°C	**mg/L**	**°C**	**mg/L**
0.0	14.621	26.0	8.113
1.0	14.216	27.0	7.968
2.0	13.829	28.0	7.827
3.0	13.460	29.0	7.691
4.0	13.107	30.0	7.559
5.0	12.770	31.0	7.430
6.0	12.447	32.0	7.305
7.0	12.139	33.0	7.183
8.0	11.843	34.0	7.065
9.0	11.559	35.0	6.950
10.0	11.288	36.0	6.837
11.0	11.027	37.0	6.727
12.0	10.777	38.0	6.620
13.0	10.537	39.0	6.515
14.0	10.306	40.0	6.412
15.0	10.084	41.0	6.312
16.0	9.870	42.0	6.213
17.0	9.665	43.0	6.116
18.0	9.467	44.0	6.021
19.0	9.276	45.0	5.927
20.0	9.092	46.0	5.835
21.0	8.915	47.0	5.744
22.0	8.743	48.0	5.654
23.0	8.578	49.0	5.565
24.0	8.418	50.0	5.477
25.0	8.263		

Notes:

The table provides three decimals to aid interpolation

Under equilibrium conditions, the partial pressure of oxygen in air-saturated water is equal to that of the oxygen in water saturated

°C = degrees Celsius

mg/L = milligrams per liter

Attachment 3
Example Field Data Form

WELL DEVELOPMENT & GROUNDWATER SAMPLING FORM

DATE:	JOB NUMBER:	EQUIPMENT (Make/Model #/Serial #):
PROJECT:	EVENT:	/ /
WELL ID:	LOCATION:	/ /
WEATHER CONDITIONS:	AMBIENT TEMP:	/ /
REVIEWED BY:	PERSONNEL:	/ /

WELL DIA:	**WELL DEVELOPMENT**	
TOTAL DEPTH from TOC (ft.):	START:	FINISH:
DEPTH TO WATER from TOC (ft.):	VOLUME PURGED (gal):	
LENGTH OF WATER COL. (ft.):	**GROUNDWATER SAMPLING**	
1 VOLUME OF WATER (gal):	START:	FINISH:
3 VOLUMES OF WATER (gal):	VOLUME PURGED (gal):	
	ANALYSIS:	

WELL DEVELOPMENT PARAMETERS		GW SAMPLING PARAMETERS	
Temperature:	± 1.0° C	Temperature:	± 0.2° C
pH:	± 0.5 standard units	pH:	± 0.2 standard units
Specific Conductance:	± 10% of the past measurement	Specific Conductance:	± 5% of the past measurement
Turbidity:	relatively stable	DO:	≤ 20% saturation
		ORP:	± 10 millivolts
		Turbidity:	≤ 10 NTU

IN-SITU TESTING

Circle one: DEVELOPMENT SAMPLING ☐ Bailer ☐ Pump Description:

Time (hh:mm):												
pH (units):												
Conductivity (mS/cm):												
Turbidity (NTU):												
DO (mg/L): YSI 556												
DO (mg/L): YSI 550												
Temperature (C°):												
ORP (mV):												
Volume Purged (gal):												
Depth to Water (ft):												
								Well Goes Dry While Purging ☐				

SAMPLE DATA

☐ Bailer ☐ Pump Description:

Sample ID	Date (m/d/y)	Time (hh:mm)	Bottles (total to lab)	Filtered (0.45 µm)	Remarks
Purging/Sampling Device Decon Process:					

COMMENTS:

Purge water placed in drum#_____

Page __ of __

Appendix B
Field Forms

RESOLUTION CONSULTANTS

Client: _____

Project #: _____

Purpose: _____

Project: _____

Location:

Sketch of Boring Location

Location ID: _____

_____ Start Date/Time:

Page _____ **of** _____

_____ End Date/Time:

_____ Total Depth:

Sampling Method: _____

Drilling Equipment: _____

Drilling Co.: _____

Geologist:

Sample		Recovery		Other	OVA Reading (ppm)	USCS	DEPTH (FT)	Lithologic Description Visual-Manual Description (ASTM D 2488-06)	Generic Notes (Sample Interval) (Well Material)
Number	Interval	Inches Recovered	Inches Driven						
							0		
							1		
							2		
							3		
							4		
							5		
							6		
							7		
							8		
							9		
							0		
							1		
							2		
							3		
							4		
							5		
							6		
							7		
							8		
							9		

Notes:

Well Constuction		Top	Base	Sample ID	Time	Interval	Analyses
Material:	Casing:			1)			
Diameter:	Screen:			2)			
Wellhead:	Grount:			3)			
Ballards:	Bent/Seal:			4)			
Pad:	Sand Pack:			5)			

WELL CONSTRUCTION AND DEVELOPMENT LOG

WELL CONSTRUCTION DATA

Well Number:	Site Name:	FDEP Facility I.D. Number:	Well Install Date(s):

Well Location and Type (check appropriate boxes): ☐ On-Site ☐ Right-of-Way ☐ Off-Site Private Property ☐ Above Grade (AG) ☐ Flush-to-Grade If AG, list feet of riser above land surface:	Well Purpose: ☐ Perched Monitoring ☐ Shallow (Water-Table) Monitoring ☐ Intermediate or Deep Monitoring ☐ Remediation or Other (describe)	Well Install Method: Surface Casing Install Method:

Borehole Depth (feet):	Well Depth (feet):	Borehole Diameter (inches):	Manhole Diameter (inches):	Well Pad Size: _____ feet by _____ feet

Riser Diameter and Material:	Riser/Screen Connections: ☐ Flush-Threaded ☐ Other (describe)	Riser Length: _____ feet from _____ feet to _____ feet
Screen Diameter and Material:	Screen Slot Size:	Screen Length: _____ feet from _____ feet to _____ feet
1st Surface Casing Material: also check: ☐ Permanent ☐ Temporary	1st Surface Casing I.D. (inches):	1st Surface Casing Length: _____ feet from 0 feet to _____ feet
2nd Surface Casing Material: also check: ☐ Permanent ☐ Temporary	2nd Surface Casing I.D. (inches):	2nd Surface Casing Length: _____ feet from 0 feet to _____ feet
3rd Surface Casing Material: also check: ☐ Permanent ☐ Temporary	3rd Surface Casing I.D. (inches):	3rd Surface Casing Length: _____ feet from 0 feet to _____ feet
Filter Pack Material and Size:	Prepacked Filter Around Screen (check one): ☐ Yes ☐ No	Filter Pack Length: _____ feet from _____ feet to _____ feet
Filter Pack Seal Material and Size:		Filter Pack Seal Length: _____ feet from _____ feet to _____ feet
Surface Seal Material:		Surface Seal Length: _____ feet from _____ feet to _____ feet

WELL DEVELOPMENT DATA

Well Development Date:	Well Development Method (check one): ☐ Surge/Pump ☐ Pump ☐ Compressed Air ☐ Other (describe)		
Development Pump Type (check): ☐ Centrifugal ☐ Peristaltic ☐ Submersible ☐ Other (describe)		Depth to Groundwater (before developing in feet):	
Pumping Rate (gallons per minute):	Maximum Drawdown of Groundwater During Development (feet):	Well Purged Dry (check one): ☐ Yes ☐ No	
Pumping Condition (check one): ☐ Continuous ☐ Intermittent	Total Development Water Removed (gallons):	Development Duration (minutes):	Development Water Drummed (check one): ☐ Yes ☐ No
Water Appearance (color and odor) At Start of Development:		Water Appearance (color and odor) At End of Development:	

WELL CONSTRUCTION OR DEVELOPMENT REMARKS

Field Instrument Calibration Form

Calibrated by: _____ **Date:** _____ **Client:** _____ **Site:** _____

Dissolved Oxygen — Standard: ± 0.3 mg/L of theoretical*

Initial Calibration

Temp (°C)	Saturation (%)	Reading (%)	Theoretical	Reading
	100		mg/L	mg/L

Calibration Verification

	Temp (°C)	Theoretical	Reading	Deviation	P/F
Saturation (%)		100 %	%		
		Theoretical	Reading	Deviation	P/F
mg/L		mg/L	mg/L		

Continuing Calibration Verification

	Temp (°C)	Theoretical	Reading	Deviation	P/F
Saturation (%)		100 %	%		
		Theoretical	Reading	Deviation	P/F
mg/L		mg/L	mg/L		

Conductivity — Standard: ± 5% of standard value

Initial Calibration

Mfr.	Lot #	Exp. Date	Standard	Reading
			mS^C/cm	mS^C/cm

Calibration Verifcation

Mfr.	Lot #	Exp. Date	Standard	Reading	Deviation	P/F
			mS^C/cm	mS^C/cm		
			mS^C/cm	mS^C/cm		

Continuing Calibration Verification

Mfr.	Lot #	Exp. Date	Standard	Reading	Deviation	P/F
			mS^C/cm	mS^C/cm		
			mS^C/cm	mS^C/cm		

pH — Standard: ± 0.2 standard units

Initial Calibration

Mfr.	Lot #	Exp. Date	Standard	Reading
			7 SU	SU
			4 SU	SU
			10 SU	SU

Calibration Verifcation

Mfr.	Lot #	Exp. Date	Standard	Reading	Deviation	P/F
			7 SU	SU		
			4 SU	SU		
			10 SU	SU		

Continuing Calibration Verification

Mfr.	Lot #	Exp. Date	Standard	Reading	Deviation	P/F
			SU	SU		
			SU	SU		

ORP (mV) — Standard: NA

Initial Calibration

Mfr.	Lot #	Exp. Date	Standard	Temp (°C)	Reading
			mV		mV

Calibration Verification

Mfr.	Lot #	Exp. Date	Standard	Temp (°C)	Reading
			mV		mV

Continuing Calibration Verification

Mfr.	Lot #	Exp. Date	Standard	Temp (°C)	Reading
			mV		mV

Turbidity (ntu) — Standard: See below

Initial Calibration

Standard	Reading

Calibration Verification

Standard	Reading	Deviation	Pass/Fail

Continuing Calibration Verification

Standard	Reading	Deviation	Pass/Fail

Turbidity Standards

0.1-10 NTU	*+/-10%*	41-100 NTU	*+/- 6.5%*
11-40 NTU	*+/- 8%*	>100 NTU	*+/- 5%*

Comments:

Water quality meter make/model/serial:

Turbidimeter make/model/serial:

Form 08/24/2015

Notes:

Mfr. = Manufacturer
P/F = Pass/Fail
Exp. Date = Expiration date
Temp = Temperature

SU = Standard Units
mV = millivolts
% = percent
mg/L = milligrams per liter

NTU = Nephelometric turbidity units
°C = degrees Celsius
mS^C/cm = millisiemens per centimeter (temp corrected)
* = Theoretical value listed on Table FT 1500-1

Resolution Consultants / Form FD 9000-24 (modified)

GROUNDWATER SAMPLING LOG

Site Name:	Site Location:	Date:
Well ID:	Sample ID:	

PURGING DATA

Well Diameter (inches):	Tubing Diameter (inches):	Well Screen Depth feet to feet	Static Depth to Water (ft):	Pump/Bailer Type

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY

(only if applicable) = (ft - ft) X gal/ft = **gal**

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOL.

(only if applicable) = gal + (gal/ft x ft)+ gal = **gal**

Initial Pump or Tubing Depth in Well (ft):	Final Pump or Tubing Depth in Well (ft):	Purging Initiated At:	Purging Ended At:	Total Vol Purged (gal):

Time	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft)	pH (standard units)	Temp (°C)	Conductivity (mS^C/cm)	Dissolved Oxygen (% sat.)	Dissolved Oxygen (mg/L)	Turbidity (NTUs)	ORP (mV)

Intial Purge Color/Odor:	Final Purge Color/Odor:

WELL CAPACITY (Gallons Per Foot): 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
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

PURGING EQUIPMENT CODES: B = Bailer; BP = Bladder Pump; ESP = Electric Submersible Pump; PP = Peristaltic Pump; O = Other (Specify)

SAMPLING DATA

Sampled by (Print) / Affiliation:	Sampler(s) Signature(s):	Sampling Initiated At:	Sampling Ended At:

Pump or Tubing Depth in Well (feet):	Tubing Material Code:	Field Filtering:

Field Decontamination:	Pump (Y/N):	Tubing Replaced (Y/N):	Duplicate (Y/N):

Field MNA Parameters:	IDW:

Dissolved Oxygen Kit Used:	Dissolved Oxygen Reading (mg/L):

Sample Container Specification				Sample Preservation			Intended Analysis and/or Method	Sampling Equipment Code	Sample Pump Flow Rate (mL per minute)
Sample ID Code	# of Cont.	Material Code	Volume	Pres. Used	Total Vol (mL)	Final pH			

Remarks:

CTO:	RC Project Code:	Phase:	Task:

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **HDPE** = High Density Polyethylene; **LDPE** = Low Density Polyethylene
PP = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump;
RFPP = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. The above do not constitute all of the information required by Chapter 62-160, F.A.C.
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3) **pH:** +/- 0.2 units **Temperature:** +/- 0.2 °C **Specific Conductance:** +/- 5% **Dissolved Oxygen:** all readings < 20% saturation (see Table FS 2200-2); optionally, +/- 0.2 mg/L or +/- 10% (whichever is greater) **Turbidity:** all readings < 20 NTU; optionally +/- 5 NTU or +/- 10% (whichever is greater)

RESOLUTION CONSULTANTS

CHAIN OF CUSTODY AND ANALYTICAL REQUEST RECORD

COC No.

Page of

Project Name:

PO No.

Project No: Phase: Task:

Site Location:

CTO No. RC Task Order Manager:

Sampler/Site Phone#

Lab Name: Turnaround Time(specify):

Sample Analysis Requested (*Enter number of containers for each test*)

Lab ID	Sample ID (sys_samp_code)	Location ID (sys_loc_code)	Date (mm/dd/yy)	Time (Military) (hhmm)	Matrix Code **(1)**	Sample Type **(2)**	Field Filtered (Y/N)	Total No. of Containers															Extra Volume for MS/MSD	HOLD
								(3)→																

***Field* Comments:**

***Lab* Comments:**

Sample Shipment and Delivery Details

Number of coolers in shipment:

Relinquished by (signature)	Date	Time	Received by (signature)	Date	Time	Samples Iced?(check) Yes_____ No____
1			1			Method of Shipment:
2			2			Airbill No:
3			3			Date Shipped:

(1) AA=Ambient air, **AQ**=Air quality control, **ASB**=Asbestos, **CK**=Caulk, **DS**=Storm drain sediment, **GS**=Soil gas, **IC**=IDW Concrete, **IDD**=IDW Solid, **IDS**=IDW soil, **IDW**=IDW Water, **LF**=Free Product, **MA**=Mastic, **PC**=Paint Chips, **SC**=Cement/Concrete, **SE**=Sediment, **SL**=Sludge, **SO**=Soil, **SQ**=Soil/Solid quality control, **SSD**=Subsurface sediment, **SU**=Surface soil (<6 in), **SW**=Swab or wipe, **TA**=Animal tissue, **TP**=Plant tissue, **TQ**=Tissue quality control, **WG**=Ground water, **WL**=Leachate, **WO**=Ocean water, **WP**=Drinking water, **WQ**=Water quality control, **WR**=Ground water effluent, **WS**=Surface water, **WU**=Storm water, **WW**=Waste water

(2) Sample Type: AB=Ambient Blk, **EB**=Equipment Blk, **FB**=Field Blk, **FD**=Field Duplicate Sample, **IDW**=Investigative-Derived Waste, **MIS**=Incremental Sampling Methodology, **N**=Normal Environmental Sample, **TB**=Trip Blk

(3) Preservative added: **HA**=Hydrochloric Acid, **NI**=Nitric Acid, **SH**=Sodium Hydroxide, **SA**=Sulfuric Acid, **ME**=Methanol, **SB**=sodium bisulfate, **ST**=Sodium Thiosulfate If **NO preservativ**e added leave blank

Rev 5/12

Appendix C
Laboratory Certification Documentation

Florida HEALTH

State of Florida

Department of Health, Bureau of Public Health Laboratories

This is to certify that

E87854

GULF COAST ANALYTICAL LABORATORIES LLC
7979 INNOVATION PARK DRIVE
BATON ROUGE, LA 70820

has complied with Florida Administrative Code 64E-1,
for the examination of environmental samples in the following categories

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 - PESTICIDES-HERBICIDES-PCB'S, SOLID AND CHEMICAL MATERIALS - GENERAL CHEMISTRY, SOLID AND CHEMICAL MATERIALS - METALS, SOLID AND CHEMICAL MATERIALS - VOLATILE ORGANICS, BIOLOGICAL TISSUE - EXTRACTABLE ORGANICS, BIOLOGICAL TISSUE - METALS, BIOLOGICAL TISSUE - PESTICIDES-HERBICIDES-PCB'S, BIOLOGICAL TISSUE - 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 Public Health 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.

Date Issued: July 15, 2015 Expiration Date: June 30, 2016

Carina Blackmore, DVM, PhD, Dipl. ACVPM, CPM
Chief, Bureau of Public Health Laboratories
DH Form 1697, 7/04
NON-TRANSFERABLE E87854-18-07/15/2015
Supersedes all previously issued certificates

Laboratory Scope of Accreditation

Attachment to Certificate #: E87854-18, expiration date June 30, 2016. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,1,1-Trichloroethane	EPA 624	Volatile Organics	NELAP	10/14/2002
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,1,2,2-Tetrachloroethane	EPA 624	Volatile Organics	NELAP	10/14/2002
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,1,2-Trichloroethane	EPA 624	Volatile Organics	NELAP	10/14/2002
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,1-Dichloroethane	EPA 624	Volatile Organics	NELAP	10/14/2002
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,1-Dichloroethylene	EPA 624	Volatile Organics	NELAP	10/14/2002
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	9/11/2008
1,2,4-Trichlorobenzene	EPA 625	Extractable Organics	NELAP	10/14/2002
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	9/11/2008
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8011	Volatile Organics	NELAP	9/11/2008
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8011	Volatile Organics	NELAP	9/11/2008
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,2-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	10/14/2002
1,2-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	10/14/2002
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	9/11/2008
1,2-Dichloroethane	EPA 624	Volatile Organics	NELAP	10/14/2002
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,2-Dichloropropane	EPA 624	Volatile Organics	NELAP	10/14/2002
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,2-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	9/11/2008
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	9/11/2008
1,2-Diphenylhydrazine (as Azobenzene)	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008

Attachment to Certificate #: E87854-18, expiration date June 30, 2016. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	9/11/2008
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	8/10/2011
1,3-Butadiene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,3-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	10/14/2002
1,3-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	10/14/2002
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	9/11/2008
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	9/11/2008
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	8/10/2011
1,4-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	10/14/2002
1,4-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	10/14/2002
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	9/11/2008
1,4-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	9/11/2008
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	9/11/2008
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	9/11/2008
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	9/11/2008
1-Bromo-2-chloroethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1-Chlorohexane	EPA 8260	Volatile Organics	NELAP	9/11/2008
1-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1-Methylnaphthalene	EPA 8310	Extractable Organics	NELAP	8/10/2011
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	9/11/2008
1-Nitropropane	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-(3H)-benzothiazolethione	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-(3H)-benzothiazolone	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,2,4-Trimethylpentane	EPA 8260	Volatile Organics	NELAP	8/10/2011
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	9/11/2008
2,2'-Oxybis(1-chloropropane),bis(2-Chloro-1-methylethyl)ether (fka bis(2-Chloroisopropyl) ether	EPA 8270	Extractable Organics	NELAP	9/11/2008
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
2,3,4-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,3,5,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,3-Diaminotoluene	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	8/10/2011
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	9/11/2008

Laboratory Scope of Accreditation

Attachment to Certificate #: E87854-18, expiration date June 30, 2016. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
2,4,6-Trichlorophenol	EPA 625	Extractable Organics	NELAP	8/10/2011
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	8/10/2011
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
2,4-Diaminotoluene	EPA 8270	Extractable Organics	NELAP	9/11/2008
2,4-Dichlorophenol	EPA 625	Extractable Organics	NELAP	8/10/2011
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
2,4-Dimethylphenol	EPA 625	Extractable Organics	NELAP	8/10/2011
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
2,4-Dinitrophenol	EPA 625	Extractable Organics	NELAP	8/10/2011
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
2,4-Dinitrotoluene (2,4-DNT)	EPA 625	Extractable Organics	NELAP	10/14/2002
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	9/11/2008
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	8/10/2011
2,5-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,6-Diaminotoluene	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
2,6-Dinitrotoluene (2,6-DNT)	EPA 625	Extractable Organics	NELAP	10/14/2002
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	9/11/2008
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	8/10/2011
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	9/11/2008
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	8/10/2011
2-Butanol (sec-butanol)	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	9/11/2008
2-Chloroethyl vinyl ether	EPA 624	Volatile Organics	NELAP	10/14/2002
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	9/11/2008
2-Chloronaphthalene	EPA 625	Extractable Organics	NELAP	10/14/2002
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	9/11/2008
2-Chlorophenol	EPA 625	Extractable Organics	NELAP	8/10/2011
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	9/11/2008
2-Hexanone	EPA 8260	Volatile Organics	NELAP	9/11/2008
2H-tetrahydropyran	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-Methyl-4,6-dinitrophenol	EPA 625	Extractable Organics	NELAP	8/10/2011

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Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
2-Methylnaphthalene	EPA 625	Extractable Organics	NELAP	8/10/2011
2-Methylnaphthalene	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	9/11/2008
2-Methylnaphthalene	EPA 8310	Extractable Organics	NELAP	8/10/2011
2-Methylphenol (o-Cresol)	EPA 625	Extractable Organics	NELAP	8/10/2011
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	9/11/2008
2-Naphthylamine	EPA 8270	Extractable Organics	NELAP	9/11/2008
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	9/11/2008
2-Nitrophenol	EPA 625	Extractable Organics	NELAP	8/10/2011
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
2-Nitropropane	EPA 8260	Volatile Organics	NELAP	9/11/2008
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	8/10/2011
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	9/11/2008
2-tert-butyl-4-methylphenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
3,3'-Dichlorobenzidine	EPA 625	Extractable Organics	NELAP	8/10/2011
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	9/11/2008
3,3-Dimethyl-1-butanol	EPA 8260	Volatile Organics	NELAP	8/10/2011
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	9/11/2008
3,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
3,4-Diaminotoluene	EPA 8270	Extractable Organics	NELAP	8/10/2011
3,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	9/11/2008
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	9/11/2008
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	9/11/2008
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	8/10/2011
4,4'-DDD	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
4,4'-DDE	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
4,4'-DDT	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
4,4'-Methylenebis(2-chloroaniline)	EPA 8270	Extractable Organics	NELAP	9/11/2008
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	8/10/2011
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	9/11/2008
4-Bromophenyl phenyl ether	EPA 625	Extractable Organics	NELAP	10/14/2002
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	9/11/2008
4-Chloro-3-methylphenol	EPA 625	Extractable Organics	NELAP	8/10/2011

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	9/11/2008
4-Chlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Chlorophenyl phenylether	EPA 625	Extractable Organics	NELAP	10/14/2002
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	9/11/2008
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	9/11/2008
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	9/11/2008
4-Methylphenol (p-Cresol)	EPA 625	Extractable Organics	NELAP	8/10/2011
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	9/11/2008
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	9/11/2008
4-Nitrophenol	EPA 625	Extractable Organics	NELAP	8/10/2011
4-Nitrophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	8/10/2011
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	9/11/2008
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	9/11/2008
a,a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	9/11/2008
Acenaphthene	EPA 625	Extractable Organics	NELAP	10/14/2002
Acenaphthene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Acenaphthene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Acenaphthylene	EPA 625	Extractable Organics	NELAP	10/14/2002
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Acetaldehyde	EPA 8315	Extractable Organics	NELAP	9/11/2008
Acetic acid	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
Acetone	EPA 8260	Volatile Organics	NELAP	9/11/2008
Acetonitrile	EPA 8260	Volatile Organics	NELAP	9/11/2008
Acetophenone	EPA 8270	Extractable Organics	NELAP	9/11/2008
Acidity, as CaCO3	SM 2310 B	General Chemistry	NELAP	10/14/2002
Acifluorfen	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Acrolein (Propenal)	EPA 624	Volatile Organics	NELAP	10/14/2002
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	9/11/2008
Acrylamide	EPA 8270	Extractable Organics	NELAP	8/10/2011
Acrylonitrile	EPA 624	Volatile Organics	NELAP	10/14/2002
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	9/11/2008

Laboratory Scope of Accreditation

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	10/14/2002
Allyl alcohol	EPA 8015	Volatile Organics	NELAP	8/10/2011
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	9/11/2008
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aluminum	EPA 200.7	Metals	NELAP	10/14/2002
Aluminum	EPA 200.8	Metals	NELAP	8/10/2011
Aluminum	EPA 6010	Metals	NELAP	9/11/2008
Aluminum	EPA 6020	Metals	NELAP	8/10/2011
Amenable cyanide	EPA 9012	General Chemistry	NELAP	8/10/2011
Ammonia as N	SM 4500-NH3 C (19th, 20th, 21st Ed.)/TITR	General Chemistry	NELAP	11/26/2013
Aniline	EPA 625	Extractable Organics	NELAP	8/10/2011
Aniline	EPA 8270	Extractable Organics	NELAP	9/11/2008
Anthracene	EPA 625	Extractable Organics	NELAP	10/14/2002
Anthracene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Anthracene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Antimony	EPA 200.7	Metals	NELAP	10/14/2002
Antimony	EPA 200.8	Metals	NELAP	8/10/2011
Antimony	EPA 6010	Metals	NELAP	9/11/2008
Antimony	EPA 6020	Metals	NELAP	8/10/2011
Aramite	EPA 8270	Extractable Organics	NELAP	9/11/2008
Aroclor-1016 (PCB-1016)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1221 (PCB-1221)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1232 (PCB-1232)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1242 (PCB-1242)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1248 (PCB-1248)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1254 (PCB-1254)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011

Laboratory Scope of Accreditation

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Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aroclor-1260 (PCB-1260)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Arsenic	EPA 200.7	Metals	NELAP	10/14/2002
Arsenic	EPA 200.8	Metals	NELAP	8/10/2011
Arsenic	EPA 6010	Metals	NELAP	9/11/2008
Arsenic	EPA 6020	Metals	NELAP	8/10/2011
Atrazine	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Atrazine	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Barium	EPA 200.7	Metals	NELAP	10/14/2002
Barium	EPA 200.8	Metals	NELAP	8/10/2011
Barium	EPA 6010	Metals	NELAP	9/11/2008
Barium	EPA 6020	Metals	NELAP	8/10/2011
Bentazon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Benzal chloride	EPA 8260	Volatile Organics	NELAP	8/10/2011
Benzaldehyde	EPA 8270	Extractable Organics	NELAP	8/10/2011
Benzene	EPA 602	Volatile Organics	NELAP	8/10/2011
Benzene	EPA 624	Volatile Organics	NELAP	10/14/2002
Benzene	EPA 8021	Volatile Organics	NELAP	9/11/2008
Benzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Benzidine	EPA 625	Extractable Organics	NELAP	8/10/2011
Benzidine	EPA 8270	Extractable Organics	NELAP	9/11/2008
Benzo(a)anthracene	EPA 625	Extractable Organics	NELAP	10/14/2002
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Benzo(a)pyrene	EPA 625	Extractable Organics	NELAP	10/14/2002
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Benzo(b)fluoranthene	EPA 625	Extractable Organics	NELAP	10/14/2002
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Benzo(g,h,i)perylene	EPA 625	Extractable Organics	NELAP	10/14/2002
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Benzo(k)fluoranthene	EPA 625	Extractable Organics	NELAP	10/14/2002
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	9/11/2008

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Benzoic acid	EPA 8270	Extractable Organics	NELAP	9/11/2008
Benzothiazole	EPA 8270	Extractable Organics	NELAP	8/10/2011
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	9/11/2008
Beryllium	EPA 200.7	Metals	NELAP	10/14/2002
Beryllium	EPA 200.8	Metals	NELAP	8/10/2011
Beryllium	EPA 6010	Metals	NELAP	9/11/2008
Beryllium	EPA 6020	Metals	NELAP	8/10/2011
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Biochemical oxygen demand	SM 5210 B	General Chemistry	NELAP	10/14/2002
Biphenyl	EPA 8270	Extractable Organics	NELAP	8/10/2011
bis(2-Chloroethoxy)methane	EPA 625	Extractable Organics	NELAP	10/14/2002
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	9/11/2008
bis(2-Chloroethyl) ether	EPA 625	Extractable Organics	NELAP	10/14/2002
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	9/11/2008
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 625	Extractable Organics	NELAP	10/14/2002
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	9/11/2008
Bolstar (Sulprofos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Boron	EPA 200.7	Metals	NELAP	10/14/2002
Boron	EPA 6010	Metals	NELAP	9/11/2008
Bromide	EPA 300.0	General Chemistry	NELAP	10/14/2002
Bromide	EPA 9056	General Chemistry	NELAP	8/10/2011
Bromobenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
Bromodichloromethane	EPA 624	Volatile Organics	NELAP	10/14/2002
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
Bromoform	EPA 624	Volatile Organics	NELAP	10/14/2002
Bromoform	EPA 8260	Volatile Organics	NELAP	9/11/2008
Butyl benzyl phthalate	EPA 625	Extractable Organics	NELAP	10/14/2002
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	9/11/2008
Butyric acid (Butanoic acid)	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
Cadmium	EPA 200.7	Metals	NELAP	10/14/2002
Cadmium	EPA 200.8	Metals	NELAP	8/10/2011
Cadmium	EPA 6010	Metals	NELAP	9/11/2008
Cadmium	EPA 6020	Metals	NELAP	8/10/2011

Laboratory Scope of Accreditation

Attachment to Certificate #: E87854-18, expiration date June 30, 2016. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Calcium	EPA 200.7	Metals	NELAP	10/14/2002
Calcium	EPA 6010	Metals	NELAP	9/11/2008
Calcium	EPA 6020	Metals	NELAP	8/10/2011
Caprolactam	EPA 8270	Extractable Organics	NELAP	8/10/2011
Carbazole	EPA 625	Extractable Organics	NELAP	8/10/2011
Carbazole	EPA 8270	Extractable Organics	NELAP	9/11/2008
Carbon dioxide	RSK-175	Volatile Organics	NELAP	8/10/2011
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	9/11/2008
Carbon tetrachloride	EPA 624	Volatile Organics	NELAP	10/14/2002
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	9/11/2008
Carbonaceous BOD (CBOD)	SM 5210 B	General Chemistry	NELAP	10/14/2002
Chemical oxygen demand	HACH 8000	General Chemistry	NELAP	10/14/2002
Chloramben	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Chlordane (tech.)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Chloride	EPA 300.0	General Chemistry	NELAP	10/14/2002
Chloride	EPA 9056	General Chemistry	NELAP	8/10/2011
Chloride	EPA 9251	General Chemistry	NELAP	8/10/2011
Chloride	SM 4500-Cl^- E	General Chemistry	NELAP	8/10/2011
Chlorine	SM 4500-Cl G	General Chemistry	NELAP	8/10/2011
Chlorobenzene	EPA 624	Volatile Organics	NELAP	10/14/2002
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Chloroethane	EPA 624	Volatile Organics	NELAP	10/14/2002
Chloroethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
Chloroform	EPA 624	Volatile Organics	NELAP	10/14/2002
Chloroform	EPA 8260	Volatile Organics	NELAP	9/11/2008
Chloroprene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Chlorpyrifos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Chromium	EPA 200.7	Metals	NELAP	10/14/2002
Chromium	EPA 200.8	Metals	NELAP	8/10/2011
Chromium	EPA 6010	Metals	NELAP	9/11/2008
Chromium	EPA 6020	Metals	NELAP	8/10/2011
Chromium VI	EPA 7196	General Chemistry	NELAP	8/10/2011
Chromium VI	SM 3500-Cr B (20th/21st/22nd Ed.)/UV-VIS	General Chemistry	NELAP	8/10/2011

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E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chrysene	EPA 625	Extractable Organics	NELAP	10/14/2002
Chrysene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Chrysene	EPA 8310	Extractable Organics	NELAP	8/10/2011
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	9/11/2008
cis-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	10/14/2002
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	9/11/2008
cis-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Cobalt	EPA 200.7	Metals	NELAP	10/14/2002
Cobalt	EPA 200.8	Metals	NELAP	8/10/2011
Cobalt	EPA 6010	Metals	NELAP	9/11/2008
Cobalt	EPA 6020	Metals	NELAP	8/10/2011
Color	NCASI 253	General Chemistry	NELAP	11/26/2013
Conductivity	EPA 9050	General Chemistry	NELAP	8/10/2011
Conductivity	SM 2510 B	General Chemistry	NELAP	8/10/2011
Copper	EPA 200.7	Metals	NELAP	10/14/2002
Copper	EPA 200.8	Metals	NELAP	8/10/2011
Copper	EPA 6010	Metals	NELAP	9/11/2008
Copper	EPA 6020	Metals	NELAP	8/10/2011
Corrosivity toward steel	EPA 1110	General Chemistry	NELAP	8/10/2011
Coumaphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Crotonaldehyde	EPA 8260	Volatile Organics	NELAP	9/11/2008
Cyanide	EPA 335.4	General Chemistry	NELAP	11/26/2013
Cyclohexane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Cyclohexanone	EPA 8260	Volatile Organics	NELAP	8/10/2011
Dacthal (DCPA)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
delta-BHC	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Demeton-o	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Demeton-s	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Diallate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Dibenz(a,h)anthracene	EPA 625	Extractable Organics	NELAP	10/14/2002
Dibenz(a,h)anthracene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Dibenz(a,h)anthracene	EPA 8310	Extractable Organics	NELAP	8/10/2011

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	9/11/2008
Dibromochloromethane	EPA 624	Volatile Organics	NELAP	10/14/2002
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
Dibromomethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Dichlorovos (DDVP, Dichlorvos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Dicyclopentadiene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Dicyclopentadiene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Dieldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	8/10/2011
Diethyl ether	EPA 8015	Volatile Organics	NELAP	8/10/2011
Diethyl ether	EPA 8260	Volatile Organics	NELAP	9/11/2008
Diethyl phthalate	EPA 625	Extractable Organics	NELAP	10/14/2002
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	9/11/2008
Diethylene glycol	EPA 8015	Volatile Organics	NELAP	8/10/2011
Dimethoate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Dimethyl disulfide	EPA 8260	Volatile Organics	NELAP	8/10/2011
Dimethyl phthalate	EPA 625	Extractable Organics	NELAP	10/14/2002
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	9/11/2008
Di-n-butyl phthalate	EPA 625	Extractable Organics	NELAP	10/14/2002
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	9/11/2008
Di-n-octyl phthalate	EPA 625	Extractable Organics	NELAP	10/14/2002
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	9/11/2008
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	9/11/2008
Diphenyl ether	EPA 8270	Extractable Organics	NELAP	8/10/2011
Diphenylamine	EPA 8270	Extractable Organics	NELAP	9/11/2008
Dissolved carbon	EPA 9060	General Chemistry	NELAP	8/10/2011
Dissolved carbon	SM 5310 B	General Chemistry	NELAP	8/10/2011
Dissolved organic carbon (DOC)	EPA 9060	General Chemistry	NELAP	8/10/2011
Dissolved organic carbon (DOC)	SM 5310 B	General Chemistry	NELAP	8/10/2011
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Endosulfan I	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Endosulfan II	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Endosulfan sulfate	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Endrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Endrin aldehyde	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
EPH Aliphatic C19-C36	MADEP-EPH (MA-EPH)	Extractable Organics	NELAP	8/10/2011
EPH Aliphatic C9-C18	MADEP-EPH (MA-EPH)	Extractable Organics	NELAP	8/10/2011
EPH Aromatic C11-C22	MADEP-EPH (MA-EPH)	Extractable Organics	NELAP	8/10/2011
EPN	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Ethane	RSK-175	Volatile Organics	NELAP	8/10/2011
Ethanol	EPA 8015	Volatile Organics	NELAP	8/10/2011
Ethanol	EPA 8260	Volatile Organics	NELAP	9/11/2008
Ethoprop	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Ethyl acetate	EPA 8260	Volatile Organics	NELAP	9/11/2008
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	9/11/2008
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	9/11/2008
Ethylbenzene	EPA 602	Volatile Organics	NELAP	8/10/2011
Ethylbenzene	EPA 624	Volatile Organics	NELAP	10/14/2002
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	9/11/2008
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Ethylene	RSK-175	Volatile Organics	NELAP	8/10/2011
Ethylene glycol	EPA 8015	Volatile Organics	NELAP	9/11/2008
Ethylene oxide	EPA 8015	Volatile Organics	NELAP	8/10/2011
Ethylene oxide	EPA 8260	Volatile Organics	NELAP	9/11/2008
Ethyl-t-butylether (ETBE)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Famphur	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Fensulfothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Fenthion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Fluoranthene	EPA 625	Extractable Organics	NELAP	10/14/2002

Laboratory Scope of Accreditation

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Fluoranthene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Fluoranthene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Fluorene	EPA 625	Extractable Organics	NELAP	10/14/2002
Fluorene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Fluorene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Fluoride	EPA 300.0	General Chemistry	NELAP	10/14/2002
Fluoride	EPA 9056	General Cbemistry	NELAP	8/10/2011
Formaldehyde	EPA 8315	Extractable Organics	NELAP	9/11/2008
Formic acid	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Gasoline range organics (GRO)	EPA 8015	Volatile Organics	NELAP	8/10/2011
Heptachlor	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Heptachlor epoxide	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Hexachlorobenzene	EPA 625	Extractable Organics	NELAP	10/14/2002
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Hexachlorobutadiene	EPA 625	Extractable Organics	NELAP	10/14/2002
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Hexachlorocyclopentadiene	EPA 625	Extractable Organics	NELAP	10/14/2002
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Hexachloroethane	EPA 625	Extractable Organics	NELAP	10/14/2002
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	9/11/2008
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Ignitability	EPA 1010	General Chemistry	NELAP	8/10/2011
Indene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Indeno(1,2,3-cd)pyrene	EPA 625	Extractable Organics	NELAP	10/14/2002
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	9/11/2008
Iron	EPA 200.7	Metals	NELAP	10/14/2002

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Iron	EPA 200.8	Metals	NELAP	8/10/2011
Iron	EPA 6010	Metals	NELAP	9/11/2008
Iron	EPA 6020	Metals	NELAP	8/10/2011
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	9/11/2008
Isodrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Isophorone	EPA 625	Extractable Organics	NELAP	10/14/2002
Isophorone	EPA 8270	Extractable Organics	NELAP	9/11/2008
Isopropyl alcohol (2-Propanol)	EPA 8015	Volatile Organics	NELAP	8/10/2011
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Isosafrole	EPA 8270	Extractable Organics	NELAP	9/11/2008
Kepone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Kjeldahl nitrogen - total	SM 4500-NH3 C (19th, 20th, 21st Ed.)/TITR	General Chemistry	NELAP	11/26/2013
Lactic acid	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
Lead	EPA 200.7	Metals	NELAP	10/14/2002
Lead	EPA 200.8	Metals	NELAP	8/10/2011
Lead	EPA 6010	Metals	NELAP	9/11/2008
Lead	EPA 6020	Metals	NELAP	8/10/2011
Lithium	EPA 200.7	Metals	NELAP	8/10/2011
Lithium	EPA 6010	Metals	NELAP	9/11/2008
m/p-Xylenes	EPA 8260	Volatile Organics	NELAP	8/10/2011
Magnesium	EPA 200.7	Metals	NELAP	10/14/2002
Magnesium	EPA 6010	Metals	NELAP	9/11/2008
Magnesium	EPA 6020	Metals	NELAP	8/10/2011
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Manganese	EPA 200.7	Metals	NELAP	10/14/2002
Manganese	EPA 200.8	Metals	NELAP	8/10/2011
Manganese	EPA 6010	Metals	NELAP	9/11/2008
Manganese	EPA 6020	Metals	NELAP	8/10/2011
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
m-Diethylbenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Mercury	EPA 245.2	Metals	NELAP	10/14/2002
Mercury	EPA 7470	Metals	NELAP	8/10/2011

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E87854
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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Merphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	9/11/2008
Methane	RSK-175	Volatile Organics	NELAP	8/10/2011
Methanol	EPA 8015	Volatile Organics	NELAP	9/11/2008
Methapyrilene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Methyl bromide (Bromomethane)	EPA 624	Volatile Organics	NELAP	10/14/2002
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	9/11/2008
Methyl chloride (Chloromethane)	EPA 624	Volatile Organics	NELAP	10/14/2002
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	9/11/2008
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	9/11/2008
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	9/11/2008
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	9/11/2008
Methylbenzothiazole	EPA 8270	Extractable Organics	NELAP	8/10/2011
Methylcyclohexane	EPA 8260	Volatile Organics	NELAP	11/26/2013
Methylene chloride	EPA 624	Volatile Organics	NELAP	10/14/2002
Methylene chloride	EPA 8260	Volatile Organics	NELAP	9/11/2008
Mevinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Mirex	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Molybdenum	EPA 200.7	Metals	NELAP	10/14/2002
Molybdenum	EPA 200.8	Metals	NELAP	8/10/2011
Molybdenum	EPA 6010	Metals	NELAP	9/11/2008
Molybdenum	EPA 6020	Metals	NELAP	8/10/2011
Monocrotophos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
m-Xylene	EPA 8021	Volatile Organics	NELAP	9/11/2008
Naled	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Naphthalene	EPA 625	Extractable Organics	NELAP	10/14/2002
Naphthalene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Naphthalene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Naphthalene	EPA 8310	Extractable Organics	NELAP	8/10/2011
n-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	9/11/2008
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
n-Decane	EPA 625	Extractable Organics	NELAP	8/10/2011
n-Hexane	EPA 8260	Volatile Organics	NELAP	8/10/2011

Laboratory Scope of Accreditation

Attachment to Certificate #: E87854-18, expiration date June 30, 2016. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Nickel	EPA 200.7	Metals	NELAP	10/14/2002
Nickel	EPA 200.8	Metals	NELAP	8/10/2011
Nickel	EPA 6010	Metals	NELAP	9/11/2008
Nickel	EPA 6020	Metals	NELAP	8/10/2011
Nitrate	EPA 300.0	General Chemistry	NELAP	8/10/2011
Nitrate	EPA 9056	General Chemistry	NELAP	8/10/2011
Nitrate as N	EPA 353.2	General Chemistry	NELAP	10/14/2002
Nitrite	EPA 300.0	General Chemistry	NELAP	8/10/2011
Nitrite	EPA 9056	General Chemistry	NELAP	8/10/2011
Nitrite as N	EPA 353.2	General Chemistry	NELAP	8/10/2011
Nitrobenzene	EPA 625	Extractable Organics	NELAP	10/14/2002
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	8/10/2011
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	9/11/2008
n-Nitrosodimethylamine	EPA 625	Extractable Organics	NELAP	10/14/2002
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	9/11/2008
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	9/11/2008
n-Nitrosodi-n-propylamine	EPA 625	Extractable Organics	NELAP	10/14/2002
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	9/11/2008
n-Nitrosodiphenylamine	EPA 625	Extractable Organics	NELAP	10/14/2002
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	9/11/2008
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	9/11/2008
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	9/11/2008
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	9/11/2008
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	9/11/2008
n-Octadecane	EPA 625	Extractable Organics	NELAP	8/10/2011
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	8/10/2011
Oil & Grease	EPA 1664A	General Chemistry	NELAP	10/14/2002
Oil range organics (ORO)	EPA 8015	Volatile Organics	NELAP	8/10/2011
Orthophosphate as P	SM 4500-P E	General Chemistry	NELAP	8/10/2011
o-Toluidine	EPA 8270	Extractable Organics	NELAP	9/11/2008
Oxygen, dissolved	SM 4500-O G	General Chemistry	NELAP	8/10/2011
o-Xylene	EPA 8021	Volatile Organics	NELAP	9/11/2008

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
o-Xylene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
p-Benzoquinone	EPA 8270	Extractable Organics	NELAP	9/11/2008
Pentachloroethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
Pentachloroethane	EPA 8270	Extractable Organics	NELAP	8/10/2011
Pentachloronitrobenzene (Quintozene)	EPA 8270	Extractable Organics	NELAP	9/11/2008
Pentachlorophenol	EPA 625	Extractable Organics	NELAP	8/10/2011
Pentachlorophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
Perchlorate	EPA 314.0	General Chemistry	NELAP	8/10/2011
pH	EPA 9040	General Chemistry	NELAP	8/10/2011
pH	SM 4500-H B	General Chemistry	NELAP	10/14/2002
Phenacetin	EPA 8270	Extractable Organics	NELAP	9/11/2008
Phenanthrene	EPA 625	Extractable Organics	NELAP	10/14/2002
Phenanthrene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Phenanthrene	EPA 8310	Extractable Organics	NELAP	8/10/2011
Phenol	EPA 625	Extractable Organics	NELAP	8/10/2011
Phenol	EPA 8270	Extractable Organics	NELAP	9/11/2008
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Phosphorus, total	EPA 365.1	General Chemistry	NELAP	8/10/2011
Phthalic acid	EPA 8270	Extractable Organics	NELAP	8/10/2011
Phthalic anhydride	EPA 8270	Extractable Organics	NELAP	9/11/2008
Picloram	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Potassium	EPA 200.7	Metals	NELAP	10/14/2002
Potassium	EPA 6010	Metals	NELAP	9/11/2008
Potassium	EPA 6020	Metals	NELAP	8/10/2011
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	9/11/2008
Propionic acid (Propanoic acid)	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	9/11/2008
p-Xylene	EPA 8021	Volatile Organics	NELAP	9/11/2008
Pyrene	EPA 625	Extractable Organics	NELAP	10/14/2002
Pyrene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Pyrene	EPA 8310	Extractable Organics	NELAP	8/10/2011

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Pyridine	EPA 625	Extractable Organics	NELAP	8/10/2011
Pyridine	EPA 8270	Extractable Organics	NELAP	9/11/2008
Pyruvic acid	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
Quinoline	EPA 8270	Extractable Organics	NELAP	8/10/2011
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	8/10/2011
Reactive cyanide	Sec. 7.3 SW-846	General Chemistry	NELAP	8/10/2011
Reactive sulfide	Sec. 7.3 SW-846	General Chemistry	NELAP	8/10/2011
Residue-filterable (TDS)	SM 2540 C	General Chemistry	NELAP	10/14/2002
Residue-nonfilterable (TSS)	SM 2540 D	General Chemistry	NELAP	10/14/2002
Residue-settleable	SM 2540 F	General Chemistry	NELAP	8/10/2011
Residue-total	SM 2540 B	General Chemistry	NELAP	10/14/2002
Residue-volatile	SM 2540 E	General Chemistry	NELAP	10/14/2002
Ronnel	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Safrole	EPA 8270	Extractable Organics	NELAP	9/11/2008
Salinity	SM 2520 B	General Chemistry	NELAP	8/10/2011
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Selenium	EPA 200.7	Metals	NELAP	10/14/2002
Selenium	EPA 200.8	Metals	NELAP	8/10/2011
Selenium	EPA 6010	Metals	NELAP	9/11/2008
Selenium	EPA 6020	Metals	NELAP	8/10/2011
Silica as SiO2	SM 4500-SiO2 C (20th/21st Ed.)/UV-VIS	General Chemistry	NELAP	11/26/2013
Silver	EPA 200.7	Metals	NELAP	10/14/2002
Silver	EPA 200.8	Metals	NELAP	8/10/2011
Silver	EPA 6010	Metals	NELAP	9/11/2008
Silver	EPA 6020	Metals	NELAP	8/10/2011
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Sodium	EPA 200.7	Metals	NELAP	10/14/2002
Sodium	EPA 6010	Metals	NELAP	9/11/2008
Sodium	EPA 6020	Metals	NELAP	8/10/2011
Stirofos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Strontium	EPA 200.7	Metals	NELAP	8/10/2011
Strontium	EPA 200.8	Metals	NELAP	8/10/2011
Strontium	EPA 6020	Metals	NELAP	8/10/2011
Styrene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Sulfate	EPA 300.0	General Chemistry	NELAP	10/14/2002

Laboratory Scope of Accreditation

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Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Sulfate	EPA 9038	General Chemistry	NELAP	8/10/2011
Sulfate	EPA 9056	General Chemistry	NELAP	8/10/2011
Sulfate	SM 4500 SO4-E	General Chemistry	NELAP	11/26/2013
Sulfide	EPA 9030/9034	General Chemistry	NELAP	8/10/2011
Sulfide	EPA 9034	General Chemistry	NELAP	8/10/2011
Sulfide	SM 4500-S D/UV-VIS	General Chemistry	NELAP	8/10/2011
Sulfide	SM 4500-S E (18th Ed.)/TITR	General Chemistry	NELAP	8/10/2011
Sulfide	SM 4500-S F	General Chemistry	NELAP	11/26/2013
Sulfite-SO3	SM 4500-SO3 B	General Chemistry	NELAP	10/14/2002
Sulfotepp	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Sulfotepp	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Surfactants - MBAS	SM 5540 C	General Chemistry	NELAP	10/14/2002
Synthetic Precipitation Leaching Procedure	EPA 1312	General Chemistry	NELAP	8/10/2011
T-amylmethylether (TAME)	EPA 8260	Volatile Organics	NELAP	8/10/2011
tert-Amyl alcohol (2-methyl-2-butanol)	EPA 8260	Volatile Organics	NELAP	8/10/2011
tert-Butyl alcohol (2-Methyl-2-propanol)	EPA 8260	Volatile Organics	NELAP	9/11/2008
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Tetrachloroethylene (Perchloroethylene)	EPA 624	Volatile Organics	NELAP	10/14/2002
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	9/11/2008
Tetrahydrofuran (THF)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	8/10/2011
Thallium	EPA 200.7	Metals	NELAP	10/14/2002
Thallium	EPA 200.8	Metals	NELAP	8/10/2011
Thallium	EPA 6010	Metals	NELAP	9/11/2008
Thallium	EPA 6020	Metals	NELAP	8/10/2011
Thionazin (Zinophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Thiophenol (Benzenethiol)	EPA 8270	Extractable Organics	NELAP	9/11/2008
Tin	EPA 200.7	Metals	NELAP	10/14/2002
Tin	EPA 200.8	Metals	NELAP	8/10/2011
Tin	EPA 6010	Metals	NELAP	9/11/2008
Titanium	EPA 200.7	Metals	NELAP	10/14/2002
Titanium	EPA 200.8	Metals	NELAP	8/10/2011
Titanium	EPA 6010	Metals	NELAP	9/11/2008
Tokuthion (Prothiophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Toluene	EPA 602	Volatile Organics	NELAP	8/10/2011

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Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Toluene	EPA 624	Volatile Organics	NELAP	10/14/2002
Toluene	EPA 8021	Volatile Organics	NELAP	9/11/2008
Toluene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Toluene diisocyanate	EPA 8270	Extractable Organics	NELAP	9/11/2008
Toluene-2,4-diamine	EPA 8270	Extractable Organics	NELAP	8/10/2011
Total carbon	EPA 9060	General Chemistry	NELAP	8/10/2011
Total carbon	SM 5310 B	General Chemistry	NELAP	8/10/2011
Total Cresols	EPA 8270	Extractable Organics	NELAP	8/10/2011
Total cyanide	EPA 9012	General Chemistry	NELAP	8/10/2011
Total difluorobenzenes	EPA 8260	Volatile Organics	NELAP	8/10/2011
Total inorganic carbon (calculated)	SM 5310 B	General Chemistry	NELAP	8/10/2011
Total nitrate-nitrite	EPA 300.0	General Chemistry	NELAP	8/10/2011
Total nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	10/14/2002
Total nitrate-nitrite	EPA 9056	General Chemistry	NELAP	8/10/2011
Total organic carbon	EPA 9060	General Chemistry	NELAP	8/10/2011
Total organic carbon	SM 5310 B	General Chemistry	NELAP	10/14/2002
Total organic halides (TOX)	EPA 9020	General Chemistry	NELAP	8/10/2011
Total Petroleum Hydrocarbons (TPH)	EPA 8015	Extractable Organics	NELAP	8/10/2011
Total Petroleum Hydrocarbons (TPH)	FL-PRO	Extractable Organics	NELAP	7/22/2008
Total phenolics	EPA 420.4	General Chemistry	NELAP	8/10/2011
Total phenolics	EPA 9066	General Chemistry	NELAP	8/10/2011
Total recoverable petroleum hydrocarbons (TRPH)	FL-PRO	Extractable Organics	NELAP	7/22/2008
Total residual chlorine	SM 4500-Cl G	General Chemistry	NELAP	10/14/2002
Toxaphene (Chlorinated camphene)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	8/10/2011
trans-1,2-Dichloroethylene	EPA 624	Volatile Organics	NELAP	10/14/2002
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	9/11/2008
trans-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	10/14/2002
trans-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	9/11/2008
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	9/11/2008
Trichloroethene (Trichloroethylene)	EPA 624	Volatile Organics	NELAP	10/14/2002
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	9/11/2008
Trichlorofluoromethane	EPA 624	Volatile Organics	NELAP	10/14/2002
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	9/11/2008
Trichloronate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008

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E87854
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Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
tris-(2,3-Dibromopropyl) phosphate (tris-BP)	EPA 8270	Extractable Organics	NELAP	8/10/2011
Turbidity	EPA 180.1	General Chemistry	NELAP	10/14/2002
Vanadium	EPA 200.7	Metals	NELAP	10/14/2002
Vanadium	EPA 200.8	Metals	NELAP	8/10/2011
Vanadium	EPA 6010	Metals	NELAP	9/11/2008
Vanadium	EPA 6020	Metals	NELAP	8/10/2011
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	9/11/2008
Vinyl chloride	EPA 624	Volatile Organics	NELAP	10/14/2002
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	9/11/2008
VPH Aromatic C9-C10	MADEP-VPH (MA-VPH)	Volatile Organics	NELAP	8/10/2011
Xylene (total)	EPA 602	Volatile Organics	NELAP	8/10/2011
Xylene (total)	EPA 624	Volatile Organics	NELAP	10/14/2002
Xylene (total)	EPA 8021	Volatile Organics	NELAP	9/11/2008
Xylene (total)	EPA 8260	Volatile Organics	NELAP	9/11/2008
Zinc	EPA 200.7	Metals	NELAP	10/14/2002
Zinc	EPA 200.8	Metals	NELAP	8/10/2011
Zinc	EPA 6010	Metals	NELAP	9/11/2008
Zinc	EPA 6020	Metals	NELAP	8/10/2011
Zirconium	EPA 200.7	Metals	NELAP	8/10/2011

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E87854
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Matrix: Solid and Chemical Materials

Analyte	Method/Tecb	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,2,3,4-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,2,3,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	10/14/2002
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/14/2002
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/14/2002
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	10/14/2002
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	10/14/2002
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	10/14/2002
1,3-Butadiene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/14/2002
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	10/14/2002
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/14/2002
1,4-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011

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E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	10/14/2002
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	10/14/2002
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	8/10/2011
1-Bromo-2-chloroethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1-Chlorohexane	EPA 8260	Volatile Organics	NELAP	10/14/2002
1-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1-Methylnaphthalene	EPA 8310	Extractable Organics	NELAP	8/10/2011
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/14/2002
1-Nitropropane	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-(3H)-benzothiazolethione	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-(3H)-benzothiazolone	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,2,4-Trimethylpentane	EPA 8260	Volatile Organics	NELAP	8/10/2011
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/14/2002
2,2'-Oxybis(1-chloropropane),bis(2-Chloro-1-methylethyl)ether (fka bis(2-Chloroisopropyl) ether	EPA 8270	Extractable Organics	NELAP	10/14/2002
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
2,3-Diaminotoluene	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	8/10/2011
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	10/14/2002
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
2,4-Diaminotoluene	EPA 8270	Extractable Organics	NELAP	10/14/2002
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	10/14/2002
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	10/14/2002
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	10/14/2002
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	10/14/2002
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	10/14/2002
2-Butanol (sec-butanol)	EPA 8260	Volatile Organics	NELAP	8/10/2011

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State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	10/14/2002
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	10/14/2002
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	10/14/2002
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
2-Chloropropane	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	10/14/2002
2-Hexanone	EPA 8260	Volatile Organics	NELAP	10/14/2002
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	10/14/2002
2-Methylnaphthalene	EPA 8310	Extractable Organics	NELAP	8/10/2011
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	10/14/2002
2-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/14/2002
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/14/2002
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
2-Nitropropane	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	10/14/2002
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	10/14/2002
2-tert-butyl-4-methylphenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	10/14/2002
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	10/14/2002
3,4-Diaminotoluene	EPA 8270	Extractable Organics	NELAP	8/10/2011
3,5-Dichlorobenzoic acid	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	10/14/2002
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	10/14/2002
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/14/2002
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	10/14/2002
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
4,4'-Methylenebis(2-chloroaniline)	EPA 8270	Extractable Organics	NELAP	10/14/2002
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	10/14/2002
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	10/14/2002
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	10/14/2002
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	10/14/2002
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	10/14/2002

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Analyte	Method/Tech	Category	Certification Type	Effective Date
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	10/14/2002
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	10/14/2002
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	10/14/2002
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/14/2002
4-Nitrophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	10/14/2002
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	10/14/2002
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Acenaphthene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Acenaphthene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Acetic acid	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
Acetone	EPA 8260	Volatile Organics	NELAP	10/14/2002
Acetonitrile	EPA 8260	Volatile Organics	NELAP	10/14/2002
Acetophenone	EPA 8270	Extractable Organics	NELAP	10/14/2002
Acifluorfen	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Acrylamide	EPA 8270	Extractable Organics	NELAP	8/10/2011
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	10/14/2002
Alachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Allyl alcohol	EPA 8015	Volatile Organics	NELAP	8/10/2011
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	10/14/2002
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aluminum	EPA 6010	Metals	NELAP	10/14/2002
Aluminum	EPA 6020	Metals	NELAP	8/10/2011
Amenable cyanide	EPA 9012	General Chemistry	NELAP	10/14/2002
Ammonia as N	SM 4500-NH3 B	General Chemistry	NELAP	8/10/2011
Ammonia as N	SM 4500-NH3 E (18th Ed.)/TITR	General Chemistry	NELAP	8/10/2011
Aniline	EPA 8270	Extractable Organics	NELAP	10/14/2002
Anthracene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Anthracene	EPA 8310	Extractable Organics	NELAP	10/14/2002

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Antimony	EPA 6010	Metals	NELAP	10/14/2002
Antimony	EPA 6020	Metals	NELAP	8/10/2011
Aramite	EPA 8270	Extractable Organics	NELAP	8/10/2011
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Aroclor-1262 (PCB-1262)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1268 (PCB-1268)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Arsenic	EPA 6010	Metals	NELAP	10/14/2002
Arsenic	EPA 6020	Metals	NELAP	8/10/2011
Atrazine	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Atrazine	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Barium	EPA 6010	Metals	NELAP	10/14/2002
Barium	EPA 6020	Metals	NELAP	8/10/2011
Bentazon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Benzal chloride	EPA 8260	Volatile Organics	NELAP	8/10/2011
Benzaldehyde	EPA 8270	Extractable Organics	NELAP	8/10/2011
Benzene	EPA 8021	Volatile Organics	NELAP	10/14/2002
Benzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Benzidine	EPA 8270	Extractable Organics	NELAP	10/14/2002
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Benzoic acid	EPA 8270	Extractable Organics	NELAP	10/14/2002

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Benzothiazole	EPA 8270	Extractable Organics	NELAP	8/10/2011
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	10/14/2002
Beryllium	EPA 6010	Metals	NELAP	10/14/2002
Beryllium	EPA 6020	Metals	NELAP	8/10/2011
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Biphenyl	EPA 8270	Extractable Organics	NELAP	8/10/2011
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	10/14/2002
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	10/14/2002
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	10/14/2002
Bolstar (Sulprofos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Boron	EPA 6010	Metals	NELAP	10/14/2002
Bromide	EPA 9056	General Chemistry	NELAP	10/14/2002
Bromobenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
Bromoform	EPA 8260	Volatile Organics	NELAP	10/14/2002
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	10/14/2002
Butyric acid (Butanoic acid)	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
Cadmium	EPA 6010	Metals	NELAP	10/14/2002
Cadmium	EPA 6020	Metals	NELAP	8/10/2011
Calcium	EPA 6010	Metals	NELAP	10/14/2002
Calcium	EPA 6020	Metals	NELAP	8/10/2011
Caprolactam	EPA 8270	Extractable Organics	NELAP	8/10/2011
Carbazole	EPA 8270	Extractable Organics	NELAP	10/14/2002
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	10/14/2002
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	10/14/2002
Chloramben	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Chloride	EPA 9056	General Chemistry	NELAP	10/14/2002
Chloride	EPA 9251	General Chemistry	NELAP	10/14/2002
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Chlorobenzilate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Chloroethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
Chloroform	EPA 8260	Volatile Organics	NELAP	10/14/2002
Chloroprene	EPA 8260	Volatile Organics	NELAP	10/14/2002

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Chlorpyrifos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Chromium	EPA 6010	Metals	NELAP	10/14/2002
Chromium	EPA 6020	Metals	NELAP	8/10/2011
Chromium VI	EPA 7196	General Chemistry	NELAP	10/14/2002
Chrysene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Chrysene	EPA 8310	Extractable Organics	NELAP	10/14/2002
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	10/14/2002
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	10/14/2002
cis-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Cobalt	EPA 6010	Metals	NELAP	10/14/2002
Cobalt	EPA 6020	Metals	NELAP	8/10/2011
Conductivity	EPA 9050	General Chemistry	NELAP	8/10/2011
Copper	EPA 6010	Metals	NELAP	10/14/2002
Copper	EPA 6020	Metals	NELAP	8/10/2011
Corrosivity (pH)	EPA 9040	General Chemistry	NELAP	10/14/2002
Corrosivity toward steel	EPA 1110	General Chemistry	NELAP	10/14/2002
Coumaphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Crotonaldehyde	EPA 8260	Volatile Organics	NELAP	8/10/2011
Cyclohexane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Cyclohexanone	EPA 8260	Volatile Organics	NELAP	8/10/2011
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Demeton-o	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Demeton-s	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Diallate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Dibenz(a,h)acridine	EPA 8270	Extractable Organics	NELAP	8/10/2011
Dibenz(a,h)anthracene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Dibenz(a,h)anthracene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	10/14/2002
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
Dibromomethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Dichlorovos (DDVP, Dichlorvos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Dicyclopentadiene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	8/10/2011
Diethyl ether	EPA 8015	Volatile Organics	NELAP	8/10/2011
Diethyl ether	EPA 8260	Volatile Organics	NELAP	10/14/2002
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	10/14/2002
Diethylene glycol	EPA 8015	Volatile Organics	NELAP	8/10/2011
Di-isopropylether (DIPE)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Dimethoate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Dimethyl disulfide	EPA 8260	Volatile Organics	NELAP	8/10/2011
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	10/14/2002
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	10/14/2002
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	10/14/2002
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	8/10/2011
Dipbenyl ether	EPA 8270	Extractable Organics	NELAP	8/10/2011
Diphenylamine	EPA 8270	Extractable Organics	NELAP	10/14/2002
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
EPH Aliphatic C19-C36	MADEP-EPH (MA-EPH)	Extractable Organics	NELAP	8/10/2011
EPH Aliphatic C9-C18	MADEP-EPH (MA-EPH)	Extractable Organics	NELAP	8/10/2011
EPH Aromatic C11-C22	MADEP-EPH (MA-EPH)	Extractable Organics	NELAP	8/10/2011
EPN	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Ethoprop	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Ethyl acetate	EPA 8260	Volatile Organics	NELAP	10/14/2002
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/14/2002
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	10/14/2002
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	10/14/2002
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Ethylene glycol	EPA 8015	Volatile Organics	NELAP	8/10/2011

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State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Ethylene oxide	EPA 8015	Volatile Organics	NELAP	8/10/2011
Ethylene oxide	EPA 8260	Volatile Organics	NELAP	10/14/2002
Ethyl-t-butylether (ETBE)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Famphur	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Fensulfothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Fenthion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Fluoranthene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Fluoranthene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Fluorene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Fluorene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Fluoride	EPA 9056	General Chemistry	NELAP	10/14/2002
Formaldehyde	EPA 8315	Extractable Organics	NELAP	8/10/2011
Formic acid	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	8/10/2011
Heat of combustion (btu)	ASTM D-240	General Chemistry	NELAP	8/10/2011
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Hexabromobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Hexachlorobenzene	EPA 8270	Extractable Organics,Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics,Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	10/14/2002
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Ignitability	EPA 1010	General Chemistry	NELAP	10/14/2002
Ignitability	EPA 1030	General Chemistry	NELAP	10/14/2002
Indene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	10/14/2002

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Iron	EPA 6010	Metals	NELAP	10/14/2002
Iron	EPA 6020	Metals	NELAP	8/10/2011
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Isodrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Isophorone	EPA 8270	Extractable Organics	NELAP	10/14/2002
Isopropyl alcohol (2-Propanol)	EPA 8015	Volatile Organics	NELAP	8/10/2011
Isopropyl alcohol (2-Propanol)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Isosafrole	EPA 8270	Extractable Organics	NELAP	10/14/2002
Kepone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Kjeldahl nitrogen - total	SM 4500-NH3 E (18th Ed.)/TITR	General Chemistry	NELAP	8/10/2011
Lactic acid	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
Lead	EPA 6010	Metals	NELAP	10/14/2002
Lead	EPA 6020	Metals	NELAP	8/10/2011
Lithium	EPA 6010	Metals	NELAP	8/10/2011
Magnesium	EPA 6010	Metals	NELAP	10/14/2002
Magnesium	EPA 6020	Metals	NELAP	8/10/2011
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Manganese	EPA 6010	Metals	NELAP	10/14/2002
Manganese	EPA 6020	Metals	NELAP	8/10/2011
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Mercury	EPA 7471	Metals	NELAP	10/14/2002
Merphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	8/10/2011
Methanol	EPA 8015	Volatile Organics	NELAP	8/10/2011
Methapyrilene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Methyl acetate	EPA 8260	Volatile Organics	NELAP	8/10/2011
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/14/2002

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	8/10/2011
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Methylbenzothiazole	EPA 8270	Extractable Organics	NELAP	8/10/2011
Methylchrysenes (total)	EPA 8270	Extractable Organics	NELAP	8/10/2011
Methylcyclohexane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Methylene chloride	EPA 8260	Volatile Organics	NELAP	10/14/2002
Methylnaphthalenes (total)	EPA 8270	Extractable Organics	NELAP	8/10/2011
Mevinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Mirex	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Molybdenum	EPA 6010	Metals	NELAP	10/14/2002
Molybdenum	EPA 6020	Metals	NELAP	8/10/2011
Monocrotophos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Naled	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Naphthalene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Naphthalene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Naphthalene	EPA 8310	Extractable Organics	NELAP	10/14/2002
n-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	10/14/2002
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
n-Hexane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Nickel	EPA 6010	Metals	NELAP	10/14/2002
Nickel	EPA 6020	Metals	NELAP	8/10/2011
Nitrate	EPA 9056	General Chemistry	NELAP	8/10/2011
Nitrate as N	EPA 353.2	General Chemistry	NELAP	8/10/2011
Nitrite	EPA 9056	General Chemistry	NELAP	8/10/2011
Nitrite as N	EPA 353.2	General Chemistry	NELAP	8/10/2011
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	10/14/2002
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	10/14/2002
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	10/14/2002
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	10/14/2002
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	10/14/2002
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	10/14/2002
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	10/14/2002
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	10/14/2002

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	10/14/2002
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	10/14/2002
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	10/14/2002
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
o,o,o-Triethyl phosphorothioate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	10/14/2002
Oil & Grease	EPA 9071	General Chemistry	NELAP	10/14/2002
Organic nitrogen	TKN minus AMMONIA	General Chemistry	NELAP	8/10/2011
o-Toluidine	EPA 8270	Extractable Organics	NELAP	10/14/2002
Paint Filter Liquids Test	EPA 9095	General Chemistry	NELAP	10/14/2002
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
p-Benzoquinone	EPA 8270	Extractable Organics	NELAP	8/10/2011
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Pentachloroethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
Pentachloroethane	EPA 8270	Extractable Organics	NELAP	8/10/2011
Pentachloronitrobenzene (Quintozene)	EPA 8270	Extractable Organics,Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Pentachlorophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
pH	EPA 9045	General Chemistry	NELAP	10/14/2002
Phenacetin	EPA 8270	Extractable Organics	NELAP	10/14/2002
Phenanthrene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Phenanthrene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Phenol	EPA 8270	Extractable Organics	NELAP	10/14/2002
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Phosphorus, total	EPA 365.1	General Chemistry	NELAP	8/10/2011
Phthalic acid	EPA 8270	Extractable Organics	NELAP	8/10/2011
Phthalic anhydride	EPA 8270	Extractable Organics	NELAP	10/14/2002
Picloram	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Potassium	EPA 6010	Metals	NELAP	10/14/2002
Potassium	EPA 6020	Metals	NELAP	8/10/2011
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	10/14/2002

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Baton Rouge, LA 70820

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Propionic acid (Propanoic acid)	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Pyrene	EPA 8270	Extractable Organics	NELAP	10/14/2002
Pyrene	EPA 8310	Extractable Organics	NELAP	10/14/2002
Pyridine	EPA 8270	Extractable Organics	NELAP	10/14/2002
Pyruvic acid	GCAL SOP WL-070/IC-COND	Volatile Organics	NELAP	7/23/2014
Quinoline	EPA 8270	Extractable Organics	NELAP	8/10/2011
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	10/14/2002
Reactive cyanide	EPA 7.3.3.2	General Chemistry	NELAP	10/14/2002
Reactive sulfide	EPA 7.3.4.2	General Chemistry	NELAP	10/14/2002
Safrole	EPA 8270	Extractable Organics	NELAP	10/14/2002
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Selenium	EPA 6010	Metals	NELAP	10/14/2002
Selenium	EPA 6020	Metals	NELAP	8/10/2011
Silver	EPA 6010	Metals	NELAP	10/14/2002
Silver	EPA 6020	Metals	NELAP	8/10/2011
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Simazine	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Sodium	EPA 6010	Metals	NELAP	10/14/2002
Sodium	EPA 6020	Metals	NELAP	8/10/2011
Stirofos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Strontium	EPA 6010	Metals	NELAP	10/14/2002
Strontium	EPA 6020	Metals	NELAP	8/10/2011
Styrene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Sulfate	EPA 9038	General Chemistry	NELAP	10/14/2002
Sulfate	EPA 9056	General Chemistry	NELAP	10/14/2002
Sulfide	EPA 9030/9034	General Chemistry	NELAP	10/14/2002
Sulfotepp	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Sulfotepp	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Synthetic Precipitation Leaching Procedure	EPA 1312	General Chemistry	NELAP	10/14/2002
T-amylmethylether (TAME)	EPA 8260	Volatile Organics	NELAP	8/10/2011
tert-Butyl alcohol (2-Methyl-2-propanol)	EPA 8260	Volatile Organics	NELAP	10/14/2002
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Tetraethyl pyrophosphate (TEPP)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Tetrahydrofuran (THF)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	10/14/2002
Thallium	EPA 6010	Metals	NELAP	10/14/2002
Thallium	EPA 6020	Metals	NELAP	8/10/2011
Thionazin (Zinophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Thiophenol (Benzenethiol)	EPA 8270	Extractable Organics	NELAP	8/10/2011
Tin	EPA 6010	Metals	NELAP	10/14/2002
Titanium	EPA 6010	Metals	NELAP	8/10/2011
Tokuthion (Prothiophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Toluene	EPA 8021	Volatile Organics	NELAP	10/14/2002
Toluene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Toluene diisocyanate	EPA 8270	Extractable Organics	NELAP	10/14/2002
Total Cresols	EPA 8270	Extractable Organics	NELAP	8/10/2011
Total cyanide	EPA 9012	General Chemistry	NELAP	10/14/2002
Total difluorobenzenes	EPA 8260	Volatile Organics	NELAP	8/10/2011
Total nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	8/10/2011
Total nitrate-nitrite	EPA 9056	General Chemistry	NELAP	8/10/2011
Total organic carbon	EPA 9060	General Chemistry	NELAP	10/14/2002
Total Petroleum Hydrocarbons (TPH)	EPA 8015	Extractable Organics	NELAP	8/10/2011
Total Petroleum Hydrocarbons (TPH)	FL-PRO	Extractable Organics	NELAP	7/22/2008
Total phenolics	EPA 9066	General Chemistry	NELAP	10/14/2002
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	10/14/2002
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	10/14/2002
trans-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	10/14/2002
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	10/14/2002
tris-(2,3-Dibromopropyl) phosphate (tris-BP)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Vanadium	EPA 6010	Metals	NELAP	10/14/2002
Vanadium	EPA 6020	Metals	NELAP	8/10/2011
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	10/14/2002
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	10/14/2002
VPH Aromatic C9-C10	MADEP-VPH (MA-VPH)	Volatile Organics	NELAP	8/10/2011
Xylene (total)	EPA 8021	Volatile Organics	NELAP	10/14/2002

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Xylene (total)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Zinc	EPA 6010	Metals	NELAP	10/14/2002
Zinc	EPA 6020	Metals	NELAP	8/10/2011

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Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,2,3,4-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,2-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,3-Butadiene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,4-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	8/10/2011
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	8/10/2011
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	8/10/2011

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State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
1-Chlorohexane	EPA 8260	Volatile Organics	NELAP	8/10/2011
1-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	8/10/2011
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	8/10/2011
2,2'-Oxybis(1-chloropropane),bis(2-Chloro-1-methylethyl)ether (fka bis(2-Chloroisopropyl) ether	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,3,5,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	8/10/2011
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
2,4-Diaminotoluene	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,5-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,6-Diaminotoluene	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-Chloropropane	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-Hexanone	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-Methylnaphthalene	EPA 8260	Volatile Organics	NELAP	8/10/2011
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011

Laboratory Scope of Accreditation

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Gulf Coast Analytical Laboratories LLC
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Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	8/10/2011
2-Sec-butyl-4,6-dinitrophenol (DNBP, Dinoseb)	EPA 8270	Extractable Organics	NELAP	8/10/2011
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	8/10/2011
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	8/10/2011
3,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
3,5-Dichlorobenzoic acid	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	8/10/2011
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	8/10/2011
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	8/10/2011
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
4,4'-Methylenebis(2-chloroaniline)	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Chlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	8/10/2011
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	8/10/2011
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	8/10/2011
4-Nitrophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	8/10/2011
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	8/10/2011
a,a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	8/10/2011
Acenaphthene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Acetone	EPA 8260	Volatile Organics	NELAP	8/10/2011
Acetonitrile	EPA 8260	Volatile Organics	NELAP	8/10/2011
Acetophenone	EPA 8270	Extractable Organics	NELAP	8/10/2011
Acifluorfen	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	8/10/2011

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Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	8/10/2011
Alachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	8/10/2011
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aluminum	EPA 6010	Metals	NELAP	8/10/2011
Aniline	EPA 8270	Extractable Organics	NELAP	8/10/2011
Anthracene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Antimony	EPA 6010	Metals	NELAP	8/10/2011
Aramite	EPA 8270	Extractable Organics	NELAP	8/10/2011
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1262 (PCB-1262)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Aroclor-1268 (PCB-1268)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Arsenic	EPA 6010	Metals	NELAP	8/10/2011
Atrazine	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Barium	EPA 6010	Metals	NELAP	8/10/2011
Bentazon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Benzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Benzidine	EPA 8270	Extractable Organics	NELAP	8/10/2011
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Benzoic acid	EPA 8270	Extractable Organics	NELAP	8/10/2011
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	8/10/2011
Beryllium	EPA 6010	Metals	NELAP	8/10/2011
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
beta-Naphthylamine	EPA 8270	Extractable Organics	NELAP	8/10/2011

Laboratory Scope of Accreditation

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Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
Biphenyl	EPA 8270	Extractable Organics	NELAP	8/10/2011
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	8/10/2011
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	8/10/2011
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	8/10/2011
Boron	EPA 6010	Metals	NELAP	8/10/2011
Bromobenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Bromoform	EPA 8260	Volatile Organics	NELAP	8/10/2011
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	8/10/2011
Cadmium	EPA 6010	Metals	NELAP	8/10/2011
Calcium	EPA 6010	Metals	NELAP	8/10/2011
Caprolactam	EPA 8270	Extractable Organics	NELAP	8/10/2011
Carbazole	EPA 8270	Extractable Organics	NELAP	8/10/2011
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	8/10/2011
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	8/10/2011
Chloramben	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Chloroethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Chloroform	EPA 8260	Volatile Organics	NELAP	8/10/2011
Chloroprene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Chromium	EPA 6010	Metals	NELAP	8/10/2011
Chrysene	EPA 8270	Extractable Organics	NELAP	8/10/2011
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	8/10/2011
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	8/10/2011
cis-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Cobalt	EPA 6010	Metals	NELAP	8/10/2011
Copper	EPA 6010	Metals	NELAP	8/10/2011
Crotonaldehyde	EPA 8260	Volatile Organics	NELAP	8/10/2011
Cyclohexane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Cyclohexanone	EPA 8260	Volatile Organics	NELAP	8/10/2011
Dacthal (DCPA)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011

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Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
Diallate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Dibenz(a,h)acridine	EPA 8270	Extractable Organics	NELAP	8/10/2011
Dibenz(a,h)anthracene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	8/10/2011
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Dibromomethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Diethyl ether	EPA 8260	Volatile Organics	NELAP	8/10/2011
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	8/10/2011
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	8/10/2011
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	8/10/2011
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	8/10/2011
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Diphenylamine	EPA 8270	Extractable Organics	NELAP	8/10/2011
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	8/10/2011
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	8/10/2011
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Ethylene glycol	EPA 8015	Volatile Organics	NELAP	8/10/2011
Ethyl-t-butylether (ETBE)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Fluoranthene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Fluorene	EPA 8270	Extractable Organics	NELAP	8/10/2011
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011

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Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	8/10/2011
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Indene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Iron	EPA 6010	Metals	NELAP	8/10/2011
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Isodrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Isophorone	EPA 8270	Extractable Organics	NELAP	8/10/2011
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Isosafrole	EPA 8270	Extractable Organics	NELAP	8/10/2011
Kepone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Lead	EPA 6010	Metals	NELAP	8/10/2011
Lithium	EPA 6010	Metals	NELAP	8/10/2011
Magnesium	EPA 6010	Metals	NELAP	8/10/2011
Maleic anhydride	EPA 8270	Extractable Organics	NELAP	8/10/2011
Manganese	EPA 6010	Metals	NELAP	8/10/2011
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Mercury	EPA 7471	Metals	NELAP	8/10/2011
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	8/10/2011
Methapyrilene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Methyl acetate	EPA 8260	Volatile Organics	NELAP	8/10/2011
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	8/10/2011
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	8/10/2011

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Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Methylene chloride	EPA 8260	Volatile Organics	NELAP	8/10/2011
Mirex	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Molybdenum	EPA 6010	Metals	NELAP	8/10/2011
Naphthalene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Naphthalene	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Nickel	EPA 6010	Metals	NELAP	8/10/2011
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	8/10/2011
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
o-Toluidine	EPA 8270	Extractable Organics	NELAP	8/10/2011
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
p-Benzoquinone	EPA 8270	Extractable Organics	NELAP	8/10/2011
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Pentachloroethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
Pentachloronitrobenzene (Quintozene)	EPA 8270	Extractable Organics	NELAP	8/10/2011
Pentachlorophenol	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
Phenacetin	EPA 8270	Extractable Organics	NELAP	8/10/2011
Phenanthrene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Phenol	EPA 8270	Extractable Organics	NELAP	8/10/2011
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Phthalic anhydride	EPA 8270	Extractable Organics	NELAP	8/10/2011
Picloram	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011

Laboratory Scope of Accreditation

Attachment to Certificate #: E87854-18, expiration date June 30, 2016. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Potassium	EPA 6010	Metals	NELAP	8/10/2011
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	8/10/2011
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Pyrene	EPA 8270	Extractable Organics	NELAP	8/10/2011
Pyridine	EPA 8270	Extractable Organics	NELAP	8/10/2011
Quinoline	EPA 8270	Extractable Organics	NELAP	8/10/2011
Safrole	EPA 8270	Extractable Organics	NELAP	8/10/2011
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Selenium	EPA 6010	Metals	NELAP	8/10/2011
Silicon	EPA 6010	Metals	NELAP	8/10/2011
Silver	EPA 6010	Metals	NELAP	8/10/2011
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Sodium	EPA 6010	Metals	NELAP	8/10/2011
Strontium	EPA 6010	Metals	NELAP	8/10/2011
Styrene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Sulfotepp	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
T-amylmethylether (TAME)	EPA 8260	Volatile Organics	NELAP	8/10/2011
tert-Butyl alcohol (2-Methyl-2-propanol)	EPA 8260	Volatile Organics	NELAP	8/10/2011
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Tetrahydrofuran (THF)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Thallium	EPA 6010	Metals	NELAP	8/10/2011
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
Thiophenol (Benzenethiol)	EPA 8270	Extractable Organics	NELAP	8/10/2011
Tin	EPA 6010	Metals	NELAP	8/10/2011
Titanium	EPA 6010	Metals	NELAP	8/10/2011
Toluene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Toluene diisocyanate	EPA 8270	Extractable Organics	NELAP	8/10/2011
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/10/2011
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	8/10/2011
trans-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	8/10/2011
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	8/10/2011
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	8/10/2011
tris-(2,3-Dibromopropyl) phosphate (tris-BP)	EPA 8270	Extractable Organics	NELAP	8/10/2011

Attachment to Certificate #: E87854-18, expiration date June 30, 2016. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
Vanadium	EPA 6010	Metals	NELAP	8/10/2011
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	8/10/2011
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	8/10/2011
Xylene (total)	EPA 8260	Volatile Organics	NELAP	8/10/2011
Zinc	EPA 6010	Metals	NELAP	8/10/2011

PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:

Gulf Coast Analytical Laboratories, LLC

7979 Innovation Park Drive, Baton Rouge, LA 70820

(Hereinafter called the Organization) and hereby declares that Organization has met the requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the DoD Quality Systems Manual for Environmental Laboratories Version 5.0 July 2013 and is accredited is accordance with the:

United States Department of Defense
Environmental Laboratory Accreditation Program
(DoD-ELAP)

This accreditation demonstrates technical competence for the defined scope:

Environmental Testing

(As detailed in the supplement)

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Initial Accreditation Date:	*Issue Date:*	*Expiration Date:*
October 2, 2013	September 9, 2014	September 9, 2016

Accreditation No.:	*Certificate No.:*
74960	L14-243

Tracy Szerszen
President/Operations Manager

Perry Johnson Laboratory
Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjlabs.com

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Gulf Coast Analytical Laboratories, LLC
7979 Innovation Park Drive, Baton Rouge, LA 70820
Randy Whittington Phone: 225-769-4900

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 1664A	Gravimetric	Oil & Grease
Aqueous	EPA 200.8	ICP-MS	Aluminum
Aqueous	EPA 200.8	ICP-MS	Antimony
Aqueous	EPA 200.8	ICP-MS	Arsenic
Aqueous	EPA 200.8	ICP-MS	Barium
Aqueous	EPA 200.8	ICP-MS	Beryllium
Aqueous	EPA 200.8	ICP-MS	Cadmium
Aqueous	EPA 200.8	ICP-MS	Calcium
Aqueous	EPA 200.8	ICP-MS	Chromium
Aqueous	EPA 200.8	ICP-MS	Cobalt
Aqueous	EPA 200.8	ICP-MS	Copper
Aqueous	EPA 200.8	ICP-MS	Iron
Aqueous	EPA 200.8	ICP-MS	Lead
Aqueous	EPA 200.8	ICP-MS	Magnesium
Aqueous	EPA 200.8	ICP-MS	Manganese
Aqueous	EPA 200.8	ICP-MS	Molybdenum
Aqueous	EPA 200.8	ICP-MS	Nickel
Aqueous	EPA 200.8	ICP-MS	Potassium
Aqueous	EPA 200.8	ICP-MS	Selenium
Aqueous	EPA 200.8	ICP-MS	Silver
Aqueous	EPA 200.8	ICP-MS	Sodium
Aqueous	EPA 200.8	ICP-MS	Strontium
Aqueous	EPA 200.8	ICP-MS	Thallium
Aqueous	EPA 200.8	ICP-MS	Tin
Aqueous	EPA 200.8	ICP-MS	Titanium
Aqueous	EPA 200.8	ICP-MS	Total Hardness (as CaCO3)
Aqueous	EPA 200.8	ICP-MS	Vanadium
Aqueous	EPA 200.8	ICP-MS	Zinc
Aqueous	EPA 200.8	ICP-MS	Zirconium
Aqueous	EPA 245.2	CVAA	Mercury
Aqueous	EPA 300.0	IC	Bromide
Aqueous	EPA 300.0	IC	Chloride
Aqueous	EPA 300.0	IC	Fluoride
Aqueous	EPA 300.0	IC	Nitrate and Nitrite as N
Aqueous	EPA 300.0	IC	Nitrate as N
Aqueous	EPA 300.0	IC	Nitrite as N

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Gulf Coast Analytical Laboratories, LLC
7979 Innovation Park Drive, Baton Rouge, LA 70820
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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 300.0	IC	Sulfate
Aqueous	EPA 420.4	FIA	Total Phenolics (4AAP)
Aqueous	EPA 624	GC-MS	1,1,1,2-Tetrachloroethane
Aqueous	EPA 624	GC-MS	1,1,1-Trichloroethane
Aqueous	EPA 624	GC-MS	1,1,2,2-Tetrachloroethane
Aqueous	EPA 624	GC-MS	1,1,2-Trichloroethane
Aqueous	EPA 624	GC-MS	1,1-Dichloroethane
Aqueous	EPA 624	GC-MS	1,1-Dichloroethene
Aqueous	EPA 624	GC-MS	1,1-Dichloropropene
Aqueous	EPA 624	GC-MS	1,2 Dichlorobenzene
Aqueous	EPA 624	GC-MS	1,2 Dichloroethane
Aqueous	EPA 624	GC-MS	1,2,3-Trichlorobenzene
Aqueous	EPA 624	GC-MS	1,2,3-Trichloropropane
Aqueous	EPA 624	GC-MS	1,2,4-Trichlorobenzene
Aqueous	EPA 624	GC-MS	1,2,4-Trimethylbenzene
Aqueous	EPA 624	GC-MS	1,2-Dibromo-3-chloropropane (DBCP)
Aqueous	EPA 624	GC-MS	1,2-Dibromoethane (EDB)
Aqueous	EPA 624	GC-MS	1,2-Dichloropropane
Aqueous	EPA 624	GC-MS	1,3 Dichlorobenzene
Aqueous	EPA 624	GC-MS	1,3,5-Trimethylbenzene
Aqueous	EPA 624	GC-MS	1,3-Dichloropropane
Aqueous	EPA 624	GC-MS	1,4 Dichlorobenzene
Aqueous	EPA 624	GC-MS	2,2-Dichloropropane
Aqueous	EPA 624	GC-MS	2-Butanone (MEK)
Aqueous	EPA 624	GC-MS	2-Chloroethylvinylether
Aqueous	EPA 624	GC-MS	2-Chlorotoluene
Aqueous	EPA 624	GC-MS	2-Hexanone
Aqueous	EPA 624	GC-MS	4-Chlorotoluene
Aqueous	EPA 624	GC-MS	4-Methyl-2-pentanone (MIBK)
Aqueous	EPA 624	GC-MS	Acetone
Aqueous	EPA 624	GC-MS	Acetonitrile
Aqueous	EPA 624	GC-MS	Acrolein
Aqueous	EPA 624	GC-MS	Acrylonitrile
Aqueous	EPA 624	GC-MS	Benzene
Aqueous	EPA 624	GC-MS	Bromochloromethane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Gulf Coast Analytical Laboratories, LLC
7979 Innovation Park Drive, Baton Rouge, LA 70820
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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 624	GC-MS	Bromodichloromethane
Aqueous	EPA 624	GC-MS	Bromoform
Aqueous	EPA 624	GC-MS	Bromomethane
Aqueous	EPA 624	GC-MS	Carbon disulfide
Aqueous	EPA 624	GC-MS	Carbon tetrachloride
Aqueous	EPA 624	GC-MS	Chlorobenzene
Aqueous	EPA 624	GC-MS	Chloroethane
Aqueous	EPA 624	GC-MS	Chloroform
Aqueous	EPA 624	GC-MS	Chloromethane
Aqueous	EPA 624	GC-MS	cis-1,2-Dichloroethene
Aqueous	EPA 624	GC-MS	cis-1,3-Dichloropropylene
Aqueous	EPA 624	GC-MS	Dibromochloromethane
Aqueous	EPA 624	GC-MS	Dibromomethane
Aqueous	EPA 624	GC-MS	Dichlorodifluoromethane
Aqueous	EPA 624	GC-MS	Ethylbenzene
Aqueous	EPA 624	GC-MS	Hexachlorobutadiene
Aqueous	EPA 624	GC-MS	Isopropylbenzene
Aqueous	EPA 624	GC-MS	m+p-Xylene
Aqueous	EPA 624	GC-MS	Methyl tert-butyl ether (MTBE)
Aqueous	EPA 624	GC-MS	Methylene Chloride
Aqueous	EPA 624	GC-MS	Naphthalene
Aqueous	EPA 624	GC-MS	n-Butylbenzene
Aqueous	EPA 624	GC-MS	n-Propylbenzene
Aqueous	EPA 624	GC-MS	o-Xylene
Aqueous	EPA 624	GC-MS	p-Isopropyltoluene
Aqueous	EPA 624	GC-MS	sec-Butylbenzene
Aqueous	EPA 624	GC-MS	Styrene
Aqueous	EPA 624	GC-MS	tert-Butylbenzene
Aqueous	EPA 624	GC-MS	Tetrachloroethene
Aqueous	EPA 624	GC-MS	Toluene
Aqueous	EPA 624	GC-MS	trans-1,2-Dichloroethene
Aqueous	EPA 624	GC-MS	trans-1,3-Dichloropropene
Aqueous	EPA 624	GC-MS	Trichloroethene
Aqueous	EPA 624	GC-MS	Trichlorofluoromethane
Aqueous	EPA 624	GC-MS	Vinyl acetate
Aqueous	EPA 624	GC-MS	Vinyl chloride

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Gulf Coast Analytical Laboratories, LLC
7979 Innovation Park Drive, Baton Rouge, LA 70820
Randy Whittington Phone: 225-769-4900

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 624	GC-MS	Xylenes, total
Aqueous	EPA 625	GC-MS	1,2,4,5-Tetrachlorobenzene
Aqueous	EPA 625	GC-MS	1,2,4-Trichlorobenzene
Aqueous	EPA 625	GC-MS	1-Methylnaphthalene
Aqueous	EPA 625	GC-MS	2,3,4,6-Tetrachlorophenol
Aqueous	EPA 625	GC-MS	2,4,5-Trichlorophenol
Aqueous	EPA 625	GC-MS	2,4,6-Trichlorophenol
Aqueous	EPA 625	GC-MS	2,4-Dichlorophenol
Aqueous	EPA 625	GC-MS	2,4-Dimethylphenol
Aqueous	EPA 625	GC-MS	2,4-Dinitrophenol
Aqueous	EPA 625	GC-MS	2,4-Dinitrotoluene
Aqueous	EPA 625	GC-MS	2,6-Dichlorophenol
Aqueous	EPA 625	GC-MS	2,6-Dinitrotoluene
Aqueous	EPA 625	GC-MS	2-Chloronaphthalene
Aqueous	EPA 625	GC-MS	2-Chlorophenol
Aqueous	EPA 625	GC-MS	2-Methyl-4,6-Dinitrophenol
Aqueous	EPA 625	GC-MS	2-Methylnaphthalene
Aqueous	EPA 625	GC-MS	2-Methylphenol
Aqueous	EPA 625	GC-MS	2-Nitroaniline
Aqueous	EPA 625	GC-MS	2-Nitrophenol
Aqueous	EPA 625	GC-MS	3,3'-Dichlorobenzidine
Aqueous	EPA 625	GC-MS	3-Nitroaniline
Aqueous	EPA 625	GC-MS	4-Bromophenyl-phenylether
Aqueous	EPA 625	GC-MS	4-Chloro-3-methylphenol
Aqueous	EPA 625	GC-MS	4-Chloroaniline
Aqueous	EPA 625	GC-MS	4-Chlorophenyl-phenylether
Aqueous	EPA 625	GC-MS	4-Methylphenol (and/or 3-Methylphenol)
Aqueous	EPA 625	GC-MS	4-Nitroaniline
Aqueous	EPA 625	GC-MS	4-Nitrophenol
Aqueous	EPA 625	GC-MS	Acenaphthene
Aqueous	EPA 625	GC-MS	Acenaphthylene
Aqueous	EPA 625	GC-MS	Aniline
Aqueous	EPA 625	GC-MS	Anthracene
Aqueous	EPA 625	GC-MS	Benzidine
Aqueous	EPA 625	GC-MS	Benzo(a)anthracene

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Gulf Coast Analytical Laboratories, LLC
7979 Innovation Park Drive, Baton Rouge, LA 70820
Randy Whittington Phone: 225-769-4900

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Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 625	GC-MS	Benzo(a)pyrene
Aqueous	EPA 625	GC-MS	Benzo(b)fluoranthene
Aqueous	EPA 625	GC-MS	Benzo(g,h,i)perylene
Aqueous	EPA 625	GC-MS	Benzo(k)fluoranthene
Aqueous	EPA 625	GC-MS	Benzoic acid
Aqueous	EPA 625	GC-MS	Benzyl alcohol
Aqueous	EPA 625	GC-MS	bis(2-Chloroethoxy)methane
Aqueous	EPA 625	GC-MS	bis(2-Chloroethyl)ether
Aqueous	EPA 625	GC-MS	bis(2-Chloroiospropyl) ether
Aqueous	EPA 625	GC-MS	bis(2-ethylhexyl) phthalate
Aqueous	EPA 625	GC-MS	Butyl benzyl phthalate
Aqueous	EPA 625	GC-MS	Carbazole
Aqueous	EPA 625	GC-MS	Chrysene
Aqueous	EPA 625	GC-MS	Dibenzo(a,h)anthracene
Aqueous	EPA 625	GC-MS	Dibenzofuran
Aqueous	EPA 625	GC-MS	Diethyl phthalate
Aqueous	EPA 625	GC-MS	Dimethyl phthalate
Aqueous	EPA 625	GC-MS	Di-n-butylphthalate
Aqueous	EPA 625	GC-MS	Di-n-octylphthalate
Aqueous	EPA 625	GC-MS	Fluoranthene
Aqueous	EPA 625	GC-MS	Fluorene
Aqueous	EPA 625	GC-MS	Hexachlorobenzene
Aqueous	EPA 625	GC-MS	Hexachlorocyclopentadiene
Aqueous	EPA 625	GC-MS	Indeno(1,2,3, cd)pyrene
Aqueous	EPA 625	GC-MS	Isophorone
Aqueous	EPA 625	GC-MS	Naphthalene
Aqueous	EPA 625	GC-MS	Nitrobenzene
Aqueous	EPA 625	GC-MS	N-Nitrosodiethylamine
Aqueous	EPA 625	GC-MS	N-Nitrosodimethylamine
Aqueous	EPA 625	GC-MS	N-Nitroso-di-n-propylamine
Aqueous	EPA 625	GC-MS	N-Nitrosodiphenylamine
Aqueous	EPA 625	GC-MS	o-Toluidine
Aqueous	EPA 625	GC-MS	Pentachlorobenzene
Aqueous	EPA 625	GC-MS	Pentachlorophenol
Aqueous	EPA 625	GC-MS	Phenanthrene
Aqueous	EPA 625	GC-MS	Phenol

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Gulf Coast Analytical Laboratories, LLC
7979 Innovation Park Drive, Baton Rouge, LA 70820
Randy Whittington Phone: 225-769-4900

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 625	GC-MS	Pyrene
Aqueous	EPA 625	GC-MS	Pyridine
Aqueous	EPA 7470A	CVAA	Mercury
Aqueous	EPA 8011	GC-ECD	1,2-Dibromo-3-chloropropane (DBCP)
Aqueous	EPA 8011	GC-ECD	1,2-Dibromoethane (EDB)
Aqueous	EPA 9040C	pH Meter	Corrosivity (pH)
Aqueous	HACH 8000	Spectrophotometer	COD
Aqueous	RSK-175	GC-FID	Acetylene
Aqueous	RSK-175	GC-FID	Butane
Aqueous	RSK-175	GC-TCD	Carbon Dioxide
Aqueous	RSK-175	GC-FID	Ethane
Aqueous	RSK-175	GC-FID	Ethene
Aqueous	RSK-175	GC-FID	Methane
Aqueous	RSK-175	GC-FID	Propane
Aqueous	SM 2130B	Turbidimetric	Turbidity
Aqueous	SM 2310B	Titration	Acidity(as CaCO3)
Aqueous	SM 2320B	Titration	Total Alkalinity(as CaCO3)
Aqueous	SM 2340 B	ICP-MS	Total Hardness (as CaCO3)
Aqueous	SM 2540B	Gravimetric	Total Solids
Aqueous	SM 2540C	Gravimetric	Total Dissolved Solids (TDS)
Aqueous	SM 2540D	Gravimetric	Non-Filterable Residue (TSS)
Aqueous	SM 3500 Fe B	Spectrophotometer	Ferrous Iron
Aqueous	SM 4500 Cl E	Autotitrator	Chloride
Aqueous	SM 4500 H+B	pH Meter	Corrosivity (pH)
Aqueous	SM 4500 H+B	pH Meter	pH
Aqueous	SM 4500 PE	Spectrophotometer	Orthophosphate as P
Aqueous	SM 4500 S2 D	Spectrophotometer	Sulfide
Aqueous	SM 4500 S2 F	Titration	Sulfide
Aqueous	SM 4500 SiO2 C	Spectrophotometer	Silica
Aqueous	SM 4500 SO4 E	IC	Sulfate
Aqueous	SM 5310B	TOC Analyzer	TOC
Aqueous	EPA 9020B	TOX Analyzer	Total Organic Halides
Solids	EPA 1030	N/A	Ignitability
Solids	EPA 7471B	CVAA	Mercury
Solids	EPA 9045D	pH Meter	Corrosivity (pH)

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

Gulf Coast Analytical Laboratories, LLC
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Randy Whittington Phone: 225-769-4900

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Solids	EPA 9095B	N/A	Paint Filter Test
Solids	SM 2540G	Gravimetric	Percent Moisture
Solids	SM 2540G	Gravimetric	Total Solids
Aqueous/Solids	ASTM D-1385	Spectrophotometer	Hydrazine
Aqueous/Solids	EPA 1010A	Automated FP Analyzer	Ignitability
Aqueous/Solids	EPA 314.0	Spectrophotometer	Perchlorate
Aqueous/Solids	EPA 353.2	FIA	Nitrate and Nitrite as N
Aqueous/Solids	EPA 353.2	FIA	Nitrate as N
Aqueous/Solids	EPA 353.2	FIA	Nitrite as N
Aqueous/Solids	EPA 365.1	FIA	Total Phosphorous
Aqueous/Solids	EPA 6020A	ICP-MS	Aluminum
Aqueous/Solids	EPA 6020A	ICP-MS	Antimony
Aqueous/Solids	EPA 6020A	ICP-MS	Arsenic
Aqueous/Solids	EPA 6020A	ICP-MS	Barium
Aqueous/Solids	EPA 6020A	ICP-MS	Beryllium
Aqueous/Solids	EPA 6020A	ICP-MS	Cadmium
Aqueous/Solids	EPA 6020A	ICP-MS	Calcium
Aqueous/Solids	EPA 6020A	ICP-MS	Chromium
Aqueous/Solids	EPA 6020A	ICP-MS	Cobalt
Aqueous/Solids	EPA 6020A	ICP-MS	Copper
Aqueous/Solids	EPA 6020A	ICP-MS	Iron
Aqueous/Solids	EPA 6020A	ICP-MS	Lead
Aqueous/Solids	EPA 6020A	ICP-MS	Magnesium
Aqueous/Solids	EPA 6020A	ICP-MS	Manganese
Aqueous/Solids	EPA 6020A	ICP-MS	Molybdenum
Aqueous/Solids	EPA 6020A	ICP-MS	Nickel
Aqueous/Solids	EPA 6020A	ICP-MS	Potassium
Aqueous/Solids	EPA 6020A	ICP-MS	Selenium
Aqueous/Solids	EPA 6020A	ICP-MS	Silver
Aqueous/Solids	EPA 6020A	ICP-MS	Sodium
Aqueous/Solids	EPA 6020A	ICP-MS	Strontium
Aqueous/Solids	EPA 6020A	ICP-MS	Thallium
Aqueous/Solids	EPA 6020A	ICP-MS	Tin
Aqueous/Solids	EPA 6020A	ICP-MS	Titanium
Aqueous/Solids	EPA 6020A	ICP-MS	Vanadium

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ISO/IEC 17025:2005 and DoD-ELAP

Gulf Coast Analytical Laboratories, LLC
7979 Innovation Park Drive, Baton Rouge, LA 70820
Randy Whittington Phone: 225-769-4900

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 6020A	ICP-MS	Zinc
Aqueous/Solids	EPA 6020A	ICP-MS	Zirconium
Aqueous/Solids	EPA 7196A	Spectrophotometer	Chromium VI
Aqueous/Solids	EPA 8015C	GC-FID	Diesel
Aqueous/Solids	EPA 8015C	GC-FID	Diesel range organics (DRO)
Aqueous/Solids	EPA 8015C	GC-FID	Gasoline range organics (GRO)
Aqueous/Solids	EPA 8015C	GC-FID	Oil Range Organics (ORO)
Aqueous/Solids	EPA 8081B	GC-ECD	Aldrin
Aqueous/Solids	EPA 8081B	GC-ECD	alpha-BHC
Aqueous/Solids	EPA 8081B	GC-ECD	alpha-Chlordane
Aqueous/Solids	EPA 8081B	GC-ECD	beta-BHC
Aqueous/Solids	EPA 8081B	GC-ECD	Chlordane
Aqueous/Solids	EPA 8081B	GC-ECD	Chlordane (total)
Aqueous/Solids	EPA 8081B	GC-ECD	DDD (4,4')
Aqueous/Solids	EPA 8081B	GC-ECD	DDE (4,4')
Aqueous/Solids	EPA 8081B	GC-ECD	DDT (4,4')
Aqueous/Solids	EPA 8081B	GC-ECD	delta-BHC
Aqueous/Solids	EPA 8081B	GC-ECD	Dieldrin
Aqueous/Solids	EPA 8081B	GC-ECD	Endosulfan I
Aqueous/Solids	EPA 8081B	GC-ECD	Endosulfan II
Aqueous/Solids	EPA 8081B	GC-ECD	Endosulfan sulfate
Aqueous/Solids	EPA 8081B	GC-ECD	Endrin
Aqueous/Solids	EPA 8081B	GC-ECD	Endrin aldehyde
Aqueous/Solids	EPA 8081B	GC-ECD	Endrin ketone
Aqueous/Solids	EPA 8081B	GC-ECD	gamma-BHC (Lindane)
Aqueous/Solids	EPA 8081B	GC-ECD	gamma-Chlordane
Aqueous/Solids	EPA 8081B	GC-ECD	Heptachlor
Aqueous/Solids	EPA 8081B	GC-ECD	Heptachlor Epoxide (beta)
Aqueous/Solids	EPA 8081B	GC-ECD	Methoxychlor
Aqueous/Solids	EPA 8081B	GC-ECD	Toxaphene
Aqueous/Solids	EPA 8081B	GC-ECD	Toxaphene (total)
Aqueous/Solids	EPA 8082A	GC-ECD	Aroclor 1016
Aqueous/Solids	EPA 8082A	GC-ECD	Aroclor 1221
Aqueous/Solids	EPA 8082A	GC-ECD	Aroclor 1232
Aqueous/Solids	EPA 8082A	GC-ECD	Aroclor 1242
Aqueous/Solids	EPA 8082A	GC-ECD	Aroclor 1248

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Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8082A	GC-ECD	Aroclor 1254
Aqueous/Solids	EPA 8082A	GC-ECD	Aroclor 1260
Aqueous/Solids	EPA 8082A	GC-ECD	Aroclor 1262
Aqueous/Solids	EPA 8082A	GC –ECD	Aroclor 1268
Aqueous/Solids	EPA 8141B	GC-NPD	Azinphos-methyl (Guthion)
Aqueous/Solids	EPA 8141B	GC-NPD	Diazinon
Aqueous/Solids	EPA 8141B	GC-NPD	Disulfoton
Aqueous/Solids	EPA 8141B	GC-NPD	Malathion
Aqueous/Solids	EPA 8141B	GC-NPD	Parathion, ethyl
Aqueous/Solids	EPA 8141B	GC-NPD	Parathion, methyl
Aqueous/Solids	EPA 8141B	GC-NPD	Phorate
Aqueous/Solids	EPA 8141B	GC-NPD	Ronnel
Aqueous/Solids	EPA 8141B	GC-NPD	Stirophos
Aqueous/Solids	EPA 8151A	GC-ECD	2, 4, DB
Aqueous/Solids	EPA 8151A	GC-ECD	2, 4-D
Aqueous/Solids	EPA 8151A	GC-ECD	2,4,5-T
Aqueous/Solids	EPA 8151A	GC-ECD	2,4,5-TP (Silvex)
Aqueous/Solids	EPA 8151A	GC-ECD	2,4-DP (Dichlorprop)
Aqueous/Solids	EPA 8151A	GC-ECD	3,5-Dichlorobenzoic acid
Aqueous/Solids	EPA 8151A	GC-ECD	4-Nitrophenol
Aqueous/Solids	EPA 8151A	GC-ECD	Acifluorfen
Aqueous/Solids	EPA 8151A	GC-ECD	Bentazon
Aqueous/Solids	EPA 8151A	GC-ECD	Chloramben
Aqueous/Solids	EPA 8151A	GC-ECD	Dacthal (DCPA)
Aqueous/Solids	EPA 8151A	GC-ECD	Dalapon
Aqueous/Solids	EPA 8151A	GC-ECD	Dicamba
Aqueous/Solids	EPA 8151A	GC-ECD	Dinoseb
Aqueous/Solids	EPA 8151A	GC-ECD	MCPA
Aqueous/Solids	EPA 8151A	GC-ECD	MCPP
Aqueous/Solids	EPA 8151A	GC-ECD	Pentachlorophenol
Aqueous/Solids	EPA 8260B	GC-MS	1,1,1,2-Tetrachloroethane
Aqueous/Solids	EPA 8260B	GC-MS	1,1,1-Trichloroethane
Aqueous/Solids	EPA 8260B	GC-MS	1,1,2,2-Tetrachloroethane
Aqueous/Solids	EPA 8260B	GC-MS	1,1,2-trichloro-1,2,2-trifluoroethane
Aqueous/Solids	EPA 8260B	GC-MS	1,1,2-Trichloroethane

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Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8260B	GC-MS	1,1-Dichloroethane
Aqueous/Solids	EPA 8260B	GC-MS	1,1-Dichloroethene
Aqueous/Solids	EPA 8260B	GC-MS	1,1-Dichloropropene
Aqueous/Solids	EPA 8260B	GC-MS	1,2 Dichlorobenzene
Aqueous/Solids	EPA 8260B	GC-MS	1,2 Dichloroethane
Aqueous/Solids	EPA 8260B	GC-MS	1,2,3-Trichlorobenzene
Aqueous/Solids	EPA 8260B	GC-MS	1,2,3-Trichloropropane
Aqueous/Solids	EPA 8260B	GC-MS	1,2,4,5-Tetrachlorobenzene
Aqueous/Solids	EPA 8260B	GC-MS	1,2,4-Trichlorobenzene
Aqueous/Solids	EPA 8260B	GC-MS	1,2,4-Trimethylbenzene
Aqueous/Solids	EPA 8260B	GC-MS	1,2-Dibromo-3-chloropropane (DBCP)
Aqueous/Solids	EPA 8260B	GC-MS	1,2-Dibromoethane (EDB)
Aqueous/Solids	EPA 8260B	GC-MS	1,2-Dichloropropane
Aqueous/Solids	EPA 8260B	GC-MS	1,3 Dichlorobenzene
Aqueous/Solids	EPA 8260B	GC-MS	1,3,5-Trimethylbenzene
Aqueous/Solids	EPA 8260B	GC-MS	1,3-Dichloropropane
Aqueous/Solids	EPA 8260B	GC-MS	1,4 Dichlorobenzene
Aqueous/Solids	EPA 8260B	GC-MS	1-Chlorohexane
Aqueous/Solids	EPA 8260B	GC-MS	2,2-Dichloropropane
Aqueous/Solids	EPA 8260B	GC-MS	2-Butanone (MEK)
Aqueous/Solids	EPA 8260B	GC-MS	2-Chloroethylvinylether
Aqueous/Solids	EPA 8260B	GC-MS	2-Chlorotoluene
Aqueous/Solids	EPA 8260B	GC-MS	2-Hexanone
Aqueous/Solids	EPA 8260B	GC-MS	4-Chlorotoluene
Aqueous/Solids	EPA 8260B	GC-MS	4-Methyl-2-pentanone (MIBK)
Aqueous/Solids	EPA 8260B	GC-MS	Acetone
Aqueous/Solids	EPA 8260B	GC-MS	Acetonitrile
Aqueous/Solids	EPA 8260B	GC-MS	Acrolein
Aqueous/Solids	EPA 8260B	GC-MS	Acrylonitrile
Aqueous/Solids	EPA 8260B	GC-MS	Benzene
Aqueous/Solids	EPA 8260B	GC-MS	Bromobenzene
Aqueous/Solids	EPA 8260B	GC-MS	Bromochloromethane
Aqueous/Solids	EPA 8260B	GC-MS	Bromodichloromethane
Aqueous/Solids	EPA 8260B	GC-MS	Bromoform
Aqueous/Solids	EPA 8260B	GC-MS	Bromomethane

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Gulf Coast Analytical Laboratories, LLC
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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8260B	GC-MS	Carbon disulfide
Aqueous/Solids	EPA 8260B	GC-MS	Carbon tetrachloride
Aqueous/Solids	EPA 8260B	GC-MS	Chlorobenzene
Aqueous/Solids	EPA 8260B	GC-MS	Chloroethane
Aqueous/Solids	EPA 8260B	GC-MS	Chloroform
Aqueous/Solids	EPA 8260B	GC-MS	Chloromethane
Aqueous/Solids	EPA 8260B	GC-MS	cis-1,2-Dichloroethene
Aqueous/Solids	EPA 8260B	GC-MS	cis-1,3-Dichloropropylene
Aqueous/Solids	EPA 8260B	GC/MS VOC	Cyclohexane
Aqueous/Solids	EPA 8260B	GC-MS	Dibromochloromethane
Aqueous/Solids	EPA 8260B	GC-MS	Dibromomethane
Aqueous/Solids	EPA 8260B	GC-MS	Dichlorodifluoromethane
Aqueous/Solids	EPA 8260B	GC-MS	DIPE
Aqueous/Solids	EPA 8260B	GC-MS	ETBE
Aqueous/Solids	EPA 8260B	GC/MS VOC	Ethyl Acetate
Aqueous/Solids	EPA 8260B	GC-MS	Ethylbenzene
Aqueous/Solids	EPA 8260B	GC-MS	Hexachlorobutadiene
Aqueous/Solids	EPA 8260B	GC-MS	Isopropylbenzene
Aqueous/Solids	EPA 8260B	GC-MS	m+p-Xylene
Aqueous/Solids	EPA 8260B	GC-MS	Methyl tert-butyl ether (MTBE)
Aqueous/Solids	EPA 8260B	GC-MS	Methylcyclohexane
Aqueous/Solids	EPA 8260B	GC-MS	Methylene Chloride
Aqueous/Solids	EPA 8260B	GC-MS	Mrthyl Acetate
Aqueous/Solids	EPA 8260B	GC-MS	MTBE
Aqueous/Solids	EPA 8260B	GC-MS	Naphthalene
Aqueous/Solids	EPA 8260B	GC/MS VOC	n-Butanol
Aqueous/Solids	EPA 8260B	GC-MS	n-Butylbenzene
Aqueous/Solids	EPA 8260B	GC-MS	n-Propylbenzene
Aqueous/Solids	EPA 8260B	GC-MS	o-Xylene
Aqueous/Solids	EPA 8260B	GC-MS	p-Isopropyltoluene
Aqueous/Solids	EPA 8260B	GC-MS	sec-Butylbenzene
Aqueous/Solids	EPA 8260B	GC-MS	Styrene
Aqueous/Solids	EPA 8260B	GC-MS	TAME
Aqueous/Solids	EPA 8260B	GC-MS	tert-Butyl alcohol
Aqueous/Solids	EPA 8260B	GC-MS	tert-Butylbenzene
Aqueous/Solids	EPA 8260B	GC-MS	Tetrachloroethene

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Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8260B	GC-MS	Toluene
Aqueous/Solids	EPA 8260B	GC-MS	trans-1,2-Dichloroethene
Aqueous/Solids	EPA 8260B	GC-MS	trans-1,3-Dichloropropene
Aqueous/Solids	EPA 8260B	GC-MS	Trichloroethene
Aqueous/Solids	EPA 8260B	GC-MS	Trichlorofluoromethane
Aqueous/Solids	EPA 8260B	GC-MS	Vinyl acetate
Aqueous/Solids	EPA 8260B	GC-MS	Vinyl chloride
Aqueous/Solids	EPA 8260B	GC-MS	Xylenes, total
Aqueous/Solids	EPA 8270C	GC-MS	1,2 Dichlorobenzene
Aqueous/Solids	EPA 8270C	GC-MS	1,2,4,5-Tetrachlorobenzene
Aqueous/Solids	EPA 8270C	GC-MS	1,2,4-Trichlorobenzene
Aqueous/Solids	EPA 8270C	GC-MS	1,2-Diphenylhydrazine
Aqueous/Solids	EPA 8270C	GC-MS	1,3 Dichlorobenzene
Aqueous/Solids	EPA 8270C	GC-MS	1,4 Dichlorobenzene
Aqueous/Solids	EPA 8270C	GC-MS	1-Methylnaphthalene
Aqueous/Solids	EPA 8270C	GC-MS	2,3,4,6-Tetrachlorophenol
Aqueous/Solids	EPA 8270C	GC-MS	2,4,5-Trichlorophenol
Aqueous/Solids	EPA 8270C	GC-MS	2,4,6-Trichlorophenol
Aqueous/Solids	EPA 8270C	GC-MS	2,4-Dichlorophenol
Aqueous/Solids	EPA 8270C	GC-MS	2,4-Dimethylphenol
Aqueous/Solids	EPA 8270C	GC-MS	2,4-Dinitrophenol
Aqueous/Solids	EPA 8270C	GC-MS	2,4-Dinitrotoluene
Aqueous/Solids	EPA 8270C	GC-MS	2,6-Dichlorophenol
Aqueous/Solids	EPA 8270C	GC-MS	2,6-Dinitrotoluene
Aqueous/Solids	EPA 8270C	GC-MS	2-Chloronaphthalene
Aqueous/Solids	EPA 8270C	GC-MS	2-Chlorophenol
Aqueous/Solids	EPA 8270C	GC-MS	2-Methyl-4,6-Dinitrophenol
Aqueous/Solids	EPA 8270C	GC-MS	2-Methylnaphthalene
Aqueous/Solids	EPA 8270C	GC-MS	2-Methylphenol
Aqueous/Solids	EPA 8270C	GC-MS	2-Nitroaniline
Aqueous/Solids	EPA 8270C	GC-MS	2-Nitrophenol
Aqueous/Solids	EPA 8270C	GC-MS	3,3'-Dichlorobenzidine
Aqueous/Solids	EPA 8270C	GC-MS	3-Nitroaniline
Aqueous/Solids	EPA 8270C	GC-MS	4-Bromophenyl-phenylether
Aqueous/Solids	EPA 8270C	GC-MS	4-Chloro-3-methylphenol
Aqueous/Solids	EPA 8270C	GC-MS	4-Chloroaniline

Certificate of Accreditation: Supplement

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Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8270C	GC-MS	4-Chlorophenyl-phenylether
Aqueous/Solids	EPA 8270C	GC-MS	4-Methylphenol (and/or 3-Methylphenol)
Aqueous/Solids	EPA 8270C	GC-MS	4-Nitroaniline
Aqueous/Solids	EPA 8270C	GC-MS	4-Nitrophenol
Aqueous/Solids	EPA 8270C	GC-MS	Acenaphthene
Aqueous/Solids	EPA 8270C	GC-MS	Acenaphthylene
Aqueous/Solids	EPA 8270C	GC-MS	Acetophenone
Aqueous/Solids	EPA 8270C	GC-MS	Aniline
Aqueous/Solids	EPA 8270C	GC-MS	Anthracene
Aqueous/Solids	EPA 8270C	GC-MS	Atrazine
Aqueous/Solids	EPA 8270C	GC-MS	Benzaldehyde
Aqueous/Solids	EPA 8270C	GC-MS	Benzidine
Aqueous/Solids	EPA 8270C	GC-MS	Benzo(a)anthracene
Aqueous/Solids	EPA 8270C	GC-MS	Benzo(a)pyrene
Aqueous/Solids	EPA 8270C	GC-MS	Benzo(b)fluoranthene
Aqueous/Solids	EPA 8270C	GC-MS	Benzo(g,h,i)perylene
Aqueous/Solids	EPA 8270C	GC-MS	Benzo(k)fluoranthene
Aqueous/Solids	EPA 8270C	GC-MS	Benzoic acid
Aqueous/Solids	EPA 8270C	GC-MS	Benzyl alcohol
Aqueous/Solids	EPA 8270C	GC-MS	Biphenyl
Aqueous/Solids	EPA 8270C	GC-MS	bis(2-Chloroethoxy)methane
Aqueous/Solids	EPA 8270C	GC-MS	bis(2-Chloroethyl)ether
Aqueous/Solids	EPA 8270C	GC-MS	bis(2-Chloroiospropyl) ether
Aqueous/Solids	EPA 8270C	GC-MS	bis(2-ethylhexyl) phthalate
Aqueous/Solids	EPA 8270C	GC-MS	bis(2-ethylhexyl) phthalate
Aqueous/Solids	EPA 8270C	GC-MS	Butyl benzyl phthalate
Aqueous/Solids	EPA 8270C	GC-MS	Butyl benzyl phthalate
Aqueous/Solids	EPA 8270C	GC-MS	Caprolactom
Aqueous/Solids	EPA 8270C	GC-MS	Carbazole
Aqueous/Solids	EPA 8270C	GC-MS	Carbazole
Aqueous/Solids	EPA 8270C	GC-MS	Chrysene
Aqueous/Solids	EPA 8270C	GC-MS	Chrysene
Aqueous/Solids	EPA 8270C	GC-MS	Dibenzo(a,h)anthracene
Aqueous/Solids	EPA 8270C	GC-MS	Dibenzo(a,h)anthracene
Aqueous/Solids	EPA 8270C	GC-MS	Dibenzofuran

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Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8270C	GC-MS	Dibenzofuran
Aqueous/Solids	EPA 8270C	GC-MS	Diethyl phthalate
Aqueous/Solids	EPA 8270C	GC-MS	Diethyl phthalate
Aqueous/Solids	EPA 8270C	GC-MS	Dimethyl phthalate
Aqueous/Solids	EPA 8270C	GC-MS	Dimethyl phthalate
Aqueous/Solids	EPA 8270C	GC-MS	Di-n-butylphthalate
Aqueous/Solids	EPA 8270C	GC-MS	Di-n-butylphthalate
Aqueous/Solids	EPA 8270C	GC-MS	Di-n-octylphthalate
Aqueous/Solids	EPA 8270C	GC-MS	Di-n-octylphthalate
Aqueous/Solids	EPA 8270C	GC-MS	Fluoranthene
Aqueous/Solids	EPA 8270C	GC-MS	Fluoranthene
Aqueous/Solids	EPA 8270C	GC-MS	Fluorene
Aqueous/Solids	EPA 8270C	GC-MS	Fluorene
Aqueous/Solids	EPA 8270C	GC-MS	Hexachlorobenzene
Aqueous/Solids	EPA 8270C	GC-MS	Hexachlorobenzene
Aqueous/Solids	EPA 8270C	GC-MS	Hexachlorobutadiene
Aqueous/Solids	EPA 8270C	GC-MS	Hexachlorobutadiene
Aqueous/Solids	EPA 8270C	GC-MS	Hexachlorocyclopentadiene
Aqueous/Solids	EPA 8270C	GC-MS	Hexachloroethane
Aqueous/Solids	EPA 8270C	GC-MS	Indeno(1,2,3, cd)pyrene
Aqueous/Solids	EPA 8270C	GC-MS	Isophorone
Aqueous/Solids	EPA 8270C	GC-MS	Naphthalene
Aqueous/Solids	EPA 8270C	GC-MS	Nitrobenzene
Aqueous/Solids	EPA 8270C	GC-MS	N-Nitrosodiethylamine
Aqueous/Solids	EPA 8270C	GC-MS	N-Nitrosodimethylamine
Aqueous/Solids	EPA 8270C	GC-MS	N-Nitroso-di-n-propylamine
Aqueous/Solids	EPA 8270C	GC-MS	N-Nitrosodiphenylamine
Aqueous/Solids	EPA 8270C	GC-MS	o-Toluidine
Aqueous/Solids	EPA 8270C	GC-MS	p-Dioxane
Aqueous/Solids	EPA 8270C	GC-MS	Pentachlorobenzene
Aqueous/Solids	EPA 8270C	GC-MS	Pentachlorophenol
Aqueous/Solids	EPA 8270C	GC-MS	Phenanthrene
Aqueous/Solids	EPA 8270C	GC-MS	Phenol
Aqueous/Solids	EPA 8270C	GC-MS	Pyrene
Aqueous/Solids	EPA 8270C	GC-MS	Pyridine
Aqueous/Solids	EPA 8270C SIM	GC-MS	1-Methylnaphthalene

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Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8270C SIM	GC-MS	2-Methylnaphthalene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Acenaphthene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Acenaphthylene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Anthracene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Benzo(a)anthracene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Benzo(a)pyrene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Benzo(b)fluoranthene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Benzo(g,h,i)perylene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Benzo(k)fluoranthene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Chrysene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Dibenz(a,h) anthracene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Fluoranthene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Fluorene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Indeno(1,2,3-cd) pyrene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Naphthalene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Phenanthrene
Aqueous/Solids	EPA 8270C SIM	GC-MS	Pyrene
Aqueous/Solids	EPA 8270D	GC-MS	1,2 Dichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,2,4,5-Tetrachlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,2,4-Trichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,2-Diphenylhydrazine
Aqueous/Solids	EPA 8270D	GC-MS	1,3 Dichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1,4 Dichlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	1-Methylnaphthalene
Aqueous/Solids	EPA 8270D	GC-MS	2,3,4,6-Tetrachlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4,5-Trichlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4,6-Trichlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dichlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dimethylphenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dinitrophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,4-Dinitrotoluene
Aqueous/Solids	EPA 8270D	GC-MS	2,6-Dichlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2,6-Dinitrotoluene
Aqueous/Solids	EPA 8270D	GC-MS	2-Chloronaphthalene
Aqueous/Solids	EPA 8270D	GC-MS	2-Chlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	2-Methyl-4,6-Dinitrophenol

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Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS	2-Methylnaphthalene
Aqueous/Solids	EPA 8270D	GC-MS	2-Methylphenol
Aqueous/Solids	EPA 8270D	GC-MS	2-Nitroaniline
Aqueous/Solids	EPA 8270D	GC-MS	2-Nitrophenol
Aqueous/Solids	EPA 8270D	GC-MS	3,3'-Dichlorobenzidine
Aqueous/Solids	EPA 8270D	GC-MS	3-Nitroaniline
Aqueous/Solids	EPA 8270D	GC-MS	4-Bromophenyl-phenylether
Aqueous/Solids	EPA 8270D	GC-MS	4-Chloro-3-methylphenol
Aqueous/Solids	EPA 8270D	GC-MS	4-Chloroaniline
Aqueous/Solids	EPA 8270D	GC-MS	4-Chlorophenyl-phenylether
Aqueous/Solids	EPA 8270D	GC-MS	4-Methylphenol (and/or 3-Methylphenol)
Aqueous/Solids	EPA 8270D	GC-MS	4-Nitroaniline
Aqueous/Solids	EPA 8270D	GC-MS	4-Nitrophenol
Aqueous/Solids	EPA 8270D	GC-MS	Acenaphthene
Aqueous/Solids	EPA 8270D	GC-MS	Acenaphthylene
Aqueous/Solids	EPA 8270D	GC-MS	Aniline
Aqueous/Solids	EPA 8270D	GC-MS	Anthracene
Aqueous/Solids	EPA 8270D	GC-MS	Atrazine
Aqueous/Solids	EPA 8270D	GC-MS	Benzidine
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(a)anthracene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(a)pyrene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(b)fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(g,h,i)perylene
Aqueous/Solids	EPA 8270D	GC-MS	Benzo(k)fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS	Benzoic acid
Aqueous/Solids	EPA 8270D	GC-MS	Benzyl alcohol
Aqueous/Solids	EPA 8270D	GC-MS	bis(2-Chloroethoxy)methane
Aqueous/Solids	EPA 8270D	GC-MS	bis(2-Chloroethyl)ether
Aqueous/Solids	EPA 8270D	GC-MS	bis(2-Chloroiospropyl) ether
Aqueous/Solids	EPA 8270D	GC-MS	bis(2-ethylhexyl) phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Butyl benzyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Caprolactom
Aqueous/Solids	EPA 8270D	GC-MS	Carbazole
Aqueous/Solids	EPA 8270D	GC-MS	Chrysene
Aqueous/Solids	EPA 8270D	GC-MS	Dibenzo(a,h)anthracene

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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8270D	GC-MS	Dibenzofuran
Aqueous/Solids	EPA 8270D	GC-MS	Diethyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Dimethyl phthalate
Aqueous/Solids	EPA 8270D	GC-MS	Di-n-butylphthalate
Aqueous/Solids	EPA 8270D	GC-MS	Di-n-octylphthalate
Aqueous/Solids	EPA 8270D	GC-MS	Fluoranthene
Aqueous/Solids	EPA 8270D	GC-MS	Fluorene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachlorobutadiene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachlorocyclopentadiene
Aqueous/Solids	EPA 8270D	GC-MS	Hexachloroethane
Aqueous/Solids	EPA 8270D	GC-MS	Indeno(1,2,3, cd)pyrene
Aqueous/Solids	EPA 8270D	GC-MS	Isophorone
Aqueous/Solids	EPA 8270D	GC-MS	Naphthalene
Aqueous/Solids	EPA 8270D	GC-MS	Nitrobenzene
Aqueous/Solids	EPA 8270D	GC-MS	N-Nitrosodiethylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-Nitrosodimethylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-Nitroso-di-n-propylamine
Aqueous/Solids	EPA 8270D	GC-MS	N-Nitrosodiphenylamine
Aqueous/Solids	EPA 8270D	GC-MS	o-Toluidine
Aqueous/Solids	EPA 8270D	GC-MS	Pentachlorobenzene
Aqueous/Solids	EPA 8270D	GC-MS	Pentachlorophenol
Aqueous/Solids	EPA 8270D	GC-MS	Phenanthrene
Aqueous/Solids	EPA 8270D	GC-MS	Phenol
Aqueous/Solids	EPA 8270D	GC-MS	Pyrene
Aqueous/Solids	EPA 8270D	GC-MS	Pyridine
Aqueous/Solids	EPA 8270D SIM	GC-MS	1-Methylnaphthalene
Aqueous/Solids	EPA 8270D SIM	GC-MS	2-Methylnaphthalene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Acenaphthene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Acenaphthylene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Anthracene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Benzo(a)anthracene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Benzo(a)pyrene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Benzo(b)fluoranthene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Benzo(g,h,i)perylene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Benzo(k)fluoranthene

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Matrix	Standard/Method	Technology	Analyte
Aqueous/Solids	EPA 8270D SIM	GC-MS	Chrysene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Dibenz(a,h) anthracene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Fluoranthene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Fluorene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Indeno(1,2,3-cd) pyrene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Naphthalene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Phenanthrene
Aqueous/Solids	EPA 8270D SIM	GC-MS	Pyrene
Aqueous/Solids	EPA 8330A	HPLC	1,3,5-Trinitrobenzene
Aqueous/Solids	EPA 8330A	HPLC	1,3-Dinitrobenzene
Aqueous/Solids	EPA 8330A	HPLC	2,4,6-Trinitrotoluene
Aqueous/Solids	EPA 8330A	HPLC	2,4-Dinitrotoluene
Aqueous/Solids	EPA 8330A	HPLC	2,6-Dinitrotoluene
Aqueous/Solids	EPA 8330A	HPLC	2-Amino-4,6-dinitrotoluene
Aqueous/Solids	EPA 8330A	HPLC	2-Nitrotoluene
Aqueous/Solids	EPA 8330A	HPLC	3,5-Dinitroaniline
Aqueous/Solids	EPA 8330A	HPLC	3-Nitrotoluene
Aqueous/Solids	EPA 8330A	HPLC	4-Amino-2,6-dinitrotoluene
Aqueous/Solids	EPA 8330A	HPLC	4-Nitrotoluene
Aqueous/Solids	EPA 8330A	HPLC	HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)
Aqueous/Solids	EPA 8330A	HPLC	Nitrobenzene
Aqueous/Solids	EPA 8330A	HPLC	Nitroglycerin
Aqueous/Solids	EPA 8330A	HPLC	Pentaerythritoltetranitrate
Aqueous/Solids	EPA 8330A	HPLC	RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)
Aqueous/Solids	EPA 8330A	HPLC	Tetryl (Methyl-2,4,6-trinitrophenylnitramine)
Aqueous/Solids	EPA 9012B	FIA	Total Cyanide
Aqueous/Solids	EPA 9038	Spectrophotometer	Sulfate
Aqueous/Solids	EPA 9056A	IC	Bromide
Aqueous/Solids	EPA 9056A	IC	Chloride
Aqueous/Solids	EPA 9056A	IC	Fluoride
Aqueous/Solids	EPA 9056A	IC	Nitrate and Nitrite as N
Aqueous/Solids	EPA 9056A	IC	Nitrate as N
Aqueous/Solids	EPA 9056A	IC	Nitrite as N
Aqueous/Solids	EPA 9056A	IC	Sulfate

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Aqueous/Solids	EPA 9060A	TOC Analyzer	TOC
Aqueous/Solids	EPA 9066	FIA	Total Phenolics (4AAP)
Aqueous/Solids	EPA 9251	FIA	Chloride
Aqueous/Solids	Florida PRO	GC-FID	Petroleum Hydrocarbons
Aqueous/Solids	GCAL SOP WL-070	IC	Acetic Acid
Aqueous/Solids	GCAL SOP WL-070	IC	Butyric Acid
Aqueous/Solids	GCAL SOP WL-070	IC	Formic Acid
Aqueous/Solids	GCAL SOP WL-070	IC	Lactic Acid
Aqueous/Solids	GCAL SOP WL-070	IC	Propionic Acid
Aqueous/Solids	MADEP EPH	GC-FID	C11-C22 Aromatic Hydrocarbons
Aqueous/Solids	MADEP EPH	GC-FID	C19-C36 Aliphatic Hydrocarbons
Aqueous/Solids	MADEP EPH	GC-FID	C9-C18 Aliphatic Hydrocarbons
Aqueous/Solids	MADEP VPH	GC-FID	C5-C8 Aliphatic Hydrocarbons
Aqueous/Solids	MADEP VPH	GC-FID	C9-C10 Aromatic Hydrocarbons
Aqueous/Solids	MADEP VPH	GC-FID	C9-C12 Aliphatic Hydrocarbons
Aqueous/Solids	SM4500 NH3 B & C	Titration	Ammonia as N
Aqueous/Solids	SM4500 NH3 B & C	Titration	Kjeldahl Nitrogen
Aqueous/Solids	SM4500 NH3 B & D	ISE	Ammonia as N
Aqueous/Solids	SW846 Sec 7.3	FIA	Reactive Cyanide
Aqueous/Solids	SW846 Sec 7.3	Titration	Reactive sulfide
Aqueous/Solids	TNRCC 1005	GC-FID	GRO-aliphatic
Aqueous/Solids	TNRCC 1005	GC-FID	GRO-aromatic
Aqueous/Solids	TNRCC 1005	GC-FID	GRO-Total
Aqueous/Solids	TNRCC 1005	GC-FID	Total Petroleum Hydrocarbon
Aqueous/Solids	TNRCC 1006	GC-FID	DRO-aliphatic
Aqueous/Solids	TNRCC 1006	GC-FID	DRO-aromatic
Aqueous/Solids	TNRCC 1006	GC-FID	DRO-Total
Aqueous/Solids	TNRCC 1006	GC-FID	ORO-aliphatic
Aqueous/Solids	TNRCC 1006	GC-FID	ORO-aromatic
Aqueous/Solids	TNRCC 1006	GC-FID	ORO-Total
Aqueous/Solids	TNRCC 1006	GC-FID	Total Petroleum Hydrocarbon

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Aqueous	EPA 3010A	Acid Digestion - Metals	Prep Method
Aqueous	EPA 3510C	Separatory Funnel	Prep Method
Aqueous	EPA 3535A	Solid Phase Extraction	Prep Method
Solids	EPA 3050B	Acid Digestion	Prep Method
Solids	EPA 3550C	Extraction - Sonication	Prep Method
Solids	EPA 5035	Purge and Trap	Prep Method
Aqueous/Solids	EPA 1311	TCLP	Prep Method
Aqueous/Solids	EPA 3540C	Extraction - Soxhlet	Prep Method
Aqueous/Solids	EPA 5030B	Purge and Trap	Prep Method