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DRAFT UNIFORM FEDERAL POLICY SAMPLING AND ANALYSIS PLAN ADDENDUM FOR THE FACILITY INVESTIGATION FOR BUILDING 1039/SWMU 9, NSB KINGS BAY GA

12/1/2014

RESOLUTION CONSULTANTS

DRAFT UNIFORM FEDERAL POLICY SAMPLING AND ANALYSIS PLAN ADDENDUM

RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION BUILDING 1039/SOLID WASTE MANAGEMENT UNIT 9 NAVAL SUBMARINE BASE, KINGS BAY, GEORGIA

Revision Number: 0

Prepared For:

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

Prepared By:

Resolution Consultants
A Joint Venture of AECOM & EnSafe
1500 Wells Fargo Building
440 Monticello Avenue
Norfolk, Virginia 23510

Contract Number: N62470-11-D-8013
CTO JM54

December 2014

SAP WORKSHEET #1: TITLE AND APPROVAL PAGE
(UFP-QAPP Manual Section 2.1)

DRAFT UNIFORM FEDERAL POLICY
SAMPLING AND ANALYSIS PLAN ADDENDUM

RESOURCE CONSERVATION AND RECOVERY ACT
FACILITY INVESTIGATION
BUILDING 1039/SOLID WASTE MANAGEMENT UNIT 9
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CTO JM25

December 2014

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Date: 2014.12.10 14:47:10 -06'00'

Tina Cantwell
Resolution Consultants Project Chemist Date

Kenneth Bowers
NAVFAC Atlantic
Navy Quality Assurance Officer/Chemist Date

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David Warren
Resolution Consultants Task Order Manager Date

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Dana Hayworth
Navy Remedial Project Manager Date

Amy Potter, Georgia Environmental Protection Division
Unit Coordinator Date

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November 2014

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Tina Cantwell
Resolution Consultants Project Chemist Date

Kenneth Bowers
NAVFAC Atlantic
Navy Quality Assurance Officer/Chemist Date

David Warren
Resolution Consultants Task Order Manager Date

Dana Hayworth
Navy Remedial Project Manager Date

Amy Potter, Georgia Environmental Protection Division
Unit Coordinator Date

Compliance Status Report
Qualified Groundwater Scientist Certification

I certify that I am a qualified groundwater scientist who has received a baccalaureate or postgraduate degree in the natural sciences or engineering, and have sufficient training and experience in groundwater hydrology and related fields as demonstrated by state registration and completion of accredited university courses that enable me to make sound professional judgments regarding groundwater monitoring and contaminant fate and transport. I further certify that this report was prepared by me or by a subordinate working under my direction.

Benjamin Brantley 12/8/14
(Signature)

Benjamin Brantley

Professional Geologist License Number: PG001051

Professional Geologist Seal:

EXECUTIVE SUMMARY

Resolution Consultants has prepared this Uniform Federal Policy Sampling and Analysis Plan (SAP) Addendum for the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for Building 1039/Solid Waste Management Unit 9, at Naval Submarine Base Kings Bay, Georgia, under Contract No. N62470-11-D-8013, Comprehensive Long-term Environmental Action Navy, Contract Task Order JM54. This addendum supplements the scope of work, as presented in the *Final Site-Specific RCRA Facility Investigation Work Plan Building 1039, Naval Submarine Base Kings Bay* (CH2M Hill 2011) and associated *Sampling And Analysis Plan, Resource Conservation And Recovery Act Facility Investigation, Building 1039/Solid Waste Management Unit 9, Naval Submarine Base Kings Bay, Georgia* (Resolution Consultants 2013).

Data associated with historical studies to date and initial RFI field activities indicate that the horizontal extent of impacted soil has not yet been delineated to applicable screening levels. Although project goals, operating procedures, and data quality objectives remain consistent with the *Sampling And Analysis Plan, Resource Conservation And Recovery Act Facility Investigation, Building 1039/Solid Waste Management Unit 9, Naval Submarine Base Kings Bay, Georgia*, revised SAP Worksheets #1, #2, #10, #16, #17, #18, and #20, as included herein, detail supplemental sampling efforts intended to provide additional information on the horizontal extent of impacted soil. Table ES-1 provides a summary of worksheets that have been modified as part of this addendum.

Table ES-1
UFP SAP Addendum Crosswalk

SAP Worksheet #	Required Information	Worksheet Revised (Yes/No)	Crosswalk to Related Information
A. Project Management and Objectives			
1	**Title and Approval Page**	**Yes**	**Updated for addendum**
ES	**Executive Summary**	**Yes**	**Updated for addendum**
TOC	**Table of Contents**	**Yes**	**Updated for addendum**
2	**SAP Identifying Information**	**Yes**	**Updated with new Certified Task Order number**
3	Distribution List	No	See original SAP (Appendix A)
4	Project Personnel Sign-Off Sheet	No	See original SAP (Appendix A)
5	Project Organizational Chart	No	See original SAP (Appendix A)
6	Communication Pathways	No	See original SAP (Appendix A)
7	Personnel Responsibilities Table	No	See original SAP (Appendix A)
8	Special Personnel Training Requirements Table	No	See original SAP (Appendix A)
9	Project Scoping Session Participants Sheet	No	See original SAP (Appendix A)
10	**Conceptual Site Model**	**Yes**	**Updated per observations and data from December 2013 field activities**

Table ES-1 UFP SAP Addendum Crosswalk			
SAP Worksheet #	**Required Information**	**Worksheet Revised (Yes/No)**	**Crosswalk to Related Information**
11	Project Quality Objectives/Systematic Planning Process Statements	No	See original SAP (Appendix A)
12	Field Quality Control Samples	No	See original SAP (Appendix A)
13	Secondary Data Criteria and Limitations Table	No	See original SAP (Appendix A)
14	Field Project Tasks	No	See original SAP (Appendix A)
15	Reference Limits and Evaluation Tables	No	See original SAP (Appendix A)
16	**Project Schedule/Timeline Table**	**Yes**	**Presents schedule for supplemental tasks**
B. Measurement/Data Acquisition			
17	**Sampling Design and Rationale**	**Yes**	**Presents rationale and design of supplemental sampling**
18	**Location-Specific Sampling Methods/SOP Requirements Table**	**Yes**	**Presents sample identifications for supplemental locations**
19	Field Sampling Requirements Table	No	See original SAP (Appendix A)
20	**Field Quality Control Sample Summary Table**	**Yes**	**Summarizes planned field quality control samples for supplemental tasks**
21	Project Sampling SOP References Table	No	See original SAP (Appendix A)
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	No	See original SAP (Appendix A)
23	Analytical SOP References Table	No	See original SAP (Appendix A)
24	Analytical Instrument Calibration Table	No	See original SAP (Appendix A)
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	No	See original SAP (Appendix A)
26	Sample Handling System	No	See original SAP (Appendix A)
27	Sample Custody Requirements	No	See original SAP (Appendix A)
28	Laboratory QC Samples Table	No	See original SAP (Appendix A)
29	Project Documents and Records Table	No	See original SAP (Appendix A)
30	Analytical Services Table	No	See original SAP (Appendix A)
C. Assessment Oversight			
31	Planned Project Assessments Table	No	See original SAP (Appendix A)
32	Assessment Findings and Corrective Action Responses Table	No	See original SAP (Appendix A)
33	Quality Assurance Management Reports Table	No	See original SAP (Appendix A)
D. Data Review			
34	Verification (Step I) Process Table	No	See original SAP (Appendix A)
35	Validation (Steps IIa and IIb) Process Table	No	See original SAP (Appendix A)
36	Validation (Steps IIa and IIb) Summary Table	No	See original SAP (Appendix A)
37	Usability Assessment	No	See original SAP (Appendix A)

Notes:

UFP = Uniform Federal Policy
SAP = Sampling and Analysis Plan
SOP = Standard operating procedure
QC = Quality control

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Appendices

Appendix A *Sampling and Analysis Plan, Resource Conservation And Recovery Act Facility Investigation, Building 1039/Solid Waste Management Unit 9, Naval Submarine Base Kings Bay, Georgia* (Resolution Consultants 2013).
Appendix B Updated Laboratory Certifications

List of Acronyms

bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, xylenes
CSM	Conceptual site model
CTO	Contract task order
EB	Equipment rinsate blanks
GA EPD	Georgia Environmental Protection Division
GCAL	Gulf Coast Analytical Laboratories
GPS	Global positioning system
IDW	Investigation derived waste
I-RSL	Industrial Regional Screening Levels
LNAPL	Light non-aqueous phase liquid
MS	Matrix spike
MSD	Matrix spike duplicate
PAH	Polynuclear aromatic hydrocarbons
PVC	polyvinyl chloride
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
RCRA	Resource Conservation and Recovery Act
R-RSL	Residential Regional Screening Levels
RFI	RCRA Facility Investigation
SAP	Sampling and analysis plan
SOP	Standard operating procedure
SSL-RISK	Soil Screening Levels for the Migration to Groundwater and Tap Water RSL
SUBASE	Naval Submarine Base
SWMU	Solid Waste Management Unit
TBD	To be determined
UFP	Uniform Federal Policy
UFP QAPP	Uniform Federal Policy for Quality Assurance Project Plans
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Society
UST	Underground storage tank

SAP WORKSHEET #2: SAMPLING AND ANALYSIS PLAN IDENTIFYING INFORMATION

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number: Building 1039/Solid Waste Management Unit 9 (SWMU 9)

Contractor Name: Resolution Consultants

Contract Number: N62470-11-D-8013

Contract Title: Comprehensive Long-term Environmental Action Navy

Work Assignment Number: Contract Task Order (CTO) JM54

1. This addendum to the *Sampling And Analysis Plan, Resource Conservation And Recovery Act Facility Investigation, Building 1039/Solid Waste Management Unit 9, Naval Submarine Base, Kings Bay, Georgia* (Resolution Consultants 2013) (referred to as the original SAP herein) was prepared in accordance with the requirements of: the *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP)* (U.S. EPA 2005) and the United States Environmental Protection Agency (U.S. EPA) *Guidance for Quality Assurance Project Plans, EPA QA/G-5* (U.S. EPA 2002).

2. Identify regulatory program: Resource Conservation and Recovery Act (RCRA), Title 42, United States Code 6901 et seq., 1976.

3. This document serves as an addendum to the original SAP. The original SAP is included as Appendix A.

4. List dates of scoping sessions that were held: No scoping meetings have been held to date; however, the original scope of work was presented in the *Final Site-Specific RCRA Facility Investigation Work Plan Building 1039, Naval Submarine Base, Kings Bay, Camden County, Georgia* (CH2M Hill 2011) (referred to as the Final RFI Work Plan herein) and the original SAP. The Final RFI Work Plan was submitted to the Georgia Environmental Protection Division (GA EPD) in June 2011, subsequent to scope refinement through review and comment of a draft RFI work plan and approval via GA EPD letter communication, as listed

in Worksheet #9 of the original SAP. The original SAP was approved by GA EPD in a letter dated, 26 September 2013. The scope of work for supplemental activities, as described in this SAP addendum, is based on field observations and data obtained during initial RFI field activities completed in December 2013. The sampling design and rationale strategy is detailed herein.

5. List dates and titles of any SAP documents written for previous site work, which are relevant to the current investigation: *Sampling and Analysis Plan, Resource Conservation And Recovery Act Facility Investigation, Building 1039/Solid Waste Management Unit 9, Naval Submarine Base Kings Bay, Georgia* (Resolution Consultants 2013).

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

   - Property Owner — U.S. Department of the Navy, Naval Submarine Base Kings Bay, Georgia (SUBASE)

   - Regulatory Oversight — GA EPD

7. Lead organization: Department of the Navy, Naval Facilities Engineering Command, Southeast

8. If any required SAP elements and required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below: All requirements were included in the original SAP. This addendum includes SAP Worksheets #1, #2, #10, #16, #17, #18, and #20, which present details associated with supplemental field activities.

SAP WORKSHEET #10: CONCEPTUAL SITE MODEL

(UFP-QAPP Manual Section 2.5.2)

This worksheet presents a brief site description, history, and a preliminary conceptual site model (CSM) for Building 1039. The CSM describes potential contamination routes and possible exposure pathways to receptors, and serves as the basis for the RFI sampling and analysis program. This CSM will be refined throughout implementation of the RFI; thus, observations and data associated with initial (December 2013) RFI field activities have been incorporated accordingly.

10.1 Site Description

Located in the southeastern corner of Georgia, approximately eight miles north of the state line (Figure 10-1); SUBASE includes approximately 16,168 acres in Camden County. Currently, SUBASE supports submarines, crew training, weapons handling and storage, submarine maintenance, and associated personnel. Building 1039, near SUBASE's western boundary, on USS James Madison Road (Figure 10-2), contains game and meeting rooms. Adjacent to Building 1039 are asphalt parking lots and maintained, grassy medians. Surrounding structures include administrative offices to the north, a library to the northwest, and housing quarters to the south and east. Topography is relatively flat, with storm water runoff to grates in the parking lot. Storm water in the area eventually discharges to retention ponds approximately 500 feet to the west and 1,000 feet to the south of Building 1039.

10.2 Site History

Building 1039 was historically serviced by a heating-oil-fired boiler system. Fuel for the boiler was stored in a 15,000-gallon underground storage tank (UST) at the exterior, southwestern corner of the building. The UST was connected to the boiler by an underground supply and return pipeline, approximately 100 feet in length (Figure 10-3). The boiler was decommissioned and the UST and associated piping removed on 22 January 1996, at which time the removal contractor reported visible petroleum in the trench excavations associated with the UST's supply/return pipeline. Light, non-aqueous phase liquid (LNAPL) was observed during the excavation of the pipeline and in temporary wells installed in the immediate vicinity.

Following release notification to GA EPD, soil and groundwater investigations and corrective actions, including product recovery, enhanced bioremediation, and soil excavation, were conducted from 1996 to February 2010.

FIGURE 10-1
SITE LOCATION MAP
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

Legend

SITE LOCATION

1 inch = 4,000 feet

0 2,000 4,000 6,000 8,000 Feet

Basemap Source: Harrietts Bluff, Georgia Quadrangle Topographic Map
http://services.arcgisonline.com/arcgis/services/USA_Topo_Maps
© 2011 National Geographic Society, i-cubed. Publish Date: 1982
(c) 2010 Microsoft Corporation and its data suppliers

NAVFAC Naval Facilities Engineering Command

RESOLUTION CONSULTANTS

REQUESTED BY: C. Tripp	DATE: 1/8/2013
DRAWN BY: N. Rinehart	PROJECT: 0888812552

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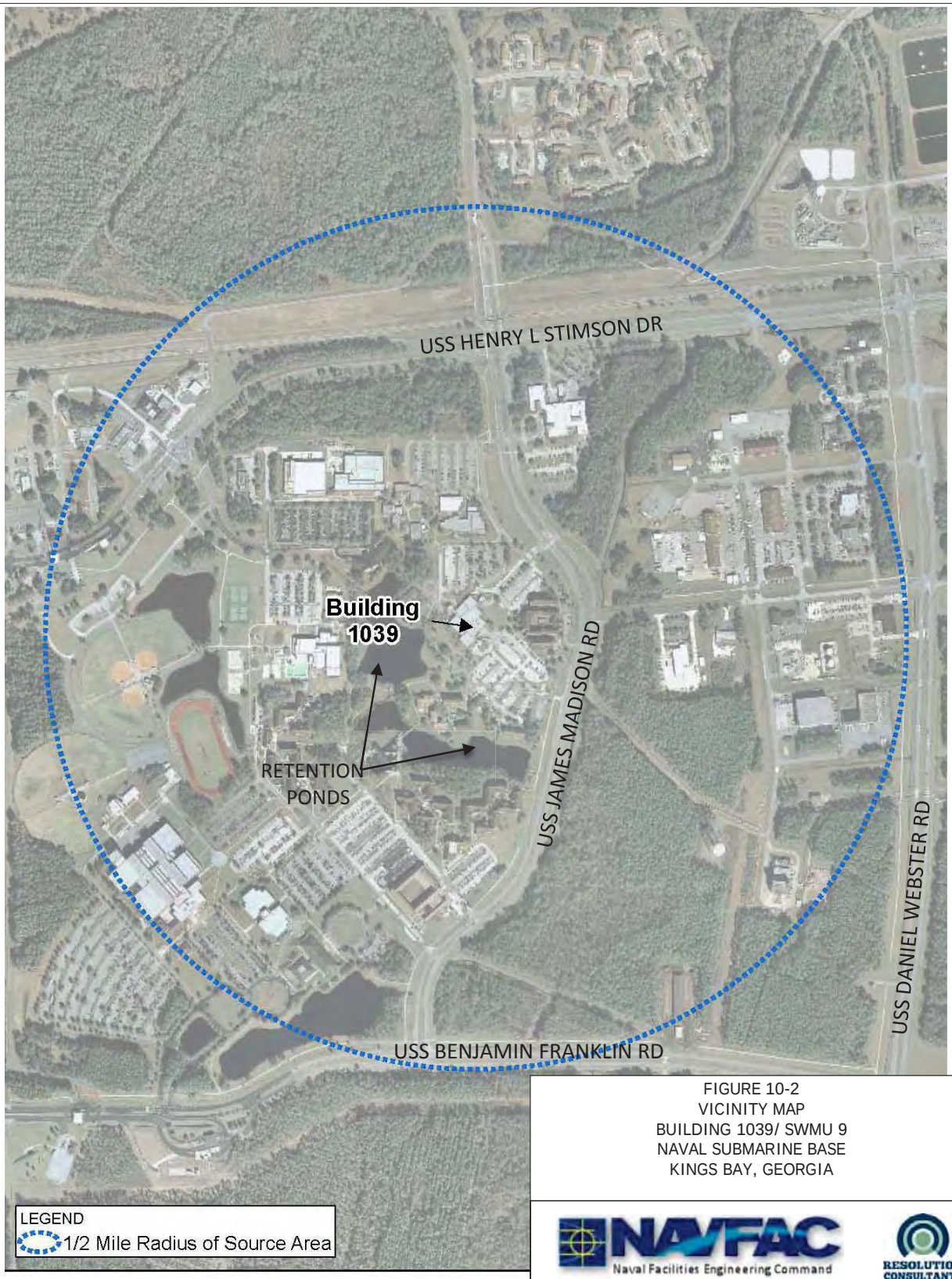

FIGURE 10-2
VICINITY MAP
BUILDING 1039/ SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

Naval Facilities Engineering Command

RESOLUTION CONSULTANTS

Source:
Figure 1-2, RFI Work Plan (CH2M Hill, 2011)

0 250 500 1,000
Feet

REQUEST BY: CT	DATE: 1/04/2013
DRAWN BY: CT	CTO NO. : JM25

Monitoring Well
Soil Boring
Monitoring Well (Abandoned)
Former Fill Port and Line
Former Location of Heating Fuel Tank
Excavation Boundary (2010)
Former Supply/Return Line

0 25 50 Feet

FIGURE 10-3
SITE MAP
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

NAVFAC Naval Facilities Engineering Command
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REQUESTED BY: C. Tripp	DATE: 10/1/2014
DRAWN BY: N. Rinehart	PROJECT: 0888813971

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

During historical investigations, concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX), and polynuclear aromatic hydrocarbons (PAHs) were reported in soil and groundwater in the vicinity of the former UST system. In 2006, GA EPD designated Building 1039 as RCRA SWMU 9. The active SUBASE Hazardous Waste Facility Permit #HW-014(S&T)-3 requires an RFI to evaluate nature and extent, risks to human health and the environment, and the need for additional corrective action at the Site. Data from previous investigations was deemed insufficient to fully satisfy the requirements of the RFI. During replacement of an underground utility in 2010, additional petroleum contaminated soil was identified and excavated to an approximate depth of 6 feet below ground surface (bgs). The limits of the excavation, which extended approximately 100 feet to the southeast of the former supply/return pipeline, are shown on Figure 10-3.

To address data gaps associated with previous studies, SUBASE submitted the Final RFI Work Plan in 2011 and the associated SAP in 2013. Initial RFI field activities, completed in December 2013, included soil and groundwater sampling and the installation of shallow (MW-11S) and deep (MW-11D) monitoring wells, immediately downgradient of the previously excavated area. Results associated with initial RFI field activities have been incorporated into the CSM and are summarized below.

10.3 Site Geology

As summarized in the Final RFI Work Plan and confirmed during December 2013 field activities, soil beneath the Site consists of sand with some silt content to approximately 24 feet bgs. Silty clay underlies the sand and silt formation to a depth of greater than 35 feet bgs. This interpretation of Site geology is consistent with details included in the *Soil Chemistry and Groundwater Quality of Water Table Zone Surficial Aquifer NSB Kings Bay* (United States Geological Society [USGS] 2002).

10.4 Site Hydrogeology

Hydrogeologic units at NSB Kings Bay include, in descending order, the surficial aquifer, the upper and lower Brunswick aquifers, and the Floridan aquifer system. This study focuses on the surficial aquifer, where water occurs under unconfined (water table) conditions. A resistance to vertical groundwater flow exists due to an increase in clay and silt content with depth. The thickness of the surficial aquifer generally varies between 60 and 80 feet bgs, largely as a result of variations in topography (USGS 2002). According to *Georgia's Groundwater Recharge Areas Map* and *Groundwater Pollution Susceptibility Map* (Georgia Department of Natural Resources 1992), SUBASE is regionally positioned in a recharge zone for the Miocene/Pliocene-Recent unconfined aquifers; therefore, SUBASE is considered a High Groundwater Pollution Susceptibility Area per Georgia State Rule 391-3-15-.09.

As summarized on Table 10-1 and depicted on Figure 10-3, the monitoring well network consists of twelve shallow monitoring wells installed to depths ranging from 11.8 to 15 feet bgs and two deep monitoring wells installed to approximately 29.5 and 32.3 feet bgs, respectively. All wells are screened within the surficial aquifer; however, the deep wells are installed within the less permeable, silty clay component. During December 2013, the water table was measured between 3.47 and 7.68 feet below top of well casings. Based on these measurements and a 2013 professional survey of monitoring wells, groundwater is estimated to flow predominantly towards the east, as depicted on Figure 10-4. Based on previous studies, the estimated groundwater flow velocity is approximately 0.183 feet per day or 67 feet per year (J.J. Sosa 1999).

10.5 Preliminary Conceptual Site Model

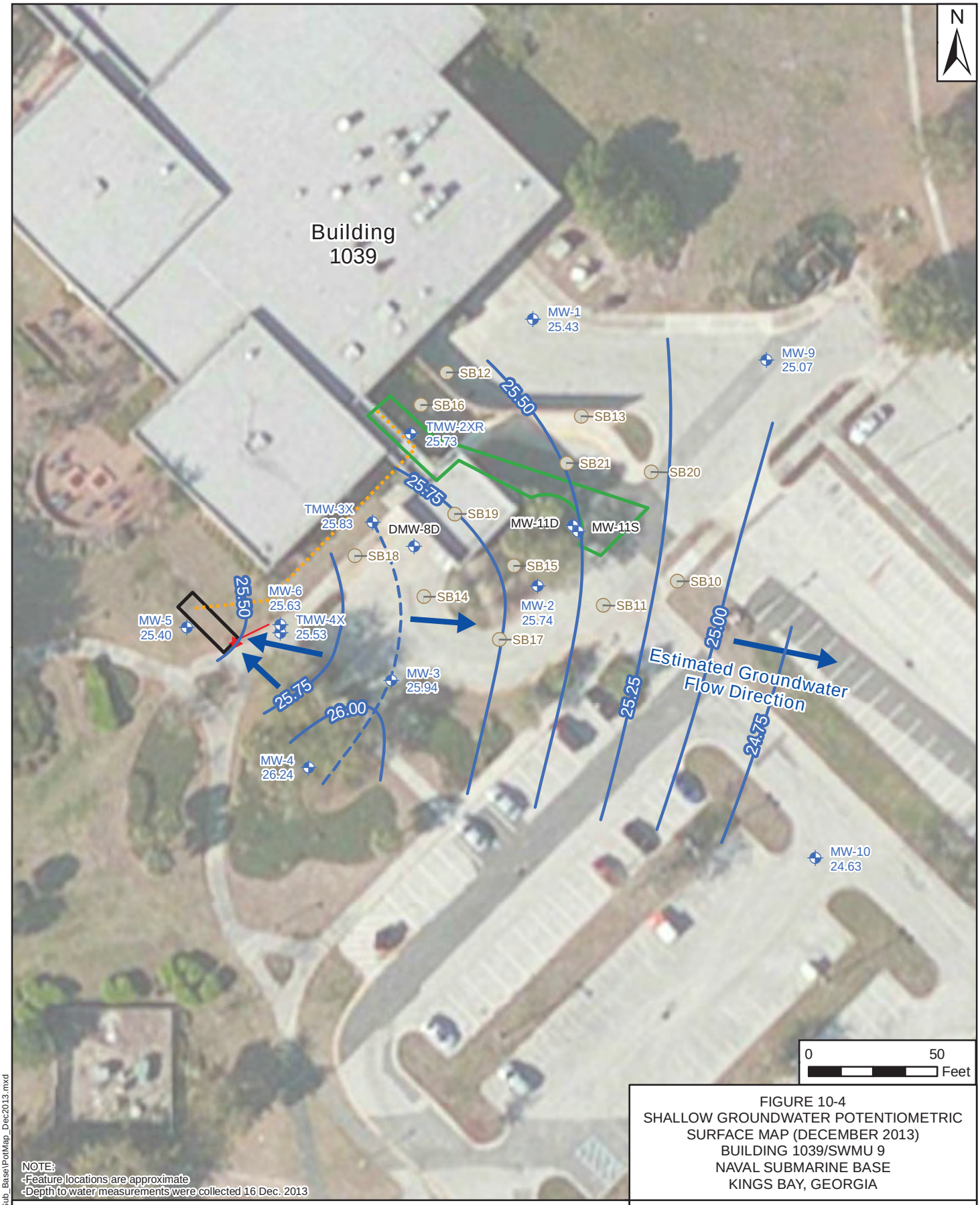
Development of the CSM is an iterative process, to be refined throughout the RFI process. Tables, 10-2 and 10-3 and Figures, 10-5 and 10-6 summarize the analytical results from the comprehensive soil investigations. Results of the most recent round of groundwater sampling in December 2013 are summarized on Table 10-4 and depicted on Figure 10-7. An updated version of the CSM is presented via Figure 10-8.

10.5.1 Source of Contaminants

The source of contamination at Building 1039 is the accidental release of heating oil from underground piping associated with a former UST system. During removal of the UST and associated piping in 1996, the contractor observed petroleum within the excavation associated with the supply/return pipeline. Immediately following UST removal efforts, LNAPL was measured in temporary wells installed adjacent to the former underground piping. Approximately 1 foot of residual LNAPL was measured at a shallow monitoring well, MW-11S, installed during December 2013 field efforts. Monitoring well MW-11S is positioned immediately adjacent to the western side of the excavated area. Based on available data, LNAPL is believed to be confined beneath paved and landscaped areas, in the immediate vicinity of the historical excavation limits. Resolution Consultants believes that reduced overhead clearance due to an overhang and limited access due to the presence of subsurface utilities prevented historical excavation in this area.

10.5.2 Nature and Extent of Contamination

During investigations to date, BTEX and PAHs have been detected in subsurface soil and groundwater samples collected at the Site. The nature and extent of contamination for soil left-in-place and groundwater is summarized below.



NOTE:
-Feature locations are approximate
-Depth to water measurements were collected 16 Dec. 2013

FIGURE 10-4
SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE MAP (DECEMBER 2013)
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

Monitoring Well
Soil Boring
Former Fill Port and Line
Former Location of Heating Fuel Tank
Excavation Boundary (2010)
Estimated Groundwater Flow Direction
Potentiometric Surface Contour (ft)
Groundwater Divide
Former Supply/Return Line

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REQUESTED BY: C. Tripp	DATE: 10/3/2014
DRAWN BY: N. Rinehart	PROJECT: 0888813971

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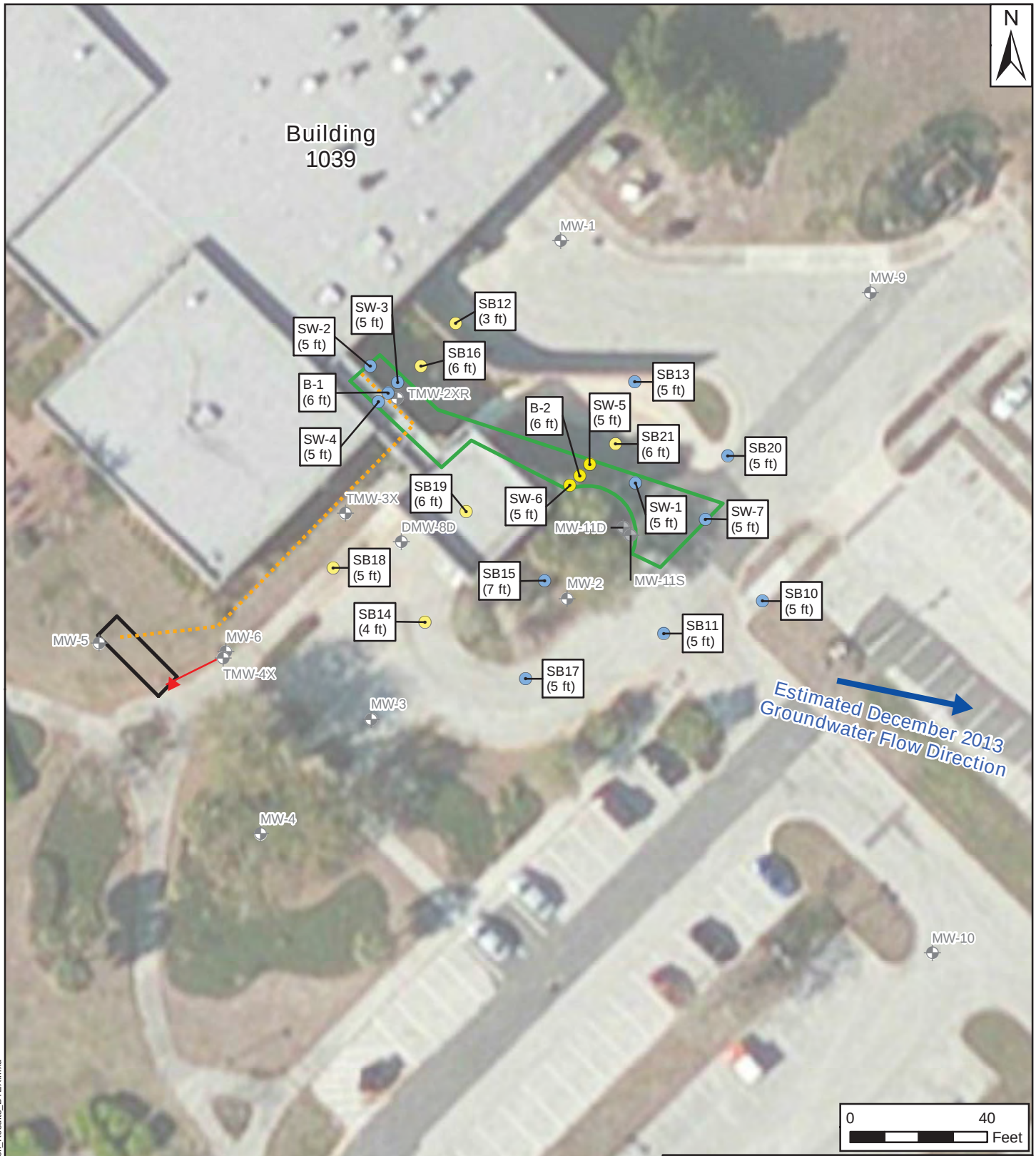
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



NOTE:
-Feature locations are approximate.
- ft = feet
-(3 ft) = sample collected from 3 feet below ground surface
-SW-1 to 7 and B-1 to 2 represent analytical results from 2010

FIGURE 10-5
SOIL ANALYTICAL RESULTS - BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENE (BTEX)
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

- Results above Protection of Groundwater Regional Screening Level
- Results below all Project Action Levels
- Monitoring Well
- Monitoring Well (Location Approximate)
- Former Fill Port and Line
- Former Supply/Return Line
- Former Location of Heating Fuel Tank
- Excavation Boundary (2010)

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: C. Tripp	DATE: 10/13/2014
DRAWN BY: M. Senne	PROJECT: 0888812552

Basemap Source:(c) 2010 Microsoft Corporation and its data suppliers

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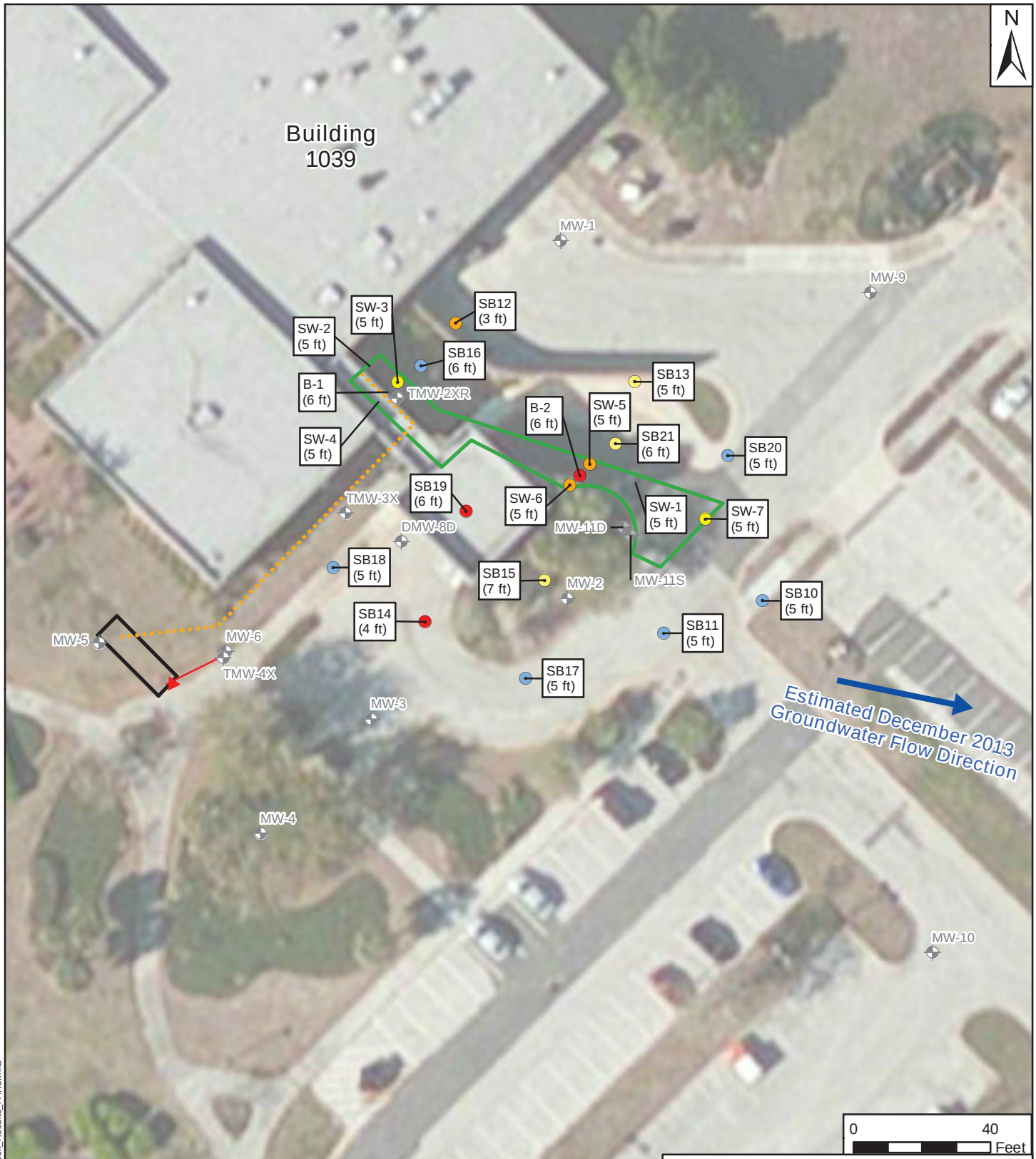

NOTE:
-Feature locations are approximate.
-ft = feet
-(3 ft) = sample collected from 3 feet below ground surface
-PAH = Polynuclear Aromatic Hydrocarbons
-SW-1 to 7 and B-1 to 2 represent analytical results from 2010

FIGURE 10-6
SOIL ANALYTICAL RESULTS - POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs)
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

- Results above Protection of Groundwater, Residential, and Industrial Regional Screening Levels
- Results above Protection of Groundwater and Residential Regional Screening Levels
- Results above Protection of Groundwater Regional Screening Level
- Results below all Project Action Levels
- Monitoring Well
- Monitoring Well (Location Approximate)
- Former Fill Port and Line
- Former Supply/Return Line
- Former Location of Heating Fuel Tank
- Excavation Boundary (2010)

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: C. Tripp	DATE: 10/13/2014
DRAWN BY: M. Senne	PROJECT: 0888812552

Basemap Source:(c) 2010 Microsoft Corporation and its data suppliers

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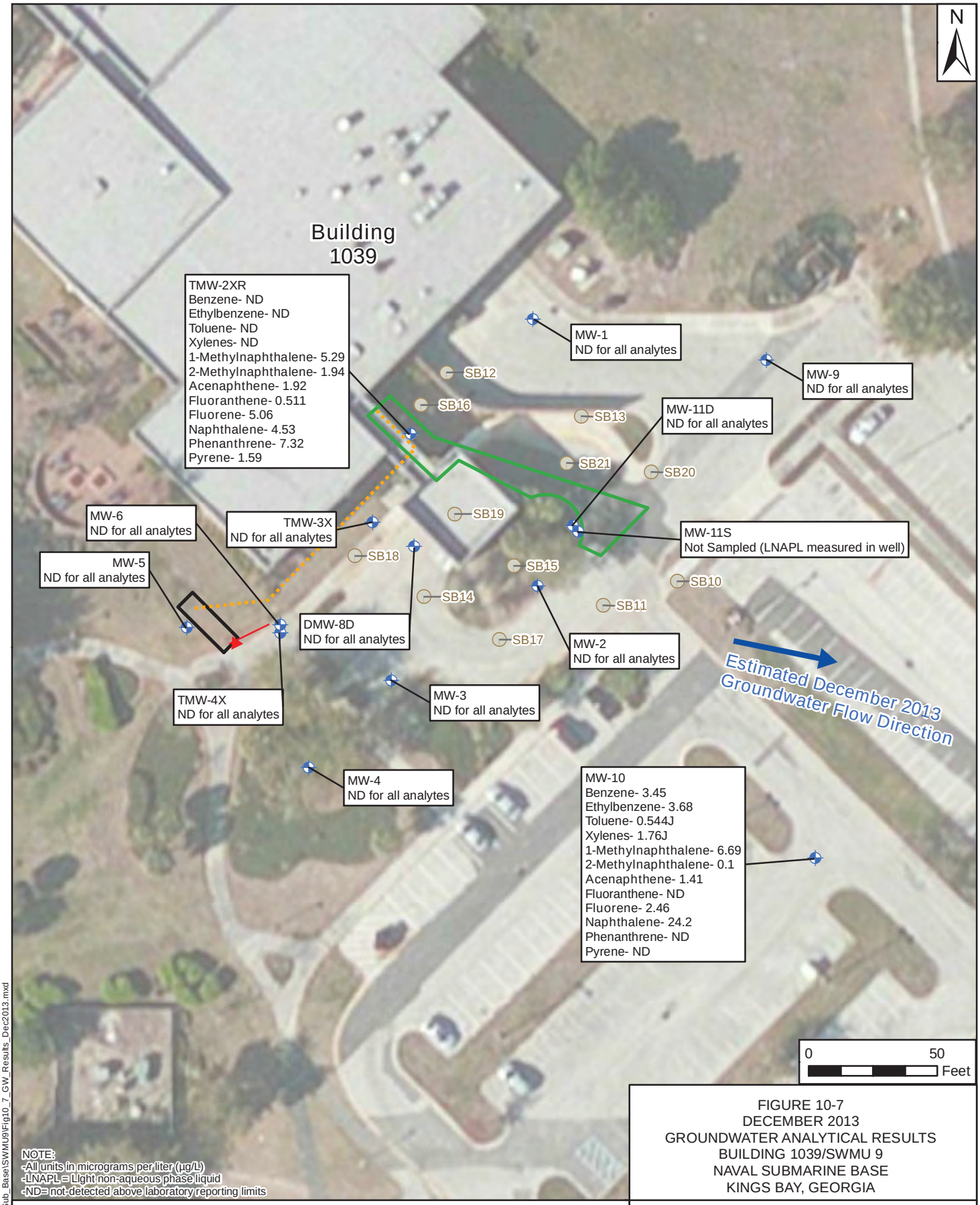

NOTE:
-All units in micrograms per liter (µg/L)
-LNAPL = Light non-aqueous phase liquid
-ND= not-detected above laboratory reporting limits

FIGURE 10-7
DECEMBER 2013
GROUNDWATER ANALYTICAL RESULTS
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

Legend

- Monitoring Well
- Soil Boring
- Former Fill Port and Line
- Former Supply/Return Line
- Former Location of Heating Fuel Tank
- Excavation Boundary (2010)

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: C. Tripp	DATE: 10/15/2014
DRAWN BY: M. Senne	PROJECT: 0888812552

Basemap Source:(c) 2010 Microsoft Corporation and its data suppliers

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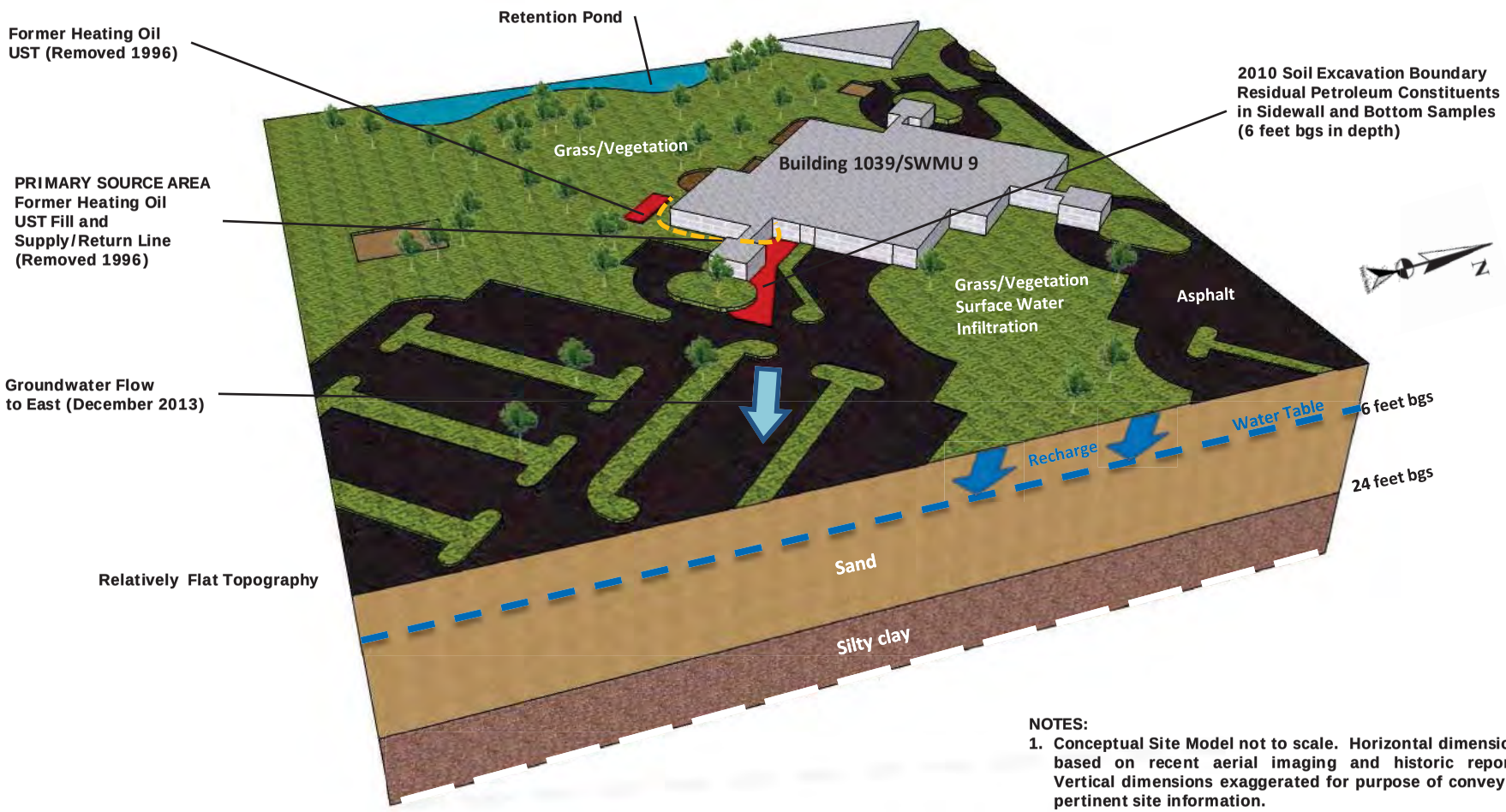

NOTES:

1. Conceptual Site Model not to scale. Horizontal dimensions based on recent aerial imaging and historic reports. Vertical dimensions exaggerated for purpose of conveying pertinent site information.
2. bgs = below ground surface
3. UST= Underground Storage Tank

Contaminant Source:
Residual petroleum constituents in subsurface soil and groundwater due to historical release of heating oil/petroleum from former UST system.

Contaminants Of Potential Concerns:
Benzene, Toluene, Ethylbenzene, Xylenes (BTEX);
Polynuclear Aromatic Hydrocarbons (PAHs)

Potential Receptors:
Site and Construction Workers.

FIGURE 10-8
PRELIMINARY CONCEPTUAL SITE MODEL
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUEST BY: CT	DATE: 10/1/2014
DRAWN BY: DW	CTO NO. JM54

Table 10-1
Groundwater Elevation Summary Table
RCRA Facility Investigation Building 1039
Naval Submarine Base Kings Bay, Georgia

	Casing Elevation (FT MLW)	Total Well Depth (APPROX FT BGS)	Well Screen Interval (APPROX FT BGS)	Depth to Water (FT BTOC)[1]	Groundwater Elevation (FT MLW)	Comments:
Shallow Wells						
MW-1	28.9	13	3 to 13	3.47	25.43	
MW-2	31.74	13	3 to 13	6	25.74	Blockage in well screen, minimal water in well
MW-3	31.23	13.5	3.5 to 13.5	5.29	25.94	
MW-4	32.32	13.7	3.7 to 13.7	6.08	26.24	
MW-5	31.67	12.4	2.4 to 12.4	6.27	25.40	
MW-6	31.96	13.3	3.3 to 13.3	6.33	25.63	
MW-9	30.29	15	5 to 15	5.22	25.07	
MW-10	30.76	14	4 to 14	6.13	24.63	
MW-11S	31.89	13	3 to 13	NA	NA	LNAPL measured from 6.76 to 7.62 FT BTOC
TMW-2XR	31.99	11.8	1.8 to 11.8	6.26	25.73	
TMW-3X	32.01	12	2 to 12	6.18	25.83	
TMW-4X	31.95	12.3	2.3 to 12.3	6.42	25.53	
Deep Wells						
DMW-8D	31.45	29.5	24.5 to 29.5	6.06	25.39	
MW-11D	31.95	32.3	27.3 to 32.3	7.68	24.27	

Notes:

[1] Depth to water measurements collected on 16 DEC 2013

* = Measured in NAD83 Vertical Datum

FT BGS = Feet below ground surface

FT BTOC = Feet belot top of casing

FT MLW = Feet mean low water referenced to NAVFAC vertical control points PCM 6, PCM 15, and USC&GS Bishop

NA = Not available

LNAPL = Light non-aqueous phase liquid

Survey performed by DeGrove Surveyors, Inc in MAR 2014

Table 10-2
Soil Analytical Results (2010)
RCRA Facility Investigation Building 1039
Naval Submarine Base Kings Bay, Georgia

			Sample Location:		SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	B-1	B-2
			Sample Depth (ft bgs):		5	5	5	5	5	5	5	6	6
Analyte	***EPA I-RSL (a)***	***EPA R-RSL (b)***	***EPA SSL-Risk (c)***	***Units***									
Volatile Organic Compounds													
Benzene	5.1	1.2	0.00023	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	4700	490	0.076	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	25	5.8	**0.0017**	mg/kg	ND	ND	ND	ND	**0.46 c**	**0.25 c**	ND	ND	**0.17 c**
Total Xylenes	250	58	0.019	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND
Polynuclear Aromatic Hydrocarbons													
1-Methylnaphthalene	**73**	**17**	**0.0058**	mg/kg	ND	ND	**0.0074 c**	**0.004**	**24 bc**	**35 bc**	**0.059 c**	ND	**74 abc**
2-Methylnaphthalene	300	**23**	**0.019**	mg/kg	ND	ND	**0.011**	**0.005**	**45 bc**	**53 bc**	**0.094 c**	ND	**120 bc**
Acenaphthene	4500	350	**0.55**	mg/kg	ND	ND	ND	ND	**3.9 c**	**4.3 c**	ND	ND	**8.2 c**
Acenaphthylene*	4500	350	0.55	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	23000	1700	**5.8**	mg/kg	ND	ND	ND	ND	**0.86**	**1.1**	ND	ND	**2.2**
Chrysene	290	15	**1.2**	mg/kg	ND	ND	ND	ND	**0.043**	**0.064**	ND	ND	ND
Fluoranthene	3000	230	8.9	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	3000	230	**0.54**	mg/kg	ND	ND	**0.0038**	ND	**5.5 c**	**6.3 c**	**0.01**	ND	**10 c**
Naphthalene	**17**	**3.8**	**0.00054**	mg/kg	ND	ND	ND	ND	**6.4 bc**	**8 bc**	**0.013 c**	ND	**21 abc**
Phenanthrene*	2300	170	**1.3**	mg/kg	ND	ND	ND	ND	**12 c**	**14 c**	**0.021**	ND	**27 c**
Pyrene	2300	170	**1.3**	mg/kg	ND	ND	ND	ND	**1.5 c**	**1.4 c**	ND	ND	**2.7 c**
TPH	-	-	-	mg/kg	48J	12	160	570	11000	14000	6.2	270	21000

Notes:

Data for soil left-in-place per RFI Work Plan (CH2M Hill, 2011).

ND = Not detected
- = Not available
ft bgs = Feet below ground surface
TPH = Total Petroleum Hydrocarbons
EPA R-RSL = US EPA Regional Screening Levels for Residential Soil, adjusted by 0.1 for noncarcinogens, May 2014
EPA I-RSL = US EPA Regional Screening Levels for Industrial Soil, adjusted by 0.1 for noncarcinogens, May 2014
EPA SSL-Risk = US EPA Soil Screening Level based on migration to groundwater and the Tap Water RSL, May 2014
* = U.S. EPA RSL Soil Screening Level (U.S. EPA, May 2014); structurally similar surrogate compound used.
a = Exceeds the EPA I-RSL
b = Exceeds the EPA R-RSL
c = Exceeds the EPA SSL-Risk

Table 10-3
Soil Analytical Results (December 2013)
RCRA Facility Investigation Building 1039
Naval Submarine Base Kings Bay, Georgia

					Sample Location:	SB10	SB11	SB12	SB13	SB14	SB15	SB15	SB16	SB17	SB18	SB18	SB19	SB20	SB21
					Sample ID:	KB09SB10S05N1	KB09SB11S05N1	KB09SB12S03N1	KB09SB13S05N1	KB09SB14S04N1	KB09SB15S07N1	KB09SB15SQ07FD1	KB09SB16S06N1	KB09SB17S05N1	KB09SB18S05N1	KB09SB18SQ05FD2	KB09SB19S06N1	KB09SB20S05N1	KB09SB21S06N1
					Sample Date:	12/03/2013	12/03/2013	12/03/2013	12/03/2013	12/03/2013	12/03/2013	12/03/2013	12/03/2013	12/04/2013	12/04/2013	12/04/2013	12/04/2013	12/04/2013	12/04/2013
					Sample Depth (ft bgs):	5	5	3	5	4	7	7	6	5	5	5	6	5	6
					Sample Type:	N	N	N	N	N	N	FD	N	N	N	FD	N	N	N
					Matrix:	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
Method	**CAS No.**	**Analyte**	**Industrial RSL (a)**	**Residential RSL (b)**	**Protection of Groundwater RSL (c)**	**Units**														
Select Volatile Organic Compounds																				
8260B	71-43-2	**BENZENE**	5.1	1.2	**0.00023**	mg/kg	0.00046 U	0.00044 U	0.026 U	0.029 U	0.026 U	0.024 U	0.025 U	**0.00081 J c**	0.00054 U	**0.00087 J c**	**0.00129 J c**	**0.108 J c**	0.00052 UJ	**0.00034 J c**
8260B	108-88-3	**TOLUENE**	4700	490	**0.076**	mg/kg	0.00046 U	0.00044 U	0.026 U	0.029 U	0.026 U	0.024 U	0.025 U	**0.00147 J**	**0.00166 J**	**0.00135 J**	**0.00227 J**	0.027 U	0.00052 UJ	**0.00065 J**
8260B	100-41-4	**ETHYLBENZENE**	25	5.8	**0.0017**	mg/kg	0.00046 U	0.00044 U	**0.148 J c**	0.029 U	**1.29 J c**	0.024 U	0.025 U	**0.00132 J**	0.00054 U	**0.00233 J c**	**0.00526 c**	**0.255 J c**	0.00052 UJ	**0.00066 J**
8260B	1330-20-7	**XYLENES, TOTAL**	250	58	**0.019**	mg/kg	0.00138 U	0.00132 U	0.079 U	0.088 U	0.079 U	0.073 U	0.074 U	0.00171 U	0.00162 U	**0.00219 J**	**0.00187 J**	0.082 U	**0.00073 J**	**0.0021 J**
Polynuclear Aromatic Hydrocarbons																				
8270D SIM	90-12-0	**1-METHYLNAPHTHALENE**	73	**17**	**0.0058**	mg/kg	0.00185 U	0.00193 U	**54 bc**	0.012 U	**61.4 bc**	0.00385 U	0.00384 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	**63.7 bc**	**0.0042**	**0.012 c**
8270D SIM	91-57-6	**2-METHYLNAPHTHALENE**	300	**23**	**0.019**	mg/kg	0.00185 U	0.00193 U	**69.5 bc**	0.012 U	**126 bc**	0.00385 U	0.00384 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	**128 bc**	**0.0073**	**0.011**
8270D SIM	83-32-9	**ACENAPHTHENE**	4500	350	**0.55**	mg/kg	0.00185 U	0.00193 U	**4.79 c**	0.012 U	0.018 U	0.00385 U	0.00384 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	**7.74 c**	0.00197 U	0.00383 U
8270D SIM	208-96-8	**ACENAPHTHYLENE***	4500	350	**0.55**	mg/kg	0.00185 U	0.00193 U	**2.43 c**	0.012 U	0.018 U	0.00385 U	0.00384 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	0.019 U	0.00197 U	0.00383 U
8270D SIM	120-12-7	ANTHRACENE	23000	1700	5.8	mg/kg	0.00185 U	0.00193 U	0.019 U	0.012 U	0.018 U	0.00385 U	0.00384 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	0.019 U	0.00197 U	0.00383 U
8270D SIM	56-55-3	**BENZO[A]ANTHRACENE**	2.9	0.15	**0.012**	mg/kg	0.00185 U	0.00193 U	**0.09 c**	**0.055 c**	**0.064 c**	0.00385 U	0.00384 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	**0.082 c**	0.00197 U	**0.016 c**
8270D SIM	50-32-8	BENZO[A]PYRENE	0.29	0.015	0.004	mg/kg	0.00185 U	0.00193 U	0.095 U	0.047 U	0.018 U	0.00385 U	0.019 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	0.019 U	0.00197 U	0.019 U
8270D SIM	205-99-2	BENZO[B]FLUORANTHENE	2.9	0.15	0.041	mg/kg	0.00185 U	0.00193 U	0.095 U	0.047 U	0.018 U	0.00385 U	0.019 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	0.019 U	0.00197 U	0.019 U
8270D SIM	191-24-2	BENZO[G,H,I]PERYLENE*	2300	170	1.3	mg/kg	0.00185 U	0.00193 U	0.095 U	0.047 U	0.018 U	0.00385 U	0.019 U	0.00179 UJ	0.00186 U	0.00178 U	0.00176 U	0.019 U	0.00197 U	0.019 U
8270D SIM	207-08-9	BENZO[K]FLUORANTHENE	29	1.5	0.4	mg/kg	0.00185 U	0.00193 U	0.095 U	0.047 U	0.018 U	0.00385 U	0.019 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	0.019 U	0.00197 U	0.019 U
8270D SIM	218-01-9	**CHRYSENE**	290	15	**1.2**	mg/kg	0.00185 U	0.00193 U	**0.216**	**0.069**	**0.095**	0.00385 U	0.00384 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	**0.175**	0.00197 U	**0.035**
8270D SIM	53-70-3	DIBENZ[A,H]ANTHRACENE	0.29	0.015	0.013	mg/kg	0.00185 U	0.00193 U	0.095 U	0.047 U	0.018 U	0.00385 U	0.019 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	0.019 U	0.00197 U	0.019 U
8270D SIM	206-44-0	**FLUORANTHENE**	3000	230	**8.9**	mg/kg	0.00185 U	0.00193 U	**0.627**	0.012 U	**0.536**	0.00385 U	0.00384 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	**0.646**	0.00197 U	**0.00873**
8270D SIM	86-73-7	**FLUORENE**	3000	230	**0.54**	mg/kg	0.00185 U	0.00193 U	**7.32 c**	0.012 U	**10.7 c**	0.00385 U	0.00384 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	**10.6 c**	0.00197 U	0.00383 U
8270D SIM	193-39-5	INDENO[1,2,3-CD]PYRENE	2.9	0.15	0.24	mg/kg	0.00185 U	0.00193 U	0.095 U	0.047 U	0.018 U	0.00385 U	0.019 U	0.00179 UJ	0.00186 U	0.00178 U	0.00176 U	0.019 U	0.00197 U	0.019 U
8270D SIM	91-20-3	**NAPHTHALENE**	**17**	**3.8**	**0.00054**	mg/kg	0.00185 U	0.00193 U	**15.1 bc**	0.012 U	**24.2 abc**	0.00385 U	0.00384 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	**34.9 abc**	0.00197 U	**0.017 c**
8270D SIM	85-01-8	**PHENANTHRENE***	2300	170	**1.3**	mg/kg	0.00185 U	0.00193 U	**15.7 c**	0.012 U	**19.8 c**	0.00385 U	0.00384 U	0.00179 U	0.00186 U	0.00178 U	0.00176 U	**19.3 c**	0.00197 U	**0.015**
8270D SIM	129-00-0	**PYRENE**	2300	170	**1.3**	mg/kg	0.00185 U	0.00193 U	**1.65 c**	**0.106**	**1.55 c**	**1.45 c**	**1.14 c**	0.00179 U	0.00186 U	0.00178 U	0.00176 U	**1.79 c**	0.00197 U	**0.044**

Notes:

Protection of Groundwater RSL= United States Environmental Protection Agency Soil Screening Levels based on Migration to Groundwater and Tap Water Regional Screening Levels, Dillution Attenuation Factor 1, May 2014
Residential RSL = United States Environmental Protection Agency Regional Screening Levels for Residential Soil, May 2014
Industrial RSL = United States Environmental Protection Agency Regional Screening Levels for Industrial Soil, May 2014
* = U.S. EPA RSL Soil Screening Level (U.S. EPA, May 2014); structurally similar surrogate compound used.
SIM = Selected ion monitoring
N = Normal environmental sample
FD = Field duplicate sample
SO = Soil
ft bgs = Feet below ground surface
NE = Not established
J = = Estimated concentration
U = = Below laboratory method detection limits
Bold font indicates analyted detected
Yellow shading indicates analyte detected above Protection of Groundwater RSL
Orange shading indicates analyte detected above Protection of Groundwater and Residential RSLs
Red shading indicates analyte detected above Protection of Groundwater, Residential, and Industrial RSLs

Table 10-4
Groundwater Analytical Results (December 2013)
RCRA Facility Investigation Building 1039
Naval Submarine Base Kings Bay, Georgia

				Sample Location:	MW-1	MW-2	MW-3	MW-4	MW-4	MW-5	MW-6	MW-9	MW-10	TMW-2XR	TMW-3X	TWM-4X	KB09DMW08D	KB09DMW08D	KB09MW11D
				Sample ID:	KB09MW01WG121713N1	KB09MW02WG031114N1	KB09MW03WG121713N1	KB09MW04WG121713N1	KB09MW04WQ121713FD1	KB09MW05WG121713N1	KB09MW06WG121713N1	KB09MW09WG121613N1	KB09MW10WG121713N1	KB09TMW2XRWG121813N1	KB09TMW03XWG121813N1	KB09TMW4XWG121713N1	KB09DMW08DWG121713N1	KB09DMW08DWQ121713FD2	KB09MW11DWG121813N1
				Sample Date:	12/17/2013	03/11/2014	12/17/2013	12/17/2013	12/17/2013	12/17/2013	12/17/2013	12/16/2013	12/17/2013	12/18/2013	12/18/2013	12/17/2013	12/17/2013	12/17/2013	12/18/2013
				Sample Type:	N	N	N	N	FD	N	N	N	N	N	N	N	N	FD	N
				Matrix:	WG	WG	WG	WG	WG	WG	WG	WG	WG	WG	WG	WG	WG	WG	WG
Method	**CAS No.**	**Analyte**	**MCL**	**Units**															
Select Volatile Organic Compounds																			
8260B	71-43-2	**BENZENE**	5	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**3.45**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
8260B	108-88-3	**TOLUENE**	1000	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.544 J**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
8260B	100-41-4	**ETHYLBENZENE**	700	µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**3.68**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
8260B	1330-20-7	**XYLENES, TOTAL**	10000	µg/L	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	**1.76 J**	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Polynuclear Aromatic Hydrocarbons																			
8270D SIM	90-12-0	**1-METHYLNAPHTHALENE**	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	**6.69**	**5.29**	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	91-57-6	**2-METHYLNAPHTHALENE**	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	**0.1**	**1.94**	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	83-32-9	**ACENAPHTHENE**	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	**1.41**	**1.92**	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	208-96-8	ACENAPHTHYLENE	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	120-12-7	ANTHRACENE	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	56-55-3	BENZO[A]ANTHRACENE	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	50-32-8	BENZO[A]PYRENE	0.2	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	205-99-2	BENZO[B]FLUORANTHENE	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	191-24-2	BENZO[G,H,I]PERYLENE	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	207-08-9	BENZO[K]FLUORANTHENE	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	218-01-9	CHRYSENE	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
8270D SIM	53-70-3	DIBENZ[A,H]ANTHRACENE	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	206-44-0	**FLUORANTHENE**	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	**0.511**	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	86-73-7	**FLUORENE**	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	**2.46**	**5.06**	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	193-39-5	INDENO[1,2,3-CD]PYRENE	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	91-20-3	**NAPHTHALENE**	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	**24.2**	**4.53**	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	85-01-8	**PHENANTHRENE**	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	**7.32**	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
8270D SIM	129-00-0	**PYRENE**	NE	µg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	**1.59**	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U

Notes:

MCL = Georgia Primary Maximum Contaminant Level for Drinking Water per Georgia Rule 391-3-5-.18
SIM = Selected ion monitoring
N = Normal environmental sample
FD = Field duplicate sample
WG = Groundwater
NE = Not established
J = Estimated concentration
U = Below method detection limits
Bold font indicates analyted detected

Soil

Tables 10-2 and 10-3 compare comprehensive soil results to applicable U.S. EPA Industrial Regional Screening Levels (I-RSLs), Residential Regional Screening Levels (R-RSL), and Soil Screening Levels for the Migration to Groundwater and Tap Water RSL (SSL-Risk), dated May 2014. In general, the highest concentrations of BTEX were reported in 2013 soil samples collected to the west of the historical excavation. Although concentrations of benzene and ethylbenzene were reported above SSL-Risk values, all BTEX constituents were below R-RSLs and I-RSLs for soil samples collected to date. In general, maximum PAH concentrations were reported in the 2010 confirmatory soil sample B-2, collected from the base of the historical excavation, and adjacent to the west of the excavated area. The PAHs 1-methylnaphthalene and naphthalene were detected above SSL-Risk values, R-RSLs, and I-RSLs in soil samples collected to date. The PAH 2-methylnaphthalene was also detected above SSL-Risk values and R-RSLs. Several additional PAHs exceeded SSL-Risk values in soil. As depicted on Figures 10-5 and 10-6, impacted soil has not yet been delineated to the north and west of the historical excavation.

Groundwater

As summarized on Table 10-4 and depicted on Figure 10-7, concentrations of BTEX and PAHs were detected in the 2013 groundwater sample collected from shallow well MW-10, positioned approximately 150 feet downgradient of the historical release area. Detectable concentrations of several PAHs were also reported in the 2013 groundwater sample collected from shallow well, TMW-2XR, positioned at the upgradient edge of the historical excavation. Consistent with results from previous studies, no analytes were detected in groundwater samples collected from deep monitoring wells during the December 2013 event. No analytes were measured above Georgia Primary Maximum Contaminant Levels for Drinking Water per Georgia Rule 391-3-5-.18, in groundwater samples collected from shallow or deep monitoring wells during the initial RFI event.

10.5.3 Fate and Transport Mechanisms

A fate and transport pathway describes mechanisms whereby contaminants are transported from the source to a receptor. Preliminary fate and transport mechanisms for each matrix are summarized below and will be refined throughout the RFI.

Soil

Contamination is limited to subsurface soil; therefore, contaminants are not subject to transport via wind or surface water runoff. Heating oil was historically released to subsurface soil as LNAPL, which can migrate vertically until the soil pore volume achieves residual saturation or residual product reaches the top of the water table. LNAPL may also migrate laterally within zones of more permeable soil or aggregate, such as the backfill of utility trenches. If sufficient product is released, some migration of LNAPL may occur along the top of the water table. Fuel constituents tend to adsorb to soil particles; the degree of adsorption is related to the organic and clay content of the soil, and to the chemical properties of the fuel, especially water solubility and organic partitioning coefficient. Factors working to reduce the mass of soil contamination include dissolution in groundwater, volatilization, and biodegradation.

Groundwater

LNAPL in soil can act as a long-term source of dissolved groundwater contaminants. As recharge travels through soil containing residual LNAPL, the water leaches some of the adsorbed contaminants, thus contributing additional dissolved contamination to the groundwater plume. Mechanisms affecting transport of the contaminant plume include advection, adsorption, dispersion, dilution, and biodegradation. Advection is migration of dissolved contaminants along with groundwater movement. In general, the contaminant plume migration rate is slower than groundwater because of contaminant adsorption to soil and organic matter. Dispersion causes the plume to spread both vertically and laterally during migration. Generally, vertical spreading is an order of magnitude less than horizontal spreading. Dilution by recharge can reduce contaminant concentrations in the downgradient direction. Biodegradation by microbial organisms naturally reduces fuel components in the plume. The combined effect of these mechanisms aids to limit the extent of the contaminant plume.

Surface Water/Sediment

In general, rainfall either infiltrates into the ground at vegetated areas or drains from impervious areas into the storm sewer. No surface water bodies or drainage ditches are located on the Site.

10.5.4 Exposure Pathways and Receptors

An exposure pathway links a source area with one or more receptors, but the pathway must be complete for exposure to occur. The potential exposure pathways identified for Building 1039 are discussed below, and will be refined throughout the RFI.

Human Health Exposures

Building 1039 is used by workers and SUBASE personnel for indoor recreation purposes. Although surface soil is not currently impacted, dermal contact with contaminated subsurface soil is a potential exposure pathway for construction workers, including hypothetical landscaping workers. These workers could also inhale contaminated dust if impacted soil is disturbed. Groundwater at Building 1039 is not used as a source of water supply; however, direct contact with contaminants in groundwater is a potential exposure pathway for current and future construction workers. The presence of supply wells at SUBASE and their proximity to Building 1039 will be investigated during the RFI. Future residents, recreational users, and industrial workers may contact contaminated groundwater if drinking water wells are installed in the shallow aquifer, although this scenario is very unlikely. Based on current and likely future land use, the most likely human receptors to contact contaminants in soil and groundwater are construction workers. Human health risks will be evaluated for site workers and construction workers in the Human Health Risk Assessment portion of the RFI, and risks to landscaping workers will be inferred from those scenarios based on shallow, subsurface soil (surface to 5 feet bgs). A chemical of concern identified in shallow subsurface soil for either site workers or construction workers will also be considered a chemical of concern for landscaping workers.

Ecological Exposures

The Site is covered by impervious surfaces, such as asphalt parking, roads, and concrete walkways, and maintained, grassy medians. Based on an ecological survey completed during the initial phase of the RFI, no ecological habitats are present at the Site, thus, ecological risk will not be further evaluated.

10.6 Existing Data Gaps

The horizontal extent of impacted soil has not been delineated to applicable screening levels. This SAP addendum describes supplemental sampling efforts intended to address this data gap.

SAP WORKSHEET #16: PROJECT SCHEDULE/TIMELINE TABLE (OPTIONAL FORMAT)

(UFP-QAPP Manual Section 2.8.2)

Activity	Organization	Duration	Start Date	Deliverable
Prepare/Submit Draft SAP Addendum	Resolution Consultants	45 days	1 day after Notice to Proceed by Navy	Draft SAP Addendum
Regulatory Review of Draft SAP Addendum	GA EPD	60 days	1 day after receipt of deliverable	NA
Respond to Regulatory Comments	Resolution Consultants	30 days	1 day after receipt of Regulatory comments	Response to Comments
Prepare/Submit Final SAP Addendum	Resolution Consultants	30 days	1 day after receipt of Regulatory comments	Final SAP Addendum
Concurrence by Regulators	GA EPD	TBD	NA	NA
Field Preparation/ Mobilization	Resolution Consultants	30 days	15 days after Regulatory concurrence	NA
Field Work	Resolution Consultants	15 days	45 days after Regulatory concurrence	NA
Laboratory Results, Data Validation, Data Management	GCAL and/or Resolution Consultants	60 days	1 day after soil and well sampling	Laboratory data packages and electronic data deliverables
Prepare/Submit Draft RFI Report	Resolution Consultants	90 days	1 day after receipt of validated data	Internal Draft RFI Report
Regulatory Review of Draft RFI Report	GA EPD	TBD	NA	NA
Respond to Regulatory Comments	Resolution Consultants	60 days	1 day after receipt of Regulatory comments	Final RFI Report
Prepare/Submit Final RFI Report	Resolution Consultants	60 days	1 day after receipt of Regulatory comments	Final RFI Report
Regulatory Concurrence	GA EPD	TBD	NA	NA

Notes:

SAP = Sampling and Analysis Plan
RFI = RCRA Facility Investigation
GCAL = Gulf Coast Analytical Laboratories
NA = Not applicable
GA EPD = Georgia Environmental Protection Division
TBD = To be determined
RCRA = Resource Conservation and Recovery Act

SAP WORKSHEET #17: SAMPLING DESIGN AND RATIONALE

(UFP-QAPP Manual Section 3.1.1)

17.1 Sampling Approach

Supplemental sampling, as detailed in this addendum, is intended to horizontally delineate impacted soil to applicable screening levels. As summarized in Worksheet #10, BTEX and several PAHs were reported above screening levels at December 2013 soil sampling locations positioned on the outer horizontal extent of the sampling grid. Proposed supplemental soil borings, intended to provide horizontal delineation, are presented on Figure 17-1. A sample summary table, including sample identification numbers, depth, relevant SOPs, and applicable laboratory and field analyses, is included as Worksheet #18. SOPs are summarized in Worksheet #21 of the original SAP.

17.2 Sampling Program

To provide additional information on the horizontal extent of impacted soil, direct push technology will be used to advance ten soil borings. Boring locations, as depicted on Figure 17-1, are subject to change based on field observations and professional judgment. Similarly, the SAP may be modified to include additional borings if deemed necessary in the field. Criteria, which may lead to changes to the SAP, may include visual observations/staining, odors, elevated headspace/organic vapor readings, etc. Soil borings will be advanced to the water table (approximately 7 feet bgs). During advancement, soil will be continuously logged for lithology and screened for organic vapors using a photo-ionization detector. One subsurface soil sample will be collected from immediately above the water table at each boring. In the event organic vapors are measured above background conditions, a second subsurface soil sample will be collected from the 2-foot depth interval exhibiting the highest organic vapor reading. Soil samples will be submitted to a laboratory for analysis of BTEX by Method 8260B and PAHs by Method 8270D selective ion monitoring.

NOTE:
-Feature locations are approximate.
- ft = feet
-(3 ft) = sample collected from 3 feet below ground surface
-SW-1 to 7 and B-1 to 2 represent analytical results from 2010; others represent analytical results from 2013

Soil Sample Location

- Results above Protection of Groundwater, Residential, and Industrial Regional Screening Levels
- Results above Protection of Groundwater and Residential Regional Screening Levels
- Results above Protection of Groundwater Regional Screening Level
- Results below all Project Action
- Proposed Soil Sample Location
- Monitoring Well
- Former Fill Port and Line
- Former Supply/Return Line
- Former Location of Heating Fuel
- Excavation Boundary (2010)

FIGURE 17-1
PROPOSED SOIL SAMPLING LOCATIONS
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: C. Tripp	DATE: 10/13/2014
DRAWN BY: N. Rinehart	PROJECT: 0888813971

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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

(UFP-QAPP Manual Section 3.1.1)

Sample Location	Sample Identification	Matrix	Estimated Depth (feet bgs)	Analytical Group	Number of Samples	Sampling Standard Operating Procedure Reference (Appendix B)
SB22	KB09SB22S06N1	Soil	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB23	KB09SB23S06N1	Soil	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB24	KB09SB23S06N1	Soil	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB25	KB09SB25S06N1	Soil	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB26	KB09SB26S06N1	Soil	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB27	KB09SB27S06N1	Soil	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB28	KB09SB28S06N1	Soil	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB29	KB09SB29S06N1	Soil	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB30	KB09SB30S06N1	Soil	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB31	KB09SB31S06N1	Soil	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SBXX*	KB09SBXXSXXN1	Soil	To Be Determined	BTEX, PAHs	up to 10	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SBXX	KB09SBXXSQ06FD1	Soil (duplicate)	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SBXX	KB09SBXXS06N1	Soil (MS/MSD)	6.0**	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21

Sample Location	Sample Identification	Matrix	Estimated Depth (feet bgs)	Analytical Group	Number of Samples	Sampling Standard Operating Procedure Reference (Appendix B)
Equipment Blank	KB09SBXXSQ06EB1	SQ (Equipment Blank)	NA	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
Equipment Blank	KB09SBXXSQ06EB2	SQ (Equipment Blank)	NA	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21

Notes:

bgs = Below ground surface
EB = Equipment blank
N = Normal/primary sample
FD = Field duplicate
MMDDYY = Numerical Month Day Year
SQ = Soil Quality
BTEX = Benzene, toluene, ethylbenzene, xylenes
PAHs = Polynuclear aromatic hydrocarbons
NA = Not Applicable
MS/MSD = Matrix Spike/Matrix Spike Duplicate
XX = To Be Determined in Field
* = Up to 10 additional samples may be collected based on field observations and professional judgment
** = Sample to be collected within the 2-foot interval immediately above the water table

SAP WORKSHEET #20: FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates(1)	No. of MS/MSDs	No. of Equipment Blanks (2)	Total No. of Samples to Lab
Soil(3)	BTEX	10	1	1/1	2	15
	PAHs	10	1	1/1	2	15

Notes:

(1) = If additional soil samples are collected, field duplicates will be collected at a ratio of one field duplicate per 10 primary samples
(2) = One equipment blank per day of sampling per media and equipment type; assumes one day of soil sampling
(3) = Up to 10 soil samples may be collected based on professional judgment and field observations
BTEX = Benzene, toluene, ethylbenzene, xylenes
PAHs = Polynuclear aromatic hydrocarbons
MS = Matrix spike
MSD = Matrix spike duplicate
No. = Number

Appendix A

Sampling and Analysis Plan, Resource Conservation and Recovery Act Facility Investigation, Building 1039/Solid Waste Management Unit 9, Naval Submarine Base Kings Bay, Georgia

(Resolution Consultants 2013)

SAMPLING AND ANALYSIS PLAN

RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION BUILDING 1039/SOLID WASTE MANAGEMENT UNIT 9 NAVAL SUBMARINE BASE, KINGS BAY, GEORGIA

Revision Number: 0

Prepared For:

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

Prepared By:

Resolution Consultants
A Joint Venture of AECOM & EnSafe
1500 Wells Fargo Building
440 Monticello Avenue
Norfolk, Virginia 23510

Contract Number: N62470-11-D-8013
CTO JM25

25 July 2013

SAP WORKSHEET #1: TITLE AND APPROVAL PAGE
(UFP-QAPP Manual Section 2.1)

SAMPLING AND ANALYSIS PLAN

RESOURCE CONSERVATION AND RECOVERY ACT
FACILITY INVESTIGATION
BUILDING 1039/ SOLID WASTE MANAGEMENT UNIT 9
NAVAL SUBMARINE BASE, KINGS BAY, GEORGIA

Revision Number: 0

Prepared For:

Department of the Navy
Naval Facilities Engineering Command Southeast
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Contract Number: N62470-11-D-8013
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25 July 2013

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Monique Nixon
NAVFAC Atlantic
Navy Quality Assurance Officer/Chemist Date

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David Warren
Resolution Consultants Task Order Manager Date

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Dana Hayworth
Navy Remedial Project Manager Date

Amy Potter, Georgia Environmental Protection Division
Unit Coordinator/ Date

SAP WORKSHEET #1: TITLE AND APPROVAL PAGE
(UFP-QAPP Manual Section 2.1)

SAMPLING AND ANALYSIS PLAN

RCRA FACILITY INVESTIGATION
BUILDING 1039/ SOLID WASTE MANAGEMENT UNIT 9
NAVAL SUBMARINE BASE, KINGS BAY, GEORGIA

Revision Number: 0

Prepared For:

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CTO JM25

April 2013

4/8/2013

Anne Kathain
Resolution Consultant Project Chemist Date

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Monique Nixon
NAVFAC Atlantic
Navy Quality Assurance Officer/Chemist Date

4/8/2013

David Warren
Resolution Consultant Task Order Manager Date

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Dana Hayworth
Navy Remedial Project Manager Date

Amy Potter, Georgia Environmental Protection
Division Unit Coordinator Date

Compliance Status Report
Qualified Groundwater Scientist Certification

I certify that I am a qualified groundwater scientist who has received a baccalaureate or postgraduate degree in the natural sciences or engineering, and have sufficient training and experience in groundwater hydrology and related fields as demonstrated by state registration and completion of accredited university courses that enable me to make sound professional judgments regarding groundwater monitoring and contaminant fate and transport. I further certify that this report was prepared by me or by a subordinate working under my direction.

Benjamin J. Brantley

(Signature)

Benjamin Brantley

Professional Geologist License Number: PG001051

Professional Geologist Seal:

EXECUTIVE SUMMARY

Resolution Consultants has prepared this Uniform Federal Policy Sampling and Analysis Plan (SAP) for the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for Building 1039/Solid Waste Management Unit (SWMU) 9, at Naval Submarine Base (SUBASE) Kings Bay, Georgia, under Contract No. N62470-11-D-8013, Comprehensive Long-term Environmental Action Navy (CLEAN), Contract Task Order (CTO) JM25.

Building 1039/SWMU 9, located on USS James Madison Road near the western boundary of SUBASE, contains game and meeting rooms and is surrounded by paved parking lots and maintained, grassy areas. Surrounding structures include the Bachelor Officer's Quarters (also known as Transient Visitor's Quarters) to the east, Bachelor Enlisted Quarters to the south, the library to the northwest, and SUBASE administrative offices to the north. Local topography is relatively flat, with storm water runoff flowing towards curb and grate drainage features in the parking lot and along roads. Storm water collected from paved surfaces drains to a retention pond, approximately 150 feet west and 400 feet south of Building 1039.

Prior to 1995, Building 1039 was serviced by a heating-oil-fired boiler system, with fuel stored in a 15,000-gallon underground storage tank (UST) at the exterior, southwestern corner. The UST was connected to the boiler by an underground supply and return pipeline, approximately 100 feet in length. The heating oil UST and associated piping were removed on 22 January 1996, at which time the removal contractor reported visible petroleum in the trench excavations associated with the UST's supply/return pipeline. Free product was observed during the excavation of the supply/return pipeline, and in temporary wells installed in the vicinity of the former supply/return lines immediately following removal.

Subsequent to notifying Georgia Environmental Protection Division (GA EPD) of a release, SUBASE performed soil and groundwater sampling and corrective action from 1996 to February 2010. Corrective actions included product recovery, enhanced bioremediation via microbe/nutrient injections, and soil excavation. Historical sampling efforts from 1997 to 2010 indicated the presence of benzene, toluene, ethylbenzene, and xylenes (BTEX) and polynuclear aromatic hydrocarbons (PAHs) in soil and shallow groundwater in the vicinity of Building 1039. While ethylbenzene and several PAHs exceeded United States Environmental Protection Agency (U.S. EPA) Soil Screening Levels for the Migration to Groundwater and Tap Water Regional Screening Level (SSL-Risk) in samples representative of soil left-in-place along the sidewalls and at the bottom of the 2010 excavation, only 1-methylnaphthalene and naphthalene exceeded Industrial Regional Screening Levels (I-RSLs). These industrial exceedances were isolated to a single sample collected at the base of the 2010 excavation. During the latest groundwater sampling efforts in

February 2010, benzene (5.1 µg/L) was reported slightly above the U.S. EPA Maximum Contaminant Level of 5.0 µg/L at shallow well, MW-2, approximately 60 feet downgradient from the former UST supply/return pipeline.

In 2006, GA EPD designated Building 1039 as RCRA SWMU 9, in accordance to SUBASE's hazardous waste permit, requiring an RFI to evaluate nature and extent, risks to human health and the environment, and the need for corrective action. Data from previous investigations are insufficient to fully satisfy the requirements of the RFI. In response to GA EPD's comments on a draft RFI work plan, SUBASE submitted the *Final Site-Specific RCRA Facility Investigation Work Plan Building 1039, Naval Submarine Base, Kings Bay* (CH2M Hill 2011) (Final RFI Work Plan) to address data gaps necessary to complete the RFI. The Final RFI Work Plan proposed collection of up to 12 soil samples for analysis of BTEX and PAHs, collection of two soil samples for determination of grain size and total organic carbon, and the installation of one shallow and one deep monitoring well. Furthermore, the Final Work RFI Work Plan proposes groundwater sampling at 12 existing and the two new wells, with samples submitted for BTEX and PAHs analysis.

This SAP, which has been prepared to accompany the Final RFI Work Plan, outlines the organization, objectives, planned activities, and data review/reporting procedures associated with the RFI. Protocols for sample collection, handling, and storage, chain-of-custody, laboratory and field analyses, data validation, and reporting are also addressed herein. This SAP was generated for, and complies with, applicable United States Department of the Navy (Navy), U.S. EPA Region 4, and GA EPD requirements, regulations, guidance, and technical standards, as appropriate. This includes the Department of Defense, Department of Energy, and U.S. EPA Interagency Data Quality Task Force environmental requirements regarding federal facilities, as specified in the Uniform Federal Policy Quality Assurance Project Plan guidance (U.S. EPA 2005) and the Navy's SAP guidance. Field activities conducted under this SAP will be conducted in accordance with Resolution Consultants' Standard Operating Procedures and a Site-Specific Health and Safety Plan.

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Appendices

Appendix A Resolution Consultants Project Personnel Resumes
Appendix B Site Specific Field Standard Operating Procedures and Field Forms
Appendix C Laboratory Accreditation Certificates

List of Acronyms

ASTM	American Society for Standards and Materials
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, xylenes
°C	Degrees Celsius
CAP	Corrective Action Plan
CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLEAN	Comprehensive Long-term Environmental Action Navy
COC	Contaminant of concern
COPC	Contaminant of potential concern
CSM	Conceptual site model
CTO	Contract task order
DL	Detection limit
DoD	Department of Defense
DOD QSM	Department of Defense Quality Systems Manual for
DPT	Direct-push technology
DQO	Data quality objective
DVM	Data Validation Manager
EB	Equipment rinsate blanks
EPA	Environmental Protection Agency
ERA	Ecological risk assessment
ESV	Ecological screening values
FTL	Field Team leader
GA EPD	Georgia Environmental Protection Division
GC	Gas chromatograph
GCAL	Gulf Coast Analytical Laboratories
GC/MS	Gas chromatograph/mass spectrometer
GPS	Global positioning system
HHRA	Human health risk assessment
HQ	Hazard quotient
IDW	Investigative derived waste
LCS	Laboratory control sample
LOD	Limit of detection
LOQ	Limit of quantitation
µg/L	Microgram per liter
mg/kg	Milligram per kilogram
MCL	Maximum contaminant level
MS	Matrix spike

MSD	Matrix spike duplicate
MS/MSD	Matrix spike/matrix spike duplicate
NAVFAC SE	Naval Facilities Engineering Command Southeast
NIRIS	Naval Installation Restoration Information Solution
%R	Percent recovery
PAH	Polynuclear aromatic hydrocarbons
PAL	Project Action Limit
PID	Photoionization detector
PM	Project manager
POC	Point of Contact
PQOs	Project quality objectives
PSQ	Principal study questions
PVC	polyvinyl chloride
QA	Quality assurance
QAM	Quality Assurance Manager
QAO	Quality assurance officer
QAPP	Quality assurance project plan
QC	Quality control
QSM	Quality systems manual
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RPD	Relative percent difference
RPM	Remedial project manager
RSD	Relative standard deviation
RSL	Regional screening levels
RT	Retention time
SAP	Sampling and analysis plan
SDG	Sample delivery group
SIM	Selective ion monitoring
SOP	Standard operating procedure
SSL	Soil screening levels
SUBASE	Naval Submarine Base
SWMU	Solid Waste Management Unit
SVOC	Semi-volatile organic compounds
TBD	To be determined
TOC	Total organic carbon
TOM	Task Order Manager
UFP	Uniform Federal Policy
U.S.	United States
U.S. EPA	United States Environmental Protection Agency
VOA	Volatile organic analysis
VOC	Volatile organic compounds

SAP WORKSHEET #2: SAMPLING AND ANALYSIS PLAN IDENTIFYING INFORMATION

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number: Building 1039/Solid Waste Management Unit 9 (SWMU 9)

Contractor Name: Resolution Consultants

Contract Number: N62470-11-D-8013

Contract Title: Comprehensive Long-term Environmental Action Navy (CLEAN)

Work Assignment Number: Contract Task Order (CTO) JM25

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)* (U.S. EPA 2005) and the United States Environmental Protection Agency (U.S. EPA) *Guidance for Quality Assurance Project Plans, EPA QA/G-5* (U.S. EPA 2002).

2. Identify regulatory program: Resource Conservation and Recovery Act (RCRA), Title 42, United States Code 6901 et seq., 1976.

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held: No scoping meetings have been held to date; however, the scope of work which this SAP is based on was presented in the *Final Site-Specific RCRA Facility Investigation Work Plan Building 1039, Naval Submarine Base, Kings Bay, Camden County, Georgia* (CH2M Hill 2011) (referred to as the Final RFI Work Plan herein). The Final RFI Work Plan was submitted to the Georgia Environmental Protection Division (GA EPD) in June 2011, subsequent to scope refinement with a draft RFI work plan and GA EPD letter communication, as listed in Worksheet #9.

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation: No SAP documents have been written for previous work.

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

   - Property Owner — U.S. Department of the Navy, Naval Submarine Base(SUBASE), Kings Bay, Georgia

   - Regulatory Oversight — GA EPD

7. Lead organization: Department of the Navy, Naval Facilities Engineering Command, Southeast (NAVFAC SE)

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

SAP WORKSHEET #3: DISTRIBUTION LIST

(UFP-QAPP Manual Section 2.3.1)

SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address
Dana Hayworth	Navy Remedial Project Manager/Technical Representative	NAVFAC SE NAS Jacksonville, Building 135 Jacksonville, FL 32212	904-542-6417	Dana.hayworth@navy.mil
Thomas Stofflet	Environmental Protection Specialist/Activity Point of Contact	SUBASE Environmental Department Public Works Office Kings Bay, Georgia 31547	912-573-4646	thomas.stofflet@navy.mil
Amy Potter	Regulator/Stakeholder	Georgia Environmental Protection Division 2 Martin Luther King, Jr. Drive SE Suite 1162 East Atlanta, GA 32399-2400	404-656-2833	Amy_Potter@dnr.state.ga.us
Bonnie Capito	Administrative Record /Librarian	NAVFAC Atlantic 6506 Hampton Blvd Bldg. A Norfolk VA 23508	757-322-4785	bonnie.capito@navy.mil
David Warren	Contract Task Order Manager	Resolution Consultants 313 Wingo Way Mount Pleasant, SC 29464	843-884-0029	dwarren@ensafe.com
Chad Tripp	Field Team Leader/Site Safety Officer	Resolution Consultants 313 Wingo Way Mount Pleasant, SC 29464	919-244-3109	ctripp@ensafe.com
Ben Brantley	Certified Groundwater Scientist	Resolution Consultantts 5724 Summer Trees Dr. Memphis, TN 38134	901-937-4222	bbrantley@ensafe.com
Tina Cantwell	Project Chemist/Quality Assurance Officer/Data Manager	Resolution Consultants 3478 Buskirk Ave Pleasant Hill, CA 94523	901-937-4315	tcantwell@ensafe.com
Brenda Martinez	Laboratory Project Manager	Gulf Coast Analytical Laboratories	225-769-4900	brenda.martinez@gcal.com
Robert Werner	Laboratory Director	Ardaman and Associates, Inc.	225-752-4790	rwerner@ardaman.com

Notes:
Each person listed in this table will be responsible for distributing copies of this SAP to appropriate personnel within their organization.
NAVFAC SE = Naval Facilities Engineering Command Southeast SUBASE = Naval Submarine Base, Kings Bay, Georgia

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 e-mails will constitute verification that applicable sections of the SAP have been reviewed. Copies of regulatory agency approval letters/e-mails will be retained in the project files and are listed in Worksheet #29 as project records.

2. E-mails will be sent to the Navy, Resolution Consultants, and subcontractor project personnel who will be requested to verify by e-mail that they have read the applicable SAP/sections and the date on which they were reviewed. Copies of the verification e-mail will be included in the project files and is identified in Worksheet #29.

A copy of the signed Worksheet #4 will be retained in the project files and is identified as a project document in Worksheet #29.

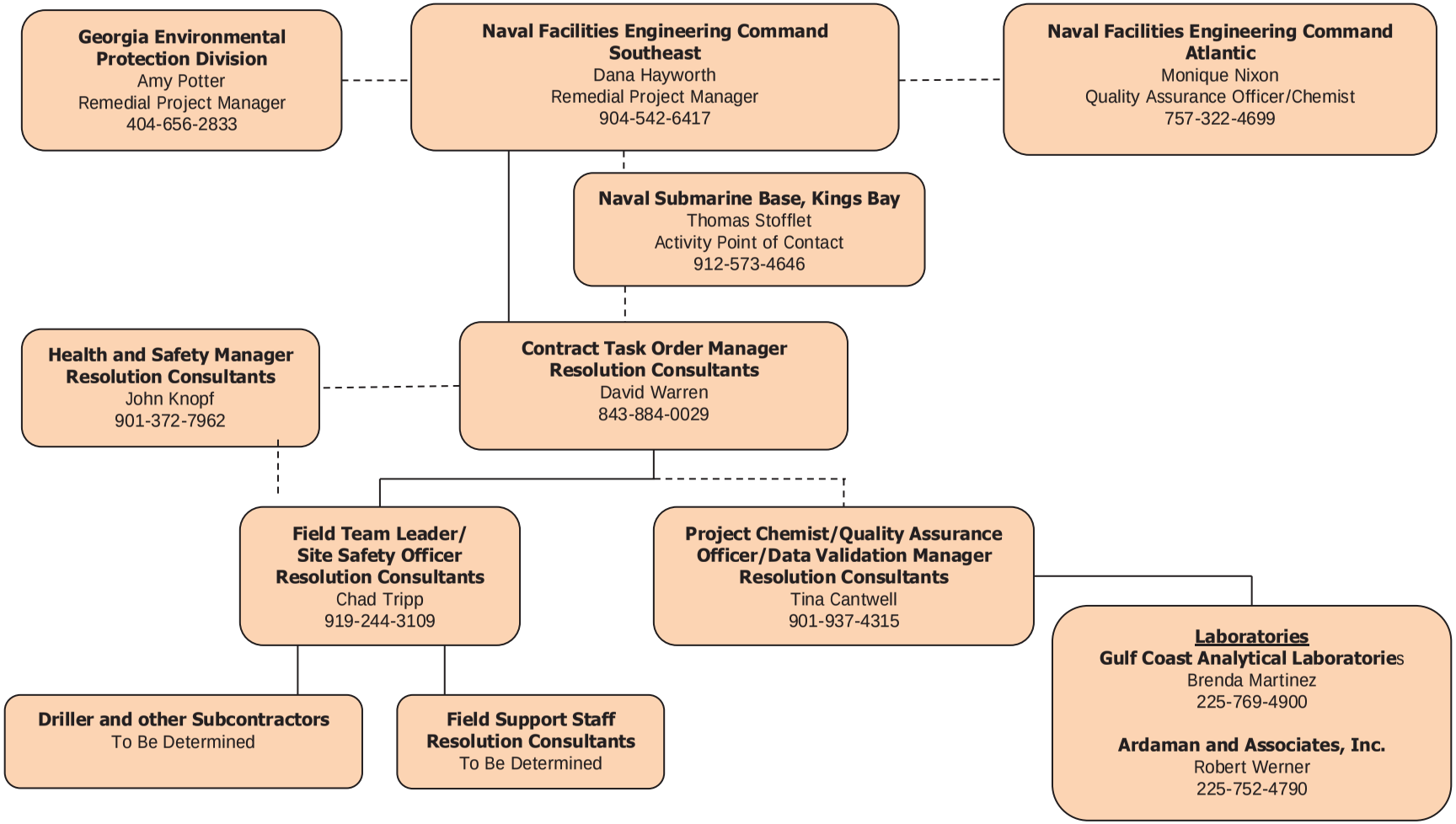
Project Personnel Sign-Off Sheet					
Name	**Organization/Title/Role**	**Telephone Number**	**Signature/E-Mail Receipt**	**Sampling and Analysis Plan Section Reviewed**	**Date Sampling and Analysis Plan Read**
Navy and Regulator Partnering Team Personnel					
Dana Hayworth	Navy Remedial Project Manager/ Technical Representative	904-542-6417		All	
Thomas Stofflet	Navy Environmental Protection Specialist / Activity Point of Contact	912-573-4646		All	
Amy Potter	Georgia Environmental Protection Division /Regulator/Stakeholder	404-656-2833		All	
Resolution Consultants' Partnering Team Personnel					
David Warren	Contract Task Order Manager/ Manages Project for Resolution Consultants	843-884-0029		All	
Ben Brantley	Certified Groundwater Scientist/ Resolution Consultants	901-937-4222		All	

Project Personnel Sign-Off Sheet					
Name	**Organization/Title/Role**	**Telephone Number**	**Signature/E-Mail Receipt**	**Sampling and Analysis Plan Section Reviewed**	**Date Sampling and Analysis Plan Read**
Chad Tripp	Field Team Leader/Site Safety Officer	919-244-3109		All	
Tina Cantwell	Project Chemist/ Quality Assurance Officer/Data Manager	901-937-4315		All	
Subcontractor Personnel					
Brenda Martinez	Gulf Coast Analytical Laboratories/Project Manager/ Laboratory PM	225-769-4900		Worksheets #6, #12, #14, #15, #19, #20, #23-28, #30, and #34-36	
Robert Werner	Ardaman and Associates, Inc./ Laboratory PM	225-752-4790		Worksheets #6, #12, #14, #15, #19, #20, #23-28, #30, and #34-36	

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 Pathways				
Communication Drivers	**Responsible Entity**	**Name**	**Phone Number**	**Procedure (Timing, Pathway To/From, etc.)**
Regulatory Agency Interface	GA EPD RPM NAVFAC SE RPM	Amy Potter Dana Hayworth	404-656-2833 904-542-6417	The NAVFAC SE RPM will contact the regulatory agency via phone and/or e-mail within 24 hours of recognizing the issue whenever issues arise.
Field Progress Reports	Resolution Consultants TOM Resolution Consultants FTL	David Warren Chad Tripp	843-884-0029 919-244-3109	The Resolution Consultants FTL will contact the Resolution Consultants TOM on a daily basis via phone, and every 1-2 days summarizing progress via e-mail.
Gaining Site Access	Resolution Consultants FTL SUBASE POC	Chad Tripp Thomas Stofflet	919-244-3109 912-573-4646	The Resolution Consultants FTL will contact the SUBASE POC verbally or via e-mail at least 10 working days prior to commencement of field work to arrange for access to the site for all field personnel.
Obtaining Utility Clearances for Intrusive Activities	Resolution Consultants FTL SUBASE POC	Chad Tripp Thomas Stofflet	919-244-3109 912-573-4646	The Resolution Consultants FTL will coordinate verbally or via e-mail with SUBASE POC at least 14 days in advance of site access to initiate the utility clearance process for all intrusive sampling locations. The Resolution Consultants FTL will contact both the Georgia Utility Protection Center, Inc. and SUBASE personnel (as directed by the SUBASE POC) verbally or via e-mail at least 14 days prior to commencement of field work to complete a utility clearance ticket for areas under investigation.
Stop Work Due to Safety Issues	Resolution Consultants TOM Resolution Consultants FTL/SSO Resolution Consultants QAO Resolution Consultants Health and Safety Manager NAVFAC SE RPM SUBASE POC	David Warren Chad Tripp Tina Cantwell John Knopf Dana Hayworth Thomas Stofflet	843-884-0029 919-244-3109 901-937-4315 901-367-7962 904-542-6417 912-573-4646	If Resolution Consultants is the responsible party for a stop work command, the Resolution Consultants SSO will inform onsite personnel, subcontractor(s), the SUBASE POC, and the identified Partnering Team members within 1 hour (verbally or by e-mail). 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 NAVFAC SE RPM SUBASE POC GA EPD RPM	Chad Tripp David Warren Dana Hayworth Thomas Stofflet Amy Potter	919-244-3109 843-884-0029 904-542-6417 912-573-4646 404-657-8604	Any change of the approved SAP will be made only upon authorization of the Navy RPM and regulatory agency. The Resolution Consultants TOM is responsible for initiating any SAP change requests via the communication channels described for the Navy and regulatory agencies.

Communication Pathways				
Communication Drivers	**Responsible Entity**	**Name**	**Phone Number**	**Procedure (Timing, Pathway To/From, etc.)**
SAP Changes in the Field	Resolution Consultants TOM Resolution Consultants FTL NAVFAC SE RPM SUBASE POC GA EPD RPM	David Warren Chad Tripp Dana Hayworth Thomas Stofflet Amy Potter	843-884-0029 919-244-3109 904-542-6417 912-573-4646 404-657-8604	The Resolution Consultants FTL will verbally inform the Resolution Consultants TOM on the day that the issue is discovered. The Resolution Consultants TOM will inform the NAVFAC SE RPM and the SUBASE POC (verbally or via e-mail) within 1 business day of discovery. The NAVFAC SE RPM will issue a scope change (verbally or via e-mail), if warranted. The scope change is to be implemented before further work is executed. The Resolution Consultants TOM will document the change via an a Field Task Modification Request form within 2 days of identifying the need for change and will obtain required approvals within 5 days of initiating the form.
Field Corrective Actions	Resolution Consultants TOM Resolution Consultants QAO NAVFAC SE RPM	David Warren Tina Cantwell Dana Hayworth	843-884-0029 901-937-4315 904-542-6417	The Resolution Consultants QAO will notify the Resolution Consultants TOM verbally or by e-mail within one business day that the corrective action has been completed. The Resolution Consultants TOM will then notify the NAVFAC SE RPM (verbally or by e-mail) within 1 business day.
Sample Receipt Variances	Resolution Consultants TOM Resolution Consultants Project Chemist GCAL Laboratory PM Ardaman and Associates Laboratory Director	David Warren Tina Cantwell Brenda Martinez Robert Werner	843-884-0029 901-937-4315 225-769-4900 225-752-4790	The Laboratory PM will notify (verbally or via e-mail) the Resolution Consultants FTL and/or project chemist 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.

Communication Pathways				
Communication Drivers	**Responsible Entity**	**Name**	**Phone Number**	**Procedure (Timing, Pathway To/From, etc.)**
Reporting Laboratory Quality Variances	GCAL Laboratory PM Ardaman and Associates Laboratory Director Resolution Consultants Project Chemist Resolution Consultants TOM Resolution Consultants FTL NAVFAC SE RPM NAVFAC QAO/Chemist	Brenda Martinez Robert Werner Tina Cantwell David Warren Chad Tripp Dana Hayworth Monique Nixon	225-769-4900 225-752-4790 901-937-4315 843-884-0029 919-244-3109 904-542-6417 757-322-4699	Any planned Standard Operating Procedure variances from the quality elements specified in the *Department of Defense Quality Systems Manual for Environmental Laboratories*, Version 4.2 October 2011, are identified in Worksheet #23. The Laboratory PM will notify (verbally or via e-mail) the Resolution Consultants project chemist of any variance from the quality limits identified in this SAP on the day that the variance becomes known. The Resolution Consultants project chemist will notify (verbally or via e-mail) the Resolution Consultants TOM within 1 business day of the need for corrective action, if the variance is a significant issue. The Resolution Consultants TOM will notify (verbally or via e-mail) the Laboratory PM and the Resolution Consultants FTL and project chemist within 1 business day of any required corrective action. The Laboratory QAM will document all quality variances in the Case Narrative of the Analytical Laboratory Report. If there are significant data Quality or Nonuseable data issues the NAVFAC LANT QAO/Chemist will be contacted to ensure the issues do not have the potential to impact other Navy projects.
Reporting Concerns Involving Laboratory	Resolution Consultants Project Chemist Resolution Consultants TOM Resolution Consultants FTL GCAL Laboratory PM Ardaman and Associates Laboratory Director	Tina Cantwell David Warren Chad Tripp Brenda Martinez Robert Werner	901-937-4315 843-884-0029 919-244-3109 225-769-4900 225-752-4790	If reported analytical results are inconsistent with the planned details identified in this SAP, the Resolution Consultants project chemist will notify (verbally or via e-mail) the Resolution Consultants TOM within 1 business day of identifying a concern to determine if corrective action is needed. The Resolution Consultants TOM will notify (verbally or via e-mail) the Laboratory PM and the Resolution Consultants FTL and project chemist within 1 business day of any required corrective action.
Notification of Non-Usable Data	GCAL Laboratory PM Ardaman and Associates Laboratory Director Resolution Consultants Project Chemist/DVM	Brenda Martinez Robert Werner Tina Cantwell	225-769-4900 225-752-4790 901-937-4315	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)

Communication Pathways				
Communication Drivers	**Responsible Entity**	**Name**	**Phone Number**	**Procedure (Timing, Pathway To/From, etc.)**
	Resolution Consultants TOM NAVFAC SE RPM NAVFAC QAO/Chemist GA EPD RPM	David Warren Dana Hayworth Monique Nixon Thomas Stofflet	843-884-0029 904-542-6417 757-3224699 912-573-4646	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 email) the NAVFAC 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 NAVFAC RPM, may at their discretion, contact the Navy project chemist for assistance in problem resolution. Such notification will be made within 1 business day of when the issue is discovered. If there are significant data Quality or Nonuseable data issues the NAVFAC LANT QAO/Chemist will be contacted to ensure the issues don not have the potential to impact other Navy projects. The NAVFAC RPM will notify GA EPD when any significant corrective action is taken.
Analytical Corrective Actions and Reporting Data Validation Issues	GCAL Laboratory PM Ardaman and Associates Laboratory Director Resolution Consultants Project Chemist/DVM Resolution Consultants TOM NAVFAC SE RPM NAVFAC QAO/Chemist	Brenda Martinez Robert Werner Tina Cantwell David Warren Dana Hayworth Monique Nixon	225-769-4900 225-752-4790 901-937-4315 843-884-0029 904-542-6417 757-322-4699	The Laboratory PM will notify (verbally or via e-mail) the Resolution Consultants project chemist within 1 business day of when an issue related to laboratory data is discovered. The Resolution Consultants project chemist will notify (verbally or via e-mail) the DVM and the Resolution Consultants TOM within 1 business day. Resolution Consultants' DVM or project chemist will notify the Resolution Consultants TOM verbally or via e-mail within 48 hours of validation completion that a non-routine and significant laboratory quality deficiency has been detected that could affect this project and/or other projects. The Resolution Consultants TOM will verbally advise the NAVFAC SE RPM within 24 hours of notification from the Resolution Consultants DVM or project chemist. The NAVFAC SE RPM will take corrective action appropriate for the identified deficiency.

Communication Pathways				
Communication Drivers	**Responsible Entity**	**Name**	**Phone Number**	**Procedure (Timing, Pathway To/From, etc.)**
				Examples of significant laboratory deficiencies include data reported that has a corresponding failed Gas chromatograph/Mass spectrometer (GC/MS) tune or initial calibration verification. Corrective actions may include a consult with the Navy QAO/ Chemist.
Data Validation Corrective Actions	Resolution Consultants DVM Resolution Consultants TOM	Tina Cantwell David Warren	901-937-4315 843-884-0029	See "Notification of Non-Usable Data" procedure above. If a Resolution Consultants DVM identifies non-usable data during the data validation process that requires corrective action, the Resolution Consultants DVM will coordinate with the Resolution Consultants TOM 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 Resolution Consultants TOM.

Notes:

DVM	=	Data Validation Manager
GA EPD	=	Georgia Environmental Protection Division
NAVFAC SE	=	Naval Facilities Engineering Command, Southeast
GCAL	=	Gulf Coast Analytical Laboratories
GC/MS	=	Gas chromatogram/ Mass spectrometer
POC	=	Point of contact
FTL	=	Field Team Leader
RPM	=	Remedial Project Manager
SSO	=	Site Safety Office
TOM	=	Task Order Manger
PM	=	Project Manger
QAM	=	Quality Assurance Manager
SAP	=	Sampling and Analysis Plan
DVM	=	Data Validation Manager
QAO	=	Quality Assurance Officer
SUBASE	=	Naval Submarine Base Kings Bay
SSO	=	Site Safety Officer

SAP WORKSHEET #7: PERSONNEL RESPONSIBILITIES TABLE

(UFP-QAPP Manual Section 2.4.3)

Resumes for Resolutions Consultants responsible project personnel may be found in Appendix A.			
Name	**Title/Role**	**Organizational Affiliation**	**Responsibilities**
Dana Hayworth	NAVFAC SE RPM/Manages project activities for the Navy	NAVFAC SE	Primary Point of Contact for the Navy. Oversees project implementation, including scoping, data review, and evaluation, on behalf of the Navy.
Thomas Stofflet	Activity Point of Contact/Oversees onsite project activities	Naval Submarine Base, Kings Bay	Point of Contact for base-specific activity. Oversees onsite activities.
Amy Potter	RPM/Regulatory Support	GA EPD	Functions as primary GA EPD interface. Participates in scoping and data review/evaluation, and provides review and approval of project deliverables.
David Warren	Contract TOM/Manages project on a daily basis	Resolution Consultants	Primary point of contact for Resolution Consultants. Oversees project implementation, including financials, schedule, and technical aspects.
Ben Brantley	Certified Groundwater Scientist	Resolution Consultants	Ensures that project planning, field activities, and reporting are in accordance with applicable state regulations.
Chad Tripp	FTL/SSO/Manages field operations and oversees site activities to ensure safety requirements are met	Resolution Consultants	Supervises, coordinates, and performs field activities. Responsible for on-site project-specific health and safety training and monitoring site conditions.
Tina Cantwell	Project Chemist/Data Validation Manager/ Quality Assurance Officer	Resolution Consultants	Participates in project scoping. Ensures quality aspects associated with chemical analysis are implemented, documented, and maintained. Manages data validation activities. Oversees development of procedures, training, control checks, and process correction/improvement actions.
John Knopf	Health and Safety Manager/Oversees health and safety activities	Resolution Consultants	Oversees CLEAN Health and Safety Program.
Brenda Martinez	Laboratory PM/Analytical Subcontractor	Gulf Coast Analytical Laboratories	Oversees quality and technical aspects related to subcontracted analytical services.
Robert Werner	Laboratory Director/Subcontractor	Ardaman and Associates	Oversees quality and technical aspects related to subcontracted analytical services.

Notes:

NAVFAC SE = Naval Facilities Engineering Command, Southeast
RPM = Remedial Project Manager
GA EPD = Georgia Environmental Protection Division
CLEAN = Comprehensive Long-term Environmental Action Navy
TOM = Task Order Manager
FTL = Field Team Leader
SSO = Site Safety Officer

SAP WORKSHEET #8: SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE

(UFP-QAPP Manual Section 2.4.4)

All field personnel will have appropriate training to conduct the field activities to which they are assigned. Additionally, each site worker will be required to have completed appropriate Hazardous Waste Operations and Emergency Response training specified in Occupational Safety and Health Administration 29 Code of Federal Regulations 1910.120(e).

SAP WORKSHEET #9: PROJECT SCOPING SESSION PARTICIPANTS SHEET

(UFP-QAPP Manual Section 2.5.1)

No scoping meetings have been conducted to-date; however, the scope of work for this SAP was developed/presented in the following documents.

Document	Document Description	Author/Date
Draft Site-Specific RCRA Facility Investigation Work Plan Building 1039, Naval Submarine Base, Kings Bay, Camden County, Georgia	Presented site background, history, preliminary CSM, and a draft work plan for sampling and analysis.	CH2M Hill/December 2010
Letter "RE: Draft Site-Specific RCRA Facility Investigation Work Plan Building 1039, dated December 2010 and received 30 December 2010"	Provided comments from GA EPD on the 2010 draft RFI Work Plan.	GA EPD 8 April 2011
Final Site-Specific RCRA Facility Investigation Work Plan Building 1039, Naval Submarine Base, Kings Bay, Camden County, Georgia	Finalized site background, history, preliminary CSM and a work plan for sampling and analysis, per GA EPD comments and CH2M Hill responses.	CH2M Hill/June 2011

Notes:

CSM = Conceptual Site Model
GA EPD = Georgia Environmental Protection Division
RCRA = Resource Conservation and Recovery Act
RFI = RCRA Facility Investigation

SAP WORKSHEET #10: CONCEPTUAL SITE MODEL

(UFP-QAPP Manual Section 2.5.2)

This worksheet presents a brief site description, history, and a preliminary conceptual site model (CSM) for Building 1039/SWMU 9. As initially presented in the Final RFI Work Plan, the CSM describes potential contamination routes and possible exposure pathways to humans and ecological receptors, and serves as the basis for the RFI sampling and analysis program. This preliminary CSM will be refined with implementation of the RFI.

10.1 Site Description

Located in the southeastern corner of Georgia, approximately eight miles north of the state line (Figure 10-1); SUBASE includes approximately 16,168 acres in Camden County. Currently, SUBASE supports submarines, crew training, weapons handling and storage, submarine maintenance, and associated personnel.

Building 1039 (SWMU 9), near SUBASE's western boundary, on USS James Madison Road (Figure 10-2), contains game and meeting rooms. Adjacent to Building 1039 are asphalt parking lots and maintained, grassy areas. Structures within a few hundred feet include the Bachelor Officer's Quarters (also known as Transient Visitor's Quarters) to the east, Bachelor Enlisted Quarters to the south, the library to the northwest, and SUBASE administrative offices to the north. Local topography is relatively flat, with storm water runoff flowing towards grates in the parking lot and along roads. These drainage features likely discharge to a retention pond approximately 150 feet west and 400 feet south of Building 1039.

10.2 Site History

Building 1039 was once serviced by a heating-oil-fired boiler system. Fuel for the boiler was historically stored in a 15,000-gallon underground storage tank (UST). The UST was connected to the boiler by an underground supply and return pipeline, approximately 100 feet in length (Figure 10-3). The boiler was decommissioned and the UST and associated piping were removed on 22 January 1996, at which time the removal contractor reported visible petroleum in the trench excavations associated with the UST's supply/return pipeline. No evidence of a release was noted in the excavation associated with the actual UST.

From 1996 to February 2010, SUBASE performed product recovery, enhanced bioremediation via microbe/nutrient injections, soil removal, and soil and groundwater sampling to evaluate and recover petroleum impacted soil and groundwater. Historical analytical results are compared to applicable project action levels (PALs) in subsequent sections of this SAP.

In May 2006, GA EPD designated Building 1039 as RCRA SWMU 9, and requested an RFI work plan in accordance to the SUBASE Hazardous Waste Facility Permit #HW-014(S&T)-3. During replacement of an underground utility in 2010, additional petroleum contaminated soil was identified and excavated to an approximate depth of 6 feet bgs. The limits of the excavation, which extended approximately 100 feet to the southeast of the former supply/return pipeline, are shown on Figure 10-3. In 2010, a draft RFI work plan was submitted to GA EPD. Following receipt and incorporation of GA EPD comments, the Final RFI Work Plan was submitted in 2011. A detailed chronology of historical investigation and corrective action at Building 1039 is presented in the Final RFI Work Plan.

10.3 Site Geology

As summarized in the Final RFI Work Plan, soil beneath the Site consists of very fine- to fine-grained sand to approximately 27 feet bgs. A layer of coarse sand, with a maximum thickness of 4 feet, was observed at approximately 4 feet bgs in the immediate vicinity of the underground piping and former UST system. Silty clay underlies the sand formation to an unknown depth. This interpretation of Site geology is consistent with details included in the *Soil Chemistry and Groundwater Quality of Water Table Zone Surficial Aquifer NSB Kings Bay* (USGS 2002), as prepared by the United States Geological Society (USGS).

10.4 Site Hydrogeology

Hydrogeologic units at NSB Kings Bay include, in descending order, the surficial aquifer, the upper and lower Brunswick aquifers, and the Floridan aquifer system. This study focuses on the surficial aquifer, where water occurs under unconfined (water table) conditions. A resistance to vertical groundwater flow exists due to an increase in clay and silt content with depth. The thickness of the surficial aquifer generally varies between 60 and 80 feet bgs, largely as a result of variations in topography (USGS 2002).

Figure 10-3 depicts eleven existing, shallow monitoring wells (MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-9, MW-10, TMW-2XR, TMW-3X, and TMW-4X) installed to 13 feet bgs and one deep monitoring well (DMW-8D) installed to 30 feet bgs. All wells are screened within the surficial aquifer; however, the deep well is installed within the less permeable, silty clay component.

Based on groundwater sampling efforts performed in February 2010, the shallow water table exists at approximately 7 feet bgs, with groundwater flow toward the southeast. The estimated groundwater flow velocity at the Site is approximately 0.183 feet per day, or 67 feet per year (J.J. Sosa 1999).

According to *Georgia's Groundwater Recharge Areas Map* and *Groundwater Pollution Susceptibility Map* (Georgia Department of Natural Resources 1992), SUBASE is regionally positioned in a recharge zone for the Miocene/Pliocene-Recent unconfined aquifers; therefore, SUBASE is considered a High Groundwater Pollution Susceptibility Area per Georgia State Rule 391-3-15-.09.

10.5 Preliminary Conceptual Site Model

The preliminary CSM, as detailed in the Final RFI Work Plan, is summarized below. Sources of contaminants, 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 during the RFI. Analytes measured above applicable regulatory screening guidelines for soil and groundwater are presented in Table 10-1, Table 10-2, and Figures 10-4 through 10-7. The preliminary CSM is presented as Figure 10-8.

10.5.1 Source of Contaminants

The source of contamination at Building 1039 is the accidental release of heating oil from underground piping associated with a former UST system. During removal of the UST and associated piping, the contractor observed petroleum within the excavation associated with the supply/return pipeline. Immediately following UST removal efforts, free product was measured in temporary wells TMW-2, TMW-3, and TMW-4, installed adjacent to the former underground piping.

10.5.2 Nature and Extent of Contamination

From 1997 to 2010, benzene, toluene, ethylbenzene, and xylene (BTEX) and polynuclear aromatic hydrocarbons (PAHs) were detected in subsurface soil and groundwater samples collected at the Site. Historical results are detailed in the Final RFI Work Plan. The nature and extent of contamination for soil left-in-place and groundwater is summarized below.

Soil

Table 10-1 compares results for soil left-in-place to 2012 U.S. EPA Industrial Regional Screening Levels (I-RSLs), Residential Regional Screening Levels (R-RSL), and Soil Screening Levels for the Migration to Groundwater and Tap Water RSL (SSL-Risk). As shown on Figure 10-4, ethylbenzene exceeded its respective SSL-Risk value in samples representative of soil left-in-place along the

sidewalls, at approximately 5 feet bgs, and at the base of the 6 foot deep excavation. Each of these soil sampling locations is positioned approximately 50 feet downgradient of the former supply/return lines and at the midpoint of the excavation completed in 2010. Ethylbenzene has not been detected above I-RSLs or R-RSLs during historical sampling activities at the Site. As shown on Figure 10-5, several PAHs exceeded SSL-Risk values and R-RSLs in samples representative of soil left-in-place along the sidewalls and at the bottom of the 2010 excavation; however, only 1-methylnaphthalene and naphthalene exceeded I-RSLs. The industrial exceedances were isolated to a single sample collected at the base of the 2010 excavation.

Groundwater

Results from historical groundwater sampling performed from 1997 through 2010 indicate that shallow groundwater has been impacted by BTEX and PAHs. A discussion on the extent of such contamination, based on available historical groundwater data, is included below.

Although samples were not collected from upgradient shallow wells MW-1, MW-5, and MW-9, during the most recent February 2010 event, BTEX and PAHs were not reported above laboratory reporting limits during historical sampling events at these wells. These shallow wells serve to delineate impacted groundwater in the upgradient direction. Furthermore, BTEX and PAHs have not been measured above laboratory reporting limits in historical groundwater samples collected from deep monitoring well, DMW-8D, screened at the interface between sand and silty clay at approximately 30 feet bgs and positioned approximately 20 feet downgradient of the former supply/return line. This deep well, positioned downgradient of the former source area, serves to delineate impacted groundwater in the vertical direction.

BTEX results from February 2010 (most recent) groundwater sampling at select wells, are summarized on Figure 10-6. During the February 2010 sampling event, benzene was reported at 5.1 µg/L, slightly above the U.S. EPA Maximum Contaminant Level (MCL) of 5 µg/L at shallow monitoring well MW-2, positioned approximately 60 feet downgradient of the former supply/return line. Benzene was not detected above the laboratory reporting limit in February 2010 groundwater samples collected from side/downgradient shallow well, MW-4, or the most downgradient shallow well, MW-10, positioned approximately 200 feet southeast of the former supply/return line. Such wells serve to delineate the downgradient edge of BTEX contamination in shallow groundwater.

As shown on Figure 10-7, the PAHs 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene were detected above their respective U.S. EPA Tap Water Regional Screening Levels (Tap Water RSLs), during February 2010 groundwater sampling at select wells. Since MCLs are not established for these PAHs, more conservative Tap Water RSLs were used for the comparison. The highest concentrations of PAHs were reported in the groundwater sample collected from shallow monitoring well, TMW-2X, located immediately adjacent to the former supply/return line and within the limits of the 2010 excavation. Concentrations of PAHs were not detected above laboratory reporting limits in the groundwater sample collected from side/downgradient, shallow well, MW-4. While in exceedance of highly conservative Tap Water RSLs, PAHs were limited to minimal concentrations in the 2010 groundwater sample collected from the most downgradient shallow well, MW-10.

10.5.3 Fate and Transport Mechanisms

A fate and transport pathway describes mechanisms whereby contaminants are transported from the source to a human or ecological receptor. Preliminary fate and transport mechanisms for each matrix are summarized below and will be refined during the RFI.

Soil

Historical soil sampling indicates all residual fuel contamination is in subsurface soil; therefore, contaminants are not subject to transport via wind or surface water runoff. Heating oil released to the subsurface will occur as free product, a non-aqueous phase liquid (NAPL) that can migrate vertically until the soil pore volume achieves residual saturation or residual product reaches the top of the water table. The NAPL may also migrate laterally within zones of more permeable soil or aggregate, such as the backfill of utility trenches. If sufficient product is released, some migration of NAPL may occur along the top of the water table. Fuel constituents tend to adsorb to soil particles; the degree of adsorption is related to the organic and clay content of the soil, and to the chemical properties of the fuel, especially water solubility and organic partitioning coefficient. Factors working to reduce the mass of soil contamination include dissolution in groundwater, volatilization, and biodegradation.

Groundwater

NAPL in soil can act as a long-term source of dissolved contaminants to groundwater. As recharge travels through soil containing residual NAPL, the water leaches some of the adsorbed contaminants, thus contributing additional dissolved contamination to the groundwater plume. The mechanisms affecting transport of the contaminant plume are advection, adsorption, dispersion, dilution, and biodegradation. Advection is migration of dissolved contaminants along with groundwater movement. In general, the contaminant plume migration rate is slower than groundwater because of contaminant adsorption to soil and organic matter.

Dispersion causes the plume to spread both vertically and laterally during migration. Generally, vertical spreading is an order of magnitude less than horizontal spreading. Dilution by recharge can reduce contaminant concentrations in the downgradient plume. Biodegradation naturally reduces fuel components in the plume as a result of degradation by microbial organisms. The combined effect of these mechanisms aids to limit the extent of the plume.

Surface Water/Sediment

No surface water bodies or drainage ditches are located adjacent to Building 1039. However, a retention pond, approximately 150 feet west and 400 feet south of Building 1039, may receive storm water runoff from site drainage features in the parking lot and along roads. In general, the site is flat and, thus, rainfall either infiltrates into the ground at vegetated areas or drains from impervious areas into the storm sewer.

10.5.4 Exposure Pathways and Receptors

An exposure pathway links a source area with one or more receptors, but the pathway must be complete for exposure to occur. The potential exposure pathways identified for Building 1039 are discussed below, and will be refined during the RFI.

Human Health Exposures

Building 1039 is used by workers and SUBASE personnel for indoor recreation purposes. Although surface soil is not currently impacted, dermal contact with contaminated subsurface soil is a potential exposure pathway for construction workers, including hypothetical landscaping workers. These workers could also inhale contaminated dust if impacted soil is disturbed. Groundwater at Building 1039 is not used as a source of water supply; however, direct contact with contaminants in groundwater is a potential exposure pathway for current and future construction workers. The presence of supply wells at SUBASE and their proximity to Building 1039 will be investigated during the RFI. Future residents, recreational users, and industrial workers may contact contaminated groundwater if drinking water wells are installed in the shallow aquifer, although this scenario is very unlikely. Based on current and likely future land use, the most likely human receptors to contact contaminants in soil and groundwater are construction workers. Human health risks will be evaluated for site workers and construction workers in the Human Health Risk Assessment (HHRA) portion of the RFI, and risks to landscaping workers will be inferred from those scenarios based on shallow, subsurface soil (surface to 5 feet bgs). A chemical of concern identified in shallow subsurface soil for either site workers or construction workers will also be considered a chemical of concern for landscaping workers.

Ecological Exposures

The site is covered by impervious surfaces, such as asphalt parking, roads, and concrete walkways, and maintained, grassy areas. Terrestrial and aquatic habitats are minimal. During the RFI, a survey will identify potential ecological receptors within a 0.5-mile radius of Building 1039. Shallow subsurface soil (surface to 5 feet bgs) in the source area is the most likely terrestrial habitat presenting a potentially complete exposure pathway. Potentially complete exposure pathways in the onsite terrestrial ecosystem include direct exposure of plants (root uptake) and soil invertebrates (dermal and direct ingestion) to ecological Contaminant of Potential Concerns (COPCs) in soil; incidental ingestion and dermal exposure to contaminated soil by terrestrial wildlife; and food chain (prey consumption) exposures by upper trophic level wildlife.

The nearest potential aquatic receptor is a storm water retention pond located cross-gradient from the source area. The basin is approximately 400 feet southwest of the former supply/return pipeline and extends approximately 900 feet southeast. Monitoring wells nearest to the retention pond (MW-4 and MW-5) have not exhibited groundwater impacts, thus the exposure pathway from groundwater to surface water at the retention pond is incomplete.

Ecological risks will be evaluated in the Ecological Risk Assessment (ERA) portion of the RFI.

Table 10-1
2010 Analytical Results for Soil Left-In-Place

				Sample Location:	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	B-1	B-2
				Sample Depth (ft bgs):	5	5	5	5	5	5	5	5	6	6
Analyte	***EPA I-RSL (a)***	***EPA R-RSL (b)***	***EPA SSL-Risk (c)***	***Units***										
Volatile Organic Compounds														
Benzene	5.4	1.1	0.0002	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	4500	500	0.59	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	27	5.4	0.0015	mg/kg	ND	ND	ND	ND	**0.46 c**	**0.25 c**	ND	ND	ND	**0.17 c**
Total Xylenes	270	63	0.19	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Polynuclear Aromatic Hydrocarbons														
1-Methylnaphthalene	53	16	0.0051	mg/kg	ND	ND	**0.0074 c**	0.0042	**24 bc**	**35 bc**	**0.059 c**	**0.014 c**	ND	**74 abc**
2-Methylnaphthalene	220	23	0.14	mg/kg	ND	ND	0.011	0.0053	**45 bc**	**53 bc**	0.094	0.021	ND	**120 bc**
Acenaphthene	3300	340	4.1	mg/kg	ND	ND	ND	ND	3.9	**4.3 c**	ND	ND	ND	**8.2 c**
Acenaphthylene	3300	340	4.1	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	17000	1700	42	mg/kg	ND	ND	ND	ND	0.86	1.1	ND	ND	ND	2.2
Chrysene	210	15	1.1	mg/kg	ND	ND	ND	ND	0.043	0.064	ND	ND	ND	ND
Fluoranthene	2200	230	70	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	2200	230	4.0	mg/kg	ND	ND	0.0038	ND	**5.5 c**	**6.3 c**	0.01	ND	ND	**10 c**
Naphthalene	18	3.6	0.00047	mg/kg	ND	ND	ND	ND	**6.4 bc**	**8 bc**	**0.013 c**	**0.0035 c**	ND	**21 abc**
Phenanthrene	1700	170	9.5	mg/kg	ND	ND	ND	ND	**12 c**	**14 c**	0.021	ND	ND	**27 c**
Pyrene	1700	170	9.5	mg/kg	ND	ND	ND	ND	1.5	1.4	ND	ND	ND	2.7
TPH	-	-	-	mg/kg	48J	12	160	570	11000	14000	6.2	37J	270	21000

Notes:

Data source is the RFI Work Plan (CH2M Hill, 2011).

ND	=	Not detected
-	=	Not available
ft bgs	=	Feet below ground surface
TPH	=	Total Petroleum Hydrocarbons
EPA R-RSL	=	US EPA Regional Screening Levels for Residential Soil, adjusted by 0.1 for noncarcinogens, November 2012
EPA I-RSL	=	US EPA Regional Screening Levels for Industrial Soil, adjusted by 0.1 for noncarcinogens, November 2012
EPA SSL-Risk	=	US EPA Soil Screening Level based on migration to groundwater and the Tap Water RSL, November 2012
a	=	Exceeds the EPA I-RSL
b	=	Exceeds the EPA R-RSL
c	=	Exceeds the EPA SSL-Risk

Table 10-2
2010 Analytical Results for Groundwater

			Sample Locations:	MW-2	MW-4	MW-6	MW-7	MW-10	TMW-2X	TMW-3X	TMW-4X
Analyte	***MCL (a)***	***Tapwater RSL (b)***	***Units***								
Volatile Organic Compounds											
Benzene	5	0.39	ug/L	**5.1 a**	ND	ND	ND	ND	ND	1.2	ND
Toluene	1000	86	ug/L	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	7000	1.3	ug/L	13	ND	ND	16	ND	8	ND	ND
Total Xylenes	10000	19	ug/L	ND	ND	ND	ND	ND	ND	ND	ND
Polynuclear Aromatic Hydrocarbons											
1-Methylnaphthalene	-	0.97	ug/L	**19 b**	ND	0.47	**39 b**	**2.3 b**	**82 b**	0.66	**6.9 b**
2-Methylnaphthalene	-	2.7	ug/L	**25 b**	ND	ND	0.12	ND	**33 b**	ND	ND
Acenaphthene	-	40	ug/L	0.64	ND	0.78	ND	0.55	ND	ND	ND
Anthracene	-	130	ug/L	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	-	2.90	ug/L	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	-	63	ug/L	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	-	22	ug/L	1.1	ND	1.5	2.1	0.84	8.7	ND	2.4
Naphthalene	-	0.14	ug/L	**26 b**	ND	**0.45 b**	ND	**0.65 b**	**25 b**	**0.24 b**	ND
Phenanthrene	-	8.7	ug/L	1.1	ND	ND	1.6	ND	8.1	ND	1.5
Pyrene	-	8.7	ug/L	ND	ND	ND	ND	ND	0.93	ND	0.39
TPH-DRO	-	-	ug/L	2.3	ND	3.2	15	0.7	28	8.1	8.2

Notes:

Data source is the RFI Work Plan (CH2M Hill, 2011).

ND = Not detected

\- = Not available

µg/L = Micrograms per kilogram

TPH-DRO = Total Petroleum Hydrocarbons, Diesel Range Organics

MCL = Georgia Maximum Contaminant Level

Tapwater RSL = US EPA Regional Screening Levels for Tapwater, adjusted by 0.1 for noncarcinogens, November 2012

MCLs are used as the primary screening value, with the use of Tapwater RSLs if the MCL is not available.

FIGURE 10-1
SITE LOCATION MAP
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

Legend

SITE LOCATION

1 inch = 4,000 feet

0 2,000 4,000 6,000 8,000 Feet

Basemap Source: Harrietts Bluff, Georgia Quadrangle Topographic Map
http://services.arcgisonline.com/arcgis/services/USA_Topo_Maps
© 2011 National Geographic Society, i-cubed. Publish Date: 1982
(c) 2010 Microsoft Corporation and its data suppliers

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REQUESTED BY: C. Tripp	DATE: 1/8/2013
DRAWN BY: N. Rinehart	PROJECT: 0888812552

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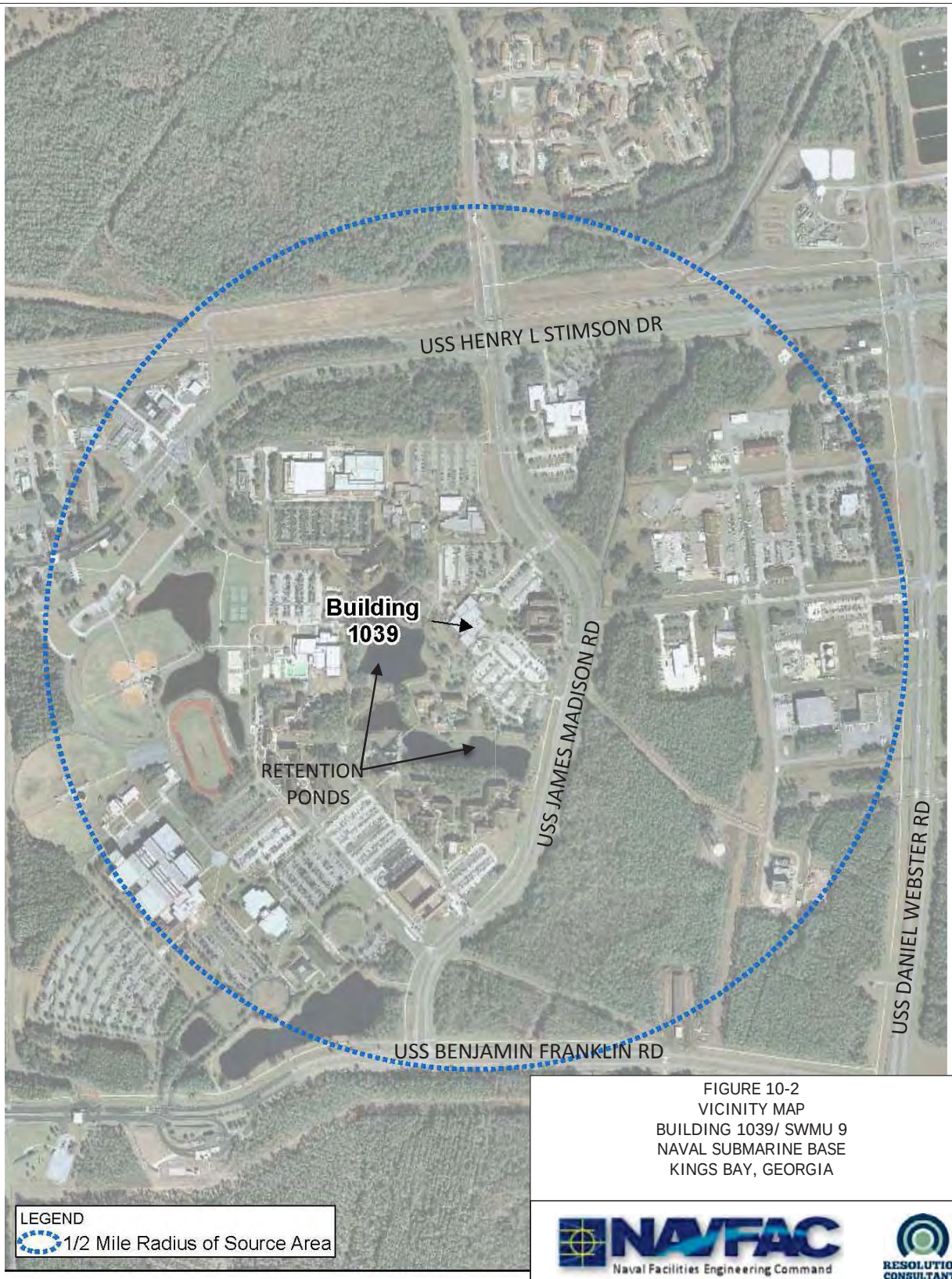

FIGURE 10-2
VICINITY MAP
BUILDING 1039/ SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

Naval Facilities Engineering Command

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Source:
Figure 1-2, RFI Work Plan (CH2M Hill, 2011)

0 250 500 1,000
Feet

REQUEST BY: CT	DATE: 1/04/2013
DRAWN BY: CT	CTO NO. : JM25

LEGEND

- Monitoring Well
- Monitoring Well (Abandonded)
- Former Fill Port and Line
- Former Supply/Return Line
- Former Location of Heating Fuel Tank
- Excavation Boundary

Source:
Figure 1-1, RFI Work Plan (CH2M Hill, 2011)

FIGURE 10-3
SITE MAP
BUILDING 1039/ SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

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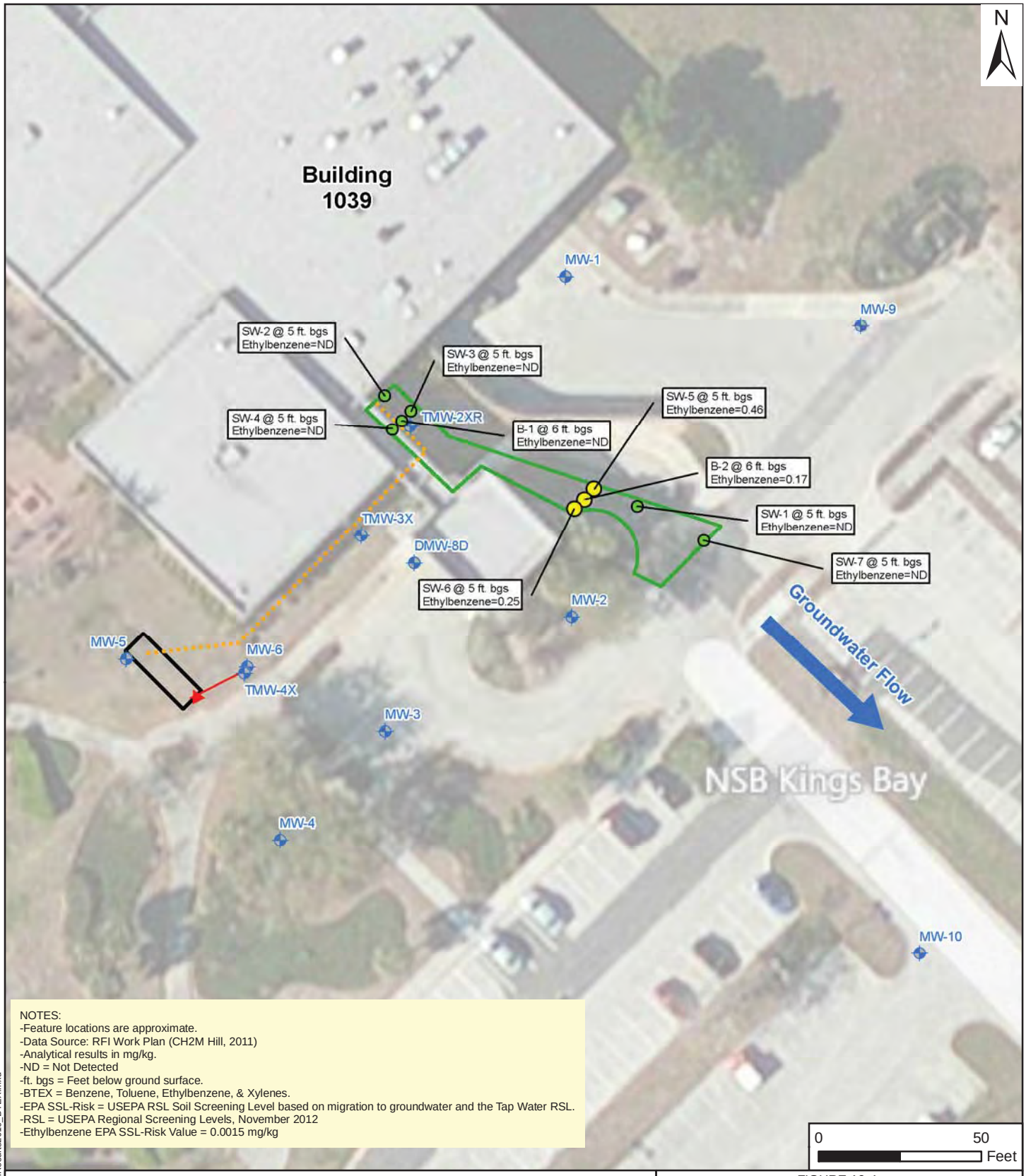
REQUEST BY: CT	DATE: 1/04/2013
DRAWN BY: CT	CTO NO. : JM25



NOTES:
-Feature locations are approximate.
-Data Source: RFI Work Plan (CH2M Hill, 2011)
-Analytical results in mg/kg.
-ND = Not Detected
-ft. bgs = Feet below ground surface.
-BTEX = Benzene, Toluene, Ethylbenzene, & Xylenes.
-EPA SSL-Risk = USEPA RSL Soil Screening Level based on migration to groundwater and the Tap Water RSL.
-RSL = USEPA Regional Screening Levels, November 2012
-Ethylbenzene EPA SSL-Risk Value = 0.0015 mg/kg

Legend

- Sidewall/Bottom Excavation Soil Sample with no exceeds
- Sidewall/Bottom Excavation Soil Sample that exceeds EPA SSL-Risk Value
- Monitoring Well
- Former Fill Port and Line
- Former Supply/Return Line
- Former Location of Heating Fuel Tank
- Excavation Boundary (2010)

FIGURE 10-4
2010 SOIL RESULTS ABOVE EPA RSLs
FOR BTEX (SOIL LEFT-IN-PLACE)
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

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Basemap Source:(c) 2010 Microsoft Corporation and its data suppliers

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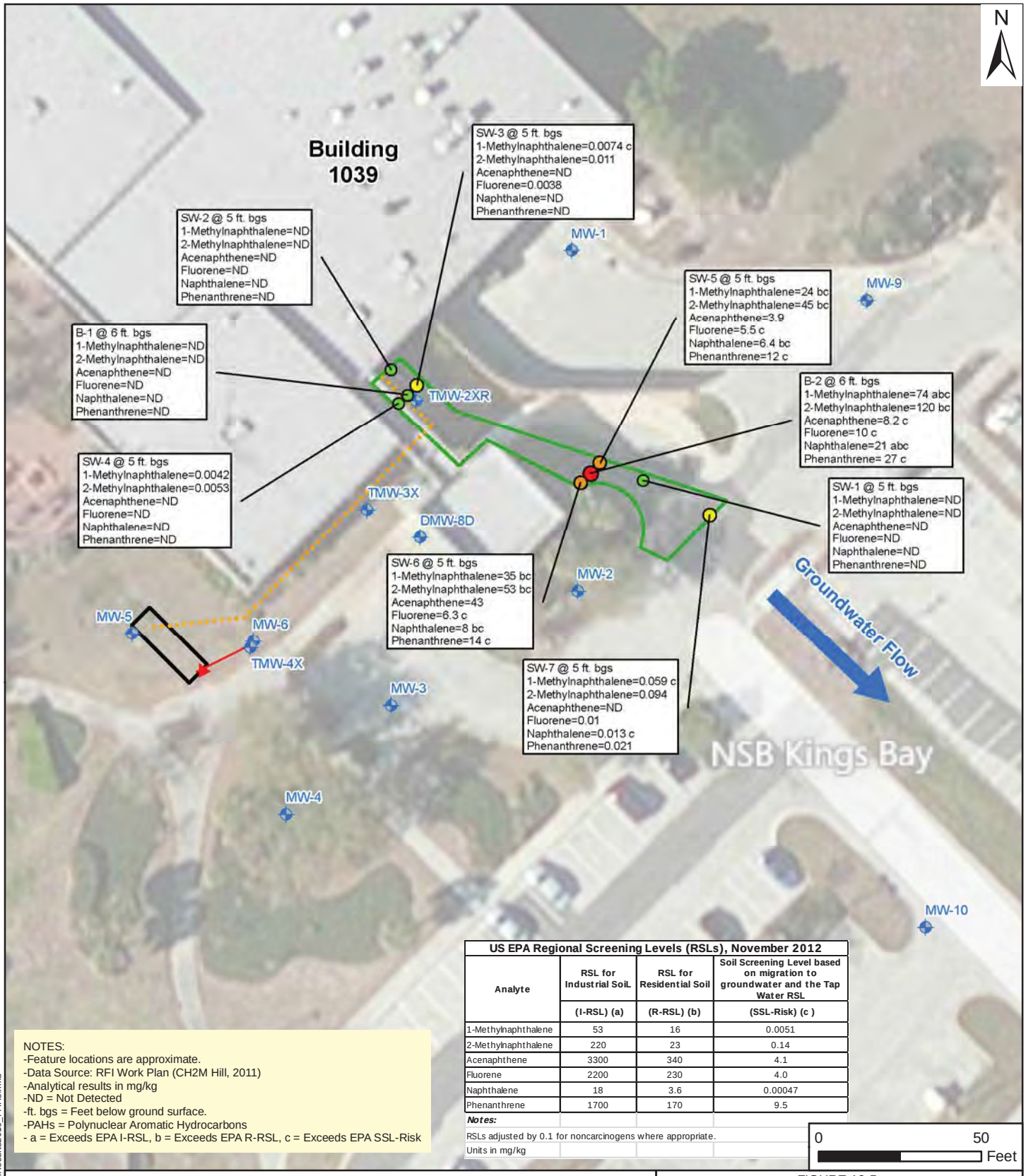

US EPA Regional Screening Levels (RSLs), November 2012			
Analyte	RSL for Industrial Soil	RSL for Residential Soil	Soil Screening Level based on migration to groundwater and the Tap Water RSL
	(I-RSL) (a)	(R-RSL) (b)	(SSL-Risk) (c)
1-Methylnaphthalene	53	16	0.0051
2-Methylnaphthalene	220	23	0.14
Acenaphthene	3300	340	4.1
Fluorene	2200	230	4.0
Naphthalene	18	3.6	0.00047
Phenanthrene	1700	170	9.5
Notes:			
RSLs adjusted by 0.1 for noncarcinogens where appropriate.			
Units in mg/kg			

NOTES:
-Feature locations are approximate.
-Data Source: RFI Work Plan (CH2M Hill, 2011)
-Analytical results in mg/kg
-ND = Not Detected
-ft. bgs = Feet below ground surface.
-PAHs = Polynuclear Aromatic Hydrocarbons
- a = Exceeds EPA I-RSL, b = Exceeds EPA R-RSL, c = Exceeds EPA SSL-Risk

0 50 Feet

Legend

- Sidewall/Bottom Excavation Soil Sample with no exceeds
- Sidewall/Bottom Excavation Soil Sample that exceeds EPA I-RSL, R-RSL,and SSL-Risk Value
- Sidewall/Bottom Excavation Soil Sample that exceeds EPA R-RSL and SSL-Risk Value
- Sidewall/Bottom Excavation Soil Sample that exceeds EPA SSL-Risk Value
- Monitoring Well
- Former Fill Port and Line
- Former Supply/Return Line
- Former Location of Heating Fuel Tank
- Excavation Boundary (2010)

FIGURE 10-5
2010 SOIL RESULTS ABOVE EPA RSLs
FOR PAHs (SOIL LEFT-IN-PLACE)
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

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REQUESTED BY: C. Tripp	DATE: 2/12/2013
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Basemap Source:(c) 2010 Microsoft Corporation and its data suppliers

NOTES:
-Feature locations are approximate.
-Data Source: RFI Work Plan (CH2M Hill, 2011)
-BTEX = Benzene, Toluene, Ethylbenzene, & Xylenes.
-Analytical results in ug/L.
ND = Not Detected
-MCL = Georgia Maximum Contaminant Level
-Benzene MCL = 5.0 ug/L

Legend

- Monitoring Well Sampled in 2010 with no exceeds
- Monitoring Well Not Sampled in 2010
- Monitoring Well Sample that exceeds MCL
- Former Fill Port and Line
- Former Supply/Return Line
- Former Location of Heating Fuel Tank
- Excavation Boundary (2010)

FIGURE 10-6
2010 GROUNDWATER RESULTS
ABOVE MCLs FOR BTEX
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

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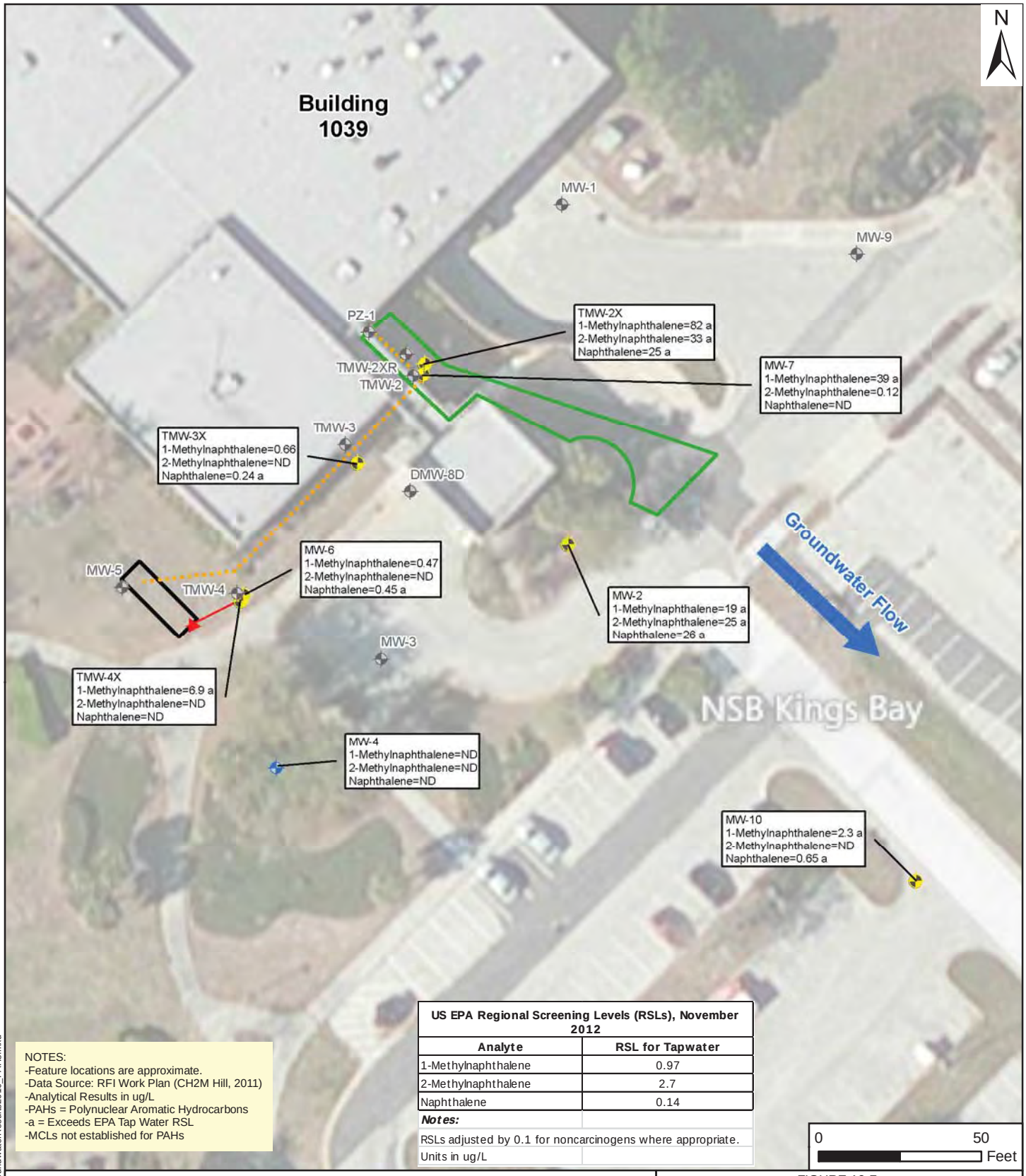

NOTES:
-Feature locations are approximate.
-Data Source: RFI Work Plan (CH2M Hill, 2011)
-Analytical Results in ug/L
-PAHs = Polynuclear Aromatic Hydrocarbons
-a = Exceeds EPA Tap Water RSL
-MCLs not established for PAHs

US EPA Regional Screening Levels (RSLs), November 2012	
Analyte	**RSL for Tapwater**
1-Methylnaphthalene	0.97
2-Methylnaphthalene	2.7
Naphthalene	0.14
Notes:	
RSLs adjusted by 0.1 for noncarcinogens where appropriate.	
Units in ug/L	

Legend

- Monitoring Well Sampled in 2010 with no exceeds
- Monitoring Well Not Sampled in 2010
- Monitoring Well Sample that exceeds EPA Tapwater RSL
- Former Fill Port and Line
- Former Supply/Return Line
- Former Location of Heating Fuel Tank
- Excavation Boundary (2010)

FIGURE 10-7
2010 GROUNDWATER RESULTS
ABOVE EPA TAPWATER RSLs FOR PAHs
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: C. Tripp	DATE: 2/12/2013
DRAWN BY: M. Senne	PROJECT: 0888812552

Basemap Source:(c) 2010 Microsoft Corporation and its data suppliers

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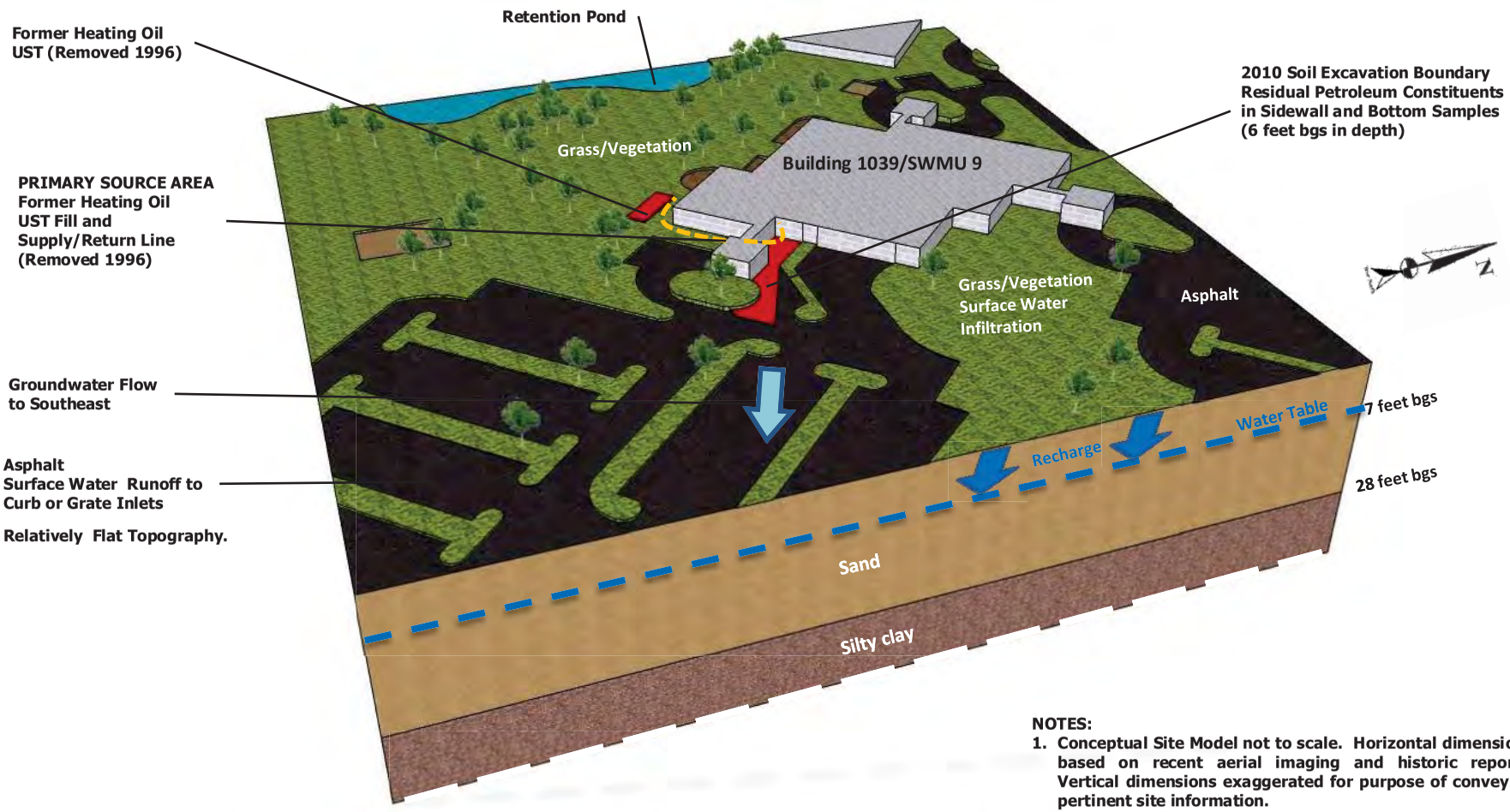

NOTES:

1. Conceptual Site Model not to scale. Horizontal dimensions based on recent aerial imaging and historic reports. Vertical dimensions exaggerated for purpose of conveying pertinent site information.
2. Groundwater monitoring well locations are approximated based on geographic information system data.
3. bgs = below ground surface
4. UST= Underground Storage Tank

Contaminant Source:

Residual petroleum constituents in subsurface soil and groundwater due to historical release of heating oil/petroleum from the former UST's fill and/or the supply/return line.

Contaminant Of Potential Concerns:

Benzene, Toluene, Ethylbenzene, Xylenes (BTEX);
Polynuclear Aromatic Hydrocarbons (PAHs)

Potential Receptors:

Human: To Be Determined; Potentially only Site and Construction Workers.
Ecological: To Be Determined

FIGURE 10-8
PRELIMINARY CONCEPTUAL SITE MODEL
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

NAVFAC Naval Facilities Engineering Command
RESOLUTIONN CONSULTANTS

REQUEST BY: CT	DATE: 1/4/2013
DRAWN BY: DM/CT	CTO NO. JM25

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

(UFP-QAPP Manual Section 2.6.1)

Project quality objectives (PQOs) were developed based on the U.S. EPA's *Guidance for Systematic Planning Using the DQO Process* (U.S. EPA 2006) and presented below.

11.1 Problem Statement

Results generated during previous investigations indicate that soil and groundwater were impacted by a historical release of BTEX and PAHs; however, the current dataset is insufficient to determine the extent of impacted soil and groundwater and if corrective action is required based on human health and ecological risks.

11.2 Goals of the Study

The goal of the RFI is to further evaluate the nature and extent of impacted soil and groundwater and assess potential risk to human health and the environment. To supplement historical studies, soil and groundwater will be evaluated for BTEX and PAHs (see Worksheet #15), based on historical knowledge of the release and detections during previous investigations at the site. Findings will provide information to support the development, evaluation, and selection of appropriate response alternatives, if necessary.

Principal study questions (PSQs) developed to define decision statements to resolve the problems are as follows:

PSQ1: Do concentrations in subsurface soil or groundwater exceed human health PALs, thus resulting in the need for further evaluation via HHRA?

PSQ2: Do sufficient ecological receptors exist at the site or in the immediate vicinity, resulting in the need for further evaluation via ERA?

PSQ3: Contingent on responses to PSQ1 and PSQ2, do concentrations in subsurface soil or groundwater pose unacceptable risks to human health and/or ecological receptors, thus requiring follow-up action?

PSQ4: Are contaminants migrating offsite at levels which pose a threat to human health or downgradient ecological receptors?

Based on these PSQs, the following project decision statements have been developed:

- Assess whether concentrations in impacted media exceed PALs and should be retained as COPCs.

- Identify the presence of ecological receptors; if identified, supplemental sampling may be necessary (not currently included in Worksheet #17).

- Evaluate whether COPCs in subsurface soil or groundwater pose an unacceptable risk to human health or ecological receptors (if present) and should be identified as a Contaminant of Concern (COCs), requiring corrective action.

- Determine the nature and extent of contamination.

11.3 Inputs to Problem Resolution

The inputs needed to resolve the project problem statement identified in Section 11.1 include the following measurements, observations, data, and PALs as described below. Details of the sampling design are presented in Worksheet #17.

- Chemical Data: Subsurface soil and groundwater chemical data will be collected for BTEX and PAHs to supplement the existing dataset to determine if target analytes are present. The concentrations of any detected target analytes will be compared to their respective PALs as part of the risk evaluation to support the decision making process. Historical groundwater and soil chemical data may be used in the evaluation.

- Groundwater Use Survey: A search for public and non-public groundwater supply resources will be conducted within a 2-mile radius of the site in accordance to GA EPD UST guidance to identify potential human receptors. Such information will be used in evaluating risks to human health.

- Ecological Checklist: Site habitats will be characterized using U.S. EPA's checklist for ecological risk assessments to determine if ecological communities at the site and in the nearby surrounding area could be affected by site activities and if the impact could have an adverse effect at a community- or population-level. Such information will be considered in determining the need for and conducting an ERA (if required).

- Geotechnical data: Subsurface soil data will be collected for grain size analysis to provide geotechnical properties of the soil which in turn will be used to assist with the evaluation of fate and transport of the contaminants at Building 1039. Such information will be incorporated into the CSM.

- Geologic/Hydrogeologic Information: Historical information on site-specific geology obtained during the previous site assessment activities will be supplemented during the upcoming RFI through observations made during soil boring activities. Onsite geologists/engineers will use the Unified Soil Classification System to thoroughly describe soil characteristics. Depth-to-groundwater measurements will be obtained at each well to provide information on site-specific hydrogeology and groundwater flow direction. Such information will be incorporated into the CSM.

- Field Screening: A photoionization detector (PID), used to measure organic vapors, will assist with characterization and in selecting samples to be submitted for laboratory analysis. Results of field screening are not considered definitive; thus, any decision-making will be made using chemical data.

- Groundwater Stabilization Parameters: Parameters, including pH, temperature, specific conductivity, oxidation-reduction potential, dissolved oxygen, and turbidity, will be used to confirm groundwater samples are representative of the formation being investigated. Field parameters will also be used to assist with understanding of the nature of contamination.

- Project Action Limits: Chemical data will be compared to PALs, as detailed on Worksheet #15, as an initial screening value to determine COPCs at the site. The PAL hierarchy and sources are as follows.

  Subsurface soil

  — Human Health (Direct Exposure evaluation): Initial soil screening levels will consist of R-RSLs and default SSLs, which use a dilution attenuation factor (DAF) of 1, to evaluate leaching to groundwater. If an R-RSL or default SSL is not established for a given analyte, any such analytes detected above method detection limits will be retained as COPCs.

— Ecological: U.S. EPA Region 4 Ecological Screening Values (ESVs) (U.S. EPA 2001) will be used to facilitate the ecological risk screening for soil (if required). If a Region 4 ESV is not available, alternative screening values will be used. Alternative screening values to be considered may include U.S. EPA Ecological Soil Screening Levels (Eco-SSLs) per the U.S. EPA's Guidance for Developing Ecological Soil Screening Levels (U.S. EPA 2003) and/or Screening Quick Reference Tables as summarized by the National Oceanic and Atmospheric Administration. When screening values other than ESVs are cited, they will be clearly identified and their acceptability and approval for their use will be coordinated with the Navy and GA DEP, before incorporating alternative values into the ecological screening process.

Although ESVs have been included, the need for an ERA will be based on actual conditions observed at the site and surrounding area, as documented in the ecological checklist. Once the ecological checklist has been completed, a scientific management decision-point will be reached and documented with regards to the presence/absence of a sufficient habitat. If the habitat is determined to be insufficient, the risk assessment will be limited to human health. If sufficient habitat is identified, the ERA will proceed as described in Worksheet #14. Note that additional sampling representative of the habitat may be required, or modeling may be required to evaluate exposure in such areas.

Groundwater

— Human Health: In accordance with Georgia Rule 391-3-5.18, the PAL for groundwater will be Georgia Primary MCLs for Drinking Water, consistent with U.S. EPA MCLs. If an MCL is not available for a particular constituent, then the method detection limit will be used as the PAL.

— Ecological: Media Target Concentrations and Standard Exposure Assumption, as presented in Georgia Rule 391-3-19, Table 1 of Appendix III, will be used to facilitate the ecological risk screening for groundwater (if necessary). As previously discussed, the use of ESVs will be dependent on site conditions as identified during the RFI. Assuming information, which will become available during the forthcoming RFI and in the fate and transport evaluation, confirms that the groundwater to surface water migration pathway is incomplete, ecological risk screening will not be necessary for groundwater.

11.4 Define the Study Boundaries

The horizontal boundaries for RFI sampling activities are assumed (pending the need for further delineation) to be southeast of Building 1039, confined between MW-4, MW-9, and MW-10. The vertical boundary for RFI sampling activities extends from the ground surface to 30 feet bgs, based on the total depth of DMW-8D. Horizontal boundaries of the groundwater use survey and ecological survey/checklist are within a radius of 2 miles and 0.5 miles, respectively, from Building 1039. The temporal boundaries of the RFI include the estimated duration of field activities.

11.5 Analytical Approach

The RFI will investigate potential contamination and assess potential threats to human health and the environment at the site. Biased sampling locations will be collected within and exterior of the suspected contaminated area based on historical investigations. Sampling locations may be adjusted based on field observations and professional judgment. Initial determinations on the need for follow-up action will be based on whether analytical data exceed PALs for the specified analytical method. Prior to implementing decision rules, risk managers will review the analytical data, human health and ecological screening results, and effective pathways to determine if the site poses any unacceptable risk. The resulting decision rules are summarized below.

Decision Rule 1: If an analyte at a soil or groundwater sampling point exceeds its method detection limit, then that sampling point will be considered within the extent of contamination. Concentrations of analytes reported below the detection limit will be considered outside of the extent of contamination.

Decision Rule 2: If an analyte at a soil or groundwater sampling point exceeds its PAL (or method detection limit for analytes without established PALs), then the analyte will be identified as a COPC and an HHRA will be performed to determine if unacceptable risk are present. If an analyte at a soil or groundwater sampling point is reported below its PAL (or method detection limit for analytes without established PALs), then no further action is required to evaluate risks to human health.

Decision Rule 3: If the ecological checklist and resulting scientific management decision indicate the presence of sufficient ecological habitat, then an ERA will be performed to determine if unacceptable risk is present.[1] If the ecological checklist and resulting scientific management decision do not indicate the presence of sufficient ecological habitat, then no further action is required to evaluate ecological risks.

[1] Supplemental sampling may be necessary to further characterize receptors. If required, sampling will be scoped upon completion of the ecological checklist.

Decision Rule 4: If the results of the HHRA or ERA (if required) indicate a COPC in soil and/or groundwater presents an unacceptable risk to human health and/or environment, then the COPC will be identified as a COC, potentially requiring follow-up action. Conversely, if results of the risk assessment indicate that COPCs in soil and/or groundwater do not present an unacceptable risk for human health and/or environment, then No Further Action will be recommended.

11.6 Performance or Acceptance Criteria

The objective of this section is to complete the following:

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

Sampling Strategy — The soil and groundwater sampling design was developed to further characterize contaminant concentrations historically detected in soil and groundwater at the site. Judgmental sampling will be used to collect additional soil borings and place the monitoring wells. This sampling approach was determined to be the most appropriate due to the availability of previous sampling data at the site.

Sources of Error — Sources of error in the RFI 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 — The investigation will utilize decision-error minimization techniques in sampling design, sampling methodologies, and laboratory measurement of COPCs. Possible decision errors will be minimized during the field investigation by using the following methods:

- Use standard field sampling methodologies (as discussed in Worksheets #18 and #21).

- Use applicable analytical methods and standard operating procedures (SOPs) for sample analysis by a competent analytical laboratory having state appropriate National Environmental Laboratory Accreditation Program accreditation, and be accredited through the Department of Defense Environmental Laboratory Accreditation Program.

- 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.

Field Data Logs — All sample information will be transcribed into a field logbook and/or onto field data sheets.

Analytical Laboratory Sample Management — The sample matrix, number of samples, and number and type of laboratory quality assurance (QA)/quality control (QC) samples are summarized in the worksheets #18, 19, 20, and 30. Also included on this combined worksheet are details on the analytical group, sample volumes, sample container specifications, preservation requirements, and maximum and holding times.

The laboratory will provide electronic data deliverable files, portable document format files of the data deliverables for all project data, and a hard copy of data deliverables for all results. Designated samples will be used to obtain necessary subsamples for laboratory QC measurements (i.e., analytical sample duplicate and sample matrix spike/matrix spike duplicate [MS/MSD]). Tasks will be completed using the laboratory SOPs.

Resolution Consultants will provide data validation services and verify and evaluate the usability of the data as described in Worksheets #34 through #36.

Portable document format copies of all analytical data packages will be stored on CD-ROM, archived in the NAVFAC Atlantic Administrative Record, and uploaded onto the Naval Installation Restoration Information Solution (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 Data Collection Plan

Non-statistical methods (professional judgment), based on historical sampling locations, will be used as the primary basis for the sampling design. This approach was chosen to identify the extent of specific COPCs and assess whether or not an impact to human or ecological receptors has occurred. The sample design and rationale is presented in Worksheet #17.

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	BTEX and PAHs	One per sampling day per matrix	Bias/Contamination	No analytes ≥ ½ LOQ, except common laboratory contaminants, which must be < LOQ.
Trip Blanks	BTEX	One per cooler containing BTEX samples	Bias/Contamination	No analytes ≥ ½ LOQ, except common laboratory contaminants, which must be < LOQ.
Field Duplicate	BTEX and PAHs	One per 10 field samples per sampling event	Precision	Values > 5X LOQ: RPD must be ≤30 (aqueous) [(1)]; ≤50 (solids)[(1)(2)].
Matrix Spike/Matrix Spike Duplicate	BTEX and PAHs	One pair per 20 field samples per sampling event	Accuracy/Bias/ Precision	Percent recoveries — DoD QSM Limits RPD must be ≤ 30 (organics)
Cooler Temperature Indicator	BTEX and PAHs	One per cooler	Representativeness	Temperature must be above freezing and less than or equal to 6 °C.

Notes:

(1) = If duplicate values for non-metals are less than five times the LOQ, the absolute difference should be less than or equal to two times the LOQ.
(2) = If duplicate values for metals are less than five times the LOQ, the absolute difference should be less than or equal to four times the LOQ.
QC = Quality control
BTEX = Benzene, toluene, ethyl benzene, and xylenes
PAH = Polynuclear aromatic hydrocarbons
LOQ = Limit of Quantitation
RPD = Relative Percent Difference
DoD QSM = *Department of Defense Quality Systems Manual for Environmental Laboratories*, Version 4.2
°C = Degrees Celsius

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 Analytical Data	CH2M Hill, *Final Site-Specific RCRA Facility Investigation Work Plan Building 1039, Naval Submarine Base, Kings Bay, Camden County, Georgia,* June 2011	*Originating Organization*: CH2M Hill, J.J. Sosa and Associates, VT Griffin *Data Types*: Location identifiers, maps, boring and well completion logs, analytical results *Data Collection Dates*: 1998, 1999, 2010, 2011	Data may be used to compare new data to prior results.	Survey data is not available for historical sample locations; therefore, historical sample locations in the RFI report will be approximately digitized.

SAP WORKSHEET #14: SUMMARY OF PROJECT TASKS

(UFP-QAPP Manual Section 2.8.1)

In general, this project includes the advancement of up to 12 soil borings, installation of two monitoring wells, and the collection and analysis of soil and groundwater samples. 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 B. Field tasks are as follows:

- Mobilization/Demobilization
- Site-Specific Health and Safety Training
- Utility Clearance
- Equipment Calibration
- Soil Sampling
- Monitoring Well Installation and Development
- Groundwater Level Measurements
- Groundwater Sampling
- Groundwater Resource and Ecological Receptor Survey/Checklist
- Global Positioning System (GPS) Locating
- Land Surveying
- Waste Handling
- Decontamination
- Site Restoration
- Field Documentation

Additional project-related tasks include:

- Analytical Tasks
- Data Management
- Data Review
- Human Health Risk Assessment (HHRA)
- Ecological Risk Assessment (ERA)
- Report Preparation

Mobilization/Demobilization

Mobilization will consist of the 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 FTL or designee will coordinate with the SUBASE's point of contact (POC) to identify appropriate locations for the temporary storage of equipment and supplies.

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 site 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, if applicable. Additional health and safety requirements will be addressed in greater detail in the forthcoming site-specific health and safety plan.

Demobilization will consist of the prompt and timely removal of equipment, materials, and supplies from the site, at the completion of fieldwork. Demobilization also includes the cleanup and removal of waste generated during the investigation.

Utility Clearance

A minimum of two weeks prior to the commencement of any intrusive activities, Resolution Consultants will coordinate utility clearance with the SUBASE POC and the Utility Protection Center Inc., of Georgia, in accordance with SOP-3-01. SUBASE personnel and the Utility Protection Center Inc. will identify and mark utilities that may be present near the proposed intrusive sampling locations. The Resolution Consultants FTL will document the utility clearance process and obtain all required approvals, as deemed necessary by the SUBASE POC. Utilities that are identified in the field, but not shown or incorrectly shown on the work approval documentation, will be marked directly on the document and returned to the SUBASE POC for inclusion in the Geographic Information System database, if available.

Equipment Calibration

Field equipment calibration procedures are described in Worksheet #22. At a minimum, field equipment will be calibrated at the beginning and end of each day, unless stated otherwise by the equipment manufacturer. Documentation of field equipment calibration is required.

Soil Sampling

The sampling and analysis program is outlined in Worksheets #17 and #18. Subsurface soil samples will be collected from soil borings advanced via direct push technology tooling, in accordance with SOP-3-17 and SOP-3-21. Representative soil will be obtained, at a minimum of 2-foot depth intervals, for lithologic logging and field screening for organic vapors per SOP-3-19. Sample collection and handling will be in accordance with SOP-3-03A, SOP-3-04A, and SOP-3-21 and as described in Worksheet #21. 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. Sample depths will be included on each log. After sampling, each borehole will be backfilled to within 6 inches of grade using soil cuttings removed from the borehole and/or bentonite grout. The surface cover will be repaired using ready-mix concrete or asphalt.

Monitoring Well Installation and Development

Monitoring wells will be installed to further evaluate groundwater contamination in the first (i.e., shallowest) and second water-bearing zones. Installation techniques and construction specifications will be in accordance with SOP-3-12. Monitoring wells will be developed in accordance with SOP-3-13.

Groundwater Level Measurements

After allowing a minimum of 24 hours equilibration time following well installation, the depth to the static water level will be measured using a water level meter in accordance with SOP-3-14. Depth-to-water will be measured in units of feet (to the nearest 0.01 foot) with respect to the top of the inner well riser. Water levels will be recorded on a Resolution Consultant water level measurement form.

Groundwater Sampling

Groundwater samples will be collected from monitoring wells in accordance with SOP-3-14. Sample handling will be in accordance with SOP-3-04A and as described in Worksheet #27.

Groundwater Resource and Ecological Receptor Survey/Checklist

A search for public and non-public groundwater supply resources will be conducted within a 2-mile radius of the site in accordance to GA EPD guidance to identify human receptors and select appropriate PALs, as presented in Worksheet #15. A survey of potential ecological receptors will be conducted within a 0.5-mile radius of the site to properly evaluate ecological risk as described herein.

Global Positioning System Locating

In general accordance with the U.S. EPA SOP SESDPROC-110-R3, included in Appendix B, a hand-held GPS unit capable of sub-meter accuracy (i.e., Trimble GeoXM or Trimble GeoHX) will be used to locate sampling points. GPS data collected during the survey 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 interferes 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.

Land Surveying

Following sampling activities, soil borings and monitoring wells will be surveyed by a professional surveyor licensed in the State of Georgia. 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 measurements will be reported and recorded in U.S. Survey Feet. The surveyor will establish the horizontal location and vertical elevation for monitoring well. One horizontal measurement and two vertical measurements will be required per well. The two vertical measurements are: (1) the top of the inner casing riser pipe (herein referred to as "top of casing"), and (2) the top of ground 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 control. It is anticipated that adequate control is located within one mile of the site. Horizontal position should be referenced to Georgia State Plane Coordinate System, North American Datum 1983 and accurate to 0.10 foot. Vertical elevation should be referenced to North American Vertical Datum of 1988 and accurate to 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 new and existing points. The record will also include a sketch of the point locations and the benchmark witness points for both project control and local control.

Waste Handing

Investigative derived waste (IDW) will be managed in accordance with SOP-3-05, included as appendix B of this SAP, and in general accordance with the Final RI Work Plan. IDW may consist of soil cuttings from well installation, personal protective equipment, decontamination fluids, and purged groundwater from well sampling. IDW will be containerized in adequately labeled 55-gallon department of transportation approved drums. Characterization samples will be collected and submitted for chemical analysis, as required by the disposal facility. Pending characterization data, the drums will be temporarily staged in a fenced secured area, a 90-day storage facility, or as instructed by the SUBASE POC. Based on characterization results, IDW will be transported and appropriately disposed at a Navy-approved offsite disposal facility. IDW disposal manifests will be appended to the RFI report. Personal protective equipment, including gloves, wipes, discarded paper towels, and disposable equipment (i.e., tubing), will be bagged and properly discarded in an appropriate on-base solid waste dumpster.

Decontamination

Decontamination of reusable sampling equipment will be conducted prior to sampling and between samples at each location, in accordance with SOP-3-06. An area for the temporary decontamination pad and a source of potable water for steam cleaning will be arranged by the FTL through the SUBASE POC.

Site Restoration

If investigation activities disturb or alter the landscape or vegetation, site surfaces will be restored to pre-existing conditions (to the extent possible). Asphalt and/or concrete patching will be performed where borings penetrate paved surfaces. Equipment and supplies used during the investigation will be removed from the site at the conclusion of field activities.

Field Documentation

Field documentation will be performed in accordance with SOP-3-02 and 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.

Analytical Tasks

Chemical analyses will be performed by Gulf Coast Analytical Laboratories (GCAL), a National Environmental Laboratory Accreditation Program and Department of Defense Environmental Laboratory Accreditation Program-accredited laboratory. Copies of pertinent laboratory accreditation certificates may be found in Appendix C. Chemical analyses will be performed in accordance with the analytical methods identified in Worksheets #23 and #30. Grain size analysis will be performed by Ardaman and Associates, Inc., Baton Rouge, Louisiana. These results will be used for qualitative purposes to provide additional soil characterization. GCAL will provide fully validatable chemical data packages, which will include summary forms containing all quality control information and raw data. Soil results will be reported on an adjusted dry-weight basis. Results of percent moisture will be reported in each analytical data package and associated electronic data deliverable files. This information will also be captured in the project database and RFI report, which will eventually be uploaded to the NIRIS database.

Data Handling and Management

The principal data generated for this project will be from field data and laboratory analytical data. Upon completion of field activities, all secondary data from field sampling forms will be organized by date and entered into Excel for electronic archiving/data evaluation. 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. All project records will be maintained in a secure location. 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 located on a secure network, which is password protected. The Resolution Consultants TOM (or designee) is responsible for the overall tracking and control of data generated for the project.

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 data will undergo validation, as cited in Worksheets #34 through #36. The usability assessment processes are described in Worksheet #37. After the data are validated, the reviewer will then prepare a technical memorandum presenting changes in the data, if necessary, and the rationale for making such changes. The final data validation report will include a technical memorandum, qualified analytical results, results reported by the laboratory, and documentation to support data qualification. All data that requires qualification will be flagged with an appropriate qualifying symbol.

Data Tracking and Control

The TOM (or designee) is responsible for the overall tracking and control of data generated for the project. Data are tracked from its generation to its 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. 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 RPM.

Data Storage, Archiving, and Retrieval

After the data are validated, the data packages are entered into the Resolution Consultants' Navy CLEAN file system and archived in secure files. The field records including field log books, sample logs, chain-of-custody records, and field calibration logs will be submitted by the Resolution Consultants FTL to be entered into the Navy CLEAN 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 and at the completion of the Navy contract; records will be stored by Resolution Consultants and eventually transferred to the Navy. Final validated environmental data will be uploaded into the NIRIS database.

Risk Assessment

A HHRA and ERA (conditional) will be conducted after data evaluation. The HHRA and ERA will identify existing or potential risks to human health and/or the environment and will serve to support the selection of COCs based on an evaluation of the threats to current and future exposure scenarios. Only RFI data that have been validated will be used in the risk assessment.

Human Health Risk Assessment

The primary objective of the baseline HHRA is to assess the health risks associated with exposure to Building 1039 soil and groundwater for human receptors under current and future site conditions. The baseline HHRA will be conducted in accordance with the National Oil and Hazardous

Substances Pollution Contingency Plan (U.S. EPA 1990) and the *Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part A) Interim Final* (U.S. EPA 1989). The risk assessment will include an identification of COCs, exposure assessment, toxicity assessment, risk characterization, and uncertainty assessment. Additional guidance documents that will be consulted include the following:

— Region 4 Human Health Risk Assessment Bulletins — Supplement to RAGS (U.S. EPA 2000)

— *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments* (U.S. EPA 2001b)

— *Risk Assessment Guidance for Superfund, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final* (U.S. EPA 2004)

— *Guidance for Selecting Media Remediation Levels at RCRA Solid Waste Management Units* (GA EPD 1996)

Ecological Risk Assessment

In accordance to decision rules in Section 11.5, the ERA (if deemed necessary) will be performed in accordance with the following guidance:

— *Ecological Risk Assessment Guidance for Superfund (RAGS): Process for Designing and Conducting Ecological Risk Assessments* (U.S. EPA 1997)

— Region 4 Ecological Risk Assessment Bulletins — Supplement to RAGS (U.S. EPA 2001a)

— *Navy Guidance for Conducting Ecological Risk Assessments* (Department of Navy 2003)

— *Guidance for Selecting Media Remediation Levels at RCRA Solid Waste Management Units* (GA EPD 1996)

Report Preparation

An RFI report will be prepared to present results of the investigation and satisfy PQOs, as identified in Worksheet #11. The report will include the following:

— Information to supplement and/or verify the environmental setting of Building 1039 including geology and hydrogeology

— Summary of the investigation/sampling activities

— Characterization of the source(s)

— Evaluation of the nature and extent of contamination

— HHRA

— ERA

— Conclusions and recommendations

Draft RFI reports will be submitted to NAVFAC SE, SUBASE, and GA EPD for comments and approval. Response to comments and necessary revisions will be made to the draft reports before issuing a final report.

SAP WORKSHEET #15: REFERENCE LIMITS AND EVALUATION TABLES

(UFP-QAPP Manual Section 2.8.1)

Matrix:	Soil								
Analytical Group:	Select Volatile Organic Compounds by U.S. EPA Method SW8260B								
							Laboratory Specific Limits (1)		
Analyte	**CAS No.**	**Project Action Level-HH (mg/kg)**	**Project Action Level Reference-HH**	**Project Action Level-Eco (mg/kg)**	**Project Action Level Reference-Eco**	**Project Quantitation Limit Goal (mg/kg)**	**LOQ (mg/kg)**	**LOD (mg/kg)**	**DL (mg/kg)**
Benzene	71-43-2	0.0002	SSL-Risk	0.05	ESVs	0.00007	**0.005**	0.0005	0.00005
Toluene	108-88-3	0.059	SSL-Risk	0.05	ESVs	0.02	0.005	0.0005	0.00011
Ethylbenzene	100-41-4	0.0015	SSL-Risk	0.05	ESVs	0.0005	**0.005**	0.0005	0.00018
Xylene (Total)	1330-20-7	0.019	SSL-Risk	0.05	ESVs	0.0063	**0.015**	0.0015	0.0004

Notes:

(1) LOQ, LOD, and DLs are provided by Gulf Coast Analytical Laboratories are targets that are achievable under optimal conditions and may vary during the course of project. Physical characteristics, such as moisture content, will affect the actual limits achieved.

CAS = Chemical Abstracts Service
HH = Human health receptors
Eco = Ecological receptors
LOQ = Limit of quantitication
LOD = Limit of detection
DL = Detection Limit
mg/kg = Milligram per kilogram
SSL-Risk = U.S. EPA RSL Risk-Based Soil Screening Level based on migration to groundwater with a dilution attenuation factor of 1(U.S. EPA, May 2013). During the screening process, both the residential and default SSLs will be assessed, but only the lower of the two values are shown in this table to represent worst-case human health values against laboratory detection limits.
U.S. EPA = U.S. Environmental Protection Agency
RSL = Regional Screening Levels
ESVs = U.S. EPA Region 4 Ecological Screening Values (U.S. EPA 2001a).
Shaded = LOQ does not meet the PAL. Uncertainties introduced by LOQs that are greater than PALs will be described in the RCRA Facility Investigation Report. The DL is provided for completeness of evaluation.

Matrix:	Soil								
Analytical Group:	Polynuclear Aromatic Hydrocarbons by U.S. EPA Method SW8270D SIM								
							Laboratory Specific Limits (1)		
Analyte	**CAS No.**	**Project Action Level-HH (mg/kg)**	**Project Action Level Reference-HH**	**Project Action Level-Eco (mg/kg)**	**Project Action Level Reference-Eco**	**Project Quantitation Limit Goal (mg/kg)**	**LOQ (mg/kg)**	**LOD (mg/kg)**	**DL (mg/kg)**
1-Methylnaphthalene	90-12-0	0.0051	SSL-Risk	29	Eco-SSLs LMW	0.0017	0.0033	0.0033	0.00086
2-Methylnaphthalene	91-57-6	0.014	SSL-Risk	29	Eco-SSLs LMW	0.0047	0.0033	0.0033	0.0011
Acenaphthene	83-32-9	0.41	SSL-Risk	20	ESVs	0.14	0.0033	0.0017	0.00083
Acenaphthylene	208-96-8	340	Res RSL-Surr	29	SSLs	9.7	0.0033	0.0017	0.00053
Anthracene	120-12-7	4.2	SSL-Risk	0.1	ESVs	0.033	0.0033	0.0017	0.00023
Benzo[a]anthracene	56-55-3	0.010	SSL-Risk	1.1	Eco-SSLs HMW	0.0033	0.0033	0.0017	0.00067
Benzo[a]pyrene	50-32-8	0.0035	SSL-Risk	0.1	ESVs	0.0012	0.0033	0.0017	0.00040
Benzo[b]fluoranthene	205-99-2	0.035	SSL-Risk	1.1	Eco-SSLs HMW	0.012	0.0033	0.0017	0.00089
Benzo[g,h,i]perylene	191-24-2	170	Res RSL-Surr	1.1	Eco-SSLs HMW	0.37	0.0033	0.0033	0.00072
Benzo[k]fluoranthene	207-08-9	0.35	SSL-Risk	1.1	Eco-SSLs HMW	0.12	0.0033	0.0017	0.00031
Chrysene	218-01-9	1.1	SSL-Risk	1.1	Eco-SSLs HMW	0.37	0.0033	0.0033	0.00035
Dibenz[a,h]anthracene	53-70-3	0.011	SSL-Risk	1.1	Eco-SSLs HMW	0.0037	0.0033	0.0033	0.00041
Fluoranthene	206-44-0	7	SSL-Risk	0.1	ESVs	0.033	0.0033	0.0017	0.00061
Fluorene	86-73-7	0.4	SSL-Risk	30	ESVs	0.13	0.0033	0.0017	0.00031
Indeno[1,2,3-cd]pyrene	193-39-5	0.20	SSL-Risk	1.1	Eco-SSLs HMW	0.067	0.0033	0.0033	0.00059
Naphthalene	91-20-3	0.00047	SSL-Risk	0.1	ESVs	0.00016	**0.0033**	**0.0033**	0.00054
Phenanthrene	85-01-8	170	Res RSL-Surr	0.1	ESVs	0.033	0.0033	0.0017	0.00057
Pyrene	129-00-0	0.95	SSL-Risk	0.1	ESVs	0.033	0.0033	0.0017	0.00052

Notes:

(1) LOQ, LOD, and DLs are provided by Gulf Coast Analytical Laboratories are targets that are achievable under optimal conditions and may vary during the course of project. Physical characteristics, such as moisture content, will affect the actual limits achieved.

U.S. EPA	=	U.S. Environmental Protection Agency	SIM	=	Selective ion monitoring	CAS	=	Chemical Abstracts Service
HH	=	Human health receptors	Eco	=	Ecological receptors	LOQ	=	Limit of quantitication
LOD	=	Limit of detection	DL	=	Detection Limit	mg/kg	=	Milligram per kilogram
RSL	=	Residential Regional Screening Levels	LMW	=	Total low molecular weight	HMW	=	Total high molecular weight

SSL-Risk = U.S. EPA RSL Risk-Based Soil Screening Level based on migration to groundwater with a dilution attenuation factor of 1 (U.S. EPA, May 2013). During the screening process, both the residential and default SSLs will be assessed, but only the lower of the two values are shown in this table to represent worst-case human health values against laboratory detection limits.

Res RSL-Surr = U.S. EPA Residential RSL Soil Screening Level (U.S. EPA, May 2013); structurally similar surrogate compound used.

U.S. EPA ESVs = U.S. EPA Region 4 Ecological Screening Values (U.S. EPA 2001a).

Eco-SSLs = U.S. EPA Ecological Soil Screening Levels per the U.S. EPA's Guidance for Developing Ecological Soil Screening Levels (U.S. EPA 2003)

Shaded = LOQs and LODs do not meet the PAL. Uncertainties introduced by LODs or LOQs that are greater than PALs will be described in the RCRA Facility Investigation Report. The DL is provided for completeness of evaluation.

Matrix:	Groundwater						
Analytical Group:	Select Volatile Organic Compounds by U.S. EPA Method SW8260B						
Analyte	**CAS No.**	**Project Action Level (µg/L)**	**Project Action Level Reference**	**Project Quantitation Limit Goal (µg/L)**	**Laboratory Specific Limits (1)**		
					LOQ (µg/L)	**LOD (µg/L)**	**DL (µg/L)**
Benzene	71-43-2	5	MCL	2.0	1.0	0.20	0.11
Ethylbenzene	100-41-4	700	MCL	333	1.0	0.20	0.12
Toluene	108-88-3	1,000	MCL	233	1.0	0.20	0.11
Xylene (total)	1330-20-7	10,000	MCL	3333	3.0	0.60	0.18

Notes:

(1) LOQ, LOD, and DLs are provided by Gulf Coast Analytical Laboratories are targets that are achievable under optimal conditions and may vary during the course of project.

U.S. EPA = U.S. Environmental Protection Agency
CAS = Chemical Abstracts Service
LOQ = Limit of quantitication
LOD = Limit of detection
DL = Detection Limit
MCL = Georgia Primary Maximum Contaminant Levels (MCLs) for Drinking Water (Georgia Rule 391-3-5.18)
µg/L = Microgram per liter

Matrix:	Groundwater						
Analytical Group:	Polynuclear Aromatic Hydrocarbons by U.S. EPA Method SW8270D SIM						
					Laboratory Specific Limits (1)		
Analyte	**CAS No.**	**Project Action Level (µg/L)**	**Project Action Level Reference**	**Project Quantitation Limit Goal (µg/L)**	**LOQ (µg/L)**	**LOD (µg/L)**	**DL (µg/L)**
1-Methylnaphthalene	90-12-0	—	—	—	0.10	0.10	0.069
2-Methylnaphthalene	91-57-6	—	—	—	0.10	0.10	0.064
Acenaphthene	83-32-9	—	—	—	0.10	0.050	0.037
Acenaphthylene	208-96-8	—	—	—	0.10	0.10	0.070
Anthracene	120-12-7	—	—	—	0.10	0.050	0.024
Benzo[a]anthracene	56-55-3	—	—	—	0.10	0.10	0.059
Benzo[a]pyrene	50-32-8	0.20	MCL	0.067	0.10	0.050	0.022
Benzo[b]fluoranthene	205-99-2	—	—	—	0.10	0.050	0.018
Benzo[g,h,i]perylene	191-24-2	—	—	—	0.10	0.050	0.036
Benzo[k]fluoranthene	207-08-9	—	—	—	0.10	0.050	0.039
Chrysene	218-01-9	—	—	—	0.10	0.050	0.018
Dibenz[a,h]anthracene	53-70-3	—	—	—	0.10	0.050	0.034
Fluoranthene	206-44-0	—	—	—	0.10	0.050	0.039
Fluorene	86-73-7	—	—	—	0.10	0.10	0.097
Indeno[1,2,3-cd]pyrene	193-39-5	—	—	—	0.10	0.050	0.040
Naphthalene	91-20-3	—	—	—	0.10	0.050	0.037
Phenanthrene	85-01-8	—	—	—	0.10	0.050	0.028
Pyrene	129-00-0	—	—	—	0.10	0.050	0.036

Notes:

(1) LOQ, LOD, and DLs are provided by Gulf Coast Analytical Laboratories are targets that are achievable under optimal conditions and may vary during the course of project.

U.S. EPA = U.S. Environmental Protection Agency
SIM = Selective ion monitoring
MCL = Georgia Primary Maximum Contaminant Levels (MCLs) for Drinking Water (Georgia Rule 391-3-5.18)
— = No MCL is available. The method detection limit will be used as the project action level.
µg/L = Microgram per liter
CAS = Chemical Abstracts Service
LOQ = Limit of quantitication
LOD = Limit of detection
DL = Detection Limit
Shaded = LOQs and LODs do not meet the PAL. Uncertainties introduced by LODs or LOQs that are greater than PALs will be described in the RCRA Facility Investigation Report. The DL is provided for completeness of evaluation.

SAP WORKSHEET #16: PROJECT SCHEDULE/TIMELINE TABLE (OPTIONAL FORMAT)

(UFP-QAPP Manual Section 2.8.2)

Activity	Organization	Duration	Number of days from start	Deliverable	Deliverable Due Date
Prepare/Submit Internal Draft SAP	Resolution Consultants	219 days	1 day after contract award	Internal Draft SAP	31 Jan 2013
Navy Review of Internal Draft SAP	Navy	75 days	1 day after submittal	Comments from Navy	16 April 2012
Prepare/Submit Draft SAP	Resolution Consultants	30 days	1 day after receipt of Navy comments	Draft SAP	17 May 2013
Regulatory Review of SAP	GA EPD	TBD	NA	NA	TBD
Prepare/Submit Final SAP	Resolution Consultants	15 days	1 day after receipt of Regulatory comments	Final SAP	TBD
Concurrence by Regulators	GA EPD	TBD	NA	NA	TBD
Field Preparation/ Mobilization	Resolution Consultants	30 days	15 days after Regulatory concurrence	NA	TBD
Field Work	Resolution Consultants	15 days	45 days after Regulatory concurrence	NA	TBD
Laboratory Results, Data Validation, Data Management	GCAL and/or Resolution Consultants	60 days	1 days after soil and well sampling	Laboratory data packages and electronic data deliverables	TBD
Prepare/Submit Internal Draft RFI Report	Resolution Consultants	90 days	1 day after receipt of validated data	Internal Draft RFI Report	TBD
Navy Review of RFI Report Complete	Navy	TBD	NA	NA	TBD
Prepare/Submit Draft RFI Report	Resolution Consultants	30 days	1 day after receipt of Navy comments	Draft RFI Report	TBD
Regulatory Review of Draft RFI Report Complete	GA EPD	TBD	NA	NA	TBD
Respond to Regulatory Comments	Resolution Consultants	30 days	1 day after receipt of Regulatory comments	Draft Final RFI Report	TBD
Regulatory Review of Draft Final	GA EPD	TBD	NA	NA	TBD
Prepare/Submit Final RFI Report	Resolution Consultants	30 days	1 day after receipt of Regulatory comments	Final RFI Report	TBD

Notes:

SAP = Sampling and Analysis Plan
RFI = RCRA Facility Investigation
GCAL = Gulf Coast Analytical Laboratories
NA = Not applicable
GA EPD = Georgia Environmental Protection Division
TBD = To be determined

SAP WORKSHEET #17: SAMPLING DESIGN AND RATIONALE

(UFP-QAPP Manual Section 3.1.1)

17.1 Sampling Approach

As previously described in Worksheet #11, additional data are necessary to determine the nature and extent of contamination, and potential risks to the human health and the environment. The sampling strategies, as presented herein, are designed to address gaps associated with the current dataset and evaluate soil and groundwater for COPCs, including BTEX and PAHs, as defined based on historical detections and operations at the site. Furthermore, the proposed strategy considers comments from GA EPD on 8 April 2011, on the *Draft Site-Specific RCRA Facility Investigation Work Plan Building 1039, Naval Submarine Base, Kings Bay, Camden County, Georgia* (CH2M Hill 2010). Findings will provide information to support a decision concerning whether or not future action is required.

This worksheet presents the design and rationale of the sampling and analysis program to be conducted during the RFI. The sampling approach, based on professional judgment, is biased to determine the boundaries of contamination identified during previous investigations. Specifically, the sampling plan was developed using information from historical investigations, corrective actions and the preliminary CSM as presented in Worksheet #10. Proposed sampling locations are illustrated on Figure 17-1. A summary table, including sample identification numbers, depth, relevant SOPs, and applicable laboratory and field analyses, is included as Worksheet #18. SOPs for field activities are summarized in Worksheet #21 and included as Appendix B. Professional judgment may be used to adjust sampling locations and/or depths in the field. Examples of criteria which may lead to changes to the sampling plan may include (but not limited to) visual observations/staining, odors, elevated headspace organic vapor readings, etc.

Samples collected during the RFI will be submitted to GCAL for chemical analyses. Physical soil analysis for grain size will be conducted by Ardaman and Associates, Inc. Analytical methods are identified in Worksheet #23. Laboratory SOPs are listed in Worksheet #23. The total numbers of sample analyses to be performed for each target analyte or analytical group are identified in Worksheets #18 and #20. Worksheets #19 and #30 present a summary of the sample analyses, container types and volumes, preservation requirements, and holding times.

Planned field QC samples will include field duplicates and equipment rinsate blanks. Worksheet #12 presents the field QC sample summary. Additional sample volume will be collected as necessary for laboratory QC analysis of MS/MSD samples.

Sample locations will be marked in the field using a wooden stake or brightly colored pin flag. Coordinates of each sample location will be recorded using a GPS device and surveyed for horizontal and vertical location by a Georgia Professional Land Surveyor, which will allow for future reacquisition of the locations if further investigation or remedial action is necessary. All sample location markers will be removed prior to final demobilization.

17.2 Soil Sampling Program

Up to 12 soil borings will be advanced using direct push technology (DPT). Proposed soil boring locations are shown on Figure 17-1. Soil borings will be advanced from the ground surface down to the water table (approximately 7 feet bgs) for lithological characterization and for the presence of organic vapors. Soil from each boring will be screened with a PID, and one subsurface soil sample will be collected at the depth exhibiting the highest organic vapors within the 2-foot interval directly above the water table[1]. Soil samples will be submitted to a laboratory for analysis of BTEX by Method 8260B and PAHs by Method 8270D selective ion monitoring (SIM).

Two additional soil borings will be advanced below the water table to assess geotechnical properties of the soil. One sample from each geotechnical boring will be collected from 7 feet to 9 feet bgs based on saturation, and submitted for determination of grain size by American Society for Testing and Materials Method D 422, and total organic carbon by Method 9060M.

17.3 Groundwater Sampling Program

17.3.1 Well Installation

Two new wells (MW-11S and MW-11D) will be installed during the RFI to further evaluate groundwater downgradient of the source area. Proposed locations are shown on Figure 17-1. Shallow well MW-11S will be installed to a depth of approximately 13 feet bgs, and deep well MW-11D will be installed to an approximate depth of 30 feet bgs, each using hollow stem auger drilling techniques. Split-spoon soil samples will be collected from each well boring for lithological descriptions and for the presence of organic vapors.

The screened interval of the shallow well will be positioned based on lithology data collected during borehole advancement and will intersect the water table to capture any floating product that may potentially exist at the location. The deep well will be screened to evaluate groundwater at the interface between sand and silty clay at approximately 30-feet bgs. Monitoring wells will be constructed using 2-inch diameter Schedule 40 polyvinyl chloride (PVC) riser and either 10-feet (shallow well) or 5-feet (deep well) ten-slot (0.010-inch) PVC screen.

[1] Due to release mechanism (see Conceptual Site Model on Worksheet #10), surface soil samples are not proposed.

A 30/40 silica sand filter pack will be placed in the annular space between the well screen and borehole wall, from the bottom of the borehole to approximately 2 feet above the top of the well screen. Bentonite pellets will be placed on top of the filter pack and hydrated (for at least 1 hour) to form a seal approximately 2 to 3 feet thick. After hydration of the bentonite pellets, the remaining annular space of the borehole will be grouted to within a one foot of the ground surface. The grout shall be allowed to cure a minimum of 24 hours prior to well completion.

A watertight, expansion cap will be installed on top of the 2-inch diameter casing and secured using a padlock. Each monitoring well will be completed at the surface with an 8-inch diameter steel, manhole type, and protective cover with concrete pad. The drilling and well installation activities will be conducted by a Georgia-licensed well driller under the supervision of a Resolution Consultants' engineer or geologist. Each new monitoring well will be developed within 48 hours after installation depending on scheduled field activities.

17.3.2 Well Gauging and Sampling

Water levels will be measured at the 12 existing monitoring wells (MW-1 through MW-6, DMW-8D, MW-9, MW-10, TMW-2XR, TMW-3X, and TMW-4X) and the two new wells (MW-11S and MW-11D) with an oil-water interface probe. Results will be used to develop a potentiometric surface map for the surficial aquifer. To determine the lateral and vertical extent of the potential contaminant plume, each of the 14 monitoring wells will be sampled in a comprehensive groundwater sampling event. Groundwater samples will be collected, through U.S. EPA low-flow sampling protocol, from each of the 14 wells and submitted to a laboratory for analysis of BTEX by Method 8260B and PAHs by Method 8270D SIM. To confirm that groundwater samples are representative of the formation being investigated, field measurements of water level/drawdown, temperature, pH, specific conductance, oxidation-reduction potential, dissolved oxygen, and turbidity will be recorded.

NOTE:
-Feature locations are approximate.
-Data Source: RFI Work Plan (CH2M Hill, 2011)

Legend

- Monitoring Well (Abandoned)
- Monitoring Well
- Proposed Monitoring Well
- Proposed Soil Boring
- Proposed Soil Boring to Include TOC and Grain Size Analysis
- Former Fill Port and Line
- Former Supply/Return Line
- Former Location of Heating Fuel Tank
- Excavation Boundary (2010)

FIGURE 17-1
PROPOSED SAMPLING LOCATIONS
BUILDING 1039/SWMU 9
NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

NAVFAC Naval Facilities Engineering Command
RESOLUTION CONSULTANTS

REQUESTED BY: C. Tripp	DATE: 2/8/2013
DRAWN BY: M. Senne	PROJECT: 0888812552

Basemap Source:(c) 2010 Microsoft Corporation and its data suppliers

X:\Navy\Kings_Bay_Sub_Base\Fig17_1_Proposed_Sample_Locs.mxd

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

(UFP-QAPP Manual Section 3.1.1)

Sample Location	Sample Identification	Matrix	Estimated Depth (feet bgs)	Analytical Group	Number of Samples	Sampling Standard Operating Procedure Reference (Appendix B)
SB10	KB09SB10S05N1	Soil	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB11	KB09SB11S05N1	Soil	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB12	KB09SB12S05N1	Soil	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB13	KB09SB13S05N1	Soil	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB14	KB09SB14S05N1	Soil	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB15	KB09SB15S05N1 KB09SB15S08N1	Soil	5.0* 8.0**	BTEX, PAHs TOC, grain size	2	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB16	KB09SB16S05N1	Soil	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB17	KB09SB17S05N1 KB09SB17S08N1	Soil	5.0* 8.0**	BTEX, PAHs TOC, grain size	2	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB18	KB09SB18S05N1	Soil	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB19	KB09SB19S05N1	Soil	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB20	KB09SB20S05N1	Soil	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SB21	KB09SB21S05N1	Soil	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SBXX	KB09SBXXSQ05FD1	Soil (duplicate)	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
SBXX	KB09SBXXSQ05FD2	Soil (duplicate)	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21

Sample Location	Sample Identification	Matrix	Estimated Depth (feet bgs)	Analytical Group	Number of Samples	Sampling Standard Operating Procedure Reference (Appendix B)
SBXX	KB09SBXXS05N1	Soil (MS/MSD)	5.0*	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
Equipment Blank	KB09SBXXSQ05EB1	SQ (Equipment Blank)	NA	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
Equipment Blank	KB09SBXXSQ05EB2	SQ (Equipment Blank)	NA	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-17, SOP-3-19, SOP-3-21
MW01	KB09MW01WG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
MW02	KB09MW02WG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
MW03	KB09MW03WG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
MW04	KB09MW04WG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
MW05	KB09MW05WG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
MW06	KB09MW06WG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
DMW08D	KB09DMW08DWG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
MW09	KB09MW09WG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
MW10	KB09MW10WG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24

Sample Location	Sample Identification	Matrix	Estimated Depth (feet bgs)	Analytical Group	Number of Samples	Sampling Standard Operating Procedure Reference (Appendix B)
MW11S	KB09MW11SWG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
MW11D	KB09MW11DWG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
TMW2XR	KB09TMW2XRWG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
TMW3X	KB09TMW3XWG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
TMW4X	KB09TMW4XWG*MMDDYY*N1	WG	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
MWXX	KB09MWXXWQ*MMDDYY*FD1	WG (duplicate)	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
MWXX	KB09MWXXWQ*MMDDYY*FD2	WG (duplicate)	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
MWXX	KB09MWXXWG*MMDDYY*N1	WG (MS/MSD)	Water Table	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
Equipment Blank	KB09MWXXWQ*MMDDYY*EB1	WQ (Equipment Blank)	NA	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24
Equipment Blank	KB09MWXXWQ*MMDDYY*EB2	WQ (Equipment Blank)	NA	BTEX, PAHs	1	SOP-3-03A, SOP-3-04A, SOP-3-14, SOP-3-24

Notes:

bgs	=	Below ground surface
EB	=	Equipment blank
N	=	Normal/primary sample
FD	=	Field duplicate
MMDDYY	=	Numerical Month Day Year
WG	=	Groundwater
WQ	=	Water Quality
SQ	=	Aqueous Soil Quality
BTEX	=	Volatile organic compounds, benzene, toluene, ethylbenzene, xylenes
PAHs	=	Semi-volatile organic compounds, polynuclear aromatic hydrocarbons
TOC	=	Total Organic Carbon
NA	=	Not Applicable
MS/MSD	=	Matrix Spike/Matrix Spike Duplicate
XX	=	To Be Determined in Field

* Sample to be collected within the 2-foot interval above the shallow water table at the highest organic vapor reading.

** Sample to be collected 1 foot below the shallow water table.

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 [a]	Maximum Holding Time[b] (preparation/ analysis)
Groundwater	BTEX	SW-846 5030/8260B GCMSV-003	(3) 40 mL glass volatile vials	40 mL	Hydrochloric acid to a pH less than 2; Cool to 0-6°C; no headspace	14 days
	PAHs	SW-846 3510C/8270D-SIM EXT-003/GCMSSV-004	(2) 1 L amber glass bottles	1000 mL	Cool to 0-6°C	7 days to prep 40 days to analysis
Soil	BTEX	SW-846 5035/8260B GCMSV-003	(3) 40 mL glass plus 2 oz jar	5 grams	Methanol and sodium bisulfate; Cool to 0-6°C	14 days
	PAHs	SW-846 3550C/8270D-SIM EXT-001-GCMSSV-004	(1) 4 oz glass jar	30 grams	Cool to 0-6°C	14 days to prep 40 days to analysis
	Total Organic Carbon	SW-846 9060M	(1) 4 oz glass jar	30 grams	Cool to 0-6°C	28 days
	Grain Size	ASTM Method D 422	(1) 4 oz plastic or glass jar	100 grams	Not Applicable	Not Applicable

Notes:

[a] = Chemical, temperature, and light protected
[b] = Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted
ASTM = American Society for Testing and Materials
GCAL = Gulf Coast Analytical Laboratory
SOP = Standard operating procedure
BTEX = Volatile Organic Compounds, benzene, ethylbenzene, toluene, xylenes
PAHs = Polynuclear aromatic hydrocarbons
SIM = Selective ion monitoring
mL = Milliliter
°C = Degrees Celsius
oz = Ounce
L = Liter

SAP WORKSHEET #20: FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs	No. of Equipment Blanks (1)	No. of VOA Trip Blanks(2)	Total No. of Samples to Lab
Groundwater	BTEX	14	2	1/1	2	3	23
	PAHs	14	2	1/1	2	0	20
Soil	BTEX	12	2	1/1	2	0	18
	PAHs	12	2	1/1	2	0	18
	Total Organic Carbon	2	0	0	0	0	2
	Grain Size	2	0	0	0	0	2

Notes:

(1) = One equipment blank per day of sampling; therefore, exact number will be determined in field.
(2) = One trip blank per VOA cooler; therefore, exact number will be determined in field.
BTEX = Benzene, toluene, ethyl benzene, xylenes
PAHs = Polynuclear aromatic hydrocarbons
MS = Matrix spike
MSD = Matrix spike duplicate
No. = Number
NA = Not applicable
VOA = Volatile organic analysis

SAP WORKSHEET #21: PROJECT SAMPLING SOP REFERENCES TABLE

(UFP-QAPP Manual Section 3.1.2)

Field sampling standard operation procedures (SOPs) for activities presented in this SAP are listed below.

Field SOPs Reference Table					
SOP Reference Number	**Title/Author**	**Revision Date or Version Number**	**Location of SOP**	**Any planned deviation for Project Work**	**Comments**
SOP-3-01	Utility Clearance/Resolution Consultants	Revision 0; June 2012	Appendix B	No	
SOP-3-02	Log Books/Resolution Consultants	Revision 0; May 2012	Appendix B	No	
SOP-3-03A	Record Keeping, Sampling Labeling, and Chain-of-Custody/Resolution Consultants	Revision 0; May 2012	Appendix B	No	
SOP-3-04A	Sample Handling, Storage, and Shipping/Resolution Consultants	Revision 0; May 2012	Appendix B	No	
SOP-3-05A	Investigation-Derived Waste Management/Resolution Consultants	Revision 0; May 2012	Appendix B	No	Investigative-derived waste will be disposed to an approved offsite facility.
SOP-3-06	Equipment Decontamination/Resolution Consultants	Revision 0; May 2012	Appendix B	No	
SOP-3-12	Monitoring Well Installation/Resolution Consultants	Revision 0; May 2012	Appendix B	No	
SOP-3-13	Monitoring Well Development/Resolution Consultants	Revision 0; June 2012	Appendix B	No	
SOP-3-14	Monitoring Well Sampling/Resolution Consultants	Revision 0; May 2012	Appendix B	No	
SOP-3-17	Direct Push Sampling Techniques/Resolution Consultants	Revision 0; May 2012	Appendix B	No	
SOP-3-19	Headspace Screening for VOCs/Resolution Consultants	Revision 0; May 2012	Appendix B	No	
SOP-3-20	Operation and Calibration of a Photoionization Detector/Resolution Consultants	Revision 0; May 2012	Appendix B	No	
SOP-3-21	Surface and Subsurface Soil Sampling/Resolution Consultants	Revision 0; May 2012	Appendix B	No	

Field SOPs Reference Table					
SOP Reference Number	**Title/Author**	**Revision Date or Version Number**	**Location of SOP**	**Any planned deviation for Project Work**	**Comments**
SOP-3-24	Water Quality Parameter Testing/Resolution Consultants	Revision 0; June 2012	Appendix B	No	
SESDPROC-110-R3	Global Positioning System/United States Environmental Protection Agency, Region 4	Revision 3, April 2011	Appendix B	No	

Notes:

SOP = Standard operating procedure
SUBASE = Naval Submarine Base Kings Bay

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	Frequency	Acceptance Criterion	Corrective Action	Responsible Person	SOP Reference	Comments
Water Quality Meter (YSI 600 Series or equivalent)	Visual Inspection Calibration/Verification	Daily Beginning and end of day	Manufacturer's guidance	Operator correction, recalibration, or replacement	Resolution Consultants FTL or designee	Manufacturer's Guidance Manual, SOP-3-24	To be used to determine purge completion
Turbidity Meter (LaMotte 2020 or equivalent)	Visual Inspection Calibration/ Verification	Daily Beginning and end of day	Manufacturer's guidance Calibrations must bracket expected values. Initial Calibration Verification must be <5 Nephelometric Turbidity Unit.	Operator correction or replacement	Resolution Consultants FTL or designee	Manufacturer's Guidance Manual, SOP-3-24	To be used to determine purge completion
Photoionization Detector	Visual Inspection Calibration/Verification	Daily Beginning and end of day	Manufacturer's guidance	Operator correction, recalibration or replacement	Resolution Consultants FTL or designee	Manufacturer's Guidance Manual, SOP-3-20	To be used to assist with determination of sampling depths and for safety monitoring
Water Level Indicator and Oil/Water Interface Probe	Visual Inspection Field checks as per manufacturer	Daily Once upon receiving from vendor	0.01 foot accuracy	Operator correction or replacement	Resolution Consultants FTL or designee	Manufacturer's Guidance Manual, SOP-3-24	
Global Positioning System	Positioning	Beginning and end of each day used	Accuracy: sub-meter horizontal dilution of precision < 3, number of satellites must be at least six	Wait for better signal, replace unit, or choose alternate location technique	Resolution Consultants FTL or designee	Manufacturer's Guidance Manual, SOP SESDPROC-110-R3	Trimble Geo XT or similar

Note:
FTL = Field team leader
SOP = Standard operating procedure

SAP WORKSHEET #23: ANALYTICAL SOP REFERENCES TABLE

(UFP-QAPP Manual Section 3.2.1)

Laboratory Name and Address: GCAL, 7979 GSRI Road, Baton Rouge, LA 70820

Laboratory Point of Contact/Project Manager: Brenda Martinez, brenda.martinez@gcal.com, 225-214-7077

GCAL SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Yes/No)
GCMSV-003	*SOP for the Analysis of Volatile Samples by 8260B*, Revision 23, 9/14/11	Definitive	Aqueous and Soil, BTEX	GC/MS Agilent 6890/5973 and Agilent 7890/5975	No	No
GCMSSV-004	*SOP for the Analysis of Method 8270D*, Revision 7, 2/13/12	Definitive	Aqueous and Soil, PAHs via SIM	GC/MS Agilent 6890/5973 and Agilent 7890/5975	No	No
EXT-003	*SOP for BNA by Separatory Funnel*, Revision 21, 11/18/11	Definitive	Aqueous, PAHs via SIM Extraction	NA	No	No
EXT-001	*SOP for BNA Solids, Revision 18*, 11/18/11	Definitive	Soil, PAHs via SIM Extraction	NA	No	No
WL-057	*Total Organic Carbon (TOC) Soil Samples, Revision 3, 10/11/10*	Definitive[1]	Soil, TOC	Total Organic Carbon Analyzer	No	No

Laboratory Name and Address: Ardaman and Associates, 316 Highlandia Drive, Baton Rouge, LA 70810
Laboratory Point of Contact/Laboratory Director: Robert Werner, rwerner@ardaman.com 225-752-4790

SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to QSM	Modified for Project Work? (Yes/No)
ASTM D422 SOP	*Particle-Size Analysis of Soils*	Screening	Soil, Grain Size	NA	NA	No

Notes:

[1] = Analytical procedure produces definitive results; however, the end use of the data will be used as a screening level tool to assess soil chemistry.
QSM = *Department of Defense Quality Systems Manual for Environmental Laboratories*, Version 4.2, October 2010 (and subsequent revisions)
ASTM = American Society for Standards and Materials
GCAL = Gulf Coast Analytical Laboratory
PAH = Polynuclear aromatic hydrocarbons
SOP = Standard operating procedure
BTEX = Benzene, toluene, ethyl benzene and xylenes
GC/MS = Gas chromatograph/mass spectrometer
NA = Not applicable
SIM = Selective ion monitoring

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 BTEX	CCV	CV daily, before sample analysis, and every 12 hours of analysis time	All targets ≤ 20%D	Repeat initial calibration and reanalyze all samples analyzed since the last successful CV.	Analyst, Supervisor	GCAL SOP GCMSV-003
GC/MS BTEX	ICAL Minimum five-point initial calibration for all analytes	Initial calibration prior to sample analysis and after any routine maintenance (source cleaning, new column, etc.) ro if ICAL fails.	Average response factor (RF) for SPCCs: VOCs ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachlorolethane; ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. RSD ≤30 for RFs of the CCCs; Average RSD ≤ 15% for all compounds, linear or quadratic curve fit with COD ≥ 0.99	Repeat calibration if criterion is not met	Analyst, Supervisor	GCAL SOP GCMSV-003
GC/MS BTEX	Second source CV	Once after each ICAL	All analytes within ± 20% of expected value	Remake standard, recalibrate if necessary	Analyst, Supervisor	GCAL SOP GCMSV-003
GC/MS BTEX	RRT Evaluation	Prior to sample analysis	Set at mid-point of ICAL; +/- 30 seconds each CCV	CCV fails, perform column maintenance, inspect pumps, and leak checks. After instrument correction, repeat ICAL	Analyst, Supervisor	GCAL SOP GCMSV-003

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/MS PAHs via SIM	Breakdown check (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 the breakdown check. No samples shall be run until degradation ≤ 20%.	Analyst, Supervisor	GCAL SOP GCMSSV-004
GC/MS PAHs via SIM	CCV	CV daily, before sample analysis, and every 12 hours of analysis time	All targets ≤ 20%D	Repeat initial calibration and reanalyze all samples analyzed since the last successful CV.	Analyst, Supervisor	GCAL SOP GCMSSV-004
GC/MS PAHs via SIM	ICAL Minimum five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Average response factor (RF) ≥ 0.050 RSD ≤30% for RFs of the CCCs; Average RSD ≤ 15% for all compounds, linear or quadratic curve fit with COD ≥ 0.99	Repeat calibration if criterion is not met	Analyst, Supervisor	GCAL SOP GCMSSV-004
GC/MS PAHs via SIM	Second source CV	Once after each ICAL	All analytes within ± 20% of expected value	Remake standard, recalibrate if necessary	Analyst, Supervisor	GCAL SOP GCMSSV-004
GC/MS PAHs via SIM	RRT Evaluation	Prior to sample analysis	Set at mid-point of ICAL; +/- 30 seconds each CCV	CCV fails, perform column maintenance, inspect pumps, and leak checks	Analyst, Supervisor	GCAL SOP GCMSSV-004
TOC Analyzer	ICAL	As needed	R ≥ 0.995	Correct the problem and repeat ICAL	Analyst, Supervisor	GCAL SOP WL-057

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
TOC Analyzer	ICV	Once after each ICAL, prior to beginning a sample run	±10% of the expected value	Correct problem and rerun ICV. If that fails, correct problem and repeat ICAL.	Analyst, Supervisor	GCAL SOP WL-057
TOC Analyzer	CCV	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	±10% of the expected value	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since the last acceptable CCV.	Analyst, Supervisor	GCAL SOP WL-057
TOC Analyzer	CCB	Immediately following the ICV and CCV	Detection < L C D	Correct problem. Re-prepare and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed.	Analyst, Supervisor	GCAL SOP WL-057

Notes:

GCAL = Gulf Coast Analytical Laboratory
SOP = Standard operating procedure
GC/MS = Gas chromatograph/mass spectrometer
BTEX = Benzene, toluene, ethyl benzene, xylenes
PAH = Polynuclear aromatic hydrocarbons
SIM = Selective ion monitoring
CCV = Continuing calibration verification
CV = Calibration verification
%D = Percent difference
SPCCs = System Performance Check Compounds
ICAL = Initial calibration
%R = Percent recovery
RSD = Relative standard deviation
RFs = Response factors
CCCs = Calibration check compounds
COD = Coefficient of the determination
RRT = Relative retention times
DDT = 4,4'-Dichlorodiphenyltrichloroethane
QC = Quality control
ICV = Initial calibration verification
TOC = Total organic carbon
CCB = Continuing calibration blank

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	Check for leaks, replace gas line filters, recondition or replace trap, replace column, clean injection port/liner	BTEX	Monitor instrument performance via Continuing Calibration Verification	As needed and will be inspected prior to each ICAL.	No maintenance is required as long as instrument QC meets DoD QSM criteria	Replace connections, clean source, replace gas line filters, replace trap, replace GC column, clip column, replace injection port liner, clean injection port, replace Electron Multiplier	Analyst, Supervisor	GCAL SOP GCMSV-003
GC/MS	Check for leaks, replace gas line filters, replace column, clean injection port/liner	PAHs	Monitor instrument performance via Continuing Calibration Verification	As needed and will be inspected prior to each ICAL.	No maintenance is required as long as instrument QC meets DoD QSM criteria	Replace connections, clean source, replace gas line filters, replace GC column, clip column, replace injection port liner, clean injection port, replace Electron Multiplier	Analyst, Supervisor	GCAL SOP GCMSSV-004
TOC Analyzer	Check for gas leaks, top off all liquid levels in water traps, pack and install new combustion tube	TOC	Monitor instrument performance via Continuing Calibration Verification	As needed and will be inspected prior to each ICAL.	No maintenance is required as long as instrument QC meets SOP criteria	Repack Combustion tube, check the level of all liquids in the instrument, run new ICAL	Analyst, Supervisor	GCAL SOP WL-057

Notes:

GCAL = Gulf Coast Analytical Laboratory
SOP = Standard operating procedure
GC/MS = Gas chromatograph/mass spectrometer
BTEX = Benzene, toluene, ethyl benzene, xylenes
PAHs = Polynuclear aromatic hydrocarbons
SIM = Selective ion monitoring
QC = Quality control
DoD QSM = *Department of Defense Quality Systems Manual for Environmental Laboratories*, Version 4.2
TOC = Total organic carbon

SAP WORKSHEET #26: SAMPLE HANDLING SYSTEM

(UFP-QAPP Manual Appendix A)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT	
Sample Collection (Personnel/Organization):	FTL/Resolution Consultants
Sample Packaging (Personnel/Organization):	FTL/Resolution Consultants
Coordination of Shipment (Personnel/Organization):	FTL/Resolution Consultants
Type of Shipment/Carrier:	Overnight via FedEx
SAMPLE RECEIPT AND ANALYSIS	
Sample Receipt (Personnel/Organization):	Sample Receiving Supervisor: GCAL, Ardaman and Associates
Sample Custody and Storage (Personnel/Organization):	Sample Receiving Supervisor: GCAL, Ardaman and Associates
Sample Preparation (Personnel/Organization):	Sample Receiving Supervisor: GCAL, Ardaman and Associates
Sample Determinative Analysis (Personnel/Organization):	Sample Receiving Supervisor: GCAL, Ardaman and Associates
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 Manager: GCAL, Ardaman and Associates
Number of Days from Analysis:	180 Days from Receipt of Samples

***Notes*:**

FTL = Field team leader
GCAL = Gulf Coast Analytical Laboratories

SAP WORKSHEET #27: SAMPLE CUSTODY REQUIREMENTS

(UFP-QAPP Manual Section 3.3.3)

27.1 Sample Nomenclature, Sample Collection Documentation, Handling, and Tracking Procedures

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.

27.1.1 Sample Nomenclature

Sample labeling will be conducted in general accordance with the procedures outlined in Resolution Consultants SOP-3-03A and Worksheet #18. Nomenclature for solid (soil) samples includes the site being investigated, soil boring identification number, sample media, sample depth, and sample type code (i.e., normal, field duplicate, equipment blank, etc.). Nomenclature for aqueous samples includes the site being investigated, monitoring well identification number, sample media, sample date, and sample type code (i.e., normal, field duplicate, equipment blank, etc.). Sample type codes planned for this event will include N for normal samples, FD for field duplicates, and EB for equipment blanks. Field trip blanks will be labeled sequentially followed by the date (i.e., TB-20131213,). Samples to be used for matrix spike (MS) and matrix spike duplicate (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. Worksheet #18 provides anticipated sample identifiers for this scope of work.

27.1.2 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 used 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 field tasks
- 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

27.1.3 Sample Handling and Tracking System

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 SOP-3-03A. All coolers will contain a temperature blank.

Following collection, all samples will be immediately placed on ice in a cooler. The glass sample containers will be enclosed in bubble-wrap in order to protect the bottleware 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 (e.g., FedEx) 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 0 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. Further details on chain-of-custody procedures are provided in SOP-3-03A.

27.2 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 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 Laboratory SOPs (available upon request).

27.3 Laboratory Chain-of-Custody

Laboratory sample custody procedures (receipt of samples, archiving, and disposal) will be used per SOPs (available upon request). 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 PM will notify the Resolution Consultants FTL or project chemist verbally or via e-mail of any problems on the same day that an issue is identified.

SAP WORKSHEET #28: LABORATORY QC SAMPLES TABLE

(UFP-QAPP Manual Section 3.4)

Matrix:	Groundwater, Soil
Analytical Group:	BTEX
Analytical Method/SOP Reference:	SW-846 8260B/ GCAL SOP GCMSV-003

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 preparatory 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). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ (see Box D-1 in DoD QSM).	Correct problem; reanalyze any sample associated with a blank that fails criteria.	Analyst, Supervisor, QA Manager	Bias Contamination	No analytes detected > ½ LOQ and > 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. For common laboratory contaminants, no analytes detected > LOQ (see Box D-1 in DoD QSM).
Surrogates	All field and QC samples	QC acceptance criteria specified in DoD QSM	Reanalyze if sufficient sample is available. If reanalysis confirms failing recoveries, report and narrate.	Analyst, Supervisor, QA Manager	Accuracy Bias	QC acceptance criteria specified in DoD QSM
LCS	One LCS per preparatory batch of 20 or fewer samples per matrix	QC acceptance criteria specified in DoD QSM	Reanalyze all associated samples.	Analyst, Supervisor, QA Manager	Accuracy Bias	QC acceptance criteria specified in DoD QSM
Internal Standards	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard	Inspect MS or GC for malfunctions. Reanalyze all samples with internal standard failures. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of midpoint of ICAL

Matrix:	Groundwater, Soil
Analytical Group:	BTEX
Analytical Method/SOP Reference:	SW-846 8260B/ GCAL SOP GCMSV-003

QC Sample	Frequency & Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicators	Measurement Performance Criteria
MS/MSD	One per preparatory batch of 20 or fewer samples per matrix	For matrix evaluation, use LCS recovery criteria; RPD $\leq$30%.	Contact the client to determine if additional measures are required.	Analyst, Supervisor, QA Manager	Accuracy Bias Precision	For matrix evaluation, use LCS recovery criteria; RPD $\leq$30%.

Notes:

BTEX = Benzene, toluene, ethyl benzene, xylenes
SOP = Standard operating procedure
GCAL = Gulf Coast Analytical Laboratory
QC = Quality assurance
LOQ = Limit of quantitation
QA = Quality assurance
DoD QSM = *Department of Defense Quality Systems Manual for Environmental Laboratories*, Version 4.2
LCS = Laboratory control sample
ICAL = Initial calibration
EICP = Extracted ion current profile
GC/MS = Gas chromatograph/Mass Spectrometer
MS/MSD = Matrix spike/matrix spike duplicate
RPD = Relative percent difference

Matrix:	Groundwater, Soil					
Analytical Group:	PAHs via SIM					
Analytical Method/SOP Reference:	SW-846 8270D/ 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 preparatory 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). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > LOQ (see Box D-1 in DoD QSM).	Correct problem; re-prepare and/or reanalyze any sample associated with a blank that fails criteria.	Analyst, Supervisor, QA Manager	Bias Contamination	No analytes detected > ½ LOQ and > 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. For common laboratory contaminants, no analytes detected > LOQ (see Box D-1 in DoD QSM).
Surrogates	All field and QC samples	QC acceptance criteria specified in DoD QSM	Re-prepare and/or reanalyze if sufficient sample is available. If reanalysis confirms failing recoveries, report and narrate.	Analyst, Supervisor, QA Manager	Accuracy Bias	QC acceptance criteria specified in DoD QSM
LCS	One LCS per preparatory batch of 20 or fewer samples per matrix	QC acceptance criteria specified in DoD QSM	Re-prepare and/or reanalyze all associated samples.	Analyst, Supervisor, QA Manager	Accuracy Bias	QC acceptance criteria specified in DoD QSM
Internal Standards	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard	Inspect MS or GC for malfunctions. Reanalyze all samples with internal standard. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of midpoint of ICAL

Matrix:	Groundwater, Soil
Analytical Group:	PAHs via SIM
Analytical Method/SOP Reference:	SW-846 8270D/ 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/MSD	One per preparatory batch of 20 or fewer samples per matrix	For matrix evaluation, use LCS recovery criteria; RPD $\leq$30%.	Contact the client to determine if additional measures are required.	Analyst, Supervisor, QA Manager	Accuracy Bias Precision	For matrix evaluation, use LCS recovery criteria; RPD $\leq$30%.

Notes:

PAHs = Polynuclear aromatic hydrocarbons
SIM = Selective ion monitoring
SOP = Standard operating procedure
GCAL = Gulf Coast Analytical
QC = Quality assurance
LOQ = Limit of quantitation
QA = Quality assurance
LCS = Laboratory control sample
ICAL = Initial calibration
EICP = Extracted ion current profile
GC/MS = Gas chromatograph /Mass Spectrometer
MS/MSD = Matrix spike/matrix spike duplicate
RPD = Relative percent difference
DOD QSM = *Department of Defense Quality Systems Manual for Environmental Laboratories*, Version 4.2

Matrix:	Soil
Analytical Group:	Total Organic Carbon
Analytical Method/SOP Reference:	SW-846 9060M GCAL SOP WL-057

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 preparatory 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). Blank result must not otherwise affect sample results.	Correct problem; re-prepare and/or reanalyze any sample associated with a blank that fails criteria.	Analyst, Supervisor, QA Manager	Bias Contamination	No analytes detected > ½ LOQ and > 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.
Calibration Blank	After ICV and CCV	Analyte concentration must be < 2X DL	Correct problem, re-prepare, and reanalyze along with all associated samples.	Analyst, Supervisor, QA Manager	Bias Contamination	Analyte concentration must be < 2X DL
LCS	One LCS per preparatory batch of 20 or fewer samples per matrix	%R= 90-110%	Re-prepare and/or reanalyze all associated samples.	Analyst, Supervisor, QA Manager	Accuracy Bias	%R= 90-110%
Sample Duplicate	One per preparatory batch of 20 or fewer samples per matrix	RPD ≤25%	Contact the client to determine if additional measures are required.	Analyst, Supervisor, QA Manager	Accuracy Bias Precision	RPD ≤25%

Notes:

DL = Detection limit
SOP = Standard operating procedure
GCAL = Gulf Coast Analytical
QC = Quality assurance
LOQ = Limit of quantitation
QA = Quality assurance
%R = Percent recovery
ICV = Initial calibration verification
CCV = Continuing calibration verification
LCS = Laboratory control sample
ICAL = Initial calibration
MS/MSD = Matrix spike/matrix spike duplicate
RPD = Relative percent difference

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 (Worksheet #4) 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 Plan Field sampling SOPs Safe work permit forms	Resolution Consultants project file (may include hard copy as well as electronic information).
Analytical Results Documents and Records Sample receipt/log-in forms Sample preparation logs Equipment calibration logs Sample analysis run logs Reported field sample results and raw data Reported results for standards, quality control checks Reported results for standards, quality control samples Data completeness checklists Data validation memoranda	Resolution Consultants project file (may include hard-copy as well as electronic information), long-term data package storage at third-party secure professional document storage firm. Electronic analytical results will be maintained in a database on a Password-protected Structured Query Language server.
Other Documents Health and Safety Plan All versions of Sampling and Analysis Plan All versions of reports (e.g., status reports, investigation report, etc.)	All versions of the subject document and all support documents will be stored in hard-copy in the Resolution Consultants project file and electronically in the server library.
Final Document/Records Repository Administrative Record files (e.g., progress reports, validation reports, investigation report) Site files Post decision Files Analytical data Spatial data Maps	All final documents and records will be stored in accordance with in the Navy's Environmental Restoration Recordkeeping Manual. Resolution Consultants will update and manage the project related documents, data and maps in the Navy's NIRIS data management system.

Notes:

NIRIS = Naval Installation Restoration Information Solution
SOP = Standard Operating Procedures

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
Groundwater	BTEX	See Worksheet #18	SW-846 5030/8260B GCMSV-003	21 Days	GCAL, 7979 GSRI Road, Baton Rouge, LA 70820 Brenda Martinez, 225-769-4900	None
	PAHs via SIM	See Worksheet #18	SW-846 3510C/8270D EXT-003/GCMSSV-004	21 Days	GCAL, 7979 GSRI Road, Baton Rouge, LA 70820 Brenda Martinez, 225-769-4900	None
Soil	BTEX	See Worksheet #18	SW-846 5035/8260B GCMSV-003	21 Days	GCAL, 7979 GSRI Road, Baton Rouge, LA 70820 Brenda Martinez, 225-769-4900	None
	PAHs via SIM	See Worksheet #18	SW-846 3550C/8270D EXT-001/GCMSSV-004	21 Days	GCAL, 7979 GSRI Road, Baton Rouge, LA 70820 Brenda Martinez, 225-769-4900	None
	Total Organic Carbon	See Worksheet #18	WL-057	21 Days	GCAL, 7979 GSRI Road, Baton Rouge, LA 70820 Brenda Martinez, 225-769-4900	None
	Grain Size	See Worksheet #18	ASTM D 422	21 Days	Ardaman and Associates, 316 Highlandia Drive, Baton Rouge, LA 70810 Robert Werner 225-752-4790	None

Notes:

[1] = Laboratory meets accreditation requirements to support project needs.
BTEX = Benzene, toluene, ethylbenzene, xylene
PAH = Polynuclear aromatic compounds
SIM = Selective ion monitoring
GCAL = Gulf Coast Analytical Laboratory
SOP = Standard operating procedure
ASTM = American Society for Standards and Materials

SAP WORKSHEET #31: PLANNED PROJECT ASSESSMENTS TABLE

(UFP-QAPP Manual Section 4.1.1)

Worksheet Not Applicable – No assessments are planned.

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

(UFP-QAPP Manual Section 4.1.2)

Worksheet Not Applicable — No assessments are currently planned.

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 sample delivery group	Within 4 weeks after receiving the data from the laboratory	Project Chemist or Data Validator, Resolution Consultants	TOM, Resolution Consultants; project file
Project Monthly Progress Report	Monthly for duration of the project	Monthly	TOM, Resolution Consultants	Program Manager, Resolution Consultants; NAVFAC SE RPM; project file
Laboratory QA Report	When significant plan deviations result from unanticipated circumstances	Immediately upon detection of problem (on the same day)	Laboratory PM, GCAL	TOM and project file, Resolution Consultants

Notes:

NAVFAC SE	=	Department of the Navy, Naval Facilities Engineering Command, Southeast
PM	=	Project manager
TOM	=	Task order manager
RPM	=	Remedial project manager
QA	=	Quality assurance
GCAL	=	Gulf Coast Analytical

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)	Internal/ External
Verification (Step I) 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.	Laboratory sample custodians and analysts, GCAL and Ardaman and Associates	Internal
Verification (Step I) 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.	Project chemist or data validators, Resolution Consultants	External
Verification (Step I) SAP sample tables	Verify that all proposed samples listed in the SAP tables have been collected.	FTL or designee, Resolution Consultants	External
Verification (Step I) Sample log sheets and field notes	Verify that information recorded in the log sheets and field notes are accurate and complete.	FTL or designee, Resolution Consultants	External
Verification (Step I) Field QC samples	Check that field QC samples, described in Worksheet #12 and listed in Worksheet #20 were collected as required.	FTL or designee, Resolution Consultants	External
Verification (Step I) 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.	Laboratory project manager, GCAL	Internal
Verification (Step I) 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.	FTL, Project chemist or data validators, Resolution Consultants	External
Verification (Step I) Electronic data deliverables	Verify the electronic data against the chain-of-custody and hard copy data package for accuracy and completeness.	Data manager and/or validator, Resolution Consultants	External
Validation (Step IIa) 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.	Project chemist or data validators, Resolution Consultants	External

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/ External
Validation (Step IIa) 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.	Project chemist or data validators, Resolution Consultants	External
Validation (Steps IIa/IIb) 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.	Project chemist or data validators, Resolution Consultants	External
Validation (Steps IIa/IIb) 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/LCSDs. Ensure compliance with the precision goals listed in Worksheet #12 and 28.	Project chemist or data validators, Resolution Consultants	External
Validation (Steps IIa/IIb) Sample results for representativeness	Check that the laboratory recorded the temperature at sample receipt and the pH of the chemically preserved samples to ensure sample integrity from sample collection to analysis.	Project chemist or data validators, Resolution Consultants	External
Validation (Steps IIa/IIb) 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 chemist or data validators, Resolution Consultants	External
Validation (Steps IIa/IIb) 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.	Project chemist or data validators, Resolution Consultants	External
Validation (Steps IIa/IIb) 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.	Project chemist or data validators, Resolution Consultants	External
Validation (Step IIb) 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.	Project chemist or data validators, Resolution Consultants	External
Validation (Step IIb) Project quantitation limits for sensitivity	Ensure that the project detection limits were achieved.	Project chemist or data validators, Resolution Consultants	External

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/ External
Validation (Steps IIa/IIb) Soil and Groundwater — BTEX	Assess BTEX data using SW846 8260B method-specific criteria, the DoD QSM, and those listed in Worksheets # 12, 19, and 28. *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, (October 1999) will be used to apply qualifiers to data.	Project chemist or data validators, Resolution Consultants	External
Validation (Steps IIa/IIb) Soil and Groundwater — PAHs via SIM	Assess PAHs via SIM data using SW846 8270D method-specific criteria, the DoD QSM, and those listed in Worksheets # 12, 19, and 28. *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, (October 1999) will be used to apply qualifiers to data.	Project chemist or data validators, Resolution Consultants	External
Validation (Steps IIA/IIb) Soil - TOC	Assess TOC data using SW846 9060 method-specific criteria and those listed in Worksheets # 12, 19, and 28. *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, (October 1999) will be used to apply qualifiers to data.	Project chemist or data validators, Resolution Consultants	External

Notes:

IIa	=	Compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.]
IIb	=	comparison with measurement performance criteria in the SAP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005]
SAP	=	Sampling and analysis plan
FTL	=	Field team leader
QC	=	Quality control
RPD	=	Relative percent difference
MS/MSD	=	Matrix spike/Matrix Spike duplicate
LCS/LCSD	=	Laboratory control sample/laboratory control sample duplicate
SOP	=	Standard operating procedure
BTEX	=	Benzene, toluene, ethyl benzene, xylenes
DoD QSM	=	*Department of Defense Quality Systems Manual for Environmental Laboratories*, Version 4.2
U.S. EPA	=	U.S Environmental Protection Agency
PAH	=	Polynuclear aromatic hydrocarbons
SIM	=	Selective ion monitoring
TOC	=	Total organic carbon
GCAL	=	Gulf Coast Analytical Laboratory

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. 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 — 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, the TOM will consult with the Navy RPM and other project team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions.

- Precision — 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 — 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, matrix spike, matrix spike duplicate, and laboratory control samples to accuracy goals identified in Worksheet #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 may 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. Although rejected data will generally not be used, there may be reason to use them in a weight-of-evidence argument, especially when they supplement data that have not been rejected. If rejected data are used, their use will be supported by technically defensible rationales.

For statistical evaluations, non-detected values will be represented by a concentration equal to one-half the limit of detection.

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
Resolution Consultants Project Personnel Resumes

Benjamin J. Brantley, PG

Sr. Scientist

Professional History

Education

M.S., Geological Sciences, University of Memphis, 1990
B.S., Geological Sciences, University of Memphis, 1984

Professional Registrations

Professional Geologist:
North Carolina, 1332
Virginia, 2801 001011
Georgia, 1051
Florida, 2412

Publications

Brantley, B., & Chung, W. Y. (1989, December). The 1984 Southern Yellow Sea earthquake of eastern China: Source properties and seismotectonic implications for a stable continental interior, Bull. Seismological Society of America. 79, pp. 1863 – 1882.

Brantley, B., & Chung, W. Y. (1991). Body-wave waveform constraints on the source parameters of the Yangjiang, China, earthquake of July 25, 1969: A devastating earthquake in a stable continental region, Pure and Applied Geophysics, 135(4). pp. 529 – 543.

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Brantley, B., Chung, W. Y., & Johnston, A. C. (1988). Source mechanisms, surface rupture, and relative location of the January 22, 1988 Tennant Creek earthquakes, central Australia, (abstract), EOS, American Geophysical Union, 69, 1301.

Brantley, B., & Chung, W. Y. (1991). Source parameters of six major earthquakes in and near the stable continental region of eastern China, (abstract), Seism. Res. Letters, 62, 163-164.

Brantley, B., Chung, W. Y., & Wei, B. Z. (1992). A re-examination of the source mechanisms of the Liyang, China, earthquakes of 1974 and 1979 from regional and teleseismic waveform data, [Abstract]. EOS, Trans. Am. Geophysical Union, 73(43), 354.

Mr. Brantley has 21 years of environmental experience, managing investigations across the southeastern U.S. He has extensive working knowledge from innovative approaches to site assessments through the completion of corrective action. Currently he's managing the corrective action and long-term monitoring at Naval Support Activity (NSA) Mid-South. He also has extensive experience monetizing cleanup cost at naval facilities and providing early transport support to the Navy in its negotiations with developers and the community. Mr. Brantley also has managed both state and federal Superfund sites and Brownfield redevelopment projects for industrial clients.

Experience

Corrective Measures/LTM, NSA Mid-South (2006-Present); Millington, Tennessee

Role: Task Order Manager

As a project manager for remediation and effectiveness long-term monitoring (LTM), he is responsible for managing Area of Concern (AOC) A and Solid Waste Management Units (SWMUs) 14, 39, and 2. Since these sites are on the active and transferred sections of the installation, the work is under contract with Naval Facilities Engineering Command (NAVFAC) Mid-West and NAVFAC Base Realignment and Closure (BRAC) PMO-SE. Three of the four sites are undergoing active remediation as interim corrective measures that Mr. Brantley manages. An anaerobic/aerobic (A-A) system has been designed to treat trichloroethylene (TCE) contamination in a relatively deep aquifer. The A-A system creates an anaerobic zone in the upgradient portion of the source area while naturally aerobic conditions are present in the downgradient portion of the aquifer. The anaerobic environment is achieved through monthly injections of sugar and nutrients (sodium acetate and ammonium phosphate), creating conditions conducive to TCE degradation. The aerobic sections of the aquifer naturally degrade the TCE daughter products (i.e., cis-1,2-DCE and vinyl chloride). Greater than 90% TCE mass reduction has been achieved in the treatment areas. The work entails project planning, staffing, developing sampling and analysis plans, coordinating quarterly sampling events, preparing annual progress reports, hosting semiannual partnering meetings, and negotiating with state and federal regulators. EnSafe also provides overall guidance and supervision to the 8(a) protégée firm that is responsible for data validation and maintaining the groundwater remedial systems for AOC A and SWMUs 14 and 39.

Dry Cleaners Assessment and Remediation (2006-Present); Orlando, Florida

Role: Project Geologist

Responsible for interfacing with the Florida Department of Environmental Protection (FDEP) as well as implementation of project planning, site assessment, and groundwater remediation of perchloroethylene (PCE) through use of in situ chemical oxidation for treating the source area beneath a laundry. Source definition through use of high-resolution volatile organic compound screening tools enabled the strategic placement of oxidant, ensuring a cost-effective and quick remediation. The site is currently in a monitoring-only phase and is anticipated to undergo closure in 2010.

Investigation/O&M, Barmet Aluminum (1995-Present); Island, Kentucky
Role: Project Geologist
Project geologist and operations and monitoring (O&M) manager for this National Priorities List (NPL) site in western Kentucky where aluminum dross (salt cake fines) was landfilled in a former coal strip-mine pit. Project responsibilities included site characterization, report preparation, regulatory interfacing, and successfully classifying site's groundwater as Class III (non-potable) per federal classification criteria.

Premcor Petroleum (2001-Present); Memphis, Tennessee
Role: Project Geologist
Project geologist for long-term monitoring at the Premcor distribution facility and refinery (formerly owned by Williams). Responsibilities include peer reviewing, work plan and report preparation, and providing ongoing hydrogeologic support.

RI and Brownfield Redevelopment, Timminco Corp. (2002-Present); Memphis, Tennessee
Role: Project Geologist
Project geologist and manager for remedial investigation (RI) at ferrochrome production facility. Responsibilities included evaluation of the extent of metals contamination in soil, surface, and groundwater; report preparation; and regulatory interface. Site was successfully de-listed from the Tennessee's Superfund list and is currently being evaluated as a proposed Class III construction/demolition debris landfill as part of a Brownfield redevelopment. Pending political rezoning hurdles from the local government, the site has the potential to be one of the first redevelopments of a former Superfund site through Tennessee's Brownfield program.

Early Transfer Support, NAVFAC Southeast (2001-2008); Multiple Locations
Role: Task Order Manager
Task order manager responsible for supporting Naval Facilities Engineering Command's (NAVFAC) Early Transfer Hub in its facilitation of early transfers of closed naval facilities to local communities. An important step in the early transfer process is preparing and/or validating environmental cleanup estimates for these facilities and ensuring that "buyout" offers are good deals for both the Navy and the community. By considering the developer's cleanup cost-savings conducted with redevelopment, the Navy was able to optimize its payout to the Port of Stockton, leading to the successful early transfer of Naval Computer & Telecommunications Station Stockton and substantial savings to the Navy. Cost-to-complete estimates in anticipation of early transfer have also been developed/validated for BRAC and non-BRAC facilities and include the Hunter's Point Naval Shipyard, the Alameda Naval Air Station, and Naval Station Treasure Island. Other services provided to the Hub are development of early transfer documents (early transfer point papers, Environmental Services Cooperative Agreements, disposal schedules), developing early transfer guidance, fact sheets, briefing presentations recommending early transfer, and providing quick turn-around technical support to the hub. Project management responsibilities include proposal presentation, budgeting, cost-tracking, invoicing, report generation, and client/agency liaison.

RFI, NSA Mid-South (1994-2006); Millington, Tennessee
Role: Lead Project Geologist
Lead project geologist for the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) and responsible for preparation of RFI work plan, implementation, and authored RFI reports for multiple SWMUs with a variety of contaminants including chlorinated solvents, metals, and petroleum hydrocarbons. Responsibilities included conducting aquifer pumping tests, developing hydrogeologic conceptual models, and groundwater modeling and interfacing with the U.S. Environmental Protection Agency and the Tennessee Department of Environment and Conservation (TDEC). Also served as task order manager for two underground storage tank (UST) sites that involved site characterization, corrective action, and quarterly monitoring in accordance with TDEC's UST Division. Responsibilities include budget and resource allocation, technical peer review, and client and regulatory interfacing.

Dry Cleaners Environmental Response Program (1998-2001); Memphis, Tennessee
Role: Project Manager
Project manager for investigating PCE contamination in soil and groundwater at abandoned dry-cleaning facility. Managed O&M of a soil-vapor extraction system and developed and implemented approach to groundwater investigation for site.

RI/FS, Naval Air Station Pensacola (1993-1994); Pensacola, Florida
Role: Project Geologist
Project geologist responsible for implementation of remedial investigation work plan and subsequent RI/feasibility study (FS) report preparation.

MAPCO Petroleum (1991-1992); Memphis, Tennessee
Role: Project Manager/Geologist
Project manager/geologist for contamination assessments at several service stations across west Tennessee and eastern Arkansas. Responsibilities included proposal preparation, budget-tracking, report preparation, and regulatory and client interface.

Tina Cantwell, CHMM

Sr. Technical Specialist

Professional History

Education

B.S., Chemistry (Environmental Science Minor), University of Michigan, 1986
Graduate Certificate, Hazardous Materials Management, Wayne State University, 1993

Professional Registrations

Certified Hazardous Materials Manager, #4232, 1993

Training and Certifications

OSHA Hazardous Waste Operations and Emergency Response

Ms. Cantwell has experience in environmental chemistry, federal and state environmental regulations, remedial investigations (RIs), soil and groundwater contamination assessments, project coordination, Quality Assurance Project Plan (QAPP) preparation, data interpretation, and data validation. She has worked under the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), the Superfund Amendments and Reauthorization Act, and the Clean Water Act. Ms. Cantwell has performed chemical analysis using U.S. Environmental Protection Agency (USEPA) methodology. In addition, she has been responsible for laboratory data validation to determine whether analytical data for organics, inorganics, pesticides, and polychlorinated biphenyls (PCBs) were generated within USEPA Solid Waste-846 and Contract Laboratory Program (CLP) method guidelines. Her data validation experience includes USEPA Regions 1, 2, 3, 4, 5, and 6. She has also validated data using New York, New Jersey, and U.S. Department of Defense (DOD) protocols.

Experience

Laboratory Data Validation for Sites throughout the United States (1987-Present)
Role: Chemist
Responsible for laboratory data validation to determine whether analytical data for organics, inorganics, and pesticides/PCBs were generated within USEPA SW-846 and CLP method guidelines. In this capacity, data are assessed as compliant or noncompliant by examining blank contamination, matrix interference, calibration curves, sample holding times, chromatogram, and other QC information generated by the laboratory. CLP data validation experience includes Regions 1, 2, 3, 4, and 5. Validated data using New York, New Jersey, Texas (TRRP-13), and DOD protocols.

Field Analysis of Environmental Samples Remedial at Sites throughout the U.S. (1989-Present)
Role: Field Analytical Support
Field analytical support for numerous sites including major automobile manufacturers, manufacturing plants, Superfund sites, military facilities, State of Michigan Bond sites, and an abandoned electrical transformer site. Designed, implemented, and trained support personnel for field analytical programs used to identify contaminated areas of the sites. Results of these analyses are used to assess the intensity of contaminants, to estimate the vertical and horizontal extent of contamination, to set monitoring well screens at the highest zones of contamination during drilling operations, and to select samples for shipment to analytical laboratories. Typical analytical instrumentation included Hewlett Packard Model 5890 GC, Varian Model 3900 GC, Photovac Model 10S50 GC, Teckmar LSC 2000 purge-and-trap units, water quality test kits by HACH, and immnoassay test kits by Millipore and EnSys.

Helena Chemical Corp., National Priorities List Site (1997-Present); Tampa, Florida
Role: Quality Assurance Officer/Chemist
QA officer and consulting chemist for three pilot-scale studies for anaerobic bioremediation of xylene and benzene hexachloride (BHC) isomers in groundwater. Studies include injection of electron acceptors, and biotic/abiotic remediation of BHCs in low-pH groundwater through injection of carbon substrate and zero-valent iron. Assisted project engineer in establishing data quality objectives and groundwater monitoring program to gauge progress of pilot testing. Authored investigation and remediation pilot study pilot QAPPs, consulted on chemical fate and transport mechanisms, and reviewed analytical data for compliance with site-specific record of decision goals.

Kayser Roth Corp., Stamina Mills National Priorities List Site; (2002-Present); North Smithfield, Rhode Island
Role: Quality Assurance Officer/Chemist
QA officer and consulting chemist at this NPL site currently undergoing chlorinated solvent mass removal in groundwater. Contributed to the investigation design that included soil gas, near-slab, sub-slab, indoor air, and ambient air samples in 100+ year-old residences. Prior to sampling, developed data quality objectives and a decision framework for assessment to facilitate data evaluation.

Soil Removal, Former Pesticide Formulation Facilities; Fairfax and Cameron, South Carolina, and Enfield, North Carolina (2008)
Role: Quality Assurance Officer
Multimillion-dollar pesticide soil removal actions were conducted to excavate and remove source contaminants down to a total pesticide level of 50 parts per million. To

achieve these goals, field screening of soil using a mobile laboratory and toxaphene immunoassay test kits were used during excavation to determine whether contamination was removed. Responsibilities included mobile laboratory oversight, confirmation laboratory coordination, and training EnSafe personnel on immunoassay test kit operation.

Louisville District, U.S. Army Corps of Engineers; Multiple Locations

Role: Project Chemist/Quality Assurance Officer

Served as project chemist and quality assurance (QA) officer for three U.S. Army Corps of Engineers (USACE) projects:

- CERCLA SI for the former Nike Missile Site CL-48 in Garfield Heights and Independence, Ohio (2008-Present); and
- SI for the Former Skeet and Trap Ranges, Proposed U.S. Army Reserve Center, Vance Air Force Base, Enid, Oklahoma (2007-2008).
- CERCLA Site Inspection (SI) and RI for the former Nike Missile Site C-41 in Chicago, Illinois (2006-Present);

Authored the Data Quality Objectives report and QAPP for all three sites. Contracted and coordinated primary and QA laboratories and ensured both laboratories conformed to the DOD Quality Systems Manual (QSM). Performed data verification using USACE's Automated Data Review software in accordance with USACE's Laboratory Chemistry Guidelines and DOD QSM. Coordinated third-party 10% data validation. Authored the Data Verification/Validation reports in accordance with Louisville DOD QSM Supplement (March 2007) with minimal comments from USACE.

Municipal Landfill Monitoring, Naval Security Group Activity (2000-2002); Sabana Seca, Puerto Rico

Role: Project Manager

Ms. Cantwell served as project manager for the municipal landfill monitoring study performed for Atlantic Division (LANTDIV) Naval Facilities Engineering Command. The objectives of this study were to assess whether landfill runoff impacted Navy property; other sources besides the landfill contributed to surface water contamination; leachate impacted adjacent wetland areas; the leachate collection system was capable of controlling leachate flow; and, the landfill met applicable solid waste regulations. She also reviewed historical documentation and landfill drawings, coordinated all project phases, interpreted results, and authored the site work plan and final report.

Terminix (2000-2001); San Bernardino, California

Role: Quality Assurance Officer

QA officer for a $2 million remediation project for a Terminix branch closure, responsible for storage and daily management of chlorinated pesticide mixtures resulting in accumulation and migration of chlorinated pesticide constituents in soil on the subject property and a neighboring elementary school. Project activities consisted of preliminary site screening evaluations, site remediation that included excavation and offsite disposal of 8,790 tons of nonhazardous and California-hazardous soil from the elementary school and Terminix properties, site restoration, and a groundwater investigation. Remediation required rapid excavation, sampling, and analysis to assess whether contaminated soils had been removed. Assessed analytical data against cleanup standards and directed sampling and excavation activities during the removal action. Authored the project QAPP and coordinated sampling and laboratory activities.

Clean Closures of Parcels, LANTDIV (1995-2000); Naval Base Norfolk, Virginia

Role: Senior Chemist

Ms. Cantwell served as senior chemist on three parcels of property on which clean closure is sought. She assisted with project planning and closure plans, negotiated clean closure detection goals with regulators, and selected laboratories to meet closure requirements.

Davis Liquid Landfill (1997-1998); Smithfield, Rhode Island

Role: Project Chemist

As project chemist for soil and groundwater remedial design/remedial action at site that received chemical wastes, municipal solid wastes, and an estimated 30 million automobile tires, Ms. Cantwell's activities included onsite volatile organic chemical screening during excavation and disposal of hazardous and municipal solid wastes and laboratory coordination. She also coordinated laboratory subcontractors, managed analytical data, and validation efforts.

U.S. Navy Projects

Role: Quality Assurance Manager

NSA Mid-South	TN (1994-Present)
NAS Pensacola	FL (1998-2009)
NWIRP Dallas	TX (1994-2005)
NAS Corpus Christi	TX (1996-2003)
Libertyville Training Site	IL (1997-2002)
NAS Glenview	IL (1995-2001)
NAS Dallas	TX (1994-1999)
NAVBASE Charleston	SC (1994-1999)
NAS New Orleans	LA (1995-1998)
NOS Louisville	KY (1995-1996)
NAVBASE Mayport	FL (1994)

Ms. Cantwell served as QA Manager for various projects under the Comprehensive Long-Term Environmental Action Navy (CLEAN) program with Naval Facilities Engineering Command Southeast. Responsibilities included overseeing proper project performance in accordance with the requirements of the Naval Energy and Environmental Support Activity (now Naval Facilities Engineering Service Center).

John Knopf, CSP

Program SH&E Manager

Professional History

Education

AAS, Occupational Safety and Health, Trinidad State Junior College, 2008

Professional Registrations

Certified Safety Professional (CSP), No. 21296, Board of Certified Safety Professionals, 2009
Occupational Health and Safety Technologist (OHST), No. 2531, Board of Certified Safety Professionals, 2002

Training and Certifications

Hazardous Material Incident Management Series, US Fire Academy, Mississippi State Fire Academy, 1996-1997
OSHA 501 General Industry Trainer Course OSHA Training Institute, Kansas City, MO, 1998
OSHA 510 Occupational Safety and Health Standards for the Construction Industry, Texas A&M Engineering Extension Service, 2001
OSHA 500 Trainer Course for The Construction Industry, OSHA Training Institute, 2001
OSHA 521, OSHA Guide to Industrial Hygiene, Texas A&M Engineering Extension Service, 2002
OSHA 503, Update for General Industry Outreach Trainers, OSHA Training Institute, 2002
40-Hour Hazardous Waste Operations and Emergency Response

Mr. Knopf, EnSafe's Corporate Health and Safety (H&S) manager, has 19 years' experience in the H&S field. A Certified Safety Professional, Mr. Knopf, is a member of the American Society of Safety Engineers. He is a United States Marine Corps veteran.

Experience

H&S, EnSafe, Safety Management System (SMS) Development (2010-present); Various
Role: Corporate H&S Manager
Reviewed and revised the pre-existing Corporate Health and Safety Program to exceed requirements of OSHA and pursue the more stringent requirements of OHSAS 18001.

Program/Contract H&S Manager, Tennessee Department of Transportation (2009-present)
Role: Program H&S Manager
Developed Programmatic H&S plan for contract; evaluated JHAs; provided senior review of safety documentation; performed surprise safety audits of project work sites throughout the State of Tennessee.

HAZWOPER Emergency Response Training, Various (1997 – 2012); Various
Role: Health & Safety Instructor
Principal instructor and course material author for 24-hour Technician (29 CFR 1910.120[q]), 40-hour General Worker, and Incident Commander HAZWOPER courses (>100) for multiple employers and clients.

Health and Safety Plan (HASP) Development, (2005 – 2012) Various
Role: HASP Development Lead
As the Corporate H&S Manager for multiple environmental remediation and consulting firms, charged with the development and implementation of project specific HASPs (>150) for jobsites across the United States.

Decommissioning and Redevelopment, Carrier Corporation, (2010-2012); Syracuse, NY
Role: HASP Development Lead & H&S Manager
Directed development of multiple Site HASPs and served as overall project H&S manager for facility decommissioning and redevelopment activities.

Construction Safety Oversight and Auditing, (1997-2012); Various
Role: H&S Oversight
Served as H&S oversight of various construction jobs both internal and external for employers and clients. Projects have varied from steel building construction to chemical tank farm construction.

OSHA Compliance Training, (1993-2012); Various
Role: Principal Instructor
Principal instructor and course material author for various 29 CFR 1910 (General Industry) and 1926 (Construction Industry) courses for multiple employers and clients.

IH Asbestos Abatement, TDOT (2008-2012);, Various
Role: HASP Development Lead
Developed Site HASPs and performed duties of project H&S manager for asbestos abatement projects for TDOT.

IH Asbestos Abatement, (2007-2012); Various
Role: HASP Development Lead
Developed Site HASP and performed duties of project H&S manager for various asbestos abatement projects to include Housing and Urban Development (HUD) apartment complexes and multi-story office buildings.

General Industry Safety Oversight and Auditing, (1993-2012); Various
Role: H&S Oversight
Served as H&S oversight of various industrial jobsites both internal and external for employers and clients. Performed

jobsite compliance audits and issued executive summary reports based upon those findings.

Machine Guarding Assessments, (1993-2012); Various
Role: H&S Manager
Conducted facility-wide machine guarding assessments for various employer and client facilities.

Lockout Tagout Assessments, (1993-2012); Various
Role: H&S Manager
Conducted facility-wide lockout tagout assessments for various employer and client facilities.

UXO HASP Development, (2007-2010); Various
Role: HASP Development Lead
As the Corporate H&S Officer for various environmental remediation companies, authored and implemented HASPs for various unexploded ordinance (UXO) affected jobsites for both commercial as well as government jobsites.

Natural Disaster Response, (2010); United States Naval Personnel Command, Millington, TN
Role: H&S Manager
Served as base subcontractor H&S manager for emergency flood recovery efforts. Served as liaison between primary rebuild contractor (Fluor) and NAVFAC personnel.

H&S, Tennessee Department of Transportation (TDOT), Programmatic Planning and Development (2010);
Role: H&S Manager
Developed Programmatic Health and Safety Plan (PHASP) for all field activities performed at TDOT facilities and rights-of-way (ROWs) under state-wide contract. PHASP was designed to provide guidance for compliance with all applicable Tennessee Occupational Safety and Health Administration (TOSHA) requirements.

H&S, Terex Corporation, Safety Management System (SMS) Development (2010)
Role: H&S Manager
Developed SMS elements for Terex Corporation Field Service Group and North American Distribution Warehousing. SMS elements were designed to provide guidance for compliance with all applicable Occupational Safety and Health Administration (OSHA) requirements for Terex Corporation Warehousing and Field Service Groups.

IH Mold Remediation and Prevention Services; (2009); United States Army, Fort Polk, LA
Role: HASP Development Lead & H&S Manager
Developed Site HASP and served as project H&S manager for mold remediation and prevention activities on U.S. Army barracks at Fort Polk.

Decommissioning H&S, Kidde Residential and Commercial; (2007-2008); Various
Role: HASP Development Lead
Developed Site Decommissioning HASPs and served as project H&S manager for multiple facility decommissioning activities.

H&S, Ops Contracting Services, LLC, Safety Management System (SMS) Development (2006); Various
Role: H&S Manager
Developed SMS for all company H&S activities. SMS was designed to provide guidance that exceeds applicable Occupational Safety and Health Administration (OSHA) requirements for a diverse environmental remediation and industrial service firm.

Petrochemical Safety Officer, (1993 - 2006); Various
Role: Lead Safety Officer
Responsible for Oil Spill Response Organization (OSRO) emergency response activities governed by the Oil Pollution Act of 1990 (OPA90) for various employers and clients. Activities varied from pipeline spills, highway transportation incidents, and inland navigable waterway spills.

Natural Disaster Response, (2005); Hurricane Katrina Impact Zone
Role: Safety Officer
Served as safety officer for multiple jobsites in response to Hurricane Katrina recovery efforts. Jobsites varied from petrochemical recovery, HUD reconstruction to Federal Aviation Administration (FAA) radar site restoration efforts.

Other Experience

Role: Corporate Health and Safety Officer
Dates: 2006 to 2010
Company: Ops Contracting Services, LLC

Role: Emergency Response Supervisor/Regional Safety Officer
Dates: 2005 to June 2006
Company: Hepaco, Inc.

Role: Regional Safety Coordinator
Dates: 2000 to 2005
Company: Ergon Inc.

Role: Facility Safety Coordinator
Dates: 1993 to 2000
Company: Ergon Inc.

Role: Meteorologist
Dates: 1990 to 1998
Company: United States Marine Corps

Chad H. Tripp, EI

Staff Engineer

Professional History

Education

BS, Environmental Science, Hydrology concentration, North Carolina State University, 1999
BS, Civil Engineering, The Citadel, 2010

Professional Registrations

Engineer-in-Training, South Carolina, #17909, 2010

Professional Affiliations

American Society of Civil Engineers
Society of Military Engineers
Local Emergency Planning Committee of Charleston County

Training and Certifications

40-Hour Hazardous Waste Operations and Emergency Response Training
Eight-Hour Refresher Training
Asbestos Hazard Emergency Response Act-Certified Asbestos Inspector
South Carolina Erosion Prevention & Sediment Control Inspector
American Red Cross Cardiopulmonary Resuscitation and First-Aid Training
ITRC -Various Technical Workshops (in situ bioremediation, permeable reactive barriers, vapor intrusion

Awards

2007 Environmental Category Award, American Council of Engineering Companies of South Carolina Engineering Excellence competition (Team Award)

Mr. Tripp has 13 years of experience in all phases of environmental assessment and remediation for federal, state, and industrial clients. He has in-depth knowledge of leading technology tools to collect, compile, analyze, and present environmental and engineering data, such as EarthSoft EQuIS, ESRI ArcGIS and EPA ProUCL. Mr. Tripp's experience includes preparation of work plans, finding reports, conceptual site models, feasibility studies, cost estimates, proposals, QAPPs and HASPs for CERCLA Superfund, RCRA, NC, SC, FL, GA and NJ led projects. As a field engineer, Mr. Tripp has been involved in numerous sampling programs, rapid subsurface assessments with direct push technology (DPT), passive soil gas studies, in-situ bioremediation injections, and contaminant source excavations. Mr. Tripp's current project management experience includes a multi-million dollar CERCLA Superfund site remediation in Charleston, SC.

Experience

Phase I ESAs, Multiple Clients; 2011-Present; SC, GA, NC
Role: Phase I ESA Assessor
Performed due-diligence Phase I ESAs for real estate transactions at numerous manufacturing facilities and commercial properties in accordance with the ASTM standard. Phase I ESAs included historical and regulatory research, evaluation of state and federal environmental databases, visual reconnaissance of the property to document indications of potential environmental impairment and regulatory compliance issues, and report preparation.

Assessment and Remediation, Former Manufacturing Facility; 2010-Present; Mebane, NC
Role: Engineer
Performed a passive soil gas survey, and groundwater and soil sampling to delineate source areas responsible for chlorinate solvent impact soil and groundwater in accordance to the NCDENR Recognized Environmental Consultant Program. Authored the Underground Injection Control permit application, and sections of the Remedial Action Plan for treatment of impacts via in-situ bioremediation/enhanced reductive dechlorination.

Assessment and Remediation, South Carolina DHEC; 2010-2012; Statewide
Role: Engineer
Engineer for on-call environmental services contract under the South Carolina Department of Health and Environmental Control (SCDHEC) Bureau of Land and Waste's Site Assessment and Remediation Section. Plan and execute response actions as requested by the state's regulatory authority. Typically, sites are high priority and involve significant risk to human health and the environment. Schedules are expedited to ensure that these risks are mitigated promptly. Planned, implemented, and reported findings of soil and groundwater assessments at residential developments and brownfields to identify sources of chlorinated solvent contamination. Prepared a feasibility study and implemented a remedial injection to treat chlorinated solvents via in-situ bioremediation/enhanced reductive dechlorination processes. Responsible for remedial performance monitoring and reports.

Decommissioning, Assessment, and Remediation, Continental Tire; 2008-2012; Charlotte, NC
Role: Engineer, Data Manager, and Task Manager
Engineer, lead data manager, and task manager for the environmental decommissioning, assessment, and remediation at Continental Tire's former manufacturing headquarters. Decommissioning tasks involve permit closure and removal and confirmatory sampling of numerous underground and aboveground storage tanks, wash racks,

wastewater units, storm water retention ponds, pump stations, and rail off-loading areas. During the decommissioning process, historical releases were noted at several areas and initial actions, including product recovery and limited soil removal, were performed to mitigate hazards and eliminate continuing source areas. Contaminants of concern at the site include petroleum constituents, solvents, and metals. Soil and groundwater were assessed in compliance with applicable North Carolina Department of Environment and Natural Resources regulations. Remedial activities, including dig and haul, institutional controls, groundwater monitoring, and LNAPL recovery are currently under way. Prepared progress reports for NCDENR and client, monitoring reports, NAPL volume assessments, excavation volume calculations, correction action and feasibility study documents.

Superfund Remediation, Macalloy NPL Site; 2004-2012; Charleston, SC
Role: Project Manager
Project manager for the CERCLA assessment and remediation of a 147-acre ferrochromium alloy manufacturing plant contaminated with hexavalent chromium. Mr. Tripp has advanced upward through several roles over the duration of the Macalloy Superfund site project: task manager, site coordinator, prime site manager, and currently the project manager. The innovative, fast-track remedy treated 200,000 cubic yards of contaminated soil and a 15 acre groundwater plume with ex situ chemical mixing and in situ chemical injection and trenching. The site, due to its waterfront location, is a critical component of a redevelopment plan intended to promote sustainable development and stimulate economic growth to a once dilapidated area. The site was identified as the 1,000th "construction complete" Superfund site at a USEPA-led ceremony. Based on achievements, the project was awarded top American Council of Engineering Companies awards in Tennessee (2006) and South Carolina (2007). Mr. Tripp was responsible for management, implementation, or oversight of personnel and contractors for soil and sediment excavation, and construction of 1000+ feet of permeable reactive barriers (PRBs) that have successfully reduced hexavalent chromium concentrations in the subsurface to below remedial goals. Mr. Tripp has authored multi-matrix monitoring reports, an EPA Five-Year Review, groundwater optimization plans, Tidal Creek Cap Repair Work Plan, and supplemental injection work plan and completion report, sections of the Final Remedial Action Report. Routinely interacts with stakeholders, and federal and local government agencies for environmental permit applications, progress reports, and site inspections. Currently long term effectiveness monitoring shows the groundwater plumes have been reduced by over 98%.

Open burning/Open detonation Unit; Naval Weapons Station Charleston; 2008; Goose Creek, SC
Role: Site Manager
As the site manager, planned for and coordinated the removal of deactivated bombs at a former open burning/open detonation unit used for the training personnel on de-arming bombs and explosives. Authored the final removal report for the Navy.

RCRA Hazardous Waste Permit Application, Navy Shipyard Norfolk; 2007; VA
Role: Technical support
Co-author and technical support for the hazardous waste permit application incorporating modified waste management procedures and a new application format. Reviewed the existing permit for inefficiency, interviewed shipyard personnel to document waste management procedures, and submitted the Part A and B permit renewal application.

Naval Air Station; 2004-2005; Pensacola, FL
Role: GIS Analyst
GIS database manager and analyst for the Naval Air Station Pensacola wetlands Site 41 CERCLA RI. Designed and built a comprehensive, site-wide GIS database containing analytical and spatial data. Performed data analysis to identify locations that exceeded remedial goal concentrations. Data migration from various historical data management software.

Other Experience

Role: Environmental Scientist/GIS Analyst
Dates: December 2003-Present
Company: EnSafe Inc.

Role: Staff Scientist
Dates: January 2003- December 2003
Company: South Carolina Department of Natural Resources

Role: Environmental Scientist/ GIS Analyst
Dates: May 1999- January 2003
Company: RETEC

Role: GIS Specialist
Dates: June 1998- May1999
Company: Town of Chapel Hill Engineering Department

David A. Warren, PG

Sr. Technical Specialist

Professional History

Education

B.S., Environmental Sciences-Geology, University of Virginia, 1998
Graduate Coursework, Geology, University of Oregon, 2004-2005

Professional Registrations

Registered Professional Geologist, Tennessee
AHERA Asbestos Inspection and Assessment

Professional Affiliations

Local Emergency Planning Committee of Charleston County - Vice Chairman, 2006/2007, Chairman, 2007/2008
United States Coast Guard- Charleston Sector Area Committee Member, 2008-2009
Charleston Chamber of Commerce- Environmental Committee Member, 2008-2009
Groundwater Professionals- Carolinas Section
Association of Engineering Geologists
Association of Environmental Professionals
Interstate Technology and Regulatory Council
Partners in Environmental Technology- Strategic Environmental Research and Development Program Member, 2004-2009
Pope Air Force Base Tier I Partnering Team, 2002-2006
Seymour Johnson Air Force Base Tier I Partnering Team, 2002-2006
University of Virginia Council on Sustainable Growth

Training and Certifications

Hazardous Waste Training (OSHA CFR 29:1910:120)
8-Hour OSHA Site Supervisor Training Course
Red Cross First Aid/CPR

Publications

USEPA Remediation Technology Development Forum — Light Non-Aqueous-Phase Liquid Recoverability, 2008
ITRC — Various Technical Workshops (landfill caps, munitions and firing ranges, in situ chemical oxidation, permeable reactive barriers, phytotechnology, etc.)
In Situ Chemical Oxidation for Groundwater and Soil Remediation Seminar- Presenter, 2007 and 2009
Air Force Environmental Symposium- Presenter, 2005-2006

Mr. Warren, branch manager for EnSafe's Charleston, South Carolina, office, has more than 10 years' environmental consulting, management, and technical experience. His client base includes government agencies, military installations, and general manufacturing, wood/paper, textile, transportation, automotive, petrochemical, agricultural, pharmaceutical, and residential/commercial development industries.

Mr. Warren's duties as a project manager include budgeting, scheduling, staff designation, and overseeing that overall technical quality and client satisfaction are achieved. To ensure that predetermined project goals are met, Mr. Warren actively communicates progress to clients and regulatory officials.

As lead geologist, Mr. Warren is responsible for overseeing technical aspects associated with large-scale assessment and remediation projects and other environmental studies. In implementing these projects, Mr. Warren prepares work plans, site safety plans, and comprehensive reporting documents.

Experience

NFA Documentation, DOD Installations (1996-Present); Multiple Locations
Role: Project Manager
Prepared "no further action" (NFA) documents for multiple U.S. Department of Defense (DOD) sites. Documents were submitted to appropriate regulatory agencies and sites were closed after remediation goals were achieved. Regulatory agencies have approved closure of 14 sites to date.

UST-Related Assessment and Remediation, Various Sites (1996-Present); Southeast U.S.
Role: Project Manager
Conducted investigations of soil, sediment, groundwater, and surface water impacted by releases from USTs at various commercial/industrial properties in the southeast. Client base includes various Superfund sites, municipal airports, BP, Chevron/Texaco, International Paper, Novartis, and DuPont. Following remediation activities, sites were closed through NFA or appropriate land-use controls/deed restrictions were instituted in accordance with applicable

Phase I ESAs, Multiple Clients (1998-Present); Multiple Locations
Role: Assessor
Phase I ESAs and Transaction Screens for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) due-diligence preacquisition real estate transactions at numerous manufacturing, petroleum, chemical, pharmaceutical, and forest products industrial facilities, hospitals and academic institutions, and commercial and residential developments across the U.S. Phase I ESAs and Transaction Screens were performed in accordance with American Society for Testing and Materials International standards and include historical and regulatory research, evaluation of state and federal environmental databases, visual reconnaissance of the property to document indications of potential environmental impairment, and report preparation.

Project experience includes a Phase I ESA and Comprehensive Hazardous Waste Inventory and Compliance Audit associated with a $125 million transaction of a 700,000-square-foot corporate headquarters of an international bank. Facility was in an urban setting and included five multi-story buildings, a daycare, underground parking garages, and numerous USTs. Recommendations were made to bring the facility into compliance with applicable state and federal requirements. Schedule was expedited to meet all transaction deadlines. Following successful closing, EnSafe assisted the client with follow-up compliance-related tasks. Due to impacts of transaction on local economy, project was highly visible to local government and media.

Materials Characterization, Savannah River Site (2006-Present); Aiken, South Carolina

Role: Project Manager

Project manager for a five-year multimedia sampling contract at this 300–square-mile U.S. Department of Energy (DOE) site, which extends across three counties and borders the Savannah River. Manage a dedicated team of onsite personnel who perform sitewide sampling of hazardous, radioactive, and mixed waste in preparation for analysis. Samples are collected to facilitate the disposal of potentially impacted media encountered during the decommissioning/demolition of historical nuclear-processing facilities. All activities are performed in strict accordance with applicable federal, state, and local laws and regulations and under appropriate Department of Homeland Security protocol. In 2008, Mr. Warren successfully transitioned EnSafe's sampling program from the previous operator to Savannah River Nuclear Solutions, whose partners include Fluor Daniel, Northrop Grumman, and Honeywell.

Industrial Hygiene Studies, U.S. Coast Guard (2006-Present); Charleston, South Carolina

Role: Project Manager

Conducted asbestos surveys/management services and lead-based paint surveys associated with renovation and demolition at various facilities in Charleston. Suspect materials were identified and properly removed and disposed of in accordance with applicable state and federal guidance.

Assessment and Remediation, Macalloy PRP Group (2006-Present); Charleston, South Carolina

Role: Project Geologist

Project geologist and UST-related task manager for the CERCLA assessment and remediation of a 147-acre former ferrochromium alloy manufacturing plant contaminated with hexavalent chromium. Worked closely with responsible parties and state and federal regulators to take the Cold War-legacy site from its inclusion on the U.S. Environmental Protection Agency's (USEPA) National Priorities List to remediation in less than six years — about half the typical duration of the Superfund process. The remediated site, adjacent to the Cooper River, is a critical part of a redevelopment plan, intended to promote sustainable development and stimulate economic growth to a once dilapidated area. The site was identified as the 1,000th "construction complete" Superfund site at a USEPA-led ceremony. Based on achievements, the project was awarded top American Council of Engineering Companies awards in Tennessee (2006) and South Carolina (2007).

Range Evaluations, Naval Facilities Engineering Command Southeast (2006-2009); Florida and Texas

Role: Project Manager/Technical Safety Oversight

Provided project management and technical/safety oversight for Range Conditions Assessments (RCAs) and Comprehensive Range Evaluations (CRE) at three active bombing ranges, operated by the U.S. Navy. Work was conducted in accordance with Range Sustainability Environmental Program Assessment (RSEPA) guidance, initiated to satisfy a lease agreement with the U.S. Forest Service and land-based ranges in the continental U.S. These projects are amongst the first within the Navy to be performed in accordance with the RSEPA guidance.

The RCA scope of work included records reviews, site inspections, personnel interviews, compliance assessments, and the preparation of a decision-point document containing information supportive of protective measures and CRE recommendations for each range. Extensive research was conducted to identify potential munitions constituents, including perchlorate and explosives, and fate-and-transport properties of those compounds. Special attention was paid to local/regional hydrogeology during the development of a Geographic Information System-based conceptual site model, around which groundwater monitoring programs were developed. During the CRE, land-based and airborne geophysical surveys were completed and monitoring wells were installed within target areas and around the perimeter of the ranges. Various environmental media were sampled to assess the potential for off-range release of munitions constituents. Results were summarized in a recommendations report, which was made available for viewing by the public.

Efficient project scheduling and coordination allowed project activities to be completed without significantly altering range operations. Based on results, a follow-up perchlorate study was awarded and is currently in the planning stages. This focused study will evaluate perchlorate and its potential origin in environmental media at Navy bombing ranges across the U.S.

Appendix B
Site Specific Field Standard Operating Procedures and Field Forms

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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Logbooks

Procedure 3-02

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the activities and responsibilities pertaining to the identification, use, and control of logbooks and associated field data records.

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 In order to keep the logbook clean, store it in a clean location and use it only when outer gloves used for PPE have been removed.

3.0 Terms and 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 assigned responsibility for maintenance of the logbook, and the beginning and ending dates of the entries.

3.2 **Data Form**

A data form is a predetermined format utilized for recording field data that may become, by reference, a part of the logbook (e.g., soil boring logs, trenching logs, surface soil sampling logs, groundwater sample logs, and well construction logs are data forms).

4.0 Training and Qualifications

4.1 The **Contract Task Order (CTO) Manager** or **designee** is responsible for determining which team members shall record information in field logbooks and for obtaining and maintaining control of the required logbooks. The **CTO Manager** shall review the field logbook on at least a monthly basis. The **CTO Manager** or **designee** is responsible for reviewing logbook entries to determine compliance with this procedure and to ensure that the entries meet the project requirements.

4.2 A knowledgeable individual such as the **Field Manager**, **CTO Manager**, or **Program Quality Manager** shall perform a technical review of each logbook at a frequency commensurate with the level of activity (weekly is suggested, or, at a minimum, monthly). Document these reviews by the dated signature of the reviewer on the last page or page immediately following the material reviewed.

4.3 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.4 The **Field Manager** is responsible for ensuring that all **field personnel** follow these procedures and that the logbook is completed properly and daily. The **Field Manager** is also responsible for submitting copies to the **CTO Manager**, who is responsible for filing them and submitting a copy (if required by the CTO Statement of Work).

4.5 The **logbook user** is responsible for recording pertinent data into the logbook to satisfy project requirements and for attesting to the accuracy of the entries by dated signature. The **logbook user** is also responsible for safeguarding the logbook while having custody of it.

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4.6 All **field personnel** are responsible for the implementation of this procedure.

5.0 Equipment and Supplies

5.1 Field logbooks shall be bound field notebooks with water-repellent pages.

5.2 Pens shall have indelible black ink.

6.0 Procedure

6.1 The field logbook serves as the primary record of field activities. Make entries chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct the applicable events. Store the logbook in a clean location and use it only when outer gloves used for personal protective equipment (PPE) have been removed.

6.2 Individual data forms may be generated to provide systematic data collection documentation. Entries on these forms shall meet the same requirements as entries in the logbook and shall be referenced in the applicable logbook entry. Individual data forms shall reference the applicable logbook and page number. At a minimum, include names of all samples collected in the logbook even if they are recorded elsewhere.

6.3 Enter field descriptions and observations into the logbook, as described in Attachment 1, using indelible black ink.

6.4 Typical information to be entered includes the following:

- Dates (month/day/year) and times (military) of all on-site activities and entries made in logbooks/forms;
- Site name and description;
- Site location by longitude and latitude, if known;
- Weather conditions, including temperature and relative humidity;
- Fieldwork documentation, including site entry and exit times;
- Descriptions of, and rationale for, approved deviations from the work plan (WP) or field sampling plan;
- Field instrumentation readings;
- Names, job functions, and organizational affiliations of on-site personnel;
- Photograph references;
- Site sketches and diagrams made on site;
- Identification and description of sample morphology, collection locations, and sample numbers;
- Sample collection information, including dates (month/day/year) and times (military) of sample collections, sample collection methods and devices, station location numbers, sample collection depths/heights, sample preservation information, sample pH (if applicable), analysis requested (analytical groups), etc., as well as chain-of-custody (COC) information such as sample identification numbers cross-referenced to COC sample numbers;
- Sample naming convention;
- Field quality control (QC) sample information;
- Site observations, field descriptions, equipment used, and field activities accomplished to reconstruct field operations;

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- Meeting information;
- Important times and dates of telephone conversations, correspondence, or deliverables;
- Field calculations;
- PPE level;
- Calibration records;
- Contractor and subcontractor information (address, names of personnel, job functions, organizational affiliations, contract number, contract name, and work assignment number);
- Equipment decontamination procedures and effectiveness;
- Laboratories receiving samples and shipping information, such as carrier, shipment time, number of sample containers shipped, and analyses requested; and
- User signatures.

6.5 The logbook shall reference data maintained in other logs, forms, etc. Correct entry errors by drawing a single line through the incorrect entry, then initialing and dating this change. Enter an explanation for the correction if the correction is more than for a mistake.

6.6 At least at the end of each day, the person making the entry shall sign or initial each entry or group of entries.

6.7 Enter logbook page numbers on each page to facilitate identification of photocopies.

6.8 If a person's initials are used for identification, or if uncommon acronyms are used, identify these on a page at the beginning of the logbook.

6.9 At least weekly and preferably daily, the **preparer** shall photocopy and retain the pages completed during that session for backup. This will prevent loss of a large amount of information if the logbook is lost.

7.0 Quality Control and Assurance

7.1 Review per Section 4.2 shall be recorded.

8.0 Records, Data Analysis, Calculations

8.1 Retain the field logbook as a permanent project record. If a particular CTO requires submittal of photocopies of logbooks, perform this as required.

8.2 Deviations from this procedure shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

9.0 Attachments or References

9.1 Attachment 1 – Description of Logbook Entries

9.2 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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Author	Reviewer	Revisions (Technical or Editorial)
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue

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Attachment 1
Description of Logbook Entries

Logbook entries shall be consistent with Section A.1.4 *Field Documentation SOPs* of the UFP-QAPP Manual (DoD 2005) and contain the following information, as applicable, for each activity recorded. Some of these details may be entered on data forms, as described previously.

Name of Activity	For example, Asbestos Bulk Sampling, Charcoal Canister Sampling, Aquifer Testing.
Task Team Members and Equipment	Name all members on the field team involved in the specified activity. List equipment used by serial number or other unique identification, including calibration information.
Activity Location	Indicate location of sampling area as indicated in the field sampling plan.
Weather	Indicate general weather and precipitation conditions.
Level of PPE	Record the level of PPE (e.g., Level D).
Methods	Indicate method or procedure number employed for the activity.
Sample Numbers	Indicate the unique numbers associated with the physical samples. Identify QC samples.
Sample Type and Volume	Indicate the medium, container type, preservative, and the volume for each sample.
Time and Date	Record the time and date when the activity was performed (e.g., 0830/08/OCT/89). Use the 24-hour clock for recording the time and two digits for recording the day of the month and the year.
Analyses	Indicate the appropriate code for analyses to be performed on each sample, as specified in the WP.
Field Measurements	Indicate measurements and field instrument readings taken during the activity.
Chain of Custody and Distribution	Indicate chain-of-custody for each sample collected and indicate to whom the samples are transferred and the destination.
References	If appropriate, indicate references to other logs or forms, drawings, or photographs employed in the activity.
Narrative (including time and location)	Create a factual, chronological record of the team's activities throughout the day including the time and location of each activity. Include descriptions of general problems encountered and their resolution. Provide the names and affiliations of non-field team personnel who visit the site, request changes in activity, impact the work schedule, request information, or observe team activities. Record any visual or other observations relevant to the activity, the contamination source, or the sample itself. It should be emphasized that logbook entries are for recording data and chronologies of events. The logbook author must include observations and descriptive notations, taking care to be objective and recording no opinions or subjective comments unless appropriate.
Recorded by	Include the signature of the individual responsible for the entries contained in the logbook and referenced forms.
Checked by	Include the signature of the individual who performs the review of the completed entries.

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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 Volumes 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			Samples Iced?(check): 33 Yes___ No___
						Method of Shipment: 34
2			2			Airbill No: 35
3			3			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 **ND 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	

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Investigation Derived Waste Management

Procedure 3-05

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes activities and responsibilities 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 United States (U.S.) Navy Environmental Restoration 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.

1.2 This procedure serves as facility-approved guidance for the management of IDW and focuses on minimizing, segregating, handling, labelling, storing, and inventorying IDW in the field. Certain drum inventory requirements related to the screening, sampling, classification, and disposal of IDW are noted in this procedure.

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, are addressed in the project Accident Prevention Plan (APP).

2.2 All **Field Personnel** responsible for IDW management must adhere to the APP and must wear the PPE specified in the site-specific APP. 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

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);

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- 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 Waste Management Procedures

The following federal and state regulations shall be used as resources for determining waste listings or characteristics and requirements for waste storage, transportation, and disposal:

- Georgia (GA) Rules 391-3-11-.08
- Code of Federal Regulations (CFR), Title 40, Parts 261, 262, 264, 265. 266, and 268;
- CFR, Title 49, Parts 171, 172, 173, 178, and 179.

Wastes are either classified as non-investigative waste or investigative-derived waste (IDW). Non-investigative waste, such as litter and household garbage, will be collected on an as needed basis to maintain each site in a clean and orderly manner. Nitrile gloves and plastic sheeting that have come in contact with sampling equipment and decontamination water are anticipated to have little to no contact with contaminated water; therefore, gloves and plastic sheeting will be bagged and disposed in a designated Base general trash collection bin. Tubing from monitoring wells will be decontaminated and the rinsate water will be collected and characterized as either hazardous or non-hazardous depending on the characterization of the purge water.

6.1 Temporary Storage

Waste generated during investigation activities, classified as “characterization pending analysis”, will be contained in U.S. Department of Transportation approved steel 55-gallon drums and temporarily stored onsite, prior to disposal. The containers will be transported to a designated staging location in such a manner to prevent spillage or particulate loss to the atmosphere. IDW will be segregated according to matrix (solid or liquid) and as to how it was derived (drill cuttings, drilling fluid, decontamination fluids, and purged groundwater). Until disposal, such containers will be inventoried, stored as securely as possible, and inspected regularly, as a general good practice.

Solid, liquid, or PPE waste generated during investigation activities that are characterized as hazardous waste shall not be accumulated onsite longer than 90 days. All hazardous waste containers shall be closed, marked, and labelled as “Hazardous Waste” with an accumulation start date, and stored in a secured storage area. Proper hazardous waste signs shall be posted at the 90-day storage area as required by any state or federal statutes.

6.2 Identification

Labelling of waste containers will be in accordance with 49 CFR 172, 173 and 178, GA Rules 391-3-11-.08, and 40 CFR 262.34. Labels will include the type of waste, location from which the waste was generated, and accumulation start date. Specifically, containers (including soil and groundwater) will include one of the following labels:

- “Analysis Pending” or “Waste Material” — Pre-printed labels are to be used until analytical results are received and reviewed, and a waste designation determined. This label will include the accumulation start date.
- “Hazardous Waste” — Pre-printed hazardous waste labels that include the following information:
  - Accumulation start date

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- — Generator Name
- — Site United States Environmental Protection Agency (U.S. EPA) ID number
- — Hazardous waste codes
- — Manifest Number for containers less than 110-gallon capacity

- "Non-Hazardous Waste" — Pre-printed labels with the following information:
  - — Accumulation start date
  - — Generator Name
  - — Site U.S. EPA ID Number
  - — Waste-specific information (e.g., contaminated liquid)

Upon completion of activities, field personnel will assure that drum lids and bungs are secure and the drums will be moved to a designated temporary storage point.

6.3 Hazardous Determination

Hazardous waste determination will be conducted in accordance with GA Rules 391-3-11-.08(1) incorporating 40 CFR parts 261 and 262. To complete a hazardous waste determination for IDW waste from soil and groundwater activities, the following questions will be answered.

1. Is the IDW waste excluded from regulation per 40 CFR 261.4?

2. Is the IDW waste a U.S. EPA defined listed waste per subpart D of 40 CFR part 261?

3. Is the IDW waste U.S. EPA defined characteristically hazardous waste either by testing the waste according to the methods in subpart C of 40 CFR 261 or applying knowledge of the hazard characteristics of the waste in light of the materials or process used?

The soil and groundwater investigation at Building 1039 for Kings Bay is associated with a historical release from a heating oil storage tank; therefore, IDW waste generated from the investigation will not be excluded from regulation and will not be a listed waste (F-, K-, P-, U-listed).

In order to determine if IDW waste is characteristically hazardous and restricted from land disposal per 40 CFR 268, field personnel will obtain individual discrete samples from each container of IDW waste (both soil and groundwater); the sampling process is described by waste stream in subsequent sections of this SOP.

6.4 Anticipated Waste Streams

Wastes will be managed and disposed in accordance with the generator regulations of the Georgia Hazardous Waste Management Act, Resource Conservation and Recovery Act (RCRA), and applicable conditions of the Hazardous Waste Facility Permit for Naval Submarine Base Kings Bay. This SOP includes requirements applicable to waste generation and subsequent management, including management of wastes in a 90-day accumulation unit or transfer to a permitted unit, but does not address the management of wastes within the permitted unit.

The waste streams associated with this scope of work may include:

- Purge and development water; decontamination waste/wastewater
- Soil generated during environmental borings/sampling activities
- Sampling wastes (e.g., used PPE)

6.5 Container Management

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Wastes will be stored according to the following requirements:

- Drums of hazardous waste will be transported to a designated temporary accumulation area on wood pallets and will be secured together with non-metallic bonding.
- Drums will be inspected and inventoried upon arrival onsite for signs of contamination and/or deterioration.
- Adequate aisle space (e.g., 30 inches) will be provided to allow the unobstructed movement of personnel and equipment. A row of drums should be no more than two drums wide.
- Each drum will be provided with its own label.
- Drums will remain closed except when removing or adding waste to the drum. Lids will be properly secured when not adding or removing waste.
- Drums will be disposed of with the contents. If the contents are removed from the drums for offsite transportation and treatment or disposal, the drums will be decontaminated prior to re-use or before leaving the site.
- Secondary containment will be provided for hazardous waste drums.
- If a container begins to leak, the waste will be transferred to another container that is in good condition; any leaked waste will be absorbed, containerized, characterized, and marked/labelled as either hazardous or non-hazardous waste depending on what type of waste leaked
- Drums will be made of or lined with materials that will not react with, and are otherwise compatible with, the waste to be stored.

6.6 Characterization

To determine if IDW waste is characteristically (per GA Rules GA Rules 391-3-11-.08(1) and 40 CFR 262.11, §261) hazardous and restricted from land disposal per 40 CFR 268, discrete samples will be collected from each container of IDW waste (both soil and groundwater). Soil IDW samples will be submitted for laboratory analysis of toxic characteristic leaching procedure (TCLP) volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and total metals (RCRA 8 Metals). Liquid IDW will be submitted for analysis of benzene, toluene, ethylbenzene, and xylene by Method 8260B and polynuclear aromatic hydrocarbons by Method 8270D.

Analytical results will be directly comparable to toxic characteristic leaching procedure (TCLP) threshold values in 40 CFR 261.24. IDW wastes with analytical results that exceed TCLP values will be managed as hazardous wastes; IDW wastes with analytical results below TCLP values will be managed as non-hazardous special wastes. All hazardous or non-hazardous waste determinations will be documented on a waste profile or waste characterization determination form.

An approved copy of the waste profile will be received from the accepting disposal facility prior to offsite transportation of the material. Navy personnel will provide generator certification and/or signature, if required.

6.7 Disposal

Waste generated during field activities will be stored, transported, and disposed of according to applicable state, federal, and local regulations. Transportation of wastes will be conducted by a subcontracted transporter, with appropriate licenses. 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. The following procedures are observed when hauling and transporting wastes offsite:

- Minimize impacts to general public traffic.
- Repair road damage caused by construction and/or hauling traffic.
- Clean-up material spilled in transit.

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- Line and cover (when applicable) trucks/trailers used for hauling contaminated materials to prevent releases and contamination.
- Decontaminate vehicles prior to re-use, other than hauling contaminated material.
- All personnel involved in offsite disposal activities will follow safety and spill response procedures outlined in the APP.
- No materials from other projects will be combined with materials from Naval Submarine Base Kings Bay

Shipped hazardous waste shall be disposed of in accordance with applicable GA/RCRA/U.S. EPA requirements. All IDW wastes will be treated and/or disposed at an appropriately licensed offsite treatment or disposal facility. All hazardous wastes will be transported to a permitted, RCRA Subtitle C facility. Prior to coordinating the waste pickup, a waste profile, along with supporting documentation, will be completed for each waste stream. Waste profiles will be reviewed by the disposal facility and a manifest will be prepared to document the disposal location. Manifests will be reviewed and signed by the Navy as the generator of the waste.

The offsite treatment or disposal facility will be responsible for providing a copy of the final waste manifest and for providing a certificate of treatment or disposal for each load of waste received. If the signed hazardous waste manifest from the designated offsite facility is not received within 35 days, Resolution Consultants will contact the transporter or the designated facility to determine the status of the waste. If the signed hazardous waste manifest has not been received within 45 days, Resolution Consultants will prepare an "Exception Report" for the Navy to submit to the State of Georgia, as required under 40 CFR 262.42.

7.0 Records and Data

7.1 Maintain records as required by implementing the procedures in this SOP.

7.2 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**.

8.0 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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1997a. *Sending Wastes Off Site? OSC and RPM Responsibilities under the Off-Site Rule*. EPA/540-F-97-006, Office of Solid Waste and Emergency Response. September.

1997b. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846.* 3rd ed., Final Update IIIA. Office of Solid Waste. Updates available: www.epa.gov/epaoswer/hazwaste/test/new-meth.htm

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(No Date). *Compliance with the Off-Site Rule During Removal Actions.* Office of Regional Counsel (Region 3). Hendershot, Michael.

Author	***Reviewer***	***Revisions (Technical or Editorial)***
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)
David Warren	Kevin Arick	Rev. 1 – NSB Kings Bay Specific (July 2013)

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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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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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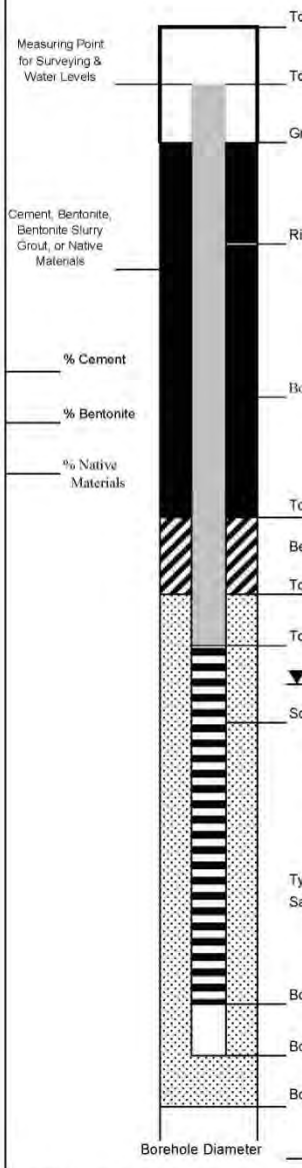
Attachment 1
Monitoring Well Construction Form

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 Sampling

Procedure 3-14

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the actions to be used during monitoring well sampling activities and establishes the method for sampling groundwater monitoring wells for water-borne contaminants and general groundwater chemistry. The objective is to obtain groundwater samples that are representative of aquifer conditions with as little alteration to water chemistry as possible.

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 Depending upon the site-specific contaminants, various protective programs must be implemented prior to sampling the first well. All field sampling personnel responsible for sampling activities must review the project-specific health and safety plan (HASP) paying particular attention to the control measures planned for the well sampling tasks. Conduct preliminary area monitoring of sampling wells to determine the potential hazard to field sampling personnel. If significant contamination is observed, minimize contact with potential contaminants in both the vapor phase and liquid matrix through the use of of appropriate personal protective equipment (PPE).

2.2 Observe standard health and safety practices according to the project-specific HASP. Suggested minimum protection during well sampling activities includes inner disposable vinyl gloves, outer chemical-protective nitrile gloves and rubberized steel-toed boots. Half-face respirators and cartridges and Tyvek® suits may be necessary depending on the contaminant concentrations. Refer to the project-specific HASP for the required PPE.

2.3 Physical Hazards associated with Well Sampling

- To avoid lifting injuries associated with pump and bailers retrieval, use the large muscles of the legs, not the back.
- Stay clear of all moving equipment, and avoid wearing loose fitting clothing.
- When using tools for cutting purposes, cut away from yourself. The use of appropriate, task specific cutting tools is recommended.
- To avoid slip/trip/fall conditions as a result of pump discharge, use textured boots/boot cover bottoms.
- To avoid heat/cold stress as a result of exposure to extreme temperatures and PPE, drink electrolyte replacement fluids (1 to 2 cups per hour is recommended) and, in cases of extreme cold, wear fitted insulating clothing.
- Be aware of restricted mobility due to PPE.

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3.0 Terms and Definitions

None.

4.0 Interferences

4.1 Potential interferences could result from cross-contamination between samples or sample locations. Minimization of the cross-contamination will occur through the following:

- The use of clean sampling tools at each location as necessary.
- Avoidance of material that is not representative of the media to be sampled.

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 **Contract Task Order (CTO) Manager** is responsible for ensuring that monitoring well sampling activities comply with this procedure. The **CTO Manager** is responsible for ensuring that all field sampling personnel involved in monitoring well sampling 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 field sampling personnel follow these procedures.

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 groundwater sampling 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 Purging and Sampling Equipment

- Pump (Peristaltic, Portable Bladder, Submersible)
- Polyethylene or Teflon bladders (for portable bladder pumps)
- Bladder pump controller (for portable bladder pumps)
- Air compressor (for portable bladder pumps)
- Nitrogen cylinders (for portable bladder pumps)
- 12-volt power source
- Polyethylene inlet and discharge tubing (except for VOC analysis which requires Teflon tubing)
- Silicone tubing appropriate for peristaltic pump head
- Teflon bailer appropriately sized for well

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- Disposable bailer string (polypropylene)
- Individual or multi-parameter water quality meter(s) with flow-through cell to measure temperature, pH, specific conductance, dissolved oxygen (DO), oxidation reduction potential (ORP), and/or turbidity
- Turbidity meter
- Water level meter
- Oil/water interface probe

6.2 General Equipment

- Sample kit (i.e., bottles, labels, preservatives, custody records and tape, cooler, ice)
- Sample Chain-of-Custody (COC) forms
- Sample Collection Records
- Sample packaging and shipping supplies
- Waterproof marker or paint
- Distilled/deionized water supply
- Water dispenser bottles
- Flow measurement cup or bucket
- 5-gallon buckets
- Instrument calibration solutions
- Stopwatch or watch
- Disposable Nitrile gloves
- Paper towels
- Trash bags
- Zipper-lock bags
- Equipment decontamination supplies
- Health and safety supplies (as required by the HASP)
- Approved plans such as: project-specific HASP and Sampling and Analysis Plan (SAP)
- Well keys or combinations
- Monitoring well location map(s)
- Field project logbook/pen

7.0 Calibration or Standardization

7.1 Field instruments will be calibrated daily according to the requirements of the SAP and manufacturer's specifications for each piece of equipment. Equipment will be checked daily with the calibration solutions at the end of use of the equipment. Calibration records shall be recorded in the field logbook or appropriate field form.

7.2 If readings are suspected to be inaccurate, the equipment shall be checked with the calibration solutions and/or re-calibrated.

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8.0 Procedure

8.1 Preparation

8.1.1 Site Background Information

Establish a thorough understanding of the purposes of the sampling event prior to field activities. Conduct a review of all available data obtained from the site and pertinent to the water sampling. Review well history data including, but not limited to, well locations, sampling history, purging rates, turbidity problems, previously used purging methods, well installation methods, well completion records, well development methods, previous analytical results, presence of an immiscible phase, historical water levels, and general hydrogeologic conditions.

Previous groundwater development and sampling logs give a good indication of well purging rates and the types of problems that might be encountered during sampling, such as excessive turbidity and low well yield. They may also indicate where dedicated pumps are placed in the water column. To help minimize the potential for cross-contamination, well purging and sampling and water level measurement collection shall proceed from the least contaminated to the most contaminated well as indicated by previous analytical results. This order may be changed in the field if conditions warrant it, particularly if dedicated sampling equipment is used. A review of prior sampling procedures and results may also identify which purging and sampling techniques are appropriate for the parameters to be tested under a given set of field conditions.

8.1.2 Groundwater Analysis Selection

Establish the requisite field and laboratory analyses prior to water sampling. Decide on the types and numbers of quality assurance/quality control (QA/QC) samples to be collected (refer to the project-specific SAP), as well as the type and volume of sample preservatives, the type and number of sample containers, the number of coolers required, and the quantity of ice or other chilling materials. The field sampling personnel shall ensure that the appropriate number and size sample containers are brought to the site, including extras in case of breakage or unexpected field conditions. Refer to the project-specific SAP for the project analytical requirements.

8.2 Groundwater Sampling Procedures

Groundwater sampling procedures at a site shall include:

1) An evaluation of the well security and condition prior to sampling;
2) Decontamination of equipment;
3) Measurement of well depth to groundwater;
4) Assessment of the presence or absence of an immiscible phase;
5) Assessment of purge parameter stabilization;
6) Purging of static water within the well and well bore; and
7) Obtaining a groundwater sample.

Each step is discussed in sequence below. Depending upon specific field conditions, additional steps may be necessary. As a rule, at least 24 hours should separate well development and well sampling events. In all cases, consult the State and local regulations for the site, which may require more stringent time separation between well development and sampling.

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8.2.1 Well Security and Condition

At each monitoring well location, observe the conditions of the well and surrounding area. The following information may be noted on a Groundwater Sample Collection Record (Attachment 1) or in the field logbook:

- Condition of the well's identification marker.
- Condition of the well lock and associated locking cap.
- Integrity of the well – well pad condition, protective outer casing, obstructions or kinks in the well casing, presence of water in the annular space, and the top of the interior casing.
- Condition of the general area surrounding the well.

8.2.2 Decontamination of Equipment

Where possible, dedicated supplies should be used at each well location to minimize the potential for cross-contamination and minimize the amount of investigation derived waste (IDW) fluids resulting from the decontamination process. If decontamination is necessary, establish a decontamination station before beginning sampling. The station shall consist of an area of at least 4 feet by 2 feet covered with plastic sheeting and be located upwind of the well being sampled. The station shall be large enough to fit the appropriate number of wash and rinse buckets, and have sufficient room to place equipment after decontamination. One central cleaning area may be used throughout the entire sampling event. The area around the well being sampled shall also be covered with plastic sheeting to prevent spillage. Further details are presented in SOP 3-06, Equipment Decontamination.

Decontaminate each piece of equipment prior to entering the well. Also, conduct decontamination prior to sampling at a site, even if the equipment has been decontaminated subsequent to its last usage. Additionally, decontaminate each piece of equipment used at the site prior to leaving the site. It is only necessary to decontaminate dedicated sampling equipment prior to installation within the well. Do not place clean sampling equipment directly on the ground or other contaminated surfaces prior to insertion into the well. Dedicated sampling equipment that has been certified by the manufacturer as being decontaminated can be placed in the well without on-site decontamination.

8.2.3 Measurement of Static Water Level Elevation

Before purging the well, measure water levels in all of the wells within the zone of influence of the well being purged. The best practice, if possible, is to measure all site wells (or wells within the monitoring well network) prior to sampling. If the well cap is not vented, remove the cap several minutes before measurement to allow water levels to equilibrate to atmospheric pressure.

Measure the depth to standing water and the total depth of the well to the nearest 0.01 foot to provide baseline hydrologic data, to calculate the volume of water in the well, and to provide information on the integrity of the well (e.g., identification of siltation problems). If not already present, mark an easily identified reference point for water level measurements which will become the measuring point for all water level measurements. This location and elevation must be surveyed.

The device used to measure the water level surface and depth of the well shall be sufficiently sensitive and accurate in order to obtain a measurement to the nearest 0.01 foot reliably. An electronic water level meter will usually be appropriate for this measurement; however, when the groundwater within a particular well is highly contaminated, an inexpensive weighted tape measure can be used to determine well depth to prevent adsorption of contaminants onto the meter tape. The presence of light, non-aqueous phase liquids (LNAPLs) and/or dense, non-aqueous phase liquids (DNAPLs) in a well requires measurement of the elevation of the top and the bottom of the product, generally using an interface probe. Water levels in such wells must then be corrected for density effects to accurately determine the elevation of the water table.

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At each location, measure water levels several times in quick succession to ensure that the well has equilibrated to atmospheric conditions prior to recording the measurement. As stated above, measure all site wells (or wells within the monitoring well network) prior to sampling whenever possible. This will provide a water level database that describes water levels across the site at one time (a synoptic sampling). Prior to sampling, measure the water level in each well immediately prior to purging the well to ascertain that static conditions have been achieved prior to sampling.

8.2.4 Detection of Immiscible Phase Layers

Complete the following steps for detecting the presence of LNAPL and DNAPL before the well is purged for conventional sampling. These procedures may not be required for all wells. Consult the project-specific SAP to determine if assessing the presence of LNAPL and/or DNAPL is necessary.

1) Sample the headspace in the wellhead immediately after the well is opened for organic vapors using either a PID or an organic vapor analyzer, and record the measurements.
2) Lower an interface probe into the well to determine the existence of any immiscible layer(s), LNAPL and/or DNAPL, and record the measurements.
3) Confirm the presence or absence of an immiscible phase by slowly lowering a clear bailer to the appropriate depth, then visually observing the results after sample recovery.
4) In rare instances, such as when very viscous product is present, it may be necessary to utilize hydrocarbon- and water-sensitive pastes for measurement of LNAPL thickness. This is accomplished by smearing adjacent, thin layers of both hydrocarbon- and water-sensitive pastes along a steel measuring tape and inserting the tape into the well. An engineering tape showing tenths and hundredths of feet is required. Record depth to water, as shown by the mark on the water-sensitive paste, and depth to product, as shown by the mark on the product-sensitive paste. In wells where the approximate depth to water and product thickness are not known, it is best to apply both pastes to the tape over a fairly long interval (5 feet or more). Under these conditions, measurements are obtained by trial and error and may require several insertions and retrievals of the tape before the paste-covered interval of the tape encounters product and water. In wells where approximate depths of air-product and product-water interfaces are known, pastes may be applied over shorter intervals. Water depth measurements should not be used in preparation of water table contour maps until they are corrected for depression by the product.
5) If the well contains an immiscible phase, it may be desirable to sample this phase separately. Section 8.2.6 presents immiscible phase sampling procedures. It may not be meaningful to conduct water sample analysis of water obtained from a well containing LNAPLs or DNAPLs. Consult the **CTO Manager** and **Program Quality Manager** if this situation is encountered.

8.2.5 Purging Equipment and Use

General Requirements

The water present in a well prior to sampling may not be representative of in situ groundwater quality and shall be removed prior to sampling. Handle all groundwater removed from potentially contaminated wells in accordance with the IDW handling procedures in SOP 3-05, IDW Management. Purging shall be accomplished by methods as indicated in the project-specific SAP or by those required by State requirements. For the purposes of this SOP, purging methods will be described by removing groundwater from the well using low-flow techniques.

According to the U.S. Environmental Protection Agency (EPA) (EPA, 1996), the rate at which groundwater is removed from the well during purging ideally should be less than 0.2 to 0.3 liters/minute. EPA further states that wells should be purged at rates below those used to develop the well to prevent further development of the well, to prevent damage to the well, and to avoid disturbing accumulated

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corrosion or reaction products in the well. EPA also indicates that wells should be purged at or below their recovery rate so that migration of water in the formation above the well screen does not occur.

Realistically, the purge rate should be low enough that substantial drawdown in the well does not occur during purging. In addition, a low purge rate will reduce the possibility of stripping volatile organic compounds (VOCs) from the water, and will reduce the likelihood of increasing the turbidity of the sample due to mobilizing colloids in the subsurface that are immobile under natural flow conditions.

The field sampler shall ensure that purging does not cause formation water to cascade down the sides of the well screen. Wells should not be purged to dryness if recharge causes the formation water to cascade down the sides of the screen, as this will cause an accelerated loss of volatiles. This problem should be anticipated based on the results of either the well development task or historical sampling events. In general, place the intake of the purge pump in the middle of the saturated screened interval within the well to allow purging and at the same time minimize disturbance/overdevelopment of the screened interval in the well. Water shall be purged from the well at a rate that does not cause recharge water to be excessively agitated unless an extremely slow recharging well is encountered where complete evacuation is unavoidable. During the well purging procedure, collect water level and/or product level measurements to assess the hydraulic effects of purging. Sample the well when it recovers sufficiently to provide enough water for the analytical parameters specified. If the well is purged dry, allow the well to recover sufficiently to provide enough water for the specified analytical parameters, and then sample it.

Evaluate water samples on a regular basis during well purging and analyze them in the field preferably using in-line devices (i.e., flow through cell) for temperature, pH, specific conductivity, dissolved oxygen (DO), and oxidation-reduction (redox) potential. Turbidity should be measured separately (outside of the flow-through cell) with a nephelometer or similar device.

Readings should be taken every 2 to 5 minutes during the purging process. These parameters are measured to demonstrate that the natural character of the formation waters has been restored.

Purging shall be considered complete per the requirements set forth in the project-specific SAP, State requirements, or when three consecutive field parameter measurements of temperature, pH, specific conductivity, DO and ORP stabilize within approximately 10 percent and the turbidity is at or below 10 nephelometric turbidity units (NTU) or within ± 10% if above 10 NTU. This criterion may not be applicable to temperature if a submersible pump is used during purging due to the heating of the water by the pump motor. Enter all information obtained during the purging and sampling process into a groundwater sampling log. Attachment 1 shows an example of a groundwater sampling log and the information typically included in the form. Whatever form is used, all blanks need to be completed on the field log during field sampling.

Groundwater removed during purging shall be stored according to the project-specific SAP or per SOP 3-05, IDW Management.

Purging Equipment and Methods

Submersible Pump

A stainless steel submersible pump may be utilized for purging both shallow and deep wells prior to sampling the groundwater for semivolatile and non-volatile constituents, but are generally not preferred for VOCs unless there are no other options (e.g., well over 200 feet deep). For wells over 200 feet deep, the submersible pump is one of the few technologies available to feasibly accomplish purging under any yield conditions. For shallow wells with low yields, submersible pumps are generally inappropriate due to overpumpage of the wells (<1 gallon per minute), which causes increased aeration of the water within the well.

Steam clean or otherwise decontaminate the pump and discharge tubing prior to placing the pump in the well. The submersible pump shall be equipped with an anti-backflow check valve to limit the amount of

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water that will flow back down the drop pipe into the well. Place the pump in the middle of the saturated screened interval within the well and maintain it in that position during purging.

Bladder Pump

A stainless steel bladder pump can be utilized for purging and sampling wells up to 200 feet in depth for volatile, semivolatile, and non-volatile constituents. Use of the bladder pump is most effective in low to moderate yield wells and are often the preferred method for low-flow sampling. When sampling for VOCs and/or SVOCs, Teflon bladders should be used. Polyethylene bladders may be used when sampling for inorganics.

Either compressed dry nitrogen or compressed dry air, depending upon availability, can operate the bladder pump. The driving gas utilized must be dry to avoid damage to the bladder pump control box. Decontaminate the bladder pump prior to use.

Centrifugal, Peristaltic, or Diaphragm Pump

A centrifugal, peristaltic, or diaphragm pump may be utilized to purge a well if the water level is within 20 feet of ground surface. New or dedicated tubing is inserted into the midpoint of the saturated screened interval of the well. Water should be purged at a rate that satisfies low-flow requirements (i.e., does not cause drawdown). Centrifugal, peristaltic, or diaphragm pump are generally discouraged for VOCs sampling; however, follow methods allowed per the project-specific SAP or State requirements.

Air Lift Pump

Airlift pumps are not appropriate for purging or sampling.

Bailer

Avoid using a bailer to purge a well because it can result in overdevelopment of the well and create excessive purge rates. If a bailer must be used, the bailer should either be dedicated or disposable. Teflon-coated cable mounted on a reel is recommended for lowering the bailer in and out of the well.

Lower the bailer below the water level of the well with as little disturbance of the water as possible to minimize aeration of the water in the well. One way to gauge the depth of water on the reel is to mark the depth to water on the bailer wire with a stainless steel clip. In this manner, less time is spent trying to identify the water level in the well.

8.2.6 Monitoring Well Sampling Methodologies

Sampling Light, Non-Aqueous Phase Liquids (LNAPL)

Collect LNAPL, if present, prior to any purging activities. The sampling device shall generally consist of a dedicated or disposable bailer equipped with a bottom-discharging device. Lower the bailer slowly until contact is made with the surface of the LNAPL, and to a depth less than that of the immiscible fluid/water interface depth as determined by measurement with the interface probe. Allow the bailer to fill with LNAPL and retrieve it.

When sampling LNAPLs, never drop bailers into a well and always remove them from the well in a manner that causes as little agitation of the sample as possible. For example, the bailer should not be removed in a jerky fashion or be allowed to continually bang against the well casing as it is raised. Teflon bailers should always be used when sampling LNAPL. The cable used to raise and lower the bailer shall be composed of an inert material (e.g., stainless steel) or coated with an inert material (e.g., Teflon).

Sampling Dense, Non-Aqueous Phase Liquids (DNAPL)

Collect DNAPL prior to any purging activities. The best method for collecting DNAPL is to use a double-check valve, stainless steel bailer, or a Kemmerer (discrete interval) sampler. The sample shall be collected by slow, controlled lowering of the bailer to the bottom of the well, activation of the closing device, and retrieval.

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Groundwater Sampling Methodology

The well shall be sampled when groundwater within it is representative of aquifer conditions per the methods described in Section 8.2.5. Prior to sampling the flow-through cell shall be removed and the samples collected directly from the purge tubing. Flow rates shall not be adjusted once aquifer conditions are met. Additionally, a period of no more than 2 hours shall elapse between purging and sampling to prevent groundwater interaction with the casing and atmosphere. This may not be possible with a slowly recharging well. Measure and record the water level prior to sampling in order to monitor drawdown when using low-flow techniques and gauge well volumes removed and recharged when using non-low-flow techniques.

Sampling equipment (e.g., especially bailers) shall never be dropped into the well, as this could cause aeration of the water upon impact. Additionally, the sampling methodology utilized shall allow for the collection of a groundwater sample in as undisturbed a condition as possible, minimizing the potential for volatilization or aeration. This includes minimizing agitation and aeration during transfer to sample containers, minimizing exposure to sunlight, and immediately placing the sample on ice once collected.

Sampling equipment shall be constructed of inert material. Equipment with neoprene fittings, polyvinyl chloride (PVC) bailers, Tygon® tubing, silicon rubber bladders, neoprene impellers, polyethylene, and Viton® are not acceptable when sampling for organics. If bailers are used, an inert cable/chain (e.g., fluorocarbon resin-coated wire or stainless steel wire or cable) shall be used to raise and lower the bailer. Dedicated equipment is highly recommended for all sampling programs.

Submersible Pumps

The submersible pump must be specifically designed for groundwater sampling (i.e., pump composed of stainless steel and Teflon, sample discharge lines composed of Teflon) and must have a controller mechanism allowing the required low-flow rate. Adjust the pump rate so that flow is continuous and does not pulsate to avoid aeration and agitation within the sample discharge lines. Run the pump for several minutes at the low-flow rate used for sampling to ensure that the groundwater in the lines was obtained at the low-flow rate.

Bladder Pumps

A gas-operated stainless steel bladder pump with adjustable flow control and equipped with a Teflon bladder and Teflon-lined tubing can be effectively utilized to collect a groundwater sample and is considered to be the best overall device for sampling inorganic and organic constituents. If only inorganics are being sampled, polyvinyl bladders and tubing may be used. Operate positive gas displacement bladder pumps in a continuous manner so that they minimize discharge pulsation that can aerate samples in the return tube or upon discharge.

When using a compressor, take several precautions. If the compressor is being powered by a gasoline generator, position the generator downwind of the well. Ground fault circuit interrupters (GFCIs) should always be used when using electric powered equipment. Do not connect the compression hose from the compressor to the pump controller until after the engine has been started.

When all precautions are completed and the compressor has been started, connect the compression hose to the pump controller. Slowly adjust the control knobs to discharge water in the shortest amount of time while maintaining a near constant flow. This does not mean that the compressor must be set to discharge the water as hard as possible. The optimal setting is one that produces the largest volume of purge water per minute (not per purge cycle) while maintaining a near constant flow rate.

Prior to sampling, adjust the flow rate (purge rate) to yield 100 to 300 mL/minute. Avoid settings that produce pulsating streams of water instead of a steady stream if possible. Operate the pump at this low flow rate for several minutes to ensure that drawdown is not occurring. At no time shall the sample flow rate exceed the flow rate used while purging.

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For those samples requiring filtration, it is recommended to use an in-line high capacity filter after all non-filtered samples have been collected.

***Peristaltic Pumps*:**

A peristaltic pump is a type of positive displacement pump that moves water via the process of peristalsis. The pump uses a flexible hose fitted inside a circular pump casing. A rotor with cams compresses the flexible tube as the rotor turns, which forces the water to be pumped to move through the tube. In peristaltic pumps, no moving parts of the pump are in contact with the water being pumped. Displacement is determined by tube size, so delivery rate can only be changed during operation by varying pump speed. Peristaltic pumps are simple and quite inexpensive for the flow rates they provide.

There are several methods available for transferring the sample into the laboratory containers. The selected method may vary based on State requirements and should be documented in the project-specific SAP. Samples typically can be collected directly from the discharge end of the Teflon tubing, after it has been disconnected from the flow through cell. For volatile analyses, the sampler should make sure that the pump is set such that a smooth laminar flow is achieved. In all cases, the project team should consult their local regulatory requirements and document the selected sample collection procedure in the project-specific SAP.

Bailers

A single- or double-check valve Teflon or stainless steel bailer equipped with a bottom discharging device can be utilized to collect groundwater samples. Bailers have a number of disadvantages, however, including a tendency to alter the chemistry of groundwater samples due to degassing, volatilization, and aeration; the possibility of creating high groundwater entrance velocities; differences in operator techniques resulting in variable samples; and difficulty in determining where in the water column the sample was collected. Therefore, use bailers for groundwater sampling only when other types of sampling devices cannot be utilized for technical, regulatory, or logistical reasons.

Dedicated or disposable bailers should always be used in order to eliminate the need for decontamination and to limit the potential of cross-contamination. Each time the bailer is lowered to the water table, lower it in such a way as to minimize disturbance and aeration of the water column within the well.

8.2.7 Sample Handling and Preservation

Many of the chemical constituents and physiochemical parameters to be measured or evaluated during groundwater monitoring programs are chemically unstable and require preservation. The U.S. EPA document entitled, *Test Methods for Evaluating Solid Waste – Physical/Chemical Methods (SW-846)* (EPA 1997), includes a discussion of appropriate sample preservation procedures. In addition, SW-846 provides guidance on the types of sample containers to use for each constituent or common set of parameters. In general, check with specific laboratory or State requirements prior to obtaining field samples. In many cases, the laboratory will supply the necessary sample bottles and required preservatives. In some cases, the field sampling personnel may add preservatives in the field.

Improper sample handling may alter the analytical results of the sample. Therefore, transfer samples in the field from the sampling equipment directly into the container that has been prepared specifically for that analysis or set of compatible parameters as described in the project-specific SAP. It is not an acceptable practice for samples to be composited in a common container in the field and then split in the laboratory, or poured first into a wide mouth container and then transferred into smaller containers.

Collect groundwater samples and place them in their proper containers in the order of decreasing volatility and increasing stability. A preferred collection order for some common groundwater parameters is:

1. VOCs and total organic halogens (TOX)

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2. Dissolved gases, total organic carbon (TOC), total fuel hydrocarbons
3. Semivolatile organics, pesticides
4. Total metals, general minerals (unfiltered)
5. Dissolved metals, general minerals (filtered)
6. Phenols
7. Cyanide
8. Sulfate and chloride
9. Nitrate and ammonia
10. Radionuclides

When sampling for VOCs, collect water samples in vials or containers specifically designed to prevent loss of VOCs from the sample. The analytical laboratory performing the analysis shall provide these vials. Collect groundwater from the sampling device in vials by allowing the groundwater to slowly flow along the sides of the vial. Sampling equipment shall not touch the interior of the vial. Fill the vial above the top of the vial to form a positive meniscus with no overflow. No headspace shall be present in the sample container once the container has been capped. This can be checked by inverting the bottle once the sample is collected and tapping the side of the vial to dislodge air bubbles. Sometimes it is not possible to collect a sample without air bubbles, particularly water that has high concentrations of dissolved gasses. In these cases, the field sampling personnel shall document the occurrence in the field logbook and/or sampling worksheet at the time the sample was collected. Likewise, the analytical laboratory shall note in the laboratory analysis reports any headspace in the sample container(s) at the time of receipt by the laboratory.

Special Handling Considerations

In general, samples for organic analyses should not be filtered. However, high turbidity samples for PCB analysis may require filtering. Consult the project-specific SAP for details on filtering requirements. Samples shall not be transferred from one container to another because this could cause aeration or a loss of organic material onto the walls of the container. TOX and TOC samples should be handled in the same manner as VOC samples.

When collecting total and dissolved metals samples, the samples should be collected sequentially. The total metals sample is collected from the pump unfiltered. The dissolved metals sample is collected after filtering with a 0.45-micron membrane in-line filter. Allow at least 500 mL of effluent to flow through the filter prior to sampling to ensure that the filter is thoroughly wetted and seated in the filter capsule. If required by the project-specific SAP, include a filter blank for each lot of filters used and always record the lot number of the filters.

Field Sampling Preservation

Preserve samples immediately upon collection. Ideally, sampling containers will be pre-preserved with a known concentration and volume of preservative. Certain matrices that have alkaline pH (greater than 7) may require more preservative than is typically required. An early assessment of preservation techniques, such as the use of pH strips after initial preservation, may therefore be appropriate. Guidance for the preservation of environmental samples can be found in the U.S. EPA *Handbook for Sampling and Sample Preservation of Water and Wastewater* (EPA 1982). Additional guidance can be found in other U.S. EPA documents (EPA 1992, 1996).

Field Sampling Log

A groundwater sampling log provided as Attachment 1 shall document the following:

- Identification of well

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- Well depth
- Static water level depth and measurement technique
- Presence of immiscible layers and detection method
- Well yield
- Purge volume and pumping rate
- Time that the well was purged
- Sample identification numbers
- Well evacuation procedure/equipment
- Sample withdrawal procedure/equipment
- Date and time of collection
- Types of sample containers used
- Preservative(s) used
- Parameters requested for analysis
- Field analysis data
- Field observations on sampling event
- Name of sampler
- Weather conditions

9.0 Quality Control and Assurance

9.1 Field personnel will follow specific quality assurance (QA) guidelines as outlined in the project-specific SAP. The goal of the QA program should be to ensure precision, accuracy, representativeness, completeness, and comparability in the project sampling program.

9.2 Quality control (QC) requirements for sample collection are dependent on project-specific sampling objectives. The project-specific SAP will provide requirements for sample preservation and holding times, container types, sample packaging and shipment, as well as requirements for the collection of various QC samples such as trip blanks, field blanks, equipment rinse blanks, and field duplicate samples.

10.0 Data and records management

10.1 Records will be maintained in accordance with SOP 3-03, Recordkeeping, Sample Labelling, and Chain-of-Custody. Various forms are required to ensure that adequate documentation is made of the sample collection activities. These forms may include:

- Sample Collection Records;
- Field logbook;
- Chain-of-custody forms; and
- Shipping labels.

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10.2 Sample collection records (Attachment 1) will provide descriptive information for the purging process and the samples collected at each monitoring well.

10.3 The field logbook is kept as a general log of activities and should not be used in place of the sample collection record.

10.4 Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes.

10.5 Shipping labels are required is sample coolers are to be transported to a laboratory by a third party (courier service).

11.0 Attachments or References

Attachment 1 – Groundwater Sampling Collection Record

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.

Environmental Protection Agency, United States (EPA). 1982. *Handbook for Sampling and Sample Preservation of Water and Wastewater.* EPA-600/4-82-029. Cincinnati: EPA Office of Research and Development, Environmental Monitoring and Support Laboratory.

EPA. 1992. *RCRA Groundwater Monitoring Draft Technical Guidance*. EPA/530/R-93/001. Office of Solid Waste. November.

EPA. 1996. *Ground Water Issue: Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. EPA/540/S-95/504. Office of Solid Waste and Emergency Response. April.

EPA. 1997. *Test Methods for Evaluating Solid Waste, Physical/Chemical Method (SW-846)*. 3rd ed., Final Update IIIA. Office of Solid Waste. Online updates at: http://www.epa.gov/epaoswer/hazwaste/test/new-meth.htm.

NAVSEA T0300-AZ-PRO-010. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. August 2009.

SOP 3-03, *Recordkeeping, Sample Labelling, and Chain-of-Custody*.

SOP 3-05, *IDW Management.*

SOP 3-06, *Equipment Decontamination*.

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
Groundwater Sample Collection Record

Well ID:

Groundwater Sample Collection Record

Client: _____ Date: _____ Time: Start _____ am/pm
Project No: _____ Finish _____ am/pm
Site Location: _____
Weather Conds: _____ Collector(s): _____

1. WATER LEVEL DATA: (measured from Top of Casing)

a. Total Well Length _____ c. Length of Water Column _____ (a-b)

b. Water Table Depth _____ d. Calculated Well Volume (see back) _____

Casing Diameter/Material _____

2. WELL PURGEABLE DATA

a. Purge Method: _____

b. Acceptance Criteria defined (see SAP or Work Plan)
- Minimum Required Purge Volume (@ _____ well volumes) _____
- Maximum Allowable Turbidity _____ NTUs
- Stabilization of parameters _____ %

c. Field Testing Equipment used: Make Model Serial Number

Time (min)	Volume Removed (gal)	Temp. (°C)	pH s.u.	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (m)	Color/Odor/etc.

(continued on back)

d. Acceptance criteria pass/fail

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A - Explain below.

_____

3. SAMPLE COLLECTION: Method: _____

Sample ID	Container Type	No. of Containers	Preservation	Analysis Req.	Time

Comments _____

Signature _____ Date _____

Page 1 of 2

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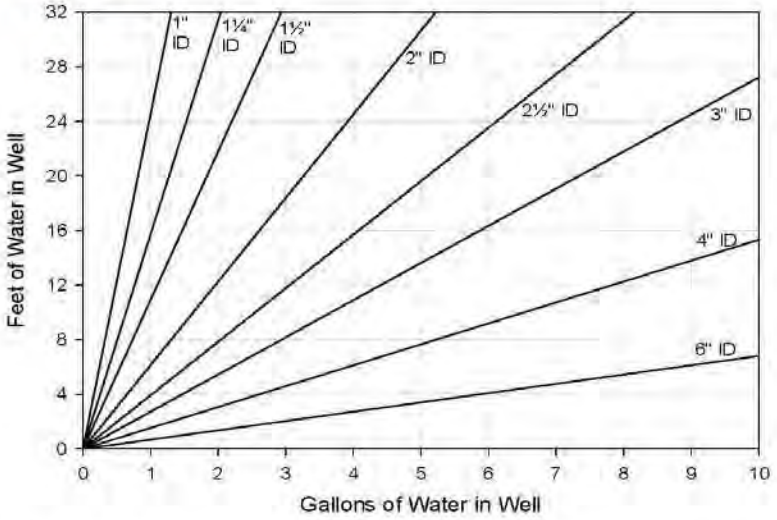
Purge Volume Computation

Well ID:



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
¼	0.0025	0.0097
⅜	0.0057	0.0217
½	0.0102	0.0386
¾	0.0229	0.0869
1	0.0408	0.1544
1¼	0.0637	0.2413
1½	0.0918	0.3475
2	0.1632	0.6178
2½	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600

(continued from front)

Time (min)	Volume Removed (gal)	Temp. (°C)	pH s.u.	Spec. Cond. (µS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (m)	Color/Odor/etc.

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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Direct Push Sampling Techniques

Procedure 3-17

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) provides guidance on the use of direct push techniques for the United States Navy Environmental Restoration (ER) Program, Naval Facilities Engineering Command, Atlantic (NAVFAC Atlantic).

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 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.

1.4 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 direct push sampling then those procedures may be added as an appendix to the project specific SAP.

2.0 Safety

2.1 Field personnel shall perform work in accordance with the site-specific health and safety plan (HASP). During monitoring well installation, subcontractors in direct contact with potentially contaminated media shall wear the proper personal protective equipment (PPE) as outlined in the site-specific health and safety plan. Failure to comply will result in disciplinary action.

2.2 If circumstances warrant, a real-time immediate response instrument, such as a Miniram Dust Monitor, organic vapor analyzer, HNu, Thermo, Draeger or Sensidyne tubes, or explosimeter, should be used to monitor the work area. When real/time instrument response exceeds the permissible exposure limit, personnel shall don the appropriate PPE and alternate control measures to ensure personnel safety. If safe control measures are not achievable, field activities shall be discontinued immediately. Company-specific HASPs offer guidelines on air surveillance and on selection of PPE. In addition, the site-specific HASP includes an air monitoring program and suggested PPE.

2.3 In addition to the aforementioned precautions and depending upon the type of contaminant expected, employ the following safe work practices:

Particulate or Metal Compounds

1. Avoid skin contact and/or incidental ingestion of soil.
2. Wear protective clothing, steel-toed boots, gloves, safety glasses, and hearing protection as warranted.

VOCs

1. Avoid breathing constituents venting from holes by approaching upwind, and/or by use of respiratory protection.

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2. Pre-survey the area with a flame ionization detector (FID) or photoionization detector (PID) prior to sampling.
3. If monitoring results indicate organic vapors that exceed action levels as specified in the site-specific HASP, sampling activities may need to be conducted in Level C protection. At a minimum, skin protection will be required by use of gloves and Tyvek or other media that is protective against the media being encountered.

Flammable or Explosive Conditions

1. Monitor explosive gases as continuously as possible using an explosimeter and oxygen meter.
2. Place all ignition sources upwind or crosswind of the borehole.
3. If explosive gases exceed the designated action levels as specified in the site-specific HASP, cease operations and evaluate conditions.

Physical Hazards Associated With Soil Sampling

1. To avoid possible back strain associated with sample collection, use the large muscles of the legs, not the back, when retrieving soil samplers.
2. Stay clear of all moving equipment, and avoid wearing loose fitting clothing.
3. To avoid slip/trip/fall hazards, be wary of open trenches, pits, or holes.
4. Be aware of restricted mobility due to PPE.
5. To avoid hand, wrist, arm, shoulder, and back trauma due to the use of slide hammers or hand augers, rotate sampling among field personnel

3.0 Terms and Definitions

3.1 Direct push techniques are methods for subsurface sampling or monitoring that involve the application of downward pressure (usually supplied through hydraulic means) without the benefit of cutting tool rotation to enter soil. A variety of systems are available under several trade names, such as GeoProbe®. Equipment may be skid-mounted, trailered, or mounted directly on the frame of a vehicle.

4.0 Interferences

4.1 Potential interferences could result from cross-contamination between samples or sample locations. Minimization of the cross contamination will occur through the following:

- The use of clean sampling tools at each location as necessary.
- Avoidance of material that is not representative of the media to be sampled.

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 these standard direct push technique procedures are followed during projects conducted under the ER Program and that a qualified individual conducts or supervises the projects. A qualified individual for subsurface sampling or monitoring using direct push techniques is defined as a person with a degree in geology, hydrogeology, or geotechnical/civil engineering with at least 1 year of experience supervising soil boring construction using conventional drilling or direct push techniques. The CTO Manager

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or designee is responsible for ensuring that all personnel involved in direct push sampling techniques shall have the appropriate education, experience, and training to perform their assigned tasks as specified in Chief of Naval Operations Instruction 5090.1c (DON 2007).

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 field personnel follow these procedures.

5.2.4 All Field Personnel are responsible for the implementation of this procedure.

5.2.5 The Field Personnel and/or Field Manager is responsible for directly supervising the direct push sampling 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

In addition to those materials provided by the subcontractor, the project **Field Manager/Field Personnel** will require:

- Boring Logs;
- Spoons or scoops;
- Sample kit (bottles, labels, custody records and tape, cooler, ice), if laboratory analysis is required;
- Sample collection pan;
- Folding rule or tape measure;
- Plastic sheeting;
- Utility knife;
- Equipment decontamination materials (as described in SOP 3-06, *Equipment Decontamination*);
- Health and safety equipment (as required by HASP); and
- Field project notebook/pen.

7.0 Procedure

Direct push techniques may be used as a cost-effective alternative to conventional drilling techniques for obtaining subsurface soil and groundwater samples and for monitoring subsurface conditions.

7.1 Method Selection

Base the decision to use direct push techniques on: (1) their ability to achieve the required information at the required level of quality control and (2) their cost-effectiveness compared to conventional drilling methods. Major limitations of direct push techniques are their inability to penetrate rock or cobbles and a shallow maximum depth of penetration. The capabilities of direct push systems vary significantly among vendors. Consider these differences in capabilities when evaluating the method for a subsurface exploration program.

Use direct push techniques to obtain groundwater samples for confirmatory analyses only if the screen placement method protects the screen from clogging during installation and allows the installation of a sand-pack around the exterior of the well screen.

7.2 Inspection of Equipment

Inspect direct push equipment prior to use for signs of fluid leakage, which could introduce contaminants to the soil. If, at any time during equipment operation, fluid is observed leaking from the rig, cease

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operations and immediately repair or contain the leak. Collect, containerize, and label soil and other materials affected by the leak for proper disposal (see SOP 3-05, *IDW Management*).

7.3 Preparation of Work Site

Inspect the work site prior to commencing operations to ensure that no overhead hazards exist that could impact the direct push equipment, and the work area should cleared and/or marked by the local underground utility locating service (e.g., DigSafe). In addition, clear locations planned for subsurface exploration using either geophysical methods and/or hand excavate locations to a depth of 2 to 3 feet prior to soil penetration, unless it is certain (by virtue of subsurface clearing activities) that no utilities or other hazardous obstructions will be encountered in the first 2 to 3 feet. Hand excavation may be waived when it is not practical.

Locate the direct push rig so that it is downslope from the penetration point, if the work is to be performed on a grade. Locate the rig downwind or crosswind of the penetration point, if possible. Cover the area surrounding, and in the vicinity of, the penetration point with plastic. Establish required exclusion zones using plastic tape or cones to designate the various areas.

7.4 Equipment Decontamination

To avoid cross-contamination, thoroughly decontaminate equipment used for direct push exploration and sampling as described in SOP 3-06, *Equipment Decontamination*. Decontaminate sampling tools and downhole equipment between each sampling event and between penetration points. At a minimum, steam clean or wash and rinse the equipment. Collect, containerize, and label all wash and rinse water for proper disposal. Clean equipment (e.g., drive rods and samplers) shall not come into contact with contaminated soils or other contaminated materials. Keep equipment on plastic or protect it in another suitable fashion. Store push rods and other equipment removed from a hole on plastic sheeting until properly decontaminated.

7.5 Soil Sampling

This SOP assumes that the subcontractor will perform sampling; therefore, detailed procedures regarding sample acquisition are not provided. Vendors of direct push equipment offer a variety of sampling systems designed specifically for their equipment. Both continuous and discreet soil samples may be obtained using sampling equipment similar to that described in Procedure 3-21, *Surface and Subsurface Soil Sampling*. The preferred methods for soil sampling using direct push techniques use brass or stainless steel split-tube samplers that are driven through the horizon to be sampled. Use plastic sample tubes (e.g., Macro-Core Samplers) only for screening purposes or, in the case of confirmatory sampling, if samples will not be analyzed for volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs).

7.6 Groundwater Sampling

Direct push vendors offer numerous methods for obtaining groundwater samples. Key differences among methods involve: (1) the maximum well diameter achievable; (2) the ability to protect the well screen from exposure to contaminated overburden soils during installation; (3) the ability to install packing around the screen; (4) flexibility in the size, materials of construction, and design of well screens; and (5) the ability to convert sampling points into permanent monitoring wells. The limitations and abilities of a given system must be thoroughly understood and matched to the needs of the project before committing to the collection of groundwater samples using direct push techniques.

Use direct push techniques only to collect screening samples unless it is confirmed that the system:

1. Effectively protects the well screen from exposure to contaminated overburden soils during installation
2. Allows the installation of effective packing around the well screen

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3. Allows the well screen to be effectively sealed against the downward infiltration of overlying groundwater or surface precipitation
4. Is constructed of materials compatible with the intended sampling and analysis goals of the project
5. Allows the use of a well screen properly sized and slotted for the needs of the project

Additional information on the collection of groundwater samples can be found in SOP 3-14 Monitoring Well Sampling.

It is the responsibility of the **CTO Manager** to evaluate and determine the appropriateness of direct push systems prior to committing to their use on any project involving groundwater sampling. As part of this evaluation, it is recommended to obtain concurrence from regulatory authorities in advance for the method selection.

7.7 Borehole Abandonment

Methods for abandoning boreholes created with direct push systems will vary among vendors. Coordinate the desired method for abandonment with the vendor in the planning stages of the project to ensure proper abandonment.

Some direct push boreholes will close naturally as the drive rods and sampling tools are withdrawn. This may occur in loose, unconsolidated soils, such as sands. Close all boreholes using one of the procedures described in this procedure, unless natural caving precludes such closure.

The three methods for closing direct push boreholes are:

1. Add granulated or pelletized bentonite and hydrate in layers, proceeding from the bottom of the hole to the surface.
2. Pour premixed cement/water (or cement/water/bentonite) mixture into the hole.
3. Fill the entire hole with granular or pelletized bentonite and hydrate by means of a previously emplaced water tube that is gradually withdrawn as water is supplied to the bentonite.

The second method is recommended. For shallow holes less than 10 feet in depth, pour a cement/water/bentonite mix directly into the opening using a funnel. For deeper holes, use a conductor (tremie) pipe to carry the grout mix to the far reaches of the borehole. Lower the conductor pipe to within 2 inches of the bottom and gradually withdraw it as grout is added, keeping the lower end of the pipe submerged in grout at all times.

The recommended grout mixture for well abandonment is 7 to 9 gallons of water per 94-pound bag of Portland cement, with 3 percent to 5 percent by weight of powdered bentonite added to the mixture. Commercial products, such as Volcay are acceptable with pre-approval of the **CTO Manager**.

Seal boreholes to within 0.5 to 2.0 feet of the surface. Inspect the abandoned borehole after 24 hours to ensure that grout shrinkage does not occur. If significant shrinkage has occurred, re-grout the borehole. Fill the remaining portion of the hole with local topsoil or appropriate paving materials.

8.0 Quality Control and Assurance

8.1 Collection of representative samples will be ensured through adherence to the procedures in this SOP and the sampling strategy outlined in the SAP. The field quality control samples identified in the SAP must be collected. These samples may include field duplicates, equipment rinsate blanks, trip blanks, and matrix spike/matrix spike duplicates

9.0 Records, Data Analysis, Calculations

9.1 Various forms are required to ensure that adequate documentation is made of the sample collection activities. These forms may include:

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- Boring logs;
- Field logbook;
- Sample collection records;
- Chain-of-custody forms; and
- Shipping labels.

9.2 Boring logs (Attachment 1) will provide visual and descriptive information for samples collected at each soil boring and are often the most critical form of documentation generated during a soil sampling program.

9.3 The field logbook is kept as a general log of activities and should not be used in place of the boring log.

9.4 Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes.

9.5 Shipping labels are required is sample coolers are to be transported to a laboratory by a third party (courier service).

10.0 Attachments or References

10.1 Attachment 1 – Boring Log

10.2 NAVSEA T0300-AZ-PRO-010. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. August 2009.

10.3 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.

10.4 Department of the Navy (DON). 2007. *Navy Environmental and Natural Resources Program Manual*. OPNAV Instruction 5090.1c. October.

10.5 SOP 3-05, *IDW Management.*

10.6 SOP 3-06, *Equipment Decontamination.*

10.7 SOP 3-21, *Surface and Subsurface Soil Sampling.*

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
Boring Log

RESOLUTION CONSULTANTS

Boring ID:

Page 1 of _____

Project Name:	Drilling Company:	Type of Surface Material:
Project Number:	Drilling Method:	Patching Material:
Date Started Drilling:	Rig Type:	Drilling Water Level:
Date Finished Drilling:	Core Size:	Boring Total Depth (bgs):
Physical Location:		Logged By:

(Note: bgs = below ground surface)

Depth Range	Re covery ft/ft	PID (ppm)	Moisture Content	GA Class.	USCS	GA Class: Garfield Avenue Sites classification & Modified Unified Soil Clasiffication System	
						Ground Surface Cover and Thickness:	Sample name & #:
0-1							
1-2							
2-3							
3-4							
4-5							
5-6							
6-7							
7-8							
8-9							
9-10							
10-11							
11-12							
12-13							
13-14							
14-15							
15-16							
16-17							
17-18							
18-19							
19-20							

Stratigraphic Unit Intervals:		Comments:
1.)	5.)	
2.)	6.)	
5.)	6.)	

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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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Operation and Calibration of a Photoionization Detector

Procedure 3-20

1.0 Purpose and Scope

1.1 Purpose and Applicability

1.1.1 This standard operating procedure (SOP) describes the procedures that will be followed by field staff for operation and calibration of a photoionization detector (PID). The PID is primarily used by AECOM personnel for safety and survey monitoring of ambient air, determining the presence of volatiles in soil and water, and detecting leakage of volatiles.

1.1.2 PIDs routinely used by field personnel include the Photovac Microtip, Thermoelectron 580EZ, and MiniRAE 2000. Personnel responsible for using the PID should first read and thoroughly familiarize themselves with the instrument instruction manual.

1.2 Principle of Operation

1.2.1 The PID is a non-specific vapor/gas detector. The unit generally consists of a hand-held probe that houses a PID, consisting of an ultraviolet (UV) lamp, two electrodes, and a small fan which pulls ambient air into the probe inlet tube. The probe is connected to a readout/control box that consists of electronic control circuits, a readout display, and the system battery. Units are available with UV lamps having an energy from 9.5 electron volts (eV) to 11.7 eV.

1.2.2 The PID analyzer measures the concentration of trace gas present in the atmosphere by photoionization. Photoionization occurs when an atom or molecule absorbs a photon of sufficient energy to release an electron and become a positive ion. This will occur when the ionization potential of the molecule (in electron volts (eV)) is less than the energy of the photon. The source of photons is an ultraviolet lamp in the probe unit. Lamps are available with energies ranging from 9.5 eV to 11.7 eV. All organic and inorganic vapor/gas compounds having ionization potentials lower than the energy output of the UV lamp are ionized and the resulting potentiometric change is seen as a positive reading on the unit. The reading is proportional to the concentration of organics and/or inorganics in the vapor.

1.2.3 Sample gases enter the probe through the inlet tube and enter the ion chamber where they are exposed to the photons emanating from the UV lamp. Ionization occurs for those molecules having ionization potentials near to or less than that of the lamp. A positive- biased polarizing electrode causes these positive ions to travel to a collector electrode in the chamber. Thus the ions create an electrical current which is amplified and displayed on the meter. This current is proportional to the concentration of trace gas present in the ion chamber and to the sensitivity of that gas to photoionization.

1.2.4 In service, the analyzer is first calibrated with a gas of known composition equal to, close to, or representative of that to be measured. Gases with ionization potentials near to or less than the energy of the lamp will be ionized. These gases will thus be detected and measured by the analyzer. Gases with ionization potentials greater than the energy of the lamp will not be detected. The ionization potentials of the major components of air, i.e., oxygen, nitrogen, and carbon dioxide, range from about 12.0 eV to 15.6 eV and are not ionized by any of the lamps available. Gases with ionization potentials near to or slightly higher than the lamp are partially ionized, with low sensitivity.

1.3 Specifications

1.3.1 Refer to the manufacturer's instructions for the technical specifications of the instrument being used. The operating concentration range is typically 0.1 to 2,000 ppm isobutylene equivalent.

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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 Only PIDs stamped Division I Class I may be used in explosive atmospheres. Refer to the project HASP for instructions pertaining to instrument use in explosive atmospheres.

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 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 operation and calibration activities comply with this procedure. The CTO Manager is responsible for ensuring that all personnel involved in the operation and calibration 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 operation and calibration activities are conducted according to this procedure.

5.2.4 All Field Personnel are responsible for the implementation of this procedure.

6.0 Equipment and Supplies

- Calibration Gas: Compressed gas cylinder of isobutylene in air or similar stable gas mixture of known concentration. The selected gas should have an ionization potential similar to that of the vapors to be monitored, if known. The concentration should be at 50-75% of the range in which the instrument is to be calibrated;

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- Regulator for calibration gas cylinder;
- Approximately 6 inches of Teflon® tubing;
- Tedlar bag (optional);
- Commercially-supplied zero grade air (optional);
- "Magic Marker" or “Sharpie” or other waterproof marker;
- Battery charger;
- Moisture traps;
- Spare lamps;
- Manufacturer’s instructions; and
- Field data sheets or logbook/pen.

7.0 Procedure

7.1 Preliminary Steps

7.1.1 Preliminary steps (battery charging, check-out, calibration, maintenance) should be conducted in a controlled or non-hazardous environment.

7.2 Calibration

7.2.1 The PID must be calibrated in order to display concentrations in units equivalent to ppm. First a supply of zero air (ambient air or from a supplied source), containing no ionizable gases or vapors is used to set the zero point. A span gas, containing a known concentration of a photoionizable gas or vapor, is then used to set the sensitivity.

7.2.2 Calibrate the instrument according to the manufacturer’s instructions. Record the instrument model and identification number, the initial and adjusted meter readings, the calibration gas composition and concentration, and the date and the time in the field records.

7.2.3 If the calibration cannot be achieved or if the span setting resulting from calibration is 0.0, then the lamp must be cleaned (Section 7.4).

7.3 Operation

7.3.1 Turn on the unit and allow it to warm up (minimum of 5 minutes). Check to see if the intake fan is functioning; if so, the probe will vibrate slightly and a distinct sound will be audible when holding the probe casing next to the ear. Also, verify on the readout display that the UV lamp is lit.

7.3.2 Calibrate the instrument as described in Section 7.2, following the manufacturer’s instructions. Record the calibration information in the field records.

7.3.3 The instrument is now operational. Readings should be recorded in the field records.

7.3.4 When the PID is not being used or between monitoring intervals, the unit may be switched off to conserve battery power and UV lamp life; however, a “bump” test should be performed each time the unit is turned on and prior to taking additional measurements. To perform a bump test, connect the outlet tubing from a Tedlar bag containing a small amount of span gas to the inlet tubing on the unit and record the reading. If the reading is not within the tolerance specified in the project plan, the unit must be recalibrated.

7.3.5 At the end of each day, recheck the calibration. The check will follow the same procedures as the initial calibration (Section 7.2) except that no adjustment will be made to the instrument. Record the information in the field records.

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7.3.6 Recharge the battery after each use (Section 7.4).

7.3.7 When transporting, ensure that the instrument is packed in its stored condition in order to prevent damage.

7.4 **Routine Maintenance**

7.4.1 Routine maintenance associated with the use of the PID includes charging the battery, cleaning the lamp window, replacing the detector UV lamp, replacing the inlet filter, and replacing the sample pump. Refer to the manufacturer's instructions for procedures and frequency.

7.4.2 All routine maintenance should be performed in a non-hazardous environment.

7.5 **Troubleshooting Tips**

7.5.1 One convenient method for periodically confirming instrument response is to hold the sensor probe next to the tip of a magic marker. A significant reading should readily be observed.

7.5.2 Air currents or drafts in the vicinity of the probe tip may cause fluctuations in readings.

7.5.3 A fogged or dirty lamp, due to operation in a humid or dusty environment, may cause erratic or fluctuating readings. The PID should never be operated without the moisture trap in place.

7.5.4 Moving the instrument from a cool or air-conditioned area to a warmer area may cause moisture to condense on the UV lamp and produce unstable readings.

7.5.5 A zero reading on the meter should not necessarily be interpreted as an absence of air contaminants. The detection capabilities of the PID are limited to those compounds that will be ionized by the particular probe used.

7.5.6 Many volatile compounds have a low odor threshold. A lack of meter response in the presence of odors does not necessarily indicate instrument failure.

7.5.7 When high vapor concentrations enter the ionization chamber in the PID the unit can become saturated or "flooded". Remove the unit to a fresh air environment to allow the vapors to be completely ionized and purged from the unit.

8.0 Quality Control and Assurance

8.1 The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. These quality assurance requirements will be defined in the site-specific workplan or Sampling and Analysis Plan (SAP), hereafter referred to as the project plan.

8.2 Calibration of the PID will be conducted at the frequency specified in the project plan. In the absence of project-specific guidance, calibration will be performed at the beginning of each day of sampling and will be checked at the end of the sampling day or whenever instrument operation is suspect. The PID will sample a calibration gas of known concentration. The instrument must agree with the calibration gas within ±10%. If the instrument responds outside this tolerance, it must be recalibrated.

8.3 Checks of the instrument response (Section 7.5) should be conducted periodically and documented in the field records.

9.0 Records, Data Analysis, Calculations

Safety and survey monitoring with the PID will be documented in a bound field logbook, or on standardized forms, and retained in the project files. The following information is to be recorded:

- Project name and number;
- Instrument manufacturer, model, and identification number;

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- Operator's signature;
- Date and time of operation;
- Calibration gas used;
- Calibration check at beginning and end of day (meter readings before adjustment);
- Span setting after calibration adjustment;
- Meter readings (monitoring data obtained);
- Instances of erratic or questionable meter readings and corrective actions taken; and
- Instrument checks and response verifications – e.g., battery check, magic marker response (Section 7.5) or similar test.

10.0 Attachments or References

United States Environmental Protection Agency. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM). USEPA, Region 4, SESD, Enforcement and Investigations Branch, Athens, GA. November 2001.

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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Surface and Subsurface Soil Sampling Procedures

Procedure 3-21

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the procedures for soil sampling. The procedure includes surface and subsurface sampling by various methods using hand auguring, test pit, direct-push, and split-spoon equipment.

1.2 The procedure includes soil sampling for volatile organic compounds (VOCs). For project specific information (e.g. sampling depths, equipment to be used, and frequency of sampling), refer to the Sampling and Analysis Plan (SAP), which takes precedence over these procedures. Surface soil sampling, typically considered to be up to two feet below ground surface by EPA standards, is typically accomplished using hand tools such as shovels or hand augers. Test pit samples are considered subsurface samples, although normally collected via hand tools similar to surface soil sampling or by excavation machinery. Direct-push and split-spoon sampling offer the benefit of collecting soil samples from a discrete or isolated subsurface interval, without the need of extracting excess material above the target depth. These methods dramatically reduce time and cost associated with disposal of material from soil cuttings when compared to test pit sampling. In addition, direct-push and split-spoon sampling methods can obtain samples at targeted intervals greater than 15 feet in depth, allowing for discrete depth soil sampling while speeding up the sampling process. Direct-push methods work best in medium to fine-grained cohesive materials such as medium to fine sands, silts, and silty clay soils. Split-spoon sampling works well in all types of soil, but is somewhat slower than direct-push methods. Samples are composited so that each sample contains a homogenized representative portion of the sample interval. Due to potential loss of analytes, samples for volatile analysis are not composited. Samples for chemical analysis can be collected by any of the above-mentioned sampling methods, as disturbed soil samples. Undisturbed samples are collected, sealed, and sent directly to the laboratory for analysis. For undisturbed samples, the samples are not homogenized.

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 soil sampling commences, appropriate entities (e.g. DigSafe, local public works departments, company facilities) must be contacted to assure the anticipated soil sampling locations are marked for utilities, including electrical, telecommunications, water, sewer, and gas.

3.0 Terms and Definitions

None.

4.0 Interferences

4.1 Low recovery of soil from sampling equipment will prevent an adequate representation of the soil profile and sufficient amount of soil sample. If low recovery is a problem, the hole may be offset and re-advanced, terminated, or continued using a larger diameter sampler.

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4.2 Asphalt in soil samples can cause false positive results for hydrocarbons. To ensure samples are free of asphalt, do not collect samples that may contain asphalt. If the collection of samples potentially containing asphalt is unavoidable, note the sampling depths at which the presence of asphalt are suspected.

4.3 Instrumentation interferences addressed in SOPs for Calibration of the Photoionization Detector (PID), Headspace Screening for Total Volatile Organics, and Equipment Decontamination must also be considered.

4.4 Cross contamination from sampling equipment must be prevented by using sampling equipment constructed of stainless steel that is adequately decontaminated between samples.

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 soil sampling activities comply with this procedure. The CTO Manager is responsible for ensuring that all personnel involved in soil sampling 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 soil sampling activities are conducted according to this procedure.

5.2.4 All Field Personnel are responsible for the implementation of this procedure.

6.0 Equipment and Supplies

The depth at which samples will be collected and the anticipated method of sample collection (direct-push, split-spoon, hand auger, shovel, or test pits) will be presented in the SAP. The following details equipment typically needed for soil sampling, based on the various methods. See the SAP for specific detail of equipment and supply needs.

6.1 Depending on the nature of suspected contamination, field screening instrumentation may be used for direct sampling. Appropriate instrumentation and calibration standards should be available. If volatile organic contaminants are suspected and a PID will be used, refer to the equipment and instrumentation listed in SOP 3-20 Operation and Calibration of a Photoionization Detector. Equipment in this SOP includes but is not limited to:

- PID/FID;
- Calibration gas; and
- Tedlar® gas bags (for calibration).

6.2 If field screening methods include jar headspace screening for volatile organics, refer to the equipment and procedure in SOP 3-19 Headspace Screening for Total VOCs. Equipment in this SOP includes but is not limited to:

- Clean soil (“drillers jars”) jars; and
- Aluminium foil.

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6.3 Appropriate decontamination procedures must be followed for sampling equipment. Refer to SOP 3-06 Equipment Decontamination. Equipment in this SOP includes but is not limited to:

- Phosphate-free detergent;
- Isopropyl Alcohol;
- Tap water;
- Deionized Ultra-Filtered (DIUF) Water;
- Plastic buckets or washbasins;
- Brushes; and
- Polyethylene sheeting.

6.4 The following general equipment is needed for all soil sampling, regardless of method:

- Stainless steel bowls;
- Stainless steel trowels;
- Appropriate sample containers for laboratory analysis;
- Personal Protective Equipment (PPE);
- Logbook;
- Cooler and ice for preservation; and
- Stakes and flagging to document sampling location.

6.5 The following additional equipment is needed for volatile organic sampling:

- Electronic pan scale and weights for calibration; and
- Syringes or other discrete soil core samplers.

6.6 The following additional equipment may be needed for surface and test pit soil sampling:

- Hand Auger

6.7 The following additional equipment may be needed for soil sampling from direct push and/or split-spoon equipment:

- Tape measure or folding carpenter's rule for recording the length of soil recovered.

Note: All subsurface drilling equipment will be provided and maintained by the subcontractor.

7.0 Procedure

7.1 **General Soil Sampling Procedure for All Soil Sampling Methods**

7.1.1 Record the weather conditions and other relevant on-site conditions.

7.1.2 Select the soil sampling location, clear vegetation if necessary, and record the sampling location identification number and pertinent location details.

7.1.3 Verify that the sampling equipment is properly decontaminated, in working order, and situated at the intended sampling location.

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7.1.4 Place polyethylene sheeting on the ground and assemble all necessary sampling equipment on top of it. Cover surfaces onto which soils or sampling equipment will be placed (i.e. tables with polyethylene sheeting).

7.1.5 Follow the appropriate procedures listed below for either surface, split-spoon, direct push, or test pit sample collection (7.2, 7.3, 7.4, and 7.5 respectively).

7.1.6 Collect soil samples according to procedures listed in Section 7.6 depending on project specific analyses.

7.1.7 Record date/time, sample ID, and sample descriptions in the field logbook or field form. A sketch or description of the location may also be recorded so the sample location can be re-constructed, especially if the location will not be recorded using global positioning satellite (GPS) equipment.

7.1.8 Immediately label the sample containers and place them on ice, if required for preservation. Complete the chain-of-custody form(s) as soon as possible.

7.1.9 Dispose of all excess excavated soil in accordance with the SAP.

7.1.10 If required, mark the sample location with a clearly labelled wooden stake or pin flag. If the location is on a paved surface, the location may be marked with spray paint.

7.1.11 Decontaminate the sampling equipment according to SOP 3-06 Equipment Decontamination.

7.2 Surface Sampling

7.2.1 The criteria used for selecting surface soil locations for sampling may include the following:

- Visual observations (soil staining, fill materials);
- Other relevant soil characteristics;
- Site features;
- Screening results;
- Predetermined sampling approach (i.e. grid or random); and
- Sampling objectives as provided in the SAP.

7.2.2 The following procedures are to be used to collect surface soil samples. Surface soils are considered to be soils that are up to two feet below ground surface, though state regulations and project objectives may define surface soils differently; therefore, the SAP should be consulted for direction on the depth from which to collect the surface soil samples. Sampling and other pertinent data and information will be recorded in the field logbook and/or on field forms. Photographs may be taken as needed or as specified in the SAP.

1. Gently scrape any vegetative covering until soil is exposed. Completely remove any pavement.
2. Remove soil from the exposed sampling area with a trowel, hand auger, or shovel. Put soils within the sampling interval in a stainless steel bowl for homogenizing. Monitor the breathing zone and sampling area as required in the HASP.
3. For VOC analyses, collect representative soil samples directly from the recently-exposed soil using a syringe or other soil coring device (e.g., TerraCore®, EnCore®). Follow procedures in Section 7.6.1 for VOC sampling.
4. Collect sufficient soil to fill all remaining sample jars into a stainless steel bowl. Homogenize the soil samples to obtain a uniform soil composition which is representative of the total soil sample collected according to the following procedure:
   a) Remove all rocks and non-soil objects using a stainless steel spoon or scoop.

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b) Form a cone shaped mound with the sample material, then flatten the cone and split the sample into quarters.

c) Use the stainless steel spoon/scoop to mix the quarter samples that are opposite.

d) After mixing the opposite quarters, reform the cone shaped mound.

e) Repeat this procedure a minimum of five (5) times, removing any non-soil objects and breaking apart any clumps.

7.3 Split-Spoon Sampling

7.3.1 At each boring location, the frequency and depth of split-spoon samples will be determined from the SAP. Split-spoon samples may be collected continuously, intermittently, or from predetermined depths.

7.3.2 Split-spoon samplers shall be driven into undisturbed soil by driving the spoon ahead of the drill augers/casing. In cohesive soils, or soils where the borehole remains open (does not collapse), two split-spoon samples may be taken prior to advancing the augers/casing.

7.3.3 After split-spoons are retrieved, open the split-spoon and measure the recovery of soil. If a PID will be used for screening, immediately scan the recovered sample for VOCs using the PID. Scan the recovered soil boring by making a hole in the soil with a decontaminated trowel and placing the PID inlet very close to the hole. Be very careful not to get soil on the tip of the PID. Take PID readings every 6 inches along the split-spoon and/or in any areas of stained or disturbed soil. Record the highest PID reading and the depth at which it was observed along with all other pertinent observations. If required in the SAP, VOC and headspace samples should be collected (see Section 7.6.1) prior to logging the sample.

7.3.4 If headspace screening for VOCs is required in the SAP, collect a soil sample (as defined in the SAP) and perform headspace screening according to SOP 3-19 Headspace Screening for Total VOCs.

7.3.5 Soils collected using the split-spoon sampler will be logged by the field representative using the procedure required in the SAP.

7.3.6 Collect the remainder of the sample volume required into a stainless steel bowl. Homogenize the soil so the material is uniform in composition and representative of the total soil sample collected. Follow homogenizing techniques as described in Section 7.2.

7.3.7 The SAP may specify that intervals to be sent to the laboratory be determined by visual observation and/or highest PID screening or headspace results, which can only be determined once the boring is complete. In this instance, a VOC sample should be collected at each interval. The remainder of the soil from that interval will be set aside in a clearly labelled stainless steel bowl covered with aluminium foil. Once the boring has been completed and the sample interval has been determined, the remainder of the soil can be homogenized according to Section 7.2 and submitted for laboratory analysis.

7.3.8 Once a boring is complete and all required samples have been collected, the boring must be completed as specified in the SAP (e.g., completed as a monitoring well, backfilled with bentonite, etc).

7.4 Direct Push Sampling

At each boring location, the frequency of direct-push samples will be determined from the SAP. Typically, samples with direct-push equipment are collected in 4 foot (ft) intervals, but smaller (e.g., 2 ft) and larger (e.g., 5 ft) intervals are also possible.

1. Sample using Macro-Core samplers with acetate liners to obtain discrete soil samples at the depths specified in the SAP.

2. Cut open the acetate liner. If required in the SAP, immediately scan the recovered soil boring for VOCs using a PID by making a hole in the soil with a decontaminated trowel and placing the PID inlet very close to the hole. Be very careful not to get soil on the tip of the PID. Take PID readings every 6 inches along the split-spoon and/or in any areas of stained or disturbed soil. Record the

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highest PID reading and the depth at which it was observed along with all other pertinent observations. VOC and headspace samples, if required in the SAP should be collected (see Section 7.6.1) prior to logging the sample.

3. If required in the SAP, collect a soil sample (as defined in the SAP) and perform headspace screening according to SOP 3-19 Headspace Screening for Total VOCs.

4. Soils collected using the direct-push sampler will be logged by the by the field representative using the procedure required in the SAP.

5. Collect the remainder of the sample into a stainless steel bowl. Homogenize the soil collected so that the material is uniform in composition and representative of the total soil sample collected. Follow homogenizing techniques as described in Section 7.2.

6. Once a boring is complete and all required samples have been collected, the boring must be completed as specified in the SAP (e.g., completed as a monitoring well, backfilled with bentonite, etc).

7.5 Test Pit Sampling

7.5.1 Excavate the test pit to the desired depth.

7.5.2 Using the excavator bucket, collect soil samples as specified in the SAP. Collect a sample and perform screening analyses as required by the SAP. If VOCs contamination is suspected, perform headspace screening according to SOP 3-19 Headspace Screening for Total VOCs.

7.5.3 Collect the sample from center of the bucket to avoid potential contamination from the bucket.

7.5.4 VOC samples should also be collected from an undisturbed section soil in the excavator bucket. The top layer of exposed soil should be scraped away just prior to collecting the VOC samples.

7.5.5 Collect the remainder of the sample volume required into a stainless steel bowl. Homogenize the soil so the material is uniform in composition and representative of the total soil sample collected. Follow homogenizing techniques as described in Section 7.2.

7.5.6 Dispose of all excavated soil according to the SAP.

7.6 Sample Collection Methods

7.6.1 Volatile Organics Sampling

For soils collected for analyses of volatile organics, including Volatile Petroleum Hydrocarbons (VPH) or other purgable compounds, a closed system is maintained. From collection through analysis, the sample bottles are not opened. The bottle kit for a routine field sample for these analyses will typically include three 40-mL VOA vials and one soil jar. Two 40-mL VOA vials will contain either 5 mL reagent water or 5 mL sodium bisulfate and magnetic stir bars (i.e., low level vials). The third VOA vial will contain 15 mL methanol with no magnetic stir bar (i.e., high level vial). These vials are usually provided by the laboratory and are pre-weighed, with the tare weight recorded on the affixed sample label. No additional sample labels are affixed to the VOA vials, as addition of a label would alter the vial weight. All information is recorded directly on the sample label using an indelible marker. The soil jar is provided for percent solids determination. For VOC or VPH analyses, samples are collected prior to sample homogenization. Collect the VOC sample in accordance with the procedure described below.

1. Determine the soil volume necessary for the required sample weight, typically 5 grams:

   a) Prepare a 5 mL sampling corer (e.g., Terra Core®) or cut-off plastic syringe.

   b) Tare the sampler by placing it on the scale, and zeroing the scale.

   c) Draw back the plunger to the 5 gram mark or 5mL (5cc) mark on cut-off syringe, and insert the open end of the sampler into an undisturbed area of soil with a twisting motion, filling the

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sampler with soil. Note the location of the plunger with respect to the milliliter (cc) or other graduation printed on the sampler.

d) Weigh the filled sampler, and remove or add soil until the desired weight is obtained. Note the location of the plunger which corresponds to this weight. Do not use this sample for laboratory analysis.

2. Once the required soil volume has been determined, pull the plunger back to this mark and hold it there while filling the syringe for each sample.

3. Collect 5 grams of soil using the cut-off syringe or Terra Core® sample device. Extrude the 5-grams of soil into one of the low level 40-mL VOA vials. Quickly wipe any soil from the threads of the VOA vial with a clean Kimwipe® and immediately close the vial. It is imperative that the threads be free from soil or other debris prior to replacing the cap on the vial in order to maintain the closed system necessary for the analysis.

4. Gently swirl the vial so that all of the soil is fully wetted with the preservative.

5. Fill the other low level 40 mL VOA vial in this manner.

6. Repeat the process for the high level VOA vials, only for the high level VOA vial three 5 gram aliquots (i.e., 15 grams total) should be extruded into the high level VOA vial.

   NOTE: Depending on the laboratory, some high level VOA vials only contain 5 mL or 10 mL of methanol. If this is the case, either 5 grams total or 10 grams total, respectively, should be extruded into the high level VOA vial. In other words, the mass of soil in grams should be identical to the volume of methanol in mL (i.e., 1:1 ratio of soil to methanol).

7. Collect any additional QC sample collected (e.g., field duplicate, MS, and MSD) in the same manner as above.

8. Fill the 4-oz glass jar with soil from the same area for percent moisture determination.

7.6.2 Soil Sampling Method (All other analyses except VOC/VPH)

When all the required soil for a sampling location has been obtained, the soil can be homogenized as described in section 7.2. Collect sufficient volume to fill all of the remaining sample containers at least ¾ full for all other analyses. Homogenize the soil in a decontaminated stainless steel bowl, removing rocks, sticks, or other non-soil objects and breaking apart any lumps of soil prior to filling the remaining sample containers.

NOTE: Soil samples must contain greater than 30% solids for the data to be considered valid.

8.0 Quality Control and Assurance

8.1 Sampling personnel should follow specific quality assurance guidelines as outlined in the SAP. Proper quality assurance requirements should be provided which will allow for collection of representative samples from representative sampling points. Quality assurance requirements outlined in the SAP typically suggest the collection of a sufficient quantity of field duplicate, field blank, and other samples.

8.2 Quality control requirements are dependent on project-specific sampling objectives. The SAP will provide requirements for equipment decontamination (frequency and materials), sample preservation and holding times, sample container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.

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9.0 Records, Data Analysis, Calculations

All data and information (e.g., sample collection method used) must be documented on field data sheets, boring logs, or within site logbooks with permanent ink. Data recorded may include the following:

- Weather conditions;
- Arrival and departure time of persons on site;
- Instrument type, lamp (PID), make, model and serial number;
- Calibration gas used;
- Date, time and results of instrument calibration and calibration checks;
- Sampling date and time;
- Sampling location;
- Samples collected;
- Sampling depth and soil type;
- Deviations from the procedure as written; and
- Readings obtained.

10.0 Attachments or References

SOP 3-06, *Equipment Decontamination*

SOP 3-19, *Headspace Screening for Total VOCs*

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°/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#_____

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Region 4
U.S. Environmental Protection Agency
Science and Ecosystem Support Division
Athens, Georgia

OPERATING PROCEDURE

Title: **Global Positioning System**

Effective Date: April 20, 2011	**Number:** SESDPROC-110-R3

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Revision History

This table shows changes to this controlled document over time. The most recent version is presented in the top row of the table. Previous versions of the document are maintained by the SESD Document Control Coordinator.

History	Effective Date
SESDPROC-110-R3, *Global Positioning System*, replaces SESDPROC-110-R2 **Cover Page:** The EIB Branch Chief was changed from Antonio Quinones to Archie Lee. The FQM was changed from Laura Ackerman to Liza Montalvo. **Revision History:** Changed Field Quality Manager to Document Control Coordinator. **Section 1.2:** Added the following statement: Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use. **Section 1.3:** Omitted the reference to the H: drive of the LAN. Changed Field Quality Manager to Document Control Coordinator.	April 20, 2011
SESDPROC-110-R2, *Global Positioning System*, replaces SESDPROC-110-R01 **Title Page** Changed title for Antonio Quinones from Environmental Investigations Branch to Enforcement and Investigations Branch. Changed Bill Cosgrove"s title from Acting Chief to Chief. **Section 1.4** Alphabetized and added a reference.	November 1, 2007
SESDPROC-110-R1, *Global Positioning System*, replaces SESDPROC-110-R0 This revision reflects the following changes: **General** Extensive rewrite with additional information added to most sections. Brian Striggow added as coauthor. **Section 2.1** Rewritten description of GPS system. Descriptions of "GPS Accuracy Factors" and "Differential GPS" isolated as separate subsections.	October 1, 2007

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Section 2.2 This Section, titled "Requirements for Locational Information" inserted. Supplies guidance on accuracy requirements for various study types and potential means used to obtain requisite accuracy. Subsection on datums and data formats included. **Section 2.3** "Quality Control Procedures", previously numbered as Section 2.2. Most information in this section moved to Section 2.1 discussion of Accuracy Factors and Section 2.4 discussion of specific receivers. Explicit statement added that no specific GPS quality control procedures are required for most SESD studies. **Section 2.4** Information added to sections on Trimble and Garmin receivers. **Section 2.5** Issue of electronic data-logging addressed. Storage of electronic data records addressed.	
SESDPROC-110-R0, Global Positioning System, Original Issue	March 22, 2007

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Contents

1 General Information

1.1 Purpose

This document describes the Global Positioning System (GPS) and procedures, methods and considerations to be used and observed when using GPS to record location data in the field. Guidance is provided on accuracy requirements for various uses of location data and potential means to obtain the requisite accuracy. This document contains direction developed solely to provide internal guidance to SESD employees.

1.2 Scope/Application

The procedures contained in this document are to be used by SESD field investigators when using the Global Positioning System to obtain the geographical coordinates of sampling locations and/or measurements during field investigations. In SESD investigations, GPS is the preferred means of collecting horizontal location information. In most cases the accuracy of GPS is unsuitable for collection of elevation data.

On the occasion that SESD field personnel determine that any of the procedures described in this section cannot be used to obtain the required coordinate information and alternate procedures are employed, the alternate procedure will be documented in the field log book, along with a description of the circumstances requiring its use. GPS users must be currently qualified as proficient in the operation of the specific GPS equipment to be used. The manufacturer‟s operation manuals should be used for detailed information on the use of specific GPS equipment. Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.

1.3 Documentation/Verification

This procedure was prepared by persons deemed technically competent by SESD management, based on their knowledge, skills and abilities and has been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the SESD local area network (LAN). The Document Control Coordinator is responsible for ensuring the most recent version of the procedure is placed on the LAN and for maintaining records of review conducted prior to its issuance.

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1.4 References

Rand Corporation, The Global Positioning System, Assessing National Policies, Appendix B, GPS History, Chronology, and Budgets, 1995.

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USEPA, Global Position Systems – Technical Implementation Guidance, Office of Environmental Information (EPA/250/R-03/001), 2003.

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USEPA, Locational Data Policy, Office of Information Resources Management, IRM Policy Manual 2100 Chapter 13, 1991.

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2 Methodology

2.1 General

2.1.1 GPS Description

The Navigation Satellite Time and Ranging (NAVSTAR) Global Positioning System (GPS) is a worldwide radio-navigation system created by the U. S. Department of Defense (DOD) to provide navigation, location, and timing information for military operations. System testing using a limited number of satellites began in 1978 with the system being declared fully operational in 1995. The system was declared available for civilian uses in the 1980s and has seen burgeoning civilian application for navigation and mapping.

The GPS system consists of three basic elements: the space segment, control segment, and user segment. The space segment consists of the constellation of up to 24 active NAVSTAR satellites in six orbital tracks. The satellites are not in geo-synchronous orbit and are in constant motion relative to a ground user. The control segment consists of several ground stations that serve as uplinks to the satellites and that make adjustments to satellite orbits and clocks when necessary. The user segment consists of the GPS receiver which will typically consist of an antenna, multi-channel receiver, and processing unit.

For the purposes of this document, the user segment GPS receivers may be loosely grouped into Recreational and Navigational receivers (henceforth referred to as General Use receivers), Mapping Grade receivers, and Survey Grade receivers.

- Most General Use grade receivers are available on the retail market to consumers for a variety of applications including boating, hiking, and automotive navigation. They display an instantaneous reading of position and are generally not optimized for data collection. Waypoints containing instantaneous position fixes can often be stored and downloaded. The accuracy of these receivers is adequate for many environmental applications.

- Mapping Grade receivers are used for applications such as resource management and Geographical Information System (GIS) feature collection. The receivers are capable of averaging multiple position fixes for greater accuracy and then data-logging the results with sufficient information to post-correct the positions as described below. The potential accuracy that can be achieved may be better than one meter.

- Survey Grade receivers can provide accuracy at the centimeter level by using long occupation times and special techniques for receiver use and data processing. Survey Grade receivers are not used by SESD in field investigations.

GPS receivers derive positions by simultaneously measuring the distance (range) to several satellites in precisely known orbits, and using triangulation of the ranges to calculate a unique position for the receiver. The range to each satellite is determined by precisely measuring the transit time of radio signals broadcast from the satellites.

2.1.2 GPS Accuracy Factors

The accuracy of the basic GPS system is approximately 15m. GPS accuracy can be affected by a number of factors including the Selective Availability feature, atmospheric delays, satellite clock and orbit errors, multipath signals, signal strength, and satellite geometry relative to the user.

In the early GPS implementation, the DOD used a feature known as Selective Availability (SA) to degrade the quality and subsequent accuracy of the GPS signals to non-DOD users. With Selective Availability enabled, accuracy of position fixes could be as poor as 100m without the use of differential correction techniques described below. Currently there is no SA limitation in accuracy in place with a stated Executive Branch intention to not return to the use of the SA signal degradation.

As satellites move in their orbits and some signals are blocked by obstructions, the geometry of the available satellite signals relative to the user will constantly change. When the satellites with available signals are clustered closely together in the sky, small errors in range will result in large errors in reported position. Conversely, when the satellites are distributed more broadly across the sky, the resultant position errors will be at their minimum. The general measure of this phenomenon is Dilution of Precision (DOP), which may be represented as Position Dilution of Precision (PDOP), or more specifically for geographical coordinate collection, Horizontal Dilution of Precision (HDOP). Mapping and Survey Grade receivers generally can calculate and display DOP and allow the user to limit logging to times when the higher potential accuracy conditions of low DOP prevail. General Use receivers may display DOP and use DOP with other factors to estimate a general accuracy figure. DOP may range from approximately 2 to 50, with high quality work usually requiring a HDOP of less than 4-6.

Signal strength and multipath signals relate to the strength and quality of the signal reaching the receiver antenna. Signal attenuation by the atmosphere, buildings, and tree cover limit the accuracy of the ranges obtained. The measure of signal strength is Signal to Noise Ratio (SNR), generally measured in decibels(db). Most receivers of any grade will display the SNR of the satellite signals in a bar graph or table. Mapping Grade Receivers generally allow the user to specify a minimum signal strength for the use of a satellite signal (commonly 2-15db). Poor signal strength can be resolved by waiting for satellite locations to change or moving the receiver location. Multipath signals result

from portions of the satellite signal bouncing off terrain, structures, or atmospheric disturbances, resulting in a degraded total signal. Higher quality Mapping Grade receivers may be capable of rejecting the stray multipath signals, such as Trimble® receivers using Everest™ technology.

2.1.3 Differential GPS

Selective Availability, clock errors, and orbital errors affect all GPS users and atmospheric delays affect all users over a relatively wide region. A second GPS receiver in the same general area as the user will experience the same errors from these sources as the user‟s receiver. Consequently, correction factors from a remote station at a known location can be applied to the user‟s receiver in a process known as Differential GPS (DGPS). DGPS can be applied in real-time using additional radio signals, or after the collection event by a method called post-correction.

Real-time DGPS uses established networks of base stations at precisely surveyed locations. The US Coast Guard operates a system of 80 base stations which became fully operational in 1999. The range corrections are broadcast on marine radiobeacon frequencies, with redundant coverage of most of the US coastline and the Mississippi River. There is near complete single beacon coverage of most of the internal US, but there are known gaps in coverage in both EPA Region 4 and the US as a whole. The system is sometimes referred to using the more general term DGPS or in nomenclature referring to the beacon-based nature of the system. Beacon-based DGPS is implemented primarily in Navigational and Mapping Grade receivers.

Real-time DGPS can also be implemented with a Space Based Augmentation System (SBAS). The most common SBAS currently used in the United States is the Wide Area Augmentation System (WAAS), developed by the Federal Aviation Administration to meet the additional demands on GPS for aircraft navigation. The WAAS network of base stations collects information on satellite clock errors, orbital errors, and atmospheric conditions. The error information is transferred to satellites in geo-synchronous orbits and subsequently broadcast to suitably equipped GPS receivers on frequencies compatible with the GPS range signals. While beacon-based DGPS passes range corrections to the receivers, WAAS communicates a model for the errors which is capable of providing more accurate corrections. Current Mapping Grade receivers will likely use WAAS with or without the option of beacon-based DGPS. All but the least expensive General Use receivers are generally equipped with WAAS differential correction capability.

Post-Corrected DGPS is generally accomplished by downloading the receiver survey files to a desktop or laptop computer and then retrieving correction files for the same time period (generally via the internet) from an established base station in the area of the survey. Post-processed accuracy improves with proximity of the base station to the surveyed locations and base station data should be used from a station within 300km of the site surveyed. The survey positions are processed by application software and a new

set of positions is generated using the correction data. The capability for post-processed differential correction is generally limited to Mapping Grade and Survey Grade receivers.

Various factors limit GPS accuracy in the vertical plane to approximately half of that obtainable in the horizontal plane, i.e., if a location fix is accurate to 3 m in the horizontal plane, it may only be accurate to 6 m in the vertical plane. Since relatively high accuracy is usually required for the uses of elevation data, GPS is rarely used to obtain and report elevations.

2.2 Requirements for Locational Information

2.2.1 Data Uses

Locational information can serve many purposes in an environmental investigation, a few of which are listed below:

1. Providing an unambiguous means to identify facilities or sampling plats.
2. Providing locational information to key analytical data in a GIS based data archiving system to the original sampling locations.
3. Differentiating watersheds.
4. Providing information to calculate extents and volumes of contamination.
5. Providing a means to relocate the media represented by samples for removal or treatment.
6. Providing information to prepare presentation graphics of sampling locations.

Depending on the specific uses for the data and the type of work being performed, there will be different needs for the accuracy of the locational data. Studies where a sample represents a large area of relatively homogeneous material would not require the same accuracy as the location of a permanent monitoring well. Below are broad guidelines for the accuracy that might be required for different applications.

Desired Accuracy	Application
100 m	Open ocean work where sample is presumed to be representative of a large area
20 m	Open water work (lakes or estuaries) where sample is presumed to be representative of a large area
10 m	Stream and river work where samples are presumed to be broadly representative of a reach
5-3 m	Stream work where samples are representative of a specific narrowly defined section

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10 m	Air Monitoring Stations
10 - 3 m	Microscale air monitoring
3 - 1 m	Permanent monitoring wells
1 m	Locations of 'Hot Spots' destined for removal of limited areal extent
3 - 1 m	Locations of Temporary groundwater wells in plumes requiring narrow delineation
3 m	Locations of Temporary groundwater wells in broad plumes
3 m	Locations of environmental samples with sample spacing >20 m
5 m	Locations of environmental samples with sample spacing >60 m
200 - 20 m	Coordinates describing a facility where mobile waste units are sampled
30 - 3 m	Locations of industrial process areas or NPDES permitted facilities where the sampling locations are described in field notes relative to the process or site features

Specific demands of a study may drive increased or decreased requirements for accuracy. The preferred means of locational data collection for most studies will be GPS, although alternate means are permissible if they meet accuracy requirements. The following table indicates the accuracy that may be expected from various means of establishing coordinates.

Accuracy	**Description**
200 - 50 m	Map Derived, coarse work
40 - 20 m	Map Derived, fine work or using GIS with digital imagery
15 m	General Use Grade GPS, w/o WAAS
5 m	General Use Grade GPS, w/ WAAS or beacon corrections
10 m	Mapping Grade GPS, no corrections, averaged readings,
3 m	Mapping Grade GPS w/ differential correction, averaged readings
1 m	Mapping Grade GPS w/ differential correction, controlled DOP and SNR, averaged readings
10 cm	Surveying Grade GPS or optical surveying (dependent on baseline length)

Accuracy is a term used to describe the degree of conformity of a measurement. In GPS, accuracy is usually specified as an estimate of the radius from the measured coordinates that is likely to include the actual coordinates. The estimate is based on several standard deviations probability of including the actual point in the measurement. As such, it is recognized that some measurements will fall outside of the specified accuracy. For the purposes of SESD GPS work, the nominal accuracy figures derived from manufacturer‟s literature for specific operating conditions, displayed by the receiver at the time of feature collection, or output from processing software will be taken at face value.

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2.2.2 Datums and Data formats

In general, a datum is a reference from which other measurements are taken. In the development of surveying systems by civil entities, different datums were used as base references that will result in differing coordinates for the same location. A GPS receiver will generally display coordinates in a number of different user-selected datums. **Unless there are specific requirements on a project, all SESD work should be conducted using the WGS84 datum. A**lternatively, the nearly equivalent NAD83 datum may be used if WGS84 is unavailable as a receiver option. If an alternate coordinate system is used where coordinates are obtained and recorded in field logbooks, the use of the alternate coordinate system should also be noted in the logbook.

The SESD Data Archival and Retrieval System (DART) requires that coordinates for sample locations be entered in the WGS84 datum and dd.dddddd format. Unless specific project requirements dictate otherwise, all coordinates explicitly stated in reports will be in WGS84 format and in all cases the datum used will be specified.

There is no SESD policy on significant digits for GPS information, and accuracy should not be implied from the presence of significant digits in reported coordinates. However, good scientific practice should be followed in the presentation of locational information in order that useful information not be truncated or a higher degree of accuracy implied. The following table shows the incremental distance in latitude represented by the least significant digit for various coordinate formats:

dd.dddddd°	Approximately 4" or 10 cm
dd.ddddd°	Approximately 44" or 1.1 m
dd.dddd°	Approximately 36' or 11 m
dd°mm’ss”	Approximately 100' or 30 m
dd°mm’ss.x”	Approximately 10' or 3 m
dd°mm’ss.xx”	Approximately 1' or 30 cm
dd°mm.xxxx’	Approximately 7" or 18 cm
dd°mm.xxx’	Approximately 6' or 1.8 m
dd°mm.xx’	Approximately 60' or 18 m

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2.3 Quality Control Procedures

By nature of its origin in the DOD and recent application to aircraft navigation, the GPS is designed for high reliability. GPS failures resulting in an incorrect reading beyond the bounds of known errors are so rare that the possibility can be ignored for most SESD studies. If a study requires the verification of receiver function, this can be accomplished by verifying that a receiver displays the correct position while occupying a known benchmark.

2.4 Special Considerations

The application will dictate the type of receiver used. There are several specific considerations for the use of the various receiver types.

2.4.1 Special considerations for the use of Trimble® Mapping Grade Receivers

The suggested settings for Trimble® receivers are:

1. Position mode: Overdetermined 3D (or manual 3D if only 4 satellites are visible)
2. Elevation mask: 15 degrees
3. PDOP: 6
4. Signal to noise ratio (SNR) mask: 6
5. Dynamics code: Land
6. Logging interval: 1 second for points, 5 seconds for lines and areas
7. Audible click: Yes
8. Log DOP data: Yes
9. Coordinate System: Geographic Datum WGS84

When using Trimble® Geoexplorer receivers, the option of using the accuracy „slider bar‟ display may be used to consolidate many of the above parameters. The slider bar position must be positioned at midscale or towards the „Precision‟ end of the scale to achieve 1m accuracy work. When conducting work requiring less accuracy, the slider should be initially positioned midscale and may be adjusted toward the Production‟ end of the scale if the higher level of accuracy can not be maintained.

The receivers may be configured to force real-time position correction. The use of real-time correction reduces the risk of being unable to obtain appropriate post-correction files, but may limit productivity when differential signals cannot be

received or are intermittent. The use of forced real-time vs. post-correction is an operator decision. If the positions are not to be downloaded and the accuracy of differential correction is required, it will be necessary to force real-time correction.

Trimble® receivers at SESD contain a data dictionary that can facilitate the management of GIS data. If the COC_GIS dictionary is selected at the time of file creation, SESD standard media codes can be assigned to features at the time of logging that will accompany the data through the download process. The use of the COC_GIS data dictionary can simplify the management of the data when processed in a GIS system or when entered into the DART system.

The logging interval of most Trimble® GPS receivers defaults to a 5 second interval. This may be changed to a 1 second interval to expedite feature collection. A point feature should have a minimum of 36 positions logged to obtain the additional accuracy afforded by averaging positions. After a minimum of 36 positions are logged and the feature is closed, the averaged position can be obtained by selecting the feature on the „Map" screen. The averaged position should always be the one entered into field notebooks.

Some Trimble® receivers may only display data in dd°mm"ss.sss" format. If the coordinates are downloaded and processed through Pathfinder Office software, they can be output in the dd.dddddd (or any other) format. If the coordinates were only recorded in field logbooks, they can be converted to decimal degrees as follows:

Converting to decimal degrees (dd.dddddd) from degrees°minutes"seconds" (dd°mm"ss.sss"):

dd.dddddd = dd + (mm/60) + (ss.sss/3600)

Example: Convert 33°28"45.241" to decimal degrees

33 + (28/60) + (45.241/3600) = 33.479236

The reverse conversion is accomplished as follows:

Converting to degrees°minutes"seconds" from decimal degrees

Starting with dd.dddddd

Multiply .dddddd by 60 to obtain mm.mmmm

Multiply .mmmm by 60 to obtain ss.sss

Then dd°mm"ss.sss" = dd & mm & ss.sss

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Example: Convert 33.479236 to dd°mm‘‘ss.sss” format

Multiply .479236 by 60 to obtain 28.7540 (mm.mmmm)

Multiply .7540 by 60 to obtain 45.241 (ss.sss)

Dd°mm‘‘ss.sss” = 33° & 28‘‘ & 45.241” = 33°28‘‘45.241”

2.4.2 Special considerations for the use of Garmin® General Use Grade Receivers

The standard format for navigational purposes is decimal minutes (dd°mm.mmm‘‘). This format is utilized due to the fact that nautical navigation charts are set up in this format. However, location information must be converted to a decimal degree (dd.ddddd°) format in order for GIS software to properly interpret the information. The conversion is accomplished by dividing the minutes portion of the coordinates by 60.

<u>Converting to decimal degrees from decimal minutes:</u>

dd.ddddd° = dd + (mm.mmm/60)

Example: Convert 81°49.386 degrees to decimal degrees

81 + (49.386/60) = 81.8231 degrees

<u>The reverse conversion is accomplished as follows:</u>

dd°mm.mmm‘‘ = dd & (.ddddd*60)

Example: Convert 81.8231 degrees to decimal minutes (dd°mm.mmm‘‘)

Multiply .8231 by 60 to obtain 49.386 (mm.mmm)

81° & 49.386‘‘ = 81°49.386‘‘

GPS users need to familiarize themselves with the differences between the two formats, as they appear similar. Spreadsheets can automate the conversion process.

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2.5 Records

The GPS coordinates and the SESD equipment identification number of the GPS receiver should be recorded in field logbooks at the time of GPS coordinate collection. The data logging capability of receivers may be used in lieu of the requirement to record the coordinates in logbooks when the following conditions can be met:

1. The location can easily be found later if it needs to be resurveyed prior to demobilization. A permanent monitoring well can easily be resurveyed, while most open-water work would not afford this opportunity.

2. The data is downloaded and ascertained to meet the accuracy requirements for the project prior to demobilization from the site.

3. The data is stored in at least two separate locations for transport, such as a laptop hard drive and a flash drive or compact disc.

In all cases where positions are electronically recorded, the provisions of the Electronic Records section of the SESD Operating Procedure for Control of Records (SESDPROC-002) should be followed.

Where locational data is collected and processed electronically, but not reported explicitly in the final report, a copy of the coordinates in text format should be output and entered into the project file in paper or electronic form. The output should include:

1. Latitude, generally in dd.dddddd format.

2. Longitude, generally in dd.dddddd format.

3. Date of collection.

4. DOP information where it supports the accuracy requirements.

5. Correction status of each point where it supports the accuracy requirements.

6. The datum used for the export.

Trimble® Pathfinder Office will create files with this information by exporting to a text file. The information will be contained in the .pos and .inf files.

Appendix C
Laboratory Accreditation Certificates

CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board/ACLASS
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

Gulf Coast Analytical Laboratories, Inc.
7979 GSRI Avenue
Baton Rouge, LA 70820

has been assessed by ACLASS
and meets the requirements of

ISO/IEC 17025:2005 and DoD-ELAP

while demonstrating technical competence in the field(s) of

TESTING

Refer to the accompanying Scope(s) of Accreditation for information regarding the types of tests to which this accreditation applies.

ADE-1482

Certificate Number

ACLASS Approval

Certificate Valid: 08/15/2012-09/09/2014
Version No. 003 Issued: 08/29/2012

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated January 2009*).

ANSI-ASQ National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 & DoD-ELAP

Gulf Coast Analytical Laboratories, Inc.

7979 GSRI Avenue, Baton Rouge, LA 70820
Karen S. Varnado Phone: 225-769-4900

TESTING

Valid to: September 9, 2014 Certificate Number: ADE- 1482

I. Environmental

MATRIX	SPECIFIC TEST or GROUP OF ANALYTES**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	Flashpoint / Ignitability	1010A	Automated FP Analyzer
Water	Alkalinity	SM 2320B / 310.1	Autotitrator
Water	Acidity	SM 2310B	Autotitrator
Water / Solid	Ammonia	SM 4500 NH3 B & E, 18th ed. SM 4500 NH3 B & C, 20th ed.	Autotitrator
Water	Mercury	7470A	CVAA
Solid	Mercury	7471B	CVAA
Water	Mercury	245.1 / 245.2	CVAA
Water / Solid	Cyanide	9012B	FIA
Water / Solid	Total Phenols	420.4 / 9066	FIA
Solid	Chloride	9251	FIA
Water / Solid	Chloride	9251 / 325.2 / SM 4500 Cl E	FIA
Water / Solid	Nitrate/Nitrite/N+N	353.2	FIA
Water / Solid	Total Phosphorous	365.1	FIA
Water / Solid	Reactive Cyanide	SW846 Sec 7.3	FIA
Water / Solid	Pesticides	8081A	GC-ECD
Water / Solid	PCB's	8082A	GC-ECD
Water / Solid	Herbicides	8151A	GC-ECD

MATRIX	SPECIFIC TEST or GROUP OF ANALYTES**	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	EDB / DBCP	8011	GC-ECD
Water / Solid	DRO / ORO	8015B	GC-FID
Water / Solid	GRO	8015B	GC-FID
Water / Solid	TPH	TX 1005 / TX 1006	GC-FID
Water / Solid	TPH	Florida PRO	GC-FID
Water / Solid	Aromatic Volatile Organics	8021B	GC-FID/PID
Water	Dissolved Gases	RSK-175	GC-FID/TCD
Water / Solid	VOCs	8260B	GC-MS
Water / Solid	SVOCs	8270C / 8270D / SIM	GC-MS
Water	VOCs	624	GC-MS
Water	SVOCs	625	GC-MS
Water / Solid	OP Pesticides	8141A	GC-NPD
Water	TSS	SM 2540D / 160.2	Gravimetric
Water	TDS	SM 2540C / 160.1	Gravimetric
Water	TS	SM 2540B / 160.3	Gravimetric
Solid	TS	SM 2540B	Gravimetric
Water / Solid	Explosives	8330A	HPLC
Water / Solid	PAH's	8310	HPLC
Water	Anions	300.0	IC
Water / Solid	Anions	9056A	IC
Water	Perchlorate	314.0	IC
Water / Solid	ICP Metals	6010B / 6010C	ICP
Water	ICP Metals	200.7	ICP
Water	Volatile Fatty Acids	GCAL SOP WL-070	Ion Chromatography
Water / Solid	Ammonia	SM 4500 NH3 B & F 18th ed	Ion Selective Electrode

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MATRIX	SPECIFIC TEST or GROUP OF ANALYTES	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	Solid Phase Extraction	3535A	N/A
Water	Separatory Funnel Extraction	3510C	N/A
Water	Metals Digestion ICP	3010A	N/A
Solid	Ultrasonic Extraction for SVOA Analysis	3550C	N/A
Solid	Soxhlet Extraction for SVOA Analysis	3540C	N/A
Solid	Metals Digestion ICP	3050B	N/A
Water / Solid	TCLP	1311	N/A
Solid	Paint Filter Test	9095B	N/A
Water	pH	SM 4500 H+B / 9040C	pH Meter
Solid	pH	9045D	pH Meter
Water	VOC's	5030B	Purge and Trap
Solid	VOC's	5035	Purge and Trap
Water	Oil & Grease	1664A	SPE/Gravimetric
Water	Hexavalent Chromium	7196A	Spectrophotometer
Water	Sulfide	SM 4500 S2 D / 376.2	Spectrophotometer
Water	COD	HACH 8000	Spectrophotometer
Water / Solid	Sulfate	9038 / 375.4	Spectrophotometer
Water	Ortho Phosphate	SM 4500 P E	Spectrophotometer
Water	Silica	SM 4500 Si D	Spectrophotometer
Water/Solid	TKN	SM4500 Norg C SM4500 NH3 B SM4500NH3 E	Spectrophotometer
Water	Sulfide	SM 4500 S2 E / 376.1	Titration
Water / Solid	Reactive Sulfide	SW846 Sec 7.3	Titration
Solid	TOC	Lloyd Kahn 9060A	TOC Analyzer
Water	TOC	SM 5310B / 415.1 / 9060A	TOC Analyzer

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MATRIX	SPECIFIC TEST or GROUP OF ANALYTES	SPECIFICATION OR STANDARD METHOD (all EPA unless specified)	* KEY EQUIPMENT OR TECHNOLOGY USED
Water	TOX	9020B	TOX Analyzer
Water	Turbidity	SM2130B	Turbidimeter
Solid	Ignitability	1030	N/A
Water	Massachusetts EPH	Massachusetts EPH	GC-FID
Solid	Massachusetts EPH	Massachusetts EPH	GC-FID
Water	Massachusetts VPH	Massachusetts VPH	GC-FID/PID
Solid	Massachusetts VPH	Massachusetts VPH	GC-FID/PID
Water/Solid	ICP-MS Metals	6020A/200.8	ICP-MS
Water	ICP-MS Metals	200.8	ICP-MS

Notes:

1. ** = As Applicable*
2. ***=Refer to accredited analyte listing for exact analyte(s) in which the lab is accredited.*
3. *This scope is part of and must be included with the Certificate of Accreditation No. ADE- 1482*

Vice President

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Accredited Analytes/Methods (by matrix)
Gulf Coast Analytical Laboratories, Inc.
Baton Rouge, LA

NELAC Code	Analyte	Matrix													
		Aqueous							Solid						
1000	Aluminum	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1005	Antimony	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1010	Arsenic	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1015	Barium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1020	Beryllium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1025	Boron	6010B	6010C		200.7				6010B	6010C					
1030	Cadmium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1035	Calcium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1040	Chromium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1045	Chromium VI	7196A													
1050	Cobalt	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1055	Copper	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1070	Iron	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1075	Lead	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1085	Magnesium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1090	Manganese	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1095	Mercury	7470A	245.2	245.1			3010 A	1311	7471B				1311	6010C	
1100	Molybdenum	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1105	Nickel	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1125	Potassium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1140	Selenium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1150	Silver	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1155	Sodium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1160	Strontium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1165	Thallium	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1175	Tin	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1180	Titanium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1185	Vanadium	6010B	6010C	6020A	200.7	200.8			6010B	6010C	6020A				
1190	Zinc	6010B	6010C	6020A	200.7	200.8	3010 A	1311	6010B	6010C	6020A		1311	6010C	
1192	Zirconium			6020A		200.8					6020A				
1500	Acidity(as CaCO3)	SM 2310B													
1505	Total Alkalinity(as CaCO3)	SM 2320B	EPA 310.1												
1515	Ammonia as N	SM4500 NH3 B & E	SM4500 NH3 B & F	SM4500 NH3 B & C					SM 4500 NH3 BE	SM 4500 NH3 BF	SM4500 NH3 B & C				
1540	Bromide	9056A	EPA 300.0						9056A						
1565	COD	HACH 8000													
1575	Chloride	9056A	EPA 300.0	9251	EPA 325.2			SM 4500 Cl E	9056A	9251					
1625	Corrosivity (pH)	9040C	SM 4500 H+B						9045D						
1645	Total Cyanide	9012B							9012B						
1730	Fluoride	9056A	EPA 300.0						9056A						
1755	Total Hardness (as CaCO3)	6020A	200.8												
1780	Ignitability	1010A							1010A						
1810	Nitrate as N	9056A	EPA 300.0	EPA 353.2					9056A	EPA 353.2					
1820	Nitrate and Nitrite as N	9056A	EPA 300.0	EPA 353.2					9056A	EPA 353.2					
1840	Nitrite as N	9056A	EPA 300.0	EPA 353.2					9056A	EPA 353.2					
1860	Oil & Grease	EPA 1664A													
1870	Orthophosphate as P	SM 4500 PE													
1895	Perchlorate	EPA 314.0							EPA 314.0						
1900	pH	9040C	SM 4500 H+B						9040C						
1905	Total Phenolics (4AAP)	9066	EPA 420.4						9066	EPA 420.4					
1910	Total Phosphorous	EPA 365.1							EPA 365.1						
1925	Reactive sulfide	SW846 Sec 7.3							SW846 Sec 7.3						
-	Reactive Cyanide	SW846 Sec 7.3							SW846 Sec 7.3						
-	Percent Moisture								SM 2540G						
1950	Total Solids	SM 2540B	EPA 160.3						SM2540 G						
1955	Total Dissolved Solids at 180° (TFR)	SM 2540C	EPA 160.1												
1960	Non-Filterable Residue (TSS)	SM 2540D	EPA 160.2												
2000	Sulfate	9056A	EPA 300.0	9038	EPA 375.4				9056A	9038	9038	EPA 375.4			

Accredited Analytes/Methods (by matrix)
Gulf Coast Analytical Laboratories, Inc.
Baton Rouge, LA

NELAC Code	Analyte	Matrix													
		Aqueous							Solid						
2005	Sulfide	SM 4500 S2 D	EPA 376.2	SM 4500 S2 E	EPA 376.1										
2040	TOC	SM 5310B	EPA 415.1	9060A					EPA 9060A						
2045	Total Organic Halides	9020B							9020B						
2055	Turbidity	SM 2130 B													
4315	Acetone	8260B	624						8260B						
4320	Acetonitrile	8260B	624						8260B						
4325	Acrolein	8260B	624						8260B						
4340	Acrylonitrile	8260B	624						8260B						
4375	Benzene	8260B	624	1311					8260B	1311					
4385	Bromobenzene	8260 B							8260 B						
4390	Bromochloromethane	8260B	624						8260B						
4395	Bromodichloromethane	8260B	624						8260B						
4400	Bromoform	8260B	624						8260B						
4410	2-Butanone (MEK)	8260B	624	1311					8260B	1311					
4435	n-Butylbenzene	8260B	624						8260B						
4440	sec-Butylbenzene	8260B	624						8260B						
4445	tert-Butylbenzene	8260B	624						8260B						
4450	Carbon disulfide	8260B	624						8260B						
4455	Carbon tetrachloride	8260B	624	1311					8260B	1311					
4475	Chlorobenzene	8260B	624	1311					8260B	1311					
4485	Chloroethane	8260B	624						8260B						
4500	2-Chloroethylvinylether	8260B	624						8260B						
4505	Chloroform	8260B	624	1311					8260B	1311					
4535	2-Chlorotoluene	8260B	624						8260B						
4540	4-Chlorotoluene	8260B	624						8260B						
4570	1,2-Dibromo-3-chloropropane (DBCP)	8260B	624	8011					8260B						
4575	Dibromochloromethane	8260B	624						8260B						
4585	1,2-Dibromoethane (EDB)	8260B	624	8011					8260B						
4595	Dibromomethane	8260B	624						8260B						
4610	1,2 Dichlorobenzene	8260B	624		8270C	8270D		625	8260B		8270C	8270D			
4615	1,3 Dichlorobenzene	8260B	624		8270C	8270D		625	8260B		8270C	8270D			
4620	1,4 Dichlorobenzene	8260B	624	1311	8270C	8270D		625	8260B	1311	8270C	8270D			
4625	Dichlorodifluoromethane	8260B	624						8260B						
4630	1,1-Dichloroethane	8260B	624						8260B						
4635	1,2 Dichloroethane	8260B	624	1311					8260B	1311					
4640	1,1-Dichloroethene	8260B	624	1311					8260B	1311					
4645	cis-1,2-Dichloroethene	8260B	624						8260B						
4655	1,2-Dichloropropane	8260B	624						8260B						
4660	1,3-Dichloropropane	8260B	624						8260B						
4665	2,2-Dichloropropane	8260B	624						8260B						
4670	1,1-Dichloropropene	8260B	624						8260B						
4680	cis-1,3-Dichloropropylene	8260B	624						8260B						
4685	trans-1,3-Dichloropropene	8260B	624						8260B						
4700	trans-1,2-Dichloroethene	8260B	624						8260B						
4740	p-Dioxane				8270C	8270D		625							
4765	Ethylbenzene	8260B	624						8260B						
4835	Hexachlorobutadiene	8260B	624	1311	8270C	8270D		625	8260B	1311	8270C	8270D			
4840	Hexachloroethane			1311	8270C	8270D		625		1311	8270C	8270D			
4860	2-Hexanone	8260B	624						8260B						
4900	Isopropylbenzene	8260B	624						8260B						
4910	p-Isopropyltoluene	8260B	624						8260B						
4950	Bromomethane	8260B	624						8260B						
4960	Chloromethane	8260B	624						8260B						
	Methyl Acetate	8260B							8260B						
4975	Methylene Chloride	8260B	624						8260B						
	Methylcyclohexane	8260B							8260B						
4995	4-Methyl-2-pentanone (MIBK)	8260B	624						8260B						

Accredited Analytes/Methods (by matrix)															
Gulf Coast Analytical Laboratories, Inc.															
Baton Rouge, LA															
NELAC Code	Analyte	Matrix													
		Aqueous							Solid						
5000	Methyl tert-butyl ether (MTBE)	8260B	624						8260B						
5005	Naphthalene	8260B	624	8310	8270 C	8270D		625	8260B		8270C	8270D			8310
5015	Nitrobenzene	8330 A		1311	8270C	8270D		625		1311	8270C	8270D		8330A	
5090	n-Propylbenzene	8260B	624						8260B						
5095	Pyridine			1311	8270C	8270D		625		1311	8270C	8270D			
5100	Styrene	8260B	624						8260B						
5105	1,1,1,2-Tetrachloroethane	8260B	624						8260B						
5110	1,1,2,2-Tetrachloroethane	8260B	624						8260B						
	1,2,4,5-Tetrachlorobenzene	8260B							8260B						
5115	Tetrachloroethene	8260B	624	1311					8260B	1311					
5140	Toluene	8260B	624						8260B						
5145	o-Toluidine				8270C	8270D		625							
	1,1,2-trichloro-1,2,2-trifluoroethane	8260B							8260B						
5150	1,2,3-Trichlorobenzene	8260B	624						8260B						
5155	1,2,4-Trichlorobenzene	8260B	624		8270C	8270D		625	8260B	8270 C	8270 D				
5160	1,1,1-Trichloroethane	8260B	624						8260B						
5165	1,1,2-Trichloroethane	8260B	624						8260B						
5170	Trichloroethene	8260B	624	1311					8260B	1311					
5175	Trichlorofluoromethane	8260B	624						8260B						
5180	1,2,3-Trichloropropane	8260B	624						8260B						
5210	1,2,4-Trimethylbenzene	8260B	624						8260B						
5215	1,3,5-Trimethylbenzene	8260B	624						8260B						
5225	Vinyl acetate	8260B	624						8260B						
5235	Vinyl chloride	8260B	624	1311					8260B	1311					
5240	m+p-Xylene	8260B	624						8260B						
5250	o-Xylene	8260B	624						8260B						
5260	Xylenes, total	8260B	624						8260B						
5500	Acenaphthene	8310			8270C	8270D		625			8270C	8270D			8310
5505	Acenaphthylene	8310			8270C	8270D		625			8270C	8270D			8310
	Acetophenone				8270C						8270C				
5545	Aniline				8270C	8270D		625			8270C	8270D			
5555	Anthracene	8310			8270C	8270D		625			8270C	8270D			8310
	Benzaldehyde				8270C						8270C				
5575	Benzo(a)anthracene	8310			8270C	8270D		625			8270C	8270D			8310
5580	Benzo(a)pyrene	8310			8270C	8270D		625			8270C	8270D			8310
5585	Benzo(b)fluoranthene	8310			8270C	8270D		625			8270C	8270D			8310
5590	Benzo(g,h,i)perylene	8310			8270C	8270D		625			8270C	8270D			8310
5595	Benzidine				8270C	8270D		625			8270C	8270D			
5600	Benzo(k)fluoranthene	8310			8270C	8270D		625			8270C	8270D			8310
5610	Benzoic acid				8270C	8270D		625			8270C	8270D			
5630	Benzyl alcohol				8270C	8270D		625			8270C	8270D			
	Biphenyl				8270C						8270C				
5660	4-Bromophenyl-phenylether				8270C	8270D		625			8270C	8270D			
5670	Butyl benzyl phthalate				8270C	8270D		625			8270C	8270D			
5680	Carbazole				8270C	8270D		625			8270C	8270D			
5700	4-Chloro-3-methylphenol				8270C	8270D		625			8270C	8270D			
5745	4-Chloroaniline				8270C	8270D		625			8270C	8270D			
5760	bis(2-Chloroethoxy)methane				8270C	8270D		625			8270C	8270D			
5765	bis(2-Chloroethyl)ether				8270C	8270D		625			8270C	8270D			
5780	bis(2-Chloroisopropyl) ether				8270C	8270D		625			8270C	8270D			
5795	2-Chloronaphthalene				8270C	8270D		625			8270C	8270D			
5800	2-Chlorophenol				8270C	8270D		625			8270C	8270D			
5825	4-Chlorophenyl-phenylether				8270C	8270D		625			8270C	8270D			
5855	Chrysene	8310			8270C	8270D		625			8270C	8270D			8310
5895	Dibenzo(a,h)anthracene	8310			8270C	8270D		625			8270C	8270D			8310
5905	Dibenzofuran				8270C	8270D		625			8270C	8270D			
5925	Di-n-butylphthalate				8270C	8270D		625			8270C	8270D			

Accredited Analytes/Methods (by matrix)
Gulf Coast Analytical Laboratories, Inc.
Baton Rouge, LA

NELAC Code	Analyte	Matrix													
		Aqueous							Solid						
5945	3,3'-Dichlorobenzidine				8270C	8270D		625			8270C	8270D			
6000	2,4-Dichlorophenol				8270C	8270D		625			8270C	8270D			
6005	2,6-Dichlorophenol				8270C	8270D		625			8270C	8270D			
6070	Diethyl phthalate				8270C	8270D		625			8270C	8270D			
6130	2,4-Dimethylphenol				8270C	8270D		625			8270C	8270D			
6135	Dimethyl phthalate				8270C	8270D		625			8270C	8270D			
6160	1,3-Dinitrobenzene	8330 A							8330A						
6175	2,4-Dinitrophenol				8270C	8270D		625			8270C	8270D			
6185	2,4-Dinitrotoluene	8330 A	1311		8270C	8270D		625		1311	8270C	8270D		8330A	
6190	2,6-Dinitrotoluene	8330 A			8270C	8270D		625			8270C	8270D		8330A	
6200	Di-n-octylphthalate				8270C	8270D		625			8270C	8270D			
6255	bis(2-ethylhexyl) phthalate				8270C	8270D		625			8270C	8270D			
6265	Fluoranthene	8310			8270C	8270D		625			8270C	8270D			8310
6270	Fluorene	8310			8270C	8270D		625			8270C	8270D			8310
6275	Hexachlorobenzene		1311		8270C	8270D		625		1311	8270C	8270D			
6285	Hexachlorocyclopentadiene				8270C	8270D		625			8270C	8270D			
6315	Indeno(1,2,3, cd)pyrene	8310			8270C	8270D		625			8270C	8270D			8310
6320	Isophorone				8270C	8270D		625			8270C	8270D			
6360	2-Methyl-4,6-Dinitrophenol				8270C	8270D		625			8270C	8270D			
6380	1-Methylnaphthalene				8270C	8270D		625							
6385	2-Methylnaphthalene	8310			8270C	8270D		625			8270C	8270D			8310
6400	2-Methylphenol		1311		8270C	8270D		625		1311	8270C	8270D			
6410	4-Methylphenol (and/or 3-Methylphenol)		1311		8270C	8270D		625		1311	8270C	8270D			
6415	Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	8330 A							8330 A						
6460	2-Nitroaniline				8270C	8270D		625			8270C	8270D			
6465	3-Nitroaniline				8270C	8270D		625			8270C	8270D			
6470	4-Nitroaniline				8270C	8270D		625			8270C	8270D			
6490	2-Nitrophenol				8270C	8270D		625			8270C	8270D			
6500	4-Nitrophenol	8151 A			8270C	8270D		625	8151 A		8270C	8270D			
6525	N-Nitrosodiethylamine				8270C	8270D		625			8270C	8270D			
6530	N-Nitrosodimethylamine				8270C	8270D		625			8270C	8270D			
6535	N-Nitrosodiphenylamine				8270C	8270D		625			8270C	8270D			
6545	N-Nitroso-di-n-propylamine				8270C	8270D		625			8270C	8270D			
6590	Pentachlorobenzene				8270C	8270D		625			8270C	8270D			
6605	Pentachlorophenol	8151 A	1311		8270C	8270D		625	8151 A	1311	8270C	8270D			
6615	Phenanthrene	8310			8270C	8270D		625			8270C	8270D			8310
6625	Phenol				8270C	8270D		625			8270C	8270D			
6665	Pyrene	8310			8270C	8270D		625			8270C	8270D			8310
6715	1,2,4,5-Tetrachlorobenzene				8270C	8270D		625			8270C	8270D			
6735	2,3,4,6-Tetrachlorophenol				8270C	8270D		625			8270C	8270D			
6835	2,4,5-Trichlorophenol		1311		8270C	8270D		625		1311	8270C	8270D			
6840	2,4,6-Trichlorophenol		1311		8270C	8270D		625		1311	8270C	8270D			
6885	1,3,5-Trinitrobenzene	8330 A												8330A	
7025	Aldrin	8081B											8081B		
7075	Azinphos-methyl (Guthion)	8141B							8141B						
7105	delta-BHC	8081B											8081B		
7110	alpha-BHC	8081B											8081B		
7115	beta-BHC	8081B											8081B		
7120	gamma-BHC (Lindane)	8081B	1311							1311			8081B		
7240	alpha-Chlordane	8081B											8081B		
7245	gamma-Chlordane	8081B											8081B		
7250	Chlordane (total)	8081B											8081B		
7355	DDD (4,4)	8081B											8081B		
7360	DDE (4,4)	8081B											8081B		
7365	DDT (4,4)	8081B											8081B		
7410	Diazinon	8141B							8141B						
7470	Dieldrin	8081B											8081B		

Accredited Analytes/Methods (by matrix)															
Gulf Coast Analytical Laboratories, Inc.															
Baton Rouge, LA															
NELAC Code	Analyte	Matrix													
		Aqueous							Solid						
7510	Endosulfan I	8081B											8081B		
7515	Endosulfan II	8081B											8081B		
7520	Endosulfan sulfate	8081B											8081B		
7530	Endrin aldehyde	8081B											8081B		
7535	Endrin ketone	8081B											8081B		
7540	Endrin	8081B	1311							1311			8081B		
7685	Heptachlor	8081B	1311							1311			8081B		
7690	Heptachlor Epoxide (beta)	8081B	1311							1311			8081B		
7770	Malathion	8141B							8141B						
7775	MCPA	8151A							8151A						
7780	MCPP	8151 A							8151 A						
7810	Methoxychlor	8081B	1311							1311			8081B		
7825	Parathion, methyl	8141B							8141B						
7955	Parathion, ethyl	8141B							8141B						
7985	Phorate	8141B							8141B						
8110	Ronnel	8141B							8141B						
8200	Stirophos	8141B							8141B						
8250	Toxaphene (total)	8081B											8081B		
8505	Acifluorfen	8151 A							8151 A						
8530	Bentazon	8151 A							8151 A						
8540	Chloramben	8151 A							8151 A						
8545	2,4-D	8151 A	1311						8151A	1311					
8550	Dacthal (DCPA)	8151 A							8151 A						
8555	Dalapon	8151 A							8151 A						
8560	2,4-DB	8151 A							8151A						
8595	Dicamba	8151 A							8151A						
8600	3,5-Dichlorobenzoic acid	8151 A							8151 A						
8605	2,4-DP (Dichlorprop)	8151 A							8151 A						
8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	8151 A							8151A						
8625	Disulfoton	8141B							8141B						
8645	Picloram	8151 A							8151 A						
8650	2,4,5-TP (Silvex)	8151 A	1311							1311			8151A		
8655	2,4,5-T	8151 A							8151A						
8880	Aroclor 1016	8082A							8082A						
8885	Aroclor 1221	8082A							8082A						
8890	Aroclor 1232	8082A							8082A						
8895	Aroclor 1242	8082A							8082A						
8900	Aroclor 1248	8082A							8082A						
8905	Aroclor 1254	8082A							8082A						
8910	Aroclor 1260	8082A							8082A						
9303	2-Amino-4,6-dinitrotoluene	8330 A												8330A	
9306	4-Amino-2,6-dinitrotoluene	8330 A												8330A	
9369	Diesel range organics (DRO)	8015C							8015C						
9432	RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	8330 A												8330A	
9507	2-Nitrotoluene	8330 A												8330A	
9510	3-Nitrotoluene	8330 A												8330A	
9513	4-Nitrotoluene	8330 A												8330A	
9522	HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	8330 A												8330A	
9651	2,4,6-Trinitrotoluene	8330 A												8330A	
	Methane	RSK-175													
	Ethane	RSK-175													
	Ethene	RSK-175													
	Carbon Dioxide	RSK-175													
	Lactic Acid	GCAL SOP WL-070													
	Formic Acid	GCAL SOP WL-070													
	Acetic Acid	GCAL SOP WL-070													
	Propionic Acid	GCAL SOP WL-070													

Accredited Analytes/Methods (by matrix)															
Gulf Coast Analytical Laboratories, Inc.															
Baton Rouge, LA															
NELAC Code	Analyte	Matrix													
		Aqueous							Solid						
	Butyric Acid	GCAL SOP WL-070													
	1-Chlorohexane	8260B													
	1-Chlorohexane								8260B						
	1,2-Diphenylhydrazine	8270C	8270D												
	1,2-Diphenylhydrazine								8270C	8270D					
	Chlordane	8082B	1311						1311	8082B					
	Toxaphene	8082 A	1311						1311	8082 A					
	Paint Filter Test	9095B							9095B						
	Oil Range Organics	8015C							8015C						
	Petroleum Hydrocarbons	Florida PRO							Florida PRO						
	Ignitability								1030						
9408	Gasoline	8015C							8015C						
4375	Benzene	8021B							8021B						
4765	Ethyl Benzene	8021B							8021B						
5140	Toluene	8021B							8021B						
5260	Xylene	8021B							8021B						
9375	DIPE	8260B							8260B						
4770	ETBE	8260B							8260B						
5000	MTBE	8260B							8260B						
4370	TAME	8260B							8260B						
4420	tert-Butyl alcohol	8260B							8260B						
9369	Diesel	8015C							8015C						
2050	Total Petroleum Hydrocarbon	TNRCC 1005							TNRCC 1005						
	Total Petroleum Hydrocarbon	TNRCC 1006							TNRCC 1006						
	GRO-Total	TNRCC 1006							TNRCC 1006						
	DRO-Total	TNRCC 1006							TNRCC 1006						
	ORO-Total	TNRCC 1006							TNRCC 1006						
	GRO-aliphatic	TNRCC 1006							TNRCC 1006						
	DRO-aliphatic	TNRCC 1006							TNRCC 1006						
	ORO-aliphatic	TNRCC 1006							TNRCC 1006						
	GRO-aromatic	TNRCC 1006							TNRCC 1006						
	DRO-aromatic	TNRCC 1006							TNRCC 1006						
	ORO-aromatic	TNRCC 1006							TNRCC 1006						
-	C5-C8 Aliphatic Hydrocarbons	MADEP VPH							MADEP VPH						
-	C9-C12 Aliphatic Hydrocarbons	MADEP VPH							MADEP VPH						
-	C9-C10 Aromatic Hydrocarbons	MADEP VPH							MADEP VPH						
-	C9-C18 Aliphatic Hydrocarbons	MADEP EPH							MADEP EPH						
	C19-C36 Aliphatic Hydrocarbons	MADEP EPH							MADEP EPH						
-	C11-C22 Aromatic Hydrocarbons	MADEP EPH							MADEP EPH						

STATE OF ILLINOIS

ENVIRONMENTAL PROTECTION AGENCY
NELAP - RECOGNIZED
ENVIRONMENTAL LABORATORY ACCREDITATION

is hereby granted to

GULF COAST ANALYTICAL LABORATORIES, INC.

7979 G.S.R.I. AVENUE

BATON ROUGE, LA 70820

NELAP ACCREDITED
ACCREDITATION NUMBER #200048

According to the Illinois Administrative Code, Title 35, Subtitle A, Chapter II, Part 186, ACCREDITATION OF LABORATORIES FOR DRINKING WATER, WASTEWATER AND HAZARDOUS WASTES ANALYSIS, the State of Illinois formally recognizes that this laboratory is technically competent to perform the environmental analyses listed on the scope of accreditation detailed below.

The laboratory agrees to perform all analyses listed on this scope of accreditation according to the Part 186 requirements and acknowledges that continued accreditation is dependent on successful ongoing compliance with the applicable requirements of Part 186. Please contact the Illinois EPA Environmental Laboratory Accreditation Program (IL ELAP) to verify the laboratory's scope of accreditation and accreditation status. Accreditation by the State of Illinois is not an endorsement or a guarantee of validity of the data generated by the laboratory.

Primary Accrediting Authority: Louisiana Department of Environmental Quality

Celeste M. Crowley
Acting Manager
Environmental Laboratory Accreditation Program

Janet Cruse
Accreditation Officer
Environmental Laboratory Accreditation Program

Certificate No.: 003106
Expiration Date: 02/17/2014
Issued On: 02/21/2013

State of Illinois
Environmental Protection Agency

Certificate No.: 003106

Awards the Certificate of Approval

Gulf Coast Analytical Laboratories, Inc.
7979 G.S.R.I. Avenue
Baton Rouge, LA 70820

According to the Illinois Administrative Code, Title 35, Subtitle A, Chapter II, Part 186, ACCREDITATION OF LABORATORIES FOR DRINKING WATER, WASTEWATER AND HAZARDOUS WASTES ANALYSIS, the State of Illinois formally recognizes that this laboratory is technically competent to perform the environmental analyses listed on the scope of accreditation detailed below.

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Hazardous and Solid Waste, Inorganic

1010A

Ignitability

1030

Ignitability of Solids

1110A

Corrosivity Toward Steel

1311

TCLP (Organic and Inorganic)

1312

Synthetic Precipitation Leaching Procedure

5050

Bomb Preparation

6010B

Aluminum	Antimony	Arsenic
Barium	Beryllium	Boron
Cadmium	Calcium	Chromium
Cobalt	Copper	Iron
Lead	Lithium	Magnesium
Manganese	Molybdenum	Nickel
Potassium	Selenium	Silver
Sodium	Strontium	Thallium
Tin	Titanium	Vanadium
Zinc		

6010C

Aluminum	Antimony	Arsenic
Barium	Beryllium	Boron
Cadmium	Calcium	Chromium
Cobalt	Copper	Iron
Lead	Lithium	Magnesium
Manganese	Molybdenum	Nickel
Potassium	Selenium	Silver
Sodium	Strontium	Thallium
Tin	Titanium	Vanadium
Zinc		

6020A

Aluminum	Antimony	Arsenic

State of Illinois
Environmental Protection Agency

Certificate No.: 003106

Awards the Certificate of Approval

Gulf Coast Analytical Laboratories, Inc.
7979 G.S.R.I. Avenue
Baton Rouge, LA 70820

Hazardous and Solid Waste, Inorganic

6020A

Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Molybdenum
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc

7196A

Chromium VI

7470A

Mercury

7471B

Mercury

9012A

Cyanide

9020B (NPW Matrix Only)

TOX (Total Organic Halides)

9034

Sulfides

9038

Sulfate

9040C

Hydrogen Ion (pH)

9045D

Hydrogen Ion (pH)

9050A

Specific Conductance

9056A

Bromide
Chloride
Fluoride
Nitrate
Nitrite
Sulfate

9060A

Total Organic Carbon (TOC)

9066

Phenolics

9071B

Oil and Grease Extractable

9095B

Paint Filter

9251

Chloride

Hazardous and Solid Waste, Organic

8011 (NPW Matrix Only)

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Baton Rouge, LA 70820

Hazardous and Solid Waste, Organic	*8011*	1,2-Dibromo-3-chloropropane (DBCP)
1,2-Dibromoethane (EDB)		
8015C		
Diesel range organics (DRO)	Ethanol	Gasoline range organics (GRO)
Isopropyl alcohol (2-Propanol)	Methanol	
8021B		
Benzene	Ethylbenzene	m-Xylene
o-Xylene	p-Xylene	Toluene
Total Xylenes		
8081B		
4,4'-DDD	4,4'-DDE	4,4'-DDT
Alachlor	Aldrin	alpha-BHC
alpha-Chlordane	beta-BHC	Chlordane - not otherwise specified
delta-BHC	Diallate	Dieldrin
Endosulfan I	Endosulfan II	Endosulfan sulfate
Endrin	Endrin aldehyde	Endrin ketone
gamma-BHC (Lindane)	gamma-Chlordane	Heptachlor
Heptachlor epoxide	Isodrin	Kepone
Methoxychlor	Mirex	Toxaphene
8082A		
PCB-1016	PCB-1221	PCB-1232
PCB-1242	PCB-1248	PCB-1254
PCB-1260		
8141B		
Atrazine	Azinphos-methyl	Chloropyrifos
Coumaphos	Demeton	Diazinon
Dichlorovos	Dimethoate	Disulfoton
EPN	Ethoprop	Famphur
Fensulfothion	Fenthion	Malathion
Mevinphos	Monocrotophos	Naled
Parathion ethyl	Parathion methyl	Phorate
Ronnel	Sulfotepp	Sulprofos (Bolstar)
Tetrachlorvinphos (Stirophos)	Thionazine (Zinophos)	Tokuthion (Protothiofos)
8151A		
2,4,5-T	2,4,5-TP (Silvex)	2,4-D
2,4-DB	3,5-Dichlorobenzoic acid	4-Nitrophenol
Acifluorfen	Bentazon	Chloramben
Dalapon	Dicamba	Dichloroprop
Dinoseb	MCPA	MCPP
Pentachlorophenol	Picloram	
8260B		
1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene
1,1-Dichloropropene	1,2,3-Trichlorobenzene	1,2,3-Trichloropropane
1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene	1,2-Dibromo-3-chloropropane (DBCP)
1,2-Dibromoethane (EDB)	1,2-Dichlorobenzene	1,2-Dichloroethane

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Baton Rouge, LA 70820

Hazardous and Solid Waste, Organic

8260B

1,3,5-Trimethylbenzene
1,3-Dichlorobenzene
1,2-Dichloropropane
1,4-Dichlorobenzene
1,4-Dioxane
1,3-Dichloropropane
2,2-Dichloropropane
2-Butanone (Methyl ethyl ketone, MEK)
1-Chlorohexane
2-Chloroethyl vinyl ether
2-Chlorotoluene
2-Chloro-1,3-butadiene (Chloroprene)
2-Methyl-1-propanol (Isobutyl alcohol)
2-Nitropropane
2-Hexanone
4-Methyl-2-pentanone (Methyl isobutyl ketone, i
Acetone
4-Chlorotoluene
Acrolein (Propenal)
Acrylonitrile
Acetonitrile
Bromobenzene
Bromochloromethane
Benzene
Bromoform
Bromomethane
Bromodichloromethane
Carbon tetrachloride
Chlorobenzene
Carbon disulfide
Chloroethane
Chloroform
Chlorodibromomethane (Dibromochlorometha
Chloroprene
cis-1,2-Dichloroethene
Chloromethane
cis-1,4-Dichloro-2-butene
Crotonaldehyde
cis-1,3-Dichloropropene
Dichlorodifluoromethane
Dichloromethane (Methylene chloride)
Dibromomethane
Ethyl acetate
Ethyl methacrylate
Diethyl ether
Ethylene oxide
Isopropyl ether
Ethylbenzene
Methacrylonitrile
Methyl acrylate
Isopropylbenzene
Methyl methacrylate
Methyl-t-butyl ether
Methyl iodide (Iodmethane)
Naphthalene
n-Butylbenzene
m-Xylene
o-Xylene
Pentachloroethane
n-Propylbenzene
Propionitrile (Ethyl cyanide)
p-Xylene
p-Isopropyltoluene
Styrene
t-Butyl alcohol
sec-Butylbenzene
Tetrachloroethene
Tetrahydrofuran
tert-Butylbenzene
trans-1,2-Dichloroethene
trans-1,3-Dichloropropene
Toluene
Trichloroethene
Trichlorofluoromethane
trans-1,4-Dichloro-2-butene
Vinyl chloride
Xylenes (Total)
Vinyl acetate

8270C

1,2,4,5-Tetrachlorobenzene
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,2-Diphenylhydrazine
1,3,5-Trinitrobenzene (1,3,5-TNB)
1,3-Dichlorobenzene
1,3-Dinitrobenzene (1,3-DNB)
1,4-Dichlorobenzene
1,4-Dinitrobenzene
1,4-Dioxane
1,4-Naphthoquinone
1,4-Phenylenediamine
1-Methylnaphthalene
1-Naphthylamine
2,3,4,6-Tetrachlorophenol
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Diaminotoluene
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene (2,4-DNT)
2,6-Dichlorophenol
2,6-Dinitrotoluene (2,6-DNT)
2-Acetylaminofluorene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol (o-Cresol)
2-Methylpyridine (2-Picoline)
2-Naphthylamine
2-Nitroaniline
2-Nitrophenol
3,3'-Dichlorobenzidine
3,3'-Dimethylbenzidine
3-Methylcholanthrene
3-Methylphenol (m-Cresol)
3-Nitroaniline
4,4'-Methylenebis(2-Chloroanaline)
4,6-Dinitro-2-methylphenol
4-Aminobiphenyl
4-Bromophenyl phenyl ether
4-Chloro-3-methylphenol
4-Chloroaniline
4-Chlorophenyl phenyl ether
4-Methylphenol (p-Cresol)
4-Nitroaniline
4-Nitrophenol
4-Nitroquinoline-1-oxide
5-Nitro-o-toluidine
7,12-Dimethylbenz(a)anthracene
Acenaphthene
Acenaphthylene
Acetophenone
Aniline
Anthracene
Aramite

State of Illinois
Environmental Protection Agency

Certificate No.: 003106

Awards the Certificate of Approval

Gulf Coast Analytical Laboratories, Inc.
7979 G.S.R.I. Avenue
Baton Rouge, LA 70820

Hazardous and Solid Waste, Organic

8270C

Benzidine
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perlyene
Benzo(k)fluoranthene
Benzoic acid
Benzyl alcohol
Bis(2-chloroethoxy) methane
Bis(2-chloroethyl) ether
Bis(2-chloroisopropyl) ether
Bis(2-ethylhexyl) phthalate
Butyl benzyl phthalate
Carbazole
Chlorobenzilate
Chrysene
Dibenz(a,h)anthracene
Dibenzofuran
Diethyl phthalate
Dimethoate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Dinoseb
Diphenylamine
Disulfoton
Ethyl methanesulfonate
Famphur
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexachlorophene
Hexachloropropene
Indeno(1,2,3-cd) pyrene
Isodrin
Isophorone
Isosafrole
Kepone
Maleic anhydride
m-Cresol (3-Methylphenol)
m-Dinitrobenzene
Methyl methanesulfonate
Methyl parathion
Methylpyrilene
Naphthalene
Nitrobenzene
N-Nitrosodiethylamine
N-Nitrosodimethylamine
N-Nitrosodi-n-butylamine (N-Nitrosodibutylam
N-Nitrosodi-n-propylamine
N-Nitrosodiphenylamine
N-Nitrosomethylethylamine
N-Nitrosomorpholine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
O,O,O-Triethyl phosphorothioate
o-Cresol (2-Methylphenol)
o-Toluidine
Parathion
p-Benzoquinone
p-Cresol (4-Methylphenol)
p-Dimethylaminoazobenzene
Pentachlorobenzene
Pentachloronitrobenzene
Pentachlorophenol
Phenacetin
Phenanthrene
Phenol
Phorate
Phthalic anhydride
p-Phenylenediame
Pronamide
Pyrene
Pyridine
Safrole
Thionazine (Zinophos)
Thiophenol (Benzenethiol)
Toluene diisocyanate

8270D

1,2,4,5-Tetrachlorobenzene
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,2-Diphenylhydrazine
1,3,5-Trinitrobenzene (1,3,5-TNB)
1,3-Dichlorobenzene
1,3-Dinitrobenzene (1,3-DNB)
1,4-Dichlorobenzene
1,4-Dinitrobenzene
1,4-Dioxane
1,4-Naphthoquinone
1,4-Phenylenediamine
1-Methylnaphthalene
1-Naphthylamine
2,3,4,6-Tetrachlorophenol
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Diaminotoluene
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene (2,4-DNT)
2,6-Dichlorophenol
2,6-Dinitrotoluene (2,6-DNT)
2-Acetylaminofluorene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol (o-Cresol)
2-Methylpyridine (2-Picoline)
2-Naphthylamine
2-Nitroaniline
2-Nitrophenol
3,3'-Dichlorobenzidine
3,3'-Dimethylbenzidine
3-Methylcholanthrene
3-Methylphenol (m-Cresol)
3-Nitroaniline
4,4'-Methylenebis(2-Chloroanaline)
4,6-Dinitro-2-methylphenol
4-Aminobiphenyl
4-Bromophenyl phenyl ether
4-Chloro-3-methylphenol
4-Chloroaniline
4-Chlorophenyl phenyl ether
4-Methylphenol (p-Cresol)
4-Nitroaniline
4-Nitrophenol
4-Nitroquinoline-1-oxide
5-Nitro-o-toluidine
7,12-Dimethylbenz(a)anthracene
Acenaphthene
Acenaphthylene
Acetophenone

State of Illinois
Environmental Protection Agency

Certificate No.: 003106

Awards the Certificate of Approval

Gulf Coast Analytical Laboratories, Inc.
7979 G.S.R.I. Avenue
Baton Rouge, LA 70820

Hazardous and Solid Waste, Organic

8270D

		Aniline
Anthracene	Aramite	Benzidine
Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
Benzo(g,h,i)perlyene	Benzo(k)fluoranthene	Benzoic acid
Benzyl alcohol	Bis(2-chloroethoxy) methane	Bis(2-chloroethyl) ether
Bis(2-chloroisopropyl) ether	Bis(2-ethylhexyl) phthalate	Butyl benzyl phthalate
Carbazole	Chlorobenzilate	Chrysene
Dibenz(a,h)anthracene	Dibenzofuran	Diethyl phthalate
Dimethoate	Dimethyl phthalate	Di-n-butyl phthalate
Di-n-octyl phthalate	Dinoseb	Diphenylamine
Disulfoton	Ethyl methanesulfonate	Famphur
Fluoranthene	Fluorene	Hexachlorobenzene
Hexachlorobutadiene	Hexachlorocyclopentadiene	Hexachloroethane
Hexachlorophene	Hexachloropropene	Indeno(1,2,3-cd) pyrene
Isodrin	Isophorone	Isosafrole
Kepone	Maleic anhydride	m-Cresol (3-Methylphenol)
m-Dinitrobenzene	Methapyrilene	Methyl methanesulfonate
Methyl parathion	Naphthalene	Nitrobenzene
N-Nitrosodiethylamine	N-Nitrosodimethylamine	N-Nitrosodi-n-butylamine (N-Nitrosodibutylam
N-Nitrosodi-n-propylamine	N-Nitrosodiphenylamine	N-Nitrosomethylethylamine
N-Nitrosomorpholine	N-Nitrosopiperidine	N-Nitrosopyrrolidine
O,O,O-Triethyl phosphorothioate	o-Cresol (2-Methylphenol)	o-Toluidine
Parathion	p-Benzoquinone	p-Cresol (4-Methylphenol)
p-Dimethylaminoazobenzene	Pentachlorobenzene	Pentachloronitrobenzene
Pentachlorophenol	Phenacetin	Phenanthrene
Phenol	Phorate	Phthalic anhydride
p-Phenylenediame	Pronamide	Pyrene
Pyridine	Safrole	Thionazine (Zinophos)
Thiophenol (Benzenethiol)	Toluene diisocyanate	

8310

Acenaphthene	Acenaphthylene	Anthracene
Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene
Dibenz(a,h)anthracene	Fluoranthene	Fluorene
Indeno(1,2,3-cd) pyrene	Naphthalene	Phenanthrene
Pyrene		

8315A

Acetaldehyde	Formaldehyde

8330A

1,3,5-Trinitrobenzene (1,3,5-TNB)	1,3-Dinitrobenzene (1,3-DNB)	2,4,6-Trinitrotoluene
2,4,6-Trinitrotoluene (2,4,6-TNT)	2,4-Dinitrotoluene (2,4-DNT)	2,6-Dinitrotoluene (2,6-DNT)
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	2-Nitrotoluene (2-NT)	3-Nitrotoluene (3-NT)
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	4-Nitrotoluene (4-NT)	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	Nitrobenzene	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocir

Wastewater, Inorganic

Hach 8000

State of Illinois
Environmental Protection Agency

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Baton Rouge, LA 70820

Wastewater, Inorganic	*Hach 8000*	Chemical Oxygen Demand (COD)
SM2120C,2001		
Color		
SM2130B,2001		
Turbidity		
SM2310B,1997		
Acidity		
SM2320B,1997		
Alkalinity		
SM2340B,1997		
Hardness		
SM2510B,1997		
Specific Conductance		
SM2540B,1997		
Residue (Total)		
SM2540C,1997		
Residue (TDS)		
SM2540D,1997		
Residue (TSS)		
SM2540F,1997		
Residue (settleable)		
SM3500Cr-B,2009		
Chromium VI		
SM4500CL-E,1997		
Chloride		
SM4500Cl-G,2000		
Chlorine		
SM4500CN-E,1999		
Cyanide		
SM4500H-B,2000		
Hydrogen Ion (pH)		
SM4500NH3-E,1997		
Ammonia	Total Kjeldahl Nitrogen	
SM4500P-E,1999		
Orthophosphate (as P)		
SM4500S-D,2000		
Sulfide		
SM5210B,2001		
Biochemical Oxygen Demand (BOD)	Carbonaceous Biochemical Oxygen Demand ((	
SM5310B,2000		
Total Organic Carbon (TOC)		
SM5540C,2000		

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Wastewater, Inorganic	*SM5540C,2000*	Surfactants
USEPA1664A		
Oil and Grease		
USEPA200.7,1994		
Aluminum	Antimony	Arsenic
Barium	Beryllium	Boron
Cadmium	Calcium	Chromium
Cobalt	Copper	Iron
Lead	Magnesium	Manganese
Molybdenum	Nickel	Potassium
Selenium	Silver	Sodium
Thallium	Tin	Titanium
Vanadium	Zinc	
USEPA200.8,1994		
Aluminum	Antimony	Arsenic
Barium	Beryllium	Cadmium
Calcium	Chromium	Cobalt
Copper	Iron	Lead
Magnesium	Manganese	Molybdenum
Nickel	Potassium	Selenium
Silver	Sodium	Thallium
Tin	Vanadium	Zinc
USEPA300.0R2.1,1993		
Bromide	Chloride	Fluoride
Nitrate	Nitrate-Nitrite (sum)	Nitrite
Sulfate		
USEPA353.2R2.0,1993		
Nitrate	Nitrate-nitrite (as N)	Nitrite (as N)
USEPA365.1R2.0,1993		
Phosphorus		
USEPA420.4R1.0,1993		
Phenolics		
Wastewater, Organic		
USEPA602		
Benzene	Ethylbenzene	Toluene
USEPA608		
4,4'-DDD	4,4'-DDE	4,4'-DDT
Aldrin	alpha-BHC	beta-BHC
Chlordane	delta-BHC	Dieldrin
Endosulfan I	Endosulfan II	Endosulfan sulfate
Endrin	Endrin aldehyde	gamma-BHC (Lindane)
Heptachlor	Heptachlor epoxide	Methoxychlor
PCB-1016	PCB-1221	PCB-1232
PCB-1242	PCB-1248	PCB-1254
PCB-1260	Toxaphene	

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Baton Rouge, LA 70820

Wastewater, Organic

USEPA624

1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane
1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichlorobenzene
1,2-Dichloroethane	1,2-Dichloropropane	1,3-Dichlorobenzene
1,4-Dichlorobenzene	2-Chloroethylvinyl ether	Acetonitrile
Acrolein (Propenal)	Acrylonitrile	Benzene
Bromodichloromethane	Bromoform	Bromomethane
Carbon tetrachloride	Chlorobenzene	Chloroethane
Chloroform	Chloromethane	cis-1,3-Dichloropropene
Dibromochloromethane	Dichloromethane (Methylene chloride)	Ethylbenzene
Methyl tert-butyl ether (MTBE)	Tetrachloroethene	Toluene
trans-1,2-Dichloroethene	trans-1,3-Dichloropropene	Trichloroethene
Trichlorofluoromethane	Vinyl chloride	Xylenes (total)

USEPA625

1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene
1,4-Dichlorobenzene	2,2-Oxybis (1-chloropropane)	2,4,5-Trichlorophenol
2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol
2,4-Dinitrophenol	2,4-Dinitrotoluene (2,4-DNT)	2,6-Dinitrotoluene (2,6-DNT)
2-Chloronaphthalene	2-Chlorophenol	2-Methyl-4,6-dinitrophenol
2-Nitrophenol	3,3'-Dichlorobenzidine	4-Bromophenyl phenyl ether
4-Chloro-3-methylphenol	4-Chlorophenyl phenyl ether	4-Nitrophenol
Acenaphthene	Acenaphthylene	Anthracene
Benzidine	Benzo(a)anthracene	Benzo(a)pyrene
Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene
Benzyl butyl phthalate	Bis(2-chloroethoxy) methane	Bis(2-chloroethyl) ether
Bis(2-ethylhexyl) phthalate	Chrysene	Dibenz(a,h)anthracene
Diethyl phthalate	Dimethyl phthalate	Di-n-butyl phthalate
Di-n-octyl phthalate	Fluoranthene	Fluorene
Hexachlorobenzene	Hexachlorobutadiene	Hexachlorocyclopentadiene
Hexachloroethane	Indeno(1,2,3-cd) pyrene	Isophorone
Naphthalene	Nitrobenzene	N-Nitrosodimethylamine
N-Nitrosodi-n-propylamine	N-Nitrosodiphenylamine	Pentachlorophenol
Phenanthrene	Phenol	Pyrene

Appendix B

Updated Laboratory Certifications

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

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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	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

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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

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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

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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

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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	RSK175	GC-FID	Acetylene
Aqueous	RSK175	GC-FID	Butane
Aqueous	RSK175	GC-TCD	Carbon Dioxide
Aqueous	RSK175	GC-FID	Ethane
Aqueous	RSK175	GC-FID	Ethene
Aqueous	RSK175	GC-FID	Methane
Aqueous	RSK175	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)

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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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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

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/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

ISO/IEC 17025:2005 and DoD-ELAP

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Accreditation is granted to the facility to perform the following testing:

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

Certificate of Accreditation: Supplement

ISO/IEC 17025:2005 and DoD-ELAP

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Accreditation is granted to the facility to perform the following testing:

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

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
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

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/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

Certificate of Accreditation: Supplement

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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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Accreditation is granted to the facility to perform the following testing:

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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Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
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	TCEQ 1005	GC-FID	GRO-aliphatic
Aqueous/Solids	TCEQ 1005	GC-FID	GRO-aromatic
Aqueous/Solids	TCEQ 1005	GC-FID	GRO-Total
Aqueous/Solids	TCEQ 1005	GC-FID	Total Petroleum Hydrocarbon
Aqueous/Solids	TCEQ 1006	GC-FID	DRO-aliphatic
Aqueous/Solids	TCEQ 1006	GC-FID	DRO-aromatic
Aqueous/Solids	TCEQ 1006	GC-FID	DRO-Total
Aqueous/Solids	TCEQ 1006	GC-FID	ORO-aliphatic
Aqueous/Solids	TCEQ 1006	GC-FID	ORO-aromatic
Aqueous/Solids	TCEQ 1006	GC-FID	ORO-Total
Aqueous/Solids	TCEQ 1006	GC-FID	Total Petroleum Hydrocarbon

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 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

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 24, 2014 Expiration Date: June 30, 2015

Clint Sperber, MPA, Interim Director
Division of Emergency Preparedness and Community Support
DH Form 1697, 7/04
NON-TRANSFERABLE E87854-17-07/24/2014
Supersedes all previously issued certificates

Laboratory Scope of Accreditation

Organization

E87854 **(225) 769-4900**

Gulf Coast Analytical Laboratories LLC
7979 Innovation Park Drive
Baton Rouge, LA 70820

Solid and Chemical Materials Certification

Method Code	Method Ref	Analyte	Status	Date Effective	Type	AA
1630	GCAL SOP WL-070/IC-COND	Acetic acid	Accredited	7/23/2014	NELAP	LA
1630	GCAL SOP WL-070/IC-COND	Butyric acid (Butanoic acid)	Accredited	7/23/2014	NELAP	LA
1630	GCAL SOP WL-070/IC-COND	Formic acid	Accredited	7/23/2014	NELAP	LA
1630	GCAL SOP WL-070/IC-COND	Lactic acid	Accredited	7/23/2014	NELAP	LA
1630	GCAL SOP WL-070/IC-COND	Propionic acid (Propanoic acid)	Accredited	7/23/2014	NELAP	LA
1630	GCAL SOP WL-070/IC-COND	Pyruvic acid	Accredited	7/23/2014	NELAP	LA

Non-Potable Water Certification

Method Code	Method Ref	Analyte	Status	Date Effective	Type	AA
1630	GCAL SOP WL-070/IC-COND	Acetic acid	Accredited	7/23/2014	NELAP	LA
1630	GCAL SOP WL-070/IC-COND	Butyric acid (Butanoic acid)	Accredited	7/23/2014	NELAP	LA
1630	GCAL SOP WL-070/IC-COND	Formic acid	Accredited	7/23/2014	NELAP	LA
1630	GCAL SOP WL-070/IC-COND	Lactic acid	Accredited	7/23/2014	NELAP	LA
1630	GCAL SOP WL-070/IC-COND	Propionic acid (Propanoic acid)	Accredited	7/23/2014	NELAP	LA
1630	GCAL SOP WL-070/IC-COND	Pyruvic acid	Accredited	7/23/2014	NELAP	LA

Laboratory Scope of Accreditation

Attachment to Certificate #: E87854-17, expiration date June 30, 2015. 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

Laboratory Scope of Accreditation

Attachment to Certificate #: E87854-17, expiration date June 30, 2015. 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
2,3,4,6-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
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008

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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: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	9/11/2008

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State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
Gulf Coast Analytical Laboratories LLC
7979 Inuovation Park Drive
Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	9/11/2008

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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: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
Aldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	10/14/2002

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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: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
a-Methylstyrene	EPA 8260	Volatile Organics	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

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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-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 625	Extractable Organics	NELAP	10/14/2002
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	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

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Analyte	Method/Tech	Category	Certification Type	Effective Date
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
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

Laboratory Scope of Accreditation

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Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chromium VI	EPA 7196	General Chemistry	NELAP	8/10/2011
Chromium VI	SM 3500-Cr B (20th/21st Ed.)/UV-VIS	General Chemistry	NELAP	8/10/2011
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

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Dibenz(a,h)anthracene	EPA 8270	Extractable Organics	NELAP	9/11/2008
Dibenz(a,h)anthracene	EPA 8310	Extractable Organics	NELAP	8/10/2011
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

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Dissolved organic carbon (DOC)	SM 5310 B	General Chemistry	NELAP	8/10/2011
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
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

Attachment to Certificate #: E87854-17, expiration date June 30, 2015. 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
Fenthion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	9/11/2008
Fluoranthene	EPA 625	Extractable Organics	NELAP	10/14/2002
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 Chemistry	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

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	9/11/2008
Iron	EPA 200.7	Metals	NELAP	10/14/2002
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

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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
Mercury	EPA 245.2	Metals	NELAP	10/14/2002
Mercury	EPA 7470	Metals	NELAP	8/10/2011
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 acrylate	EPA 8260	Volatile Organics	NELAP	9/11/2008
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

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Baton Rouge, LA 70820

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
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

Laboratory Scope of Accreditation

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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
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
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

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E87854
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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
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

Laboratory Scope of Accreditation

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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: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
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	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

Attachment to Certificate #: E87854-17, expiration date June 30, 2015. 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
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
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

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E87854
Gulf Coast Analytical Laboratories LLC
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Baton Rouge, LA 70820

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
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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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
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

Laboratory Scope of Accreditation

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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
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
2,3,4,6-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
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	10/14/2002

Laboratory Scope of Accreditation

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E87854
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Baton Rouge, LA 70820

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
4-Chlorotoluene	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
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
Antimony	EPA 6010	Metals	NELAP	10/14/2002

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
Benzothiazole	EPA 8270	Extractable Organics	NELAP	8/10/2011

Laboratory Scope of Accreditation

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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
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-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	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

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Chloroprene	EPA 8260	Volatile Organics	NELAP	10/14/2002
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

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Dichlorovos (DDVP, Dichlorvos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
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
Diphenyl 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
Ethanol	EPA 8015	Volatile Organics	NELAP	8/10/2011
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

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	10/14/2002
Ethylene glycol	EPA 8015	Volatile Organics	NELAP	8/10/2011
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

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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
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

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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/14/2002
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

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Analyte	Method/Tech	Category	Certification Type	Effective Date
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	10/14/2002
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	10/14/2002
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

Laboratory Scope of Accreditation

Attachment to Certificate #: E87854-17, expiration date June 30, 2015. 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: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Potassium	EPA 6020	Metals	NELAP	8/10/2011
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	10/14/2002
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	EPA 8260	Volatile Organics	NELAP	10/14/2002
tert-Butylbenzene	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
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	10/14/2002
Tetraethyl pyrophosphate (TEPP)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/14/2002
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

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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
VPH Aromatic C9-C10	MADEP-VPH (MA-VPH)	Volatile Organics	NELAP	8/10/2011
Xylene (total)	EPA 8021	Volatile Organics	NELAP	10/14/2002
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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State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

E87854
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Baton Rouge, LA 70820

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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Gulf Coast Analytical Laboratories LLC
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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
2,3,4,6-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
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	8/10/2011

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Baton Rouge, LA 70820

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	8/10/2011

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Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
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
Biphenyl	EPA 8270	Extractable Organics	NELAP	8/10/2011

Laboratory Scope of Accreditation

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State Laboratory ID: E87854 **EPA Lab Code: LA00024** **(225) 769-4900**

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Baton Rouge, LA 70820

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
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-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	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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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
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

Laboratory Scope of Accreditation

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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

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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	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

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E87854
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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