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SAMPLING AND ANALYSIS PLAN SITES 8B AND 8C ENGINEERING EFFORT HERBICIDE ORANGE STORAGE AREA NCBC GULFPORT MS
12/01/2014
RESOLUTION CONSULTANTS

SAMPLING AND ANALYSIS PLAN

SITES 8B AND 8C ENGINEERING EFFORT
HERBICIDE ORANGE STORAGE AREA
NAVAL CONSTRUCTION BATTALION CENTER GULFPORT
GULFPORT, MISSISSIPPI

Revision: 0

Prepared For:

Department of the Navy
Naval Facilities Engineering Command Southeast
Building 135 N, 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 JM70

December 2014

SAP WORKSHEET #1: TITLE AND APPROVAL PAGE

(UFP-QAPP Manual Section 2.1)

SAMPLING AND ANALYSIS PLAN

SITES 8B AND 8C ENGINEERING EFFORT
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November 2014

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Robert Fisher, NAVFAC Southeast
Remedial Project Manager/Date

EXECUTIVE SUMMARY

Resolution Consultants has prepared this Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) for engineering work at Sites 8B and 8C, Herbicide Orange Storage Area, Naval Construction Battalion Center (NCBC) Gulfport, Gulfport, Mississippi, under Contract No. N62470-11-D-8013, Comprehensive Long-term Environmental Action Navy, Contract Task Order JM70.

NCBC Gulfport occupies approximately 1,100 acres in Gulfport, Harrison County, Mississippi. Gulfport is in the southeastern corner of the state, approximately 2 miles north of the Gulf of Mexico. The Navy acquired the installation property in April 1942.

Site 8 consists of three contiguous storage areas (Areas A, B, and C) located in the north-central portion of NCBC Gulfport. Site 8A was the main former drum storage area for Herbicide Orange (HO) defoliant. Site 8A covers approximately 13 acres. Approximately 73,000 cubic yards, or 100,000 tons, of material contaminated with dioxin was stabilized with Portland Type I cement, compacted into a mound, and covered with a cap at Site 8A from 2004 to 2006. As a result, Site 8A is not included in this effort.

Sites 8B and 8C encompass approximately 18 acres and were also used for storage of HO drums. Site 8B and 8C surface soils have been stabilized with Portland cement. Sites 8B and 8C are also located at the head of local drainage basins. Surface water from Site 8B flows north and exits the base through Outfall 4, discharging to the Turkey Creek drainage basin. Surface water from Site 8C flows to the southeast, exiting the base through Outfall 2 into Brickyard Creek.

This UFP-SAP is intended to facilitate two sampling tasks associated with engineering work at Sites 8B and 8C designed to:

- Confirm that dioxin-contaminated sediment above the Mississippi Department of Environmental Quality Tier 1 Soil Target Remediation Goal has been removed from the drainage ditches that received runoff from Sites 8B and 8C.
- Show that dioxins will not leach from stabilized sediment.

This Sampling and Analysis Plan outlines the organization, project management, objectives, planned activities, measurement, data acquisition, assessment, oversight, and data review procedures associated with these two tasks at NCBC Gulfport. Protocols for sample collection, handling, storage, chain of custody, laboratory and field analyses, data validation, and reporting are also addressed. Field activities conducted under this plan will be conducted in accordance with Resolution Consultants Standard Operating Procedures and will meet the requirements of the Site-Specific Health and Safety Plan/Accident Prevention Plan, prepared under separate cover.

Table of Contents

SAP WORKSHEET #1: TITLE AND APPROVAL PAGE ..... WS 1-1

SAP WORKSHEET #2: SAMPLING AND ANALYSIS PLAN IDENTIFYING INFORMATION ..... WS 2-1

SAP WORKSHEET #3: DISTRIBUTION LIST ..... WS 3-1

SAP WORKSHEET #4: PROJECT PERSONNEL SIGN-OFF SHEET ..... WS 4-1

SAP WORKSHEET #5: PROJECT ORGANIZATIONAL CHART ..... WS 5-1

SAP WORKSHEET #6: COMMUNICATION PATHWAYS ..... WS 6-1

SAP WORKSHEET #7: PERSONNEL RESPONSIBILITIES TABLE ..... WS 7-1

SAP WORKSHEET #8: SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE ..... WS 8-1

SAP WORKSHEET #9: PROJECT SCOPING SESSION PARTICIPANTS SHEET ..... WS 9-1

SAP WORKSHEET #10: CONCEPTUAL SITE MODEL ..... WS 10-1

SAP WORKSHEET #11: PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS ..... WS 11-1

SAP WORKSHEET #12: FIELD QUALITY CONTROL SAMPLES ..... WS 12-1

SAP WORKSHEET #13: SOURCES OF SECONDARY DATA CRITERIA AND LIMITATIONS TABLE ..... WS 13-1

SAP WORKSHEET #14: SUMMARY OF PROJECT TASKS ..... WS 14-1

SAP WORKSHEET #15: REFERENCE LIMITS AND EVALUATION TABLES ..... WS 15-1

SAP WORKSHEET #16: PROJECT/TIMELINE TABLE ..... WS 16-1

SAP WORKSHEET #17: SAMPLING DESIGN AND RATIONALE ..... WS 17-1

SAP WORKSHEET #18: LOCATION-SPECIFIC SAMPLING METHODS/ SOP REQUIREMENTS TABLE ..... WS 18-1

SAP WORKSHEET #19: ANALYTICAL METHODS/SOP REQUIREMENTS TABLE ..... WS 19-1

SAP WORKSHEET #20: FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE ..... WS 20-1

SAP WORKSHEET #21: PROJECT SAMPLING SOP REFERENCES TABLE ..... WS 21-1

SAP WORKSHEET #22: FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE ..... WS 22-1

SAP WORKSHEET #23: ANALYTICAL SOP REFERENCES TABLE ..... WS 23-1

SAP WORKSHEET #24: ANALYTICAL INSTRUMENT CALIBRATION TABLE ..... WS 24-1

SAP WORKSHEET #25: ANALYTICAL INSTRUMENT AND EQUIPMENT ..... MAINTENANCE, TESTING, AND INSPECTION TABLE ..... WS 25-1

SAP WORKSHEET #26: SAMPLE HANDLING SYSTEM ..... WS 26-1

SAP WORKSHEET #27: SAMPLE CUSTODY REQUIREMENTS ..... WS 27-1

SAP WORKSHEET #28: LABORATORY QC SAMPLES TABLE ..... WS 28-1

SAP WORKSHEET #29: PROJECT DOCUMENTS AND RECORDS TABLE ..... WS 29-1

SAP WORKSHEET #30: ANALYTICAL SERVICES TABLE ..... WS 30-1

SAP WORKSHEET #31: PLANNED PROJECT ASSESSMENTS TABLE ..... WS 31-1

SAP WORKSHEET #32: ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES TABLE ..... WS 32-1

SAP WORKSHEET #33: QUALITY ASSURANCE MANAGEMENT REPORTS TABLE ..... WS 33-1

SAP WORKSHEETS #34-36: DATA VERIFICATION AND VALIDATION (STEPS I and IIa/IIb) PROCESS TABLE ..... WS 34-36-1

SAP WORKSHEET #37: USABILITY ASSESSMENT ..... WS 37-1

REFERENCES REF-1

Figures

Figure 10-1 Site Location Map ..... WS 10-2
Figure 10-2 Site Vicinity Map ..... WS 10-3
Figure 10-3A Site Conceptual Model ..... WS 10-7
Figure 10-3B Site Conceptual Model — Cross Section ..... WS 10-8
Figure 10-4 Ditch Locations and Flow Direction Map ..... WS 10-9
Figure 17-1 Proposed Confirmation Sample Locations ..... WS 17-3

Appendices

Appendix A Field Standard Operating Procedures
Appendix B Laboratory Certification

List of Acronyms

2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
bgs	Below Ground Surface
CAS	Chemical Abstracts Service
CCV	Continuing calibration verification
CLEAN	Comprehensive Long-term Environmental Action Navy
CSM	Conceptual Site Model
CTO	Contract Task Order
CY	Cubic yard
DL	Detection Limit
DoD	Department of Defense
DoD QSM	Department of Defense Quality Systems Manual
DQO	Data Quality Objective
DVA	Data Validation Assistant
DVM	Data Validation Manager
%D	Percent Difference or Percent Drift
EB	Equipment blank
ELAP	Environmental Laboratory Accreditation Program
eQAPP	Electronic Quality Assurance Project Plan
FRC	Federal Records Center
FTL	Field Team Leader
GC	Gas chromatograph
GPS	Global Positioning System
HASP	Health and Safety Plan
HO	Herbicide Orange
HRGC/HRMS	High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry
HSM	Health and Safety Manager
ICAL	Initial calibration
ICV	Initial calibration verification
IDW	Investigation-Derived Waste
LCS	Laboratory Control Sample
LOD	Limit of Detection
LOQ	Limit of Quantitation
MDEQ	Mississippi Department of Environmental Quality
MPC	Measurement Performance Criteria
MS/MSD	Matrix Spike/Matrix Spike Duplicate

List of Acronyms (continued)

NA	Not applicable
NAVFAC	Naval Facilities Engineering Command
NCBC	Naval Construction Battalion Center
NIRIS	Naval Installation Restoration Information Solution
ng/kg	Nanogram per kilogram
PCB	Polychlorinated biphenyl
PDF	Portable document format
pg/L	Picogram per liter
PM	Project Manger
POC	Point of Contact
PSL	Project Screening Level
PSQ	Principal study questions
OSHA	Occupational Safety and Health Administration
QA	Quality Assurance
QAO	Quality Assurance Officer
QC	Quality Control
RF	Response factor
RPD	Relative Percent Difference
RPM	Remedial Project Manager
%R	Percent Recovery
RSD	Relative standard deviation
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SPLP	Synthetic precipitation leaching procedure
SSO	Site Safety Officer
TAT	Turn-around time
TBD	To Be Determined
TCDD	2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEF	Toxicity Equivalency Factor
TEQ	Toxicity Equivalent
TOM	Task Order Manager
TRG	Target Remediation Goals
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
USAF	United States Air Force
U.S. EPA	United States Environmental Protection Agency

SAP WORKSHEET #2: SAMPLING AND ANALYSIS PLAN IDENTIFYING INFORMATION

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number: Sites 8B and 8C, Naval Construction Battalion Center (NCBC), Gulfport, Mississippi

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) JM70

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 United States Environmental Protection Agency (U.S. EPA) *Guidance for Quality Assurance Project Plans, EPA QA/G-5. EPA/240/R-02/009.* (U.S. EPA 2002 December).

2. Regulatory program(s): Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as reauthorized by Superfund Amendments and Reauthorization Act, with Mississippi Department of Environmental Quality (MDEQ) oversight, review, and input.

3. This SAP is a Tier I project-specific SAP for engineering work at Sites 8B and 8C, Herbicide Orange (HO) Storage Area, NCBC Gulfport, Gulfport, Mississippi.

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

Organization Partners/Stakeholders	Connection
Navy, Naval Facilities Engineering Command, Southeast	Responsible Federal Agency
Mississippi Department of Environmental Quality	State Regulatory Agency
Naval Construction Battalion Center Gulfport	Property Owner

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

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

SAP WORKSHEET #3: DISTRIBUTION LIST

(UFP-QAPP Manual Section 2.3.2)

Distribution List				
SAP Recipients	**Title/Role**	**Organization**	**Telephone Number**	**E-Mail Address**
Robert Fisher	Remedial Project Manager	Department of the Navy — NAVFAC Southeast P.O. Box 30A Ajax Street, Building 135N Jacksonville, Florida 32212-0030	904-542-6196	robert.r.fisher@navy.mil
Gordon Crane	NCBC Gulfport Site Manager/Point of Contact	NCBC Building 322, Floor 1 Gulfport, Mississippi 39501	228-871-2485	gordon.crane@navy.mil
Bob Merrill	MDEQ RPM – Provides Regulator Input	MDEQ 515 E Amite Street Jackson, Mississippi 39201-2709	601-961-5049	bob.merrill@deq.state.ms.us
David Felter	Task Order Manager	Resolution Consultants 5724 Summer Trees Drive Memphis, Tennessee 38134	901-937-4280	dfelter@ensafe.com
Paul Jobmann	Field Team Leader/Site Safety Officer	Resolution Consultants 7775 Baymeadows Way, Suite 104 Jacksonville, Florida 32256	904-301-4508	pjobmann@ensafe.com
Tina Cantwell	Project Chemist/Quality Assurance Officer/Data Manager	Resolution Consultants 5724 Summer Trees Drive Memphis, Tennessee 38134	901-937-4315	tcantwell@ensafe.com
Chris Cornwell	Laboratory Project Manager	Cape Fear Analytical 3306 Kitty Hawk Road, Suite 120 Wilmington, North Carolina 28405	910-795-0422	ccornwell@cfanalytical.com

Notes:
Each person listed in this table will be responsible for distributing copies of this SAP to appropriate personnel within their organization.

SAP = sampling and analysis plan
NAVFAC = Naval Facilities Engineering Command
NCBC = Naval Construction Battalion Center
MDEQ = Mississippi Department of Environmental Quality
RPM = Remedial Project Manager

SAP WORKSHEET #4: PROJECT PERSONNEL SIGN-OFF SHEET

(UFP-QAPP Manual Section 2.3.2)

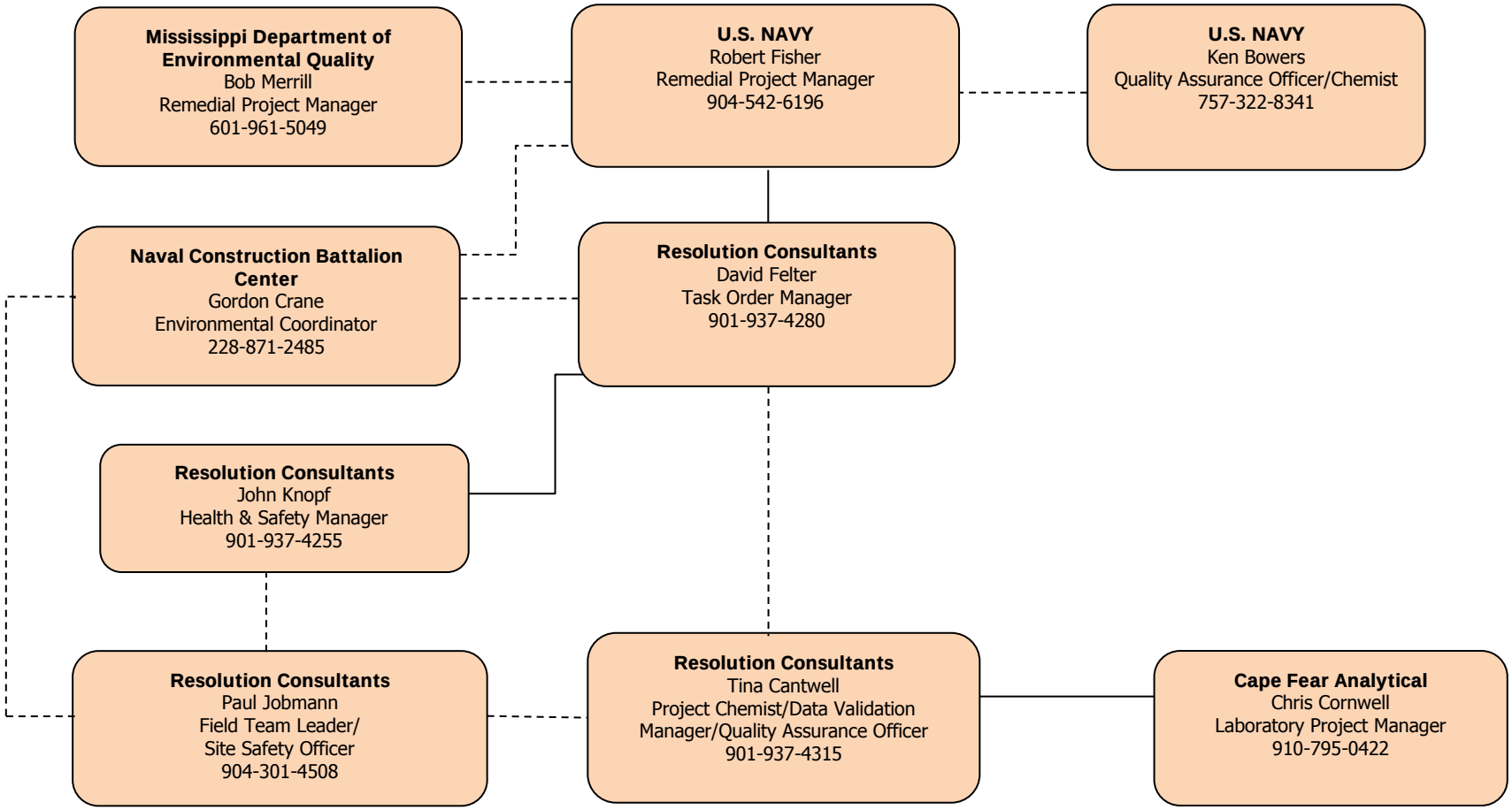
Certification that project personnel have read the text will be obtained by the following methods:

E-mails will be sent to Navy, Resolution Consultants, regulatory agencies, and subcontractor project personnel, who will be requested to verify by email that they have read the applicable SAP sections and provide the date on which they were reviewed. Copies of the verification email will be included in the project files and identified in Worksheet #29. Copies of regulatory agency comments, if received, will be retained in the project files and are listed in Worksheet #29 as project records.

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)

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	MDEQ RPM NAVFAC Southeast RPM	Bob Merrill Robert Fisher	601-961-5049 904-542-6196	The NAVFAC Southeast RPM will contact the MDEQ via phone and/or email within 24 hours of recognizing the issue whenever issues arise.
Field Progress Reports	Resolution Consultants TOM Resolution Consultants FTL	David Felter Paul Jobmann	901-937-4280 904-301-4508	The Resolution Consultants FTL will contact the Resolution Consultants TOM on a daily basis via phone, and every 1 to 2 days will summarize progress via email.
Gaining Site Access	Resolution Consultants FTL NCBC Gulfport POC	Paul Jobmann Gordon Crane	904-301-4508 228-871-2485	The Resolution Consultants FTL will contact the NCBC Gulfport POC verbally or via email at least 3 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 NCBC Gulfport POC	Paul Jobmann Gordon Crane	904-301-4508 228-871-2485	The Resolution Consultants FTL will coordinate verbally or via email with NCBC Gulfport 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 utility service and NCBC Gulfport personnel (as directed by the NCBC Gulfport POC) verbally or via email 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 HSM NAVFAC Southeast RPM NCBC Gulfport POC	David Felter Paul Jobmann Tina Cantwell John Knopf Robert Fisher Gordon Crane	901-937-4280 904-301-4508 901-937-4315 901-937-4255 904-542-6196 228-871-2485	Any field team member who observes an unsafe situation has the authority to stop work. If Resolution Consultants is the responsible party for a stop work command, the Resolution Consultants SSO will inform onsite personnel, subcontractor(s), the NCBC Gulfport POC, TOM, and HSM within 1 hour (verbally or by email). The HSM will notify the NAVFAC Southeast RPM within 24 hours of notification from the SSO. If a subcontractor is the responsible party, the subcontractor PM must verbally inform the Resolution Consultants SSO within 15 minutes, and the Resolution Consultants SSO will then follow the procedure listed above.

Communication Pathways				
Communication Drivers	**Responsible Entity**	**Name**	**Phone Number**	**Procedure (Timing, Pathway To/From, etc.)**
SAP Changes Prior to Field/ Laboratory Work	Resolution Consultants TOM Resolution Consultants FTL NAVFAC Southeast RPM MDEQ RPM Resolution Consultants Project Chemist	David Felter Paul Jobmann Robert Fisher Bob Merrill Tina Cantwell	901-937-4280 904-301-4508 904-542-6196 601-961-5049 901-937-4315	The Resolution Consultants FTL will verbally inform the TOM upon realizing a need for a SAP modification. The FTL or TOM will document the proposed changes via a SAP modification form within five days and send it to the Project Chemist. The Project Chemist will assess whether: a) the modification has the potential to affect the project's ability to achieve DQOs, b) the modification requires a change in field or laboratory methods, which may affect project schedule or cost, or c) the modification does not affect DQOs, schedule, or cost and is for documentation purposes only. SAP modifications potentially affecting DQOs will be submitted to the NAVFAC Southeast RPM and MDEQ RPM for review and consideration and may require SAP amendments and approval. Modifications in laboratory/field methods, project schedule or cost will be submitted to the Navy for review and consideration. Minor modifications not affecting DQOs, schedule or cost will be documented in the project file.
SAP Changes in the Field	Resolution Consultants TOM Resolution Consultants FTL NAVFAC Southeast NCBC Gulfport POC MDEQ RPM	David Felter Paul Jobmann Robert Fisher Gordon Crane Bob Merrill	901-937-4280 904-301-4508 904-542-6196 228-871-2485 601-961-5049	The Resolution Consultants FTL will inform the TOM verbally within same day of the need for a SAP change in the field. The Resolution Consultants TOM will inform the NAVFAC Southeast RPM and NCBC Gulfport POC (verbally or via email) within 1 business day of discovery; the TOM sends a concurrence letter to the NAVFAC Southeast RPM, if warranted, within 7 calendar days and the NAVFAC Southeast RPM signs the letter within 5 business days of receipt. Scope change is to be implemented before work is executed. Document the change on the SAP modification form (within 2 business days) or SAP amendment (within timeframe agreed to by Project Team). The NAVFAC Southeast RPM will notify MDEQ RPM of any significant SAP field changes within 5 business days. Any change of the approved SAP affecting the scope or implementation of the sampling program will be made only upon authorization of the NAVFAC Southeast RPM and MDEQ RPM.
Field Corrective Actions	Resolution Consultants TOM Resolution Consultants FTL NAVFAC Southeast RPM	David Felter Paul Jobmann Robert Fisher	901-937-4280 904-301-4508 904-542-6196	The Resolution Consultants FTL will inform the TOM verbally within same day of field corrective actions. The Resolution Consultants TOM will then notify the NAVFAC Southeast RPM (verbally or by email) within 1 business day.
Recommendations to stop work and initiate work upon corrective action	Resolution Consultants FTL/SSO Resolution Consultants TOM NAVFAC Southeast RPM MDEQ RPM	Paul Jobmann David Felter Robert Fisher Bob Merrill	904-301-4508 901-937-4280 904-542-6196 601-961-5049	Responsible party verbally informs the Resolution Consultants TOM, FTL, and subcontractors within 1 hour of recommendation to stop work and within 24 hours of recommendation to restart work. Responsible party follows verbal notification with an email to the Project Team within 24 hours.

Communication Pathways				
Communication Drivers	**Responsible Entity**	**Name**	**Phone Number**	**Procedure (Timing, Pathway To/From, etc.)**
Sample Receipt and Laboratory Quality Variances	Resolution Consultants TOM Resolution Consultants Project Chemist Cape Fear Analytical PM Resolution Consultants FTL	David Felter Tina Cantwell Chris Cornwell Paul Jobmann	901-937-4280 901-937-4315 910-795-0422 904-301-4508	The Laboratory PM will notify (verbally or via email) the Resolution Consultants FTL and 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 email) the Resolution Consultants TOM within 1 business day, if corrective action is required. The Resolution Consultants TOM will notify (verbally or via email) the Laboratory PM and the Resolution Consultants FTL within 1 business day of any required corrective action.
Analytical Corrective Actions	Cape Fear Analytical PM Resolution Consultants Project Chemist	Chris Cornwell Tina Cantwell	910-795-0422 901-937-4315	The laboratory shall notify the Resolution Consultants' chemist of any analytical data anomaly within 1 business day of discovery. After the laboratory receives guidance from Resolution Consultants' chemist, the laboratory shall initiate any corrective action to prevent further anomalies.
Analytical Corrective Actions and Reporting Data Validation Issues	Cape Fear Analytical PM Resolution Consultants Project Chemist/DVM Resolution Consultants TOM NAVFAC Southeast RPM	Chris Cornwell Tina Cantwell David Felter Robert Fisher	910-795-0422 901-937-4315 901-937-4280 904-542-6196	The Laboratory PM will notify (verbally or via email) 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 email) the Resolution Consultants TOM within 1 business day. Resolution Consultants' DVM/Project Chemist will notify the Resolution Consultants TOM verbally or via email 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 Southeast RPM within 24 hours of notification from the Resolution Consultants DVM or Project Chemist. The NAVFAC Southeast RPM will take corrective action appropriate for the identified deficiency.
Data Validation Corrective Actions	Resolution Consultants DVM Resolution Consultants TOM	Tina Cantwell David Felter	901-937-4315 901-937-4280	See "Notification of Non-Usable Data" procedure below. If the Resolution Consultants DVM identifies non-usable data during the data validation process that requires corrective action, the Resolution Consultants TOM will coordinate with the Resolution Consultants DVM 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.

Communication Pathways				
Communication Drivers	**Responsible Entity**	**Name**	**Phone Number**	**Procedure (Timing, Pathway To/From, etc.)**
Notification of Non-Usable Data	Cape Fear Analytical PM Resolution Consultants Project Chemist/DVM Resolution Consultants TOM NAVFAC Southeast RPM	Chris Cornwell Tina Cantwell David Felter Robert Fisher	910-795-0422 901-937-4315 901-937-4280 904-542-6196	If the laboratory determines that any data they have generated is non-usable, the Laboratory PM will notify (verbally or via email) 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 email) the 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 Data Validator identifies non-usable data during the data validation process, the Resolution Consultants DVM will notify the Resolution Consultants TOM verbally or via email 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 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 Southeast 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 will engage the NAVFAC chemist to ensure issues with this project can be evaluated to determine impact to other DoD projects. Such notification will be made within 1 business day of when the issue is discovered.

Notes:

NAVFAC = Naval Facilities Engineering Command
RPM = Remedial Project Manager
TOM = Task Order Manger
FTL = Field Team Leader
NCBC = Naval Construction Battalion Center
POC = Point of contact
MDEQ = Mississippi Department of Environmental Quality
DQO = Data Quality Objective
SSO = Site Safety Office
SAP = Sampling and Analysis Plan
QAO = Quality Assurance Officer
PM = Project Manager
DVM = Data Validation Manager
HSM = Health and Safety Manager
DoD = Department of Defense

SAP WORKSHEET #7: PERSONNEL RESPONSIBILITIES TABLE

(UFP-QAPP Manual Section 2.4.3)

Name	Title/Role	Organizational Affiliation	Responsibilities
Robert Fisher	NAVFAC RPM/Manages project activities for the Navy	NAVFAC Southeast	Primary Point of Contact for the Navy. Oversees project implementation, including scoping, data review, and evaluation, on behalf of the Navy.
Gordon Crane	NCBC Gulfport Point of Contact/Oversees onsite project activities	NCBC Gulfport	Point of Contact for base-specific activity. Oversees onsite activities.
Bob Merrill	MDEQ RPM — Provides regulator input	MDEQ	Participates in scoping, data review, evaluation, and approves the SAP.
David Felter	Task Order Manager/Manages project on a daily basis	Resolution Consultants	Primary point of contact for Resolution Consultants. Oversees project implementation, including financials, schedule, and technical aspects.
Paul Jobmann	Field Team Leader/ Site Safety Officer/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. Details are included in Health and Safety Plan.
Tina Cantwell	Project Chemist/Quality Assurance Officer/ Data Validation Manager/Oversees laboratory, project quality, and data validation.	Resolution Consultants	As Project Chemist, prepares laboratory scopes of work, and coordinates laboratory related functions with laboratory. Performs or oversees data quality reviews and quality assurance of data validation deliverables. As quality assurance officer, ensures quality aspects of the project are implemented, documented, and maintained. As data validation manager, performs or oversees data validation and data input in both the project database and the Navy's Naval Installation Restoration Information Solution database.
John Knopf	Health and Safety Manager/Oversees health and safety activities	Resolution Consultants	Oversees CLEAN Health and Safety Program.
Chris Cornwell	Laboratory Project Manager/Analytical Subcontractor	Cape Fear Analytical	Oversees quality and technical aspects related to subcontracted analytical services.

Notes:

NAVFAC = Naval Facilities Engineering Command
NCBC = Marine Corps Recruit Depot
RPM = Remedial Project Manager
MDEQ = Mississippi Department of Environmental Quality
CLEAN = Comprehensive Long-term Environmental Action Navy

SAP WORKSHEET #8: SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE

(UFP-QAPP Manual Section 2.4.4)

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

SAP WORKSHEET #9: PROJECT SCOPING SESSION PARTICIPANTS SHEET

(UFP-QAPP Manual Section 2.5.1)

No formal Partnering Team meetings or scoping sessions have been held to date to discuss the proposed engineering effort.

SAP WORKSHEET #10: CONCEPTUAL SITE MODEL

(UFP-QAPP Manual Section 2.5.2)

This worksheet presents general background information and the current Conceptual Site Model (CSM), which describes potential contamination routes and possible exposure pathways to humans and ecological receptors. The CSM serves as the basis for developing the sampling and analysis program.

10.1 Introduction

NCBC Gulfport occupies approximately 1,100 acres in Gulfport, Harrison County, Mississippi (Figure 10-1). Gulfport is in the southeastern corner of the state, approximately 2 miles north of the Gulf of Mexico. The Navy acquired the installation property in April 1942.

Site 8 is subdivided into three contiguous storage areas (Areas A, B, and C) located in the north-central portion of NCBC Gulfport (Figure 10-2). The three areas were based on the level of storage and handling of HO which occurred between 1968 and 1977. Sites 8B and 8C were periodically used as overflow storage areas while Site 8A was continually in use. Site 8A covers approximately 13 acres; Site 8B, approximately 15 acres; Site 8C, approximately3 acres.

10.2 Dioxins

HO is an herbicide formulation used during the Vietnam War to defoliate trees and shrubbery. It is an equal mixture of two agricultural herbicides (2,4-dichlorophenoxyacetic acid [2,4-D] and 2,4,5-trichlorophenoxyacetic acid [2,4,5-T]) solubilized in diesel fuel or jet fuel. HO is also known as "Agent Orange," a code name for the orange band that was used to mark the drums used to store the herbicide mixture. Spills and leaks of HO occurred within Site 8, contaminating the surface soil and sediment with 2,4,5-T and 2,4-D and byproduct contaminants (dioxins and furans), primarily 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Concentrations of 2,4,5-T and 2,4-D have degraded over time; however, dioxin and furan concentrations have not attenuated, and are being transported offsite in surface water and/or sediment.

There are 75 polychlorinated dibenzo-p-dioxin congeners and each congener differs in the number and positions of chlorine atoms. The total TCDD toxicity equivalent (TEQ) is an expression of an equivalent amount of TCDD, represented by the concentrations of various dioxin and furan congeners in a sample. TCDD is the basis for the TCDD TEQ comparison because it is the most toxic of the congeners.

World_Imagery – Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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FIGURE 10-1
SITE LOCATION MAP
SITE 8
NCBC GULFPORT
GULFPORT, MISSISSIPPI

REQUESTED BY: D.FELTER	DATE: 08/22/14
DRAWN BY: BRONSON	DWG NAME: 15339_B001

\\ESDATANET\CAD\CAD PROJECTS\15339 GULFPORT_MS\PLANS\15339_B001_SITE LOCATION_NCBC GULFPORT.DWG

World_Imagery – Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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FIGURE 10-2
SITE VICINITY MAP
SITE 8
NCBC GULFPORT
GULFPORT, MISSISSIPPI

REQUESTED BY: D.FELTER	DATE: 08/22/14
DRAWN BY: BRONSON	DWG NAME: 15339_B002

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Each dioxin and furan congener is assigned a toxicity equivalency factor (TEF) based on its toxicity relative to TCDD. The concentration of each congener in a sample is multiplied by its TEF and the resulting products are summed to obtain the total TCDD TEQ for that sample. All dioxin and furan data at NCBC Gulfport will be evaluated as total TCDD TEQ concentrations.

The most recent guidance regarding TEFs is the *Recommended Toxicity Equivalency Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds* (U.S. EPA 2010), which recommends adopting revised 2005 TEFs published in the *World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds* (U.S. EPA 2010) Previous investigations at Site 8 cite U.S. EPA guidance dated 1989. A comparison of the 1989 and 2010 guidance shows that the TEFs presented in the 2010 guidance are the same with the following exceptions:

- 1,2,3,7,8-Pentachlorodibenzo-p-dioxin was 0.5 and now is 1.0.
- 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin was 0.001 and now is 0.0003.

At NCBC Gulfport, TCDD TEQs are compared to the MDEQ TCDD TEQ Restricted Soil Tier 1 Target Remediation Goal (TRG) of 38.2 nanograms per kilogram (ng/kg) and the MDEQ TCDD TEQ Groundwater Tier 1 TRG of 30 picograms per liter (pg/L). This site has been under investigation since the late 1970s and MDEQ Tier 1 TRGs have been the MDEQ-approved standard for comparison.

10.3 Site 8 Description and Environmental History

Prior to 1968, Site 8 was used as an equipment storage and staging area. Around 1961, the surface soils were stabilized with Portland cement to provide a hardened surface for heavy equipment operation and storage. Between 1968 and 1977, Site 8 was used by the United States Air Force (USAF) for storage and handling of approximately 850,000 gallons of HO in 55-gallon drums. In 1977, the HO drums were removed from Site 8, transported to port by railroad, and placed on a ship for destruction by incineration at sea. The release of dioxins at Site 8 was confirmed in 1977, and the site was fenced and left inactive until 1985.

Starting in 1985, there have been a series of remedial actions targeting both Site 8 and on- and off-base areas suspected of having been impacted by dioxins migrating from Site 8. These remedial actions were supported by soil, groundwater, surface water, and sediment investigations; risk assessments; engineering planning documents; pilot tests; treatability studies, etc., the earliest of which was conducted in 1977 by the USAF. A list of available documents reviewed for this UFP-SAP is presented in the reference section.

In 1985, after onsite investigative activities conducted by the USAF, the USAF began operations to clean up the dioxin-contaminated soils that remained on site. Soil impacts resulted from spills and leaks during the 10 years that HO was stored at Site 8. Soil was excavated to the then current U.S. EPA criterion of 1.0 microgram per kilogram and incinerated. During test burns, two additional areas outside the original 13 acres, designated Site 8A, were identified and verified as previous storage locations for drums containing HO (Sites 8B and 8C). Following U.S. EPA acceptance of the test burn data, full-scale incineration of dioxin-contaminated soils from Sites 8A, 8B, and 8C was conducted. The incineration process included approximately 27,000 cubic yards (CY) of contaminated soil and was completed in 1987. The resulting 21,000 CY of ash was placed on Site 8A.

No remedial actions were conducted at Site 8 from 1988 to 2001. Removal actions were conducted in off-base areas in April through May 1995, November through December 2001, and in April 2003. Excavated sediments from all three removal actions were staged on Site 8A.

In August 2002, the Navy performed a sediment removal action in the drainage ditches of Sites 8B and 8C. Approximately 2,600 CY of sediments were excavated from 3,800 linear feet of drainage ditches and were transported and stabilized at Site 8A.

From 2004 to 2007, approximately 73,000 CY of material contaminated with dioxin was stabilized with Portland Type I cement at Site 8A. Contaminated soil was derived from onsite sources, such as the ash, and dredged from on- and off-base drainage ditches and swamps. Afterward, Site 8A was covered with a cap and is currently in use as a parking area. As a result, Site 8A is not included in this effort.

In 2008, 5,815 tons of additional contaminated soil in the form of dredge spoil piles by Canal Road were excavated and stabilized on the southern part of Site 8B. Approximately 162 tons of other contaminated materials were also stabilized in the southern part of Site 8B at that time. The area was capped and is currently used as a parking area.

Long-term monitoring for Site 8 includes collecting sediment samples from drainage ditches that receive runoff from Site 8. Currently, sediment piles are staged on Site 8B by facility personnel performing routine ditch maintenance. TCDD TEQ concentrations in sediment have increased over time until, in 2013, one result exceeded 446 ng/kg, triggering the need for further action. Twenty-two sediment samples were collected in the vicinity of the hot spot; results showed several other locations with TCDD TEQ concentrations above its Tier 1 Restricted TRG.

These results culminated in the decision to stabilize existing onsite sediment piles and re-excavate and stabilize drainage ditch sediments impacted with dioxins.

10.4 Conceptual Site Model

Long-term monitoring shows that dioxins have re-contaminated ditch sediment in the Sites 8B and 8C area following initial excavation conducted in 2005. Concentrations detected have triggered the need to re-excavate portions of those ditches. Additionally, sediment excavated from site ditches as part of routine maintenance and stockpiled on Site 8B is also impacted by dioxins. Further investigation of fate and transport mechanisms at Sites 8B and 8C will be the subject of a separate UFP-SAP.

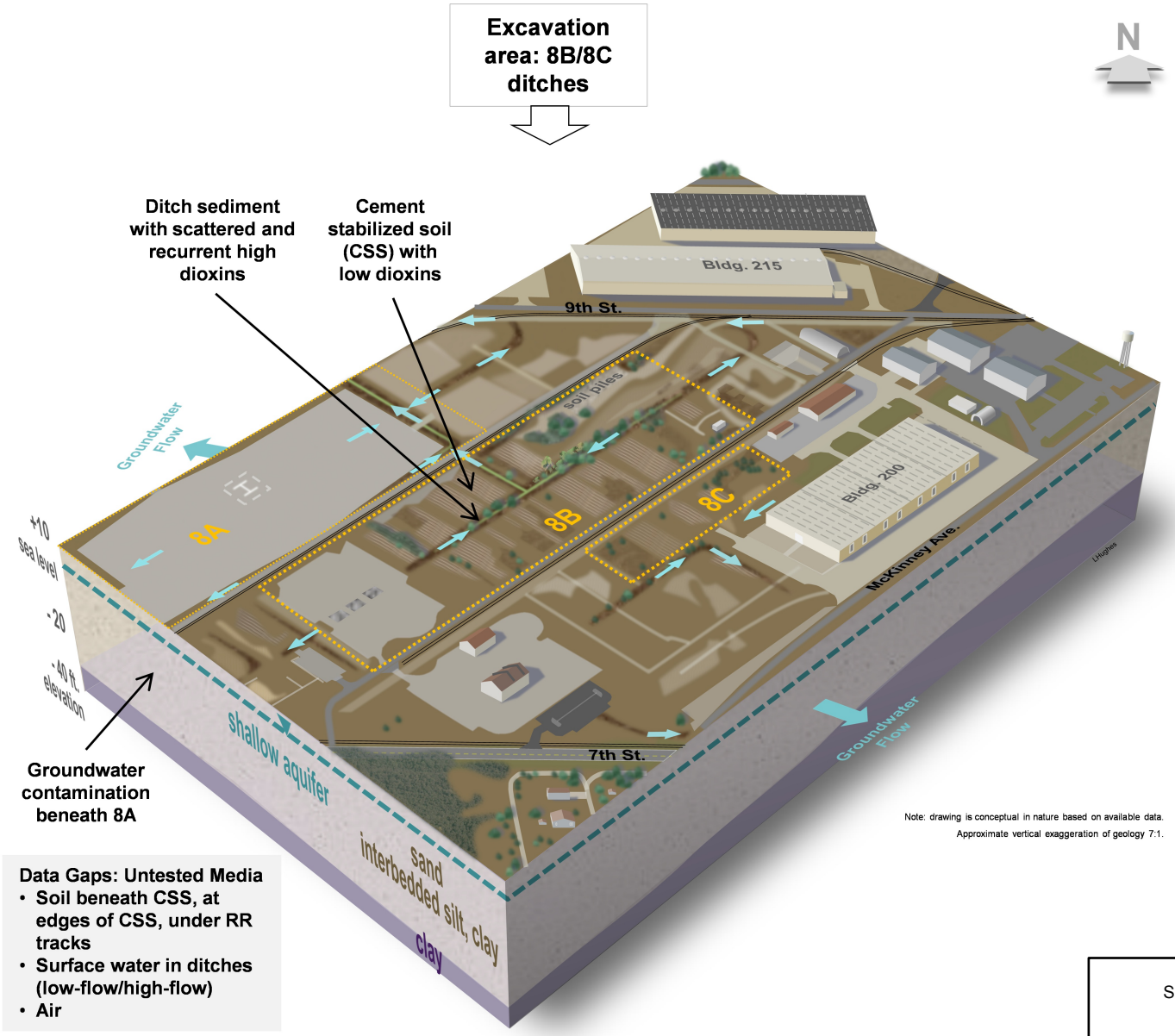
Figures 10-3A and 10-3B provide a model for fate and transport mechanisms potentially at work re-contaminating associated site ditches; Figure 10-4 provides a map of the ditch system in the Site 8 area.

10.4.1 Geology, Hydrogeology, and Hydrology

Based on a review of Site 8 documents, approximately one-third of the surface of Site 8B and 8C has been stabilized with Portland cement. However, a review of historical aerial photographs suggests that the coverage is closer to 90 percent with the remaining 10 percent removed by the USAF in the 1980s as part of remedial activities. January and July 2014 onsite inspections revealed that the stabilized soil was eroding across most of its surface.

Beneath stabilized soil is lithology consisting of fine to medium silty sand which becomes saturated at approximately 3 to 6 feet below ground surface. Historical groundwater flow maps shows the surficial aquifer at Site 8 on a hydrologic divide with groundwater flowing west-northwest beneath Site 8A and east beneath Sites 8B and 8C.

According to the *Groundwater Monitoring Report Site 8, NCBC Gulfport, MS* (HLA 1999), during an observation of four monitoring wells in 1995, it was discovered that when water levels dropped by more than 2.5 feet, dioxin concentrations in groundwater were reduced from levels in the 40 to 60 pg/L range to nearly non-detect. This indicates that dioxin contamination generally tends to remain within the upper 2 feet of the saturated zone. This 1999 report also concluded, based on distribution patterns of TCDD TEQ, that HO-related dioxin contamination is limited to the original boundaries of Sites 8A, 8B, and 8C.



Note: drawing is conceptual in nature based on available data.
Approximate vertical exaggeration of geology 7:1.

Data Gaps: Untested Media

- Soil beneath CSS, at edges of CSS, under RR tracks
- Surface water in ditches (low-flow/high-flow)
- Air

FIGURE 10-3A
SITE CONCEPTUAL MODEL
SITE 8B
NCBC GULFPORT
GULFPORT, MISSISSIPPI

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REQUESTED BY: L. HUGHES	DATE: 8/6/2014
DRAWN BY: M. SENNE	TASK ORDER NUMBER: XXXX

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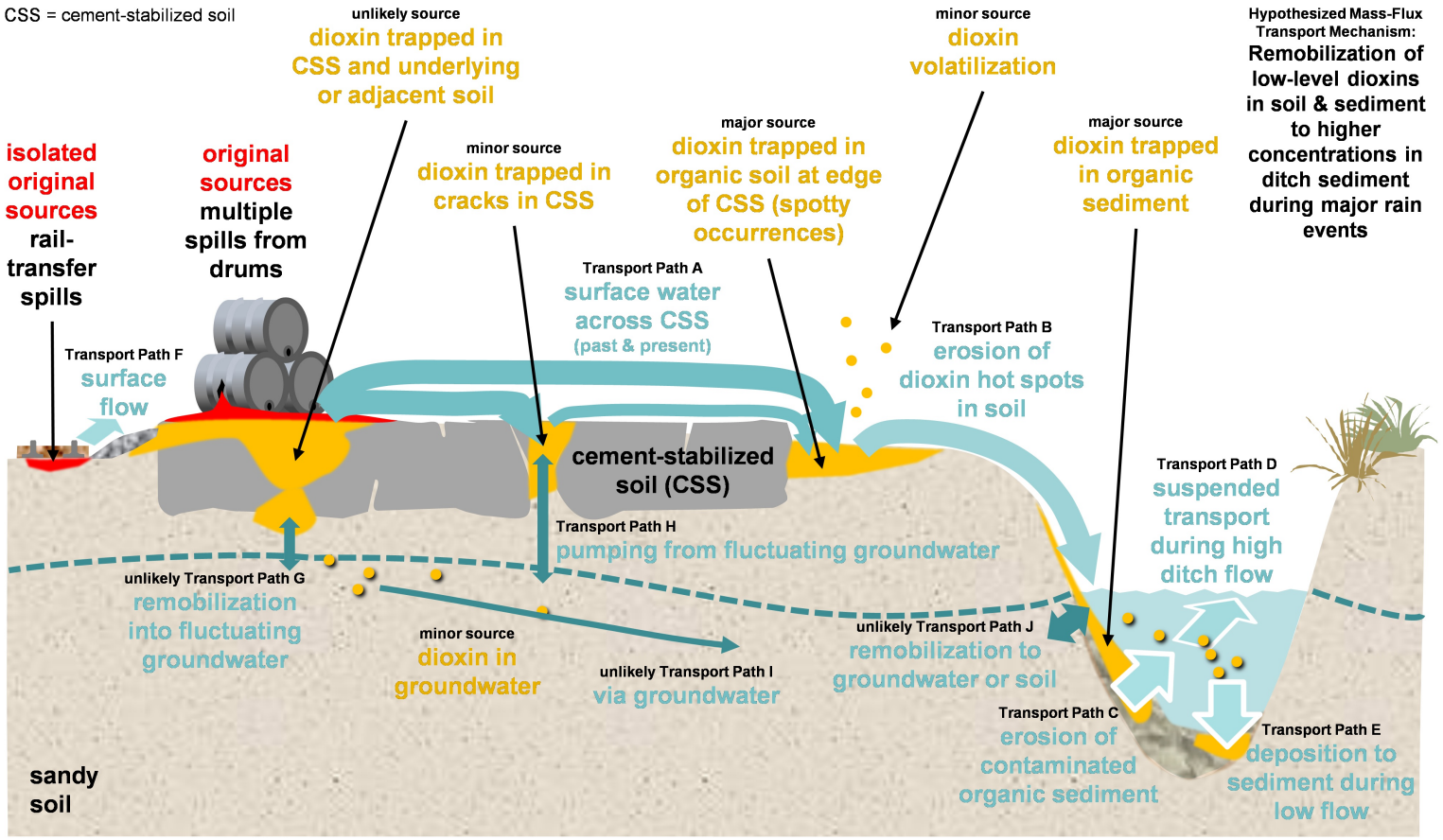

Note: transport arrow sizes proportional to hypothesized likelihood of importance

FIGURE 10-3B
SITE CONCEPTUAL MODEL
SITE 8B
NCBC GULFPORT
GULFPORT, MISSISSIPPI

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REQUESTED BY: L. HUGHES	DATE: 8/6/2014
DRAWN BY: M. SENNE	TASK ORDER NUMBER: XXXX

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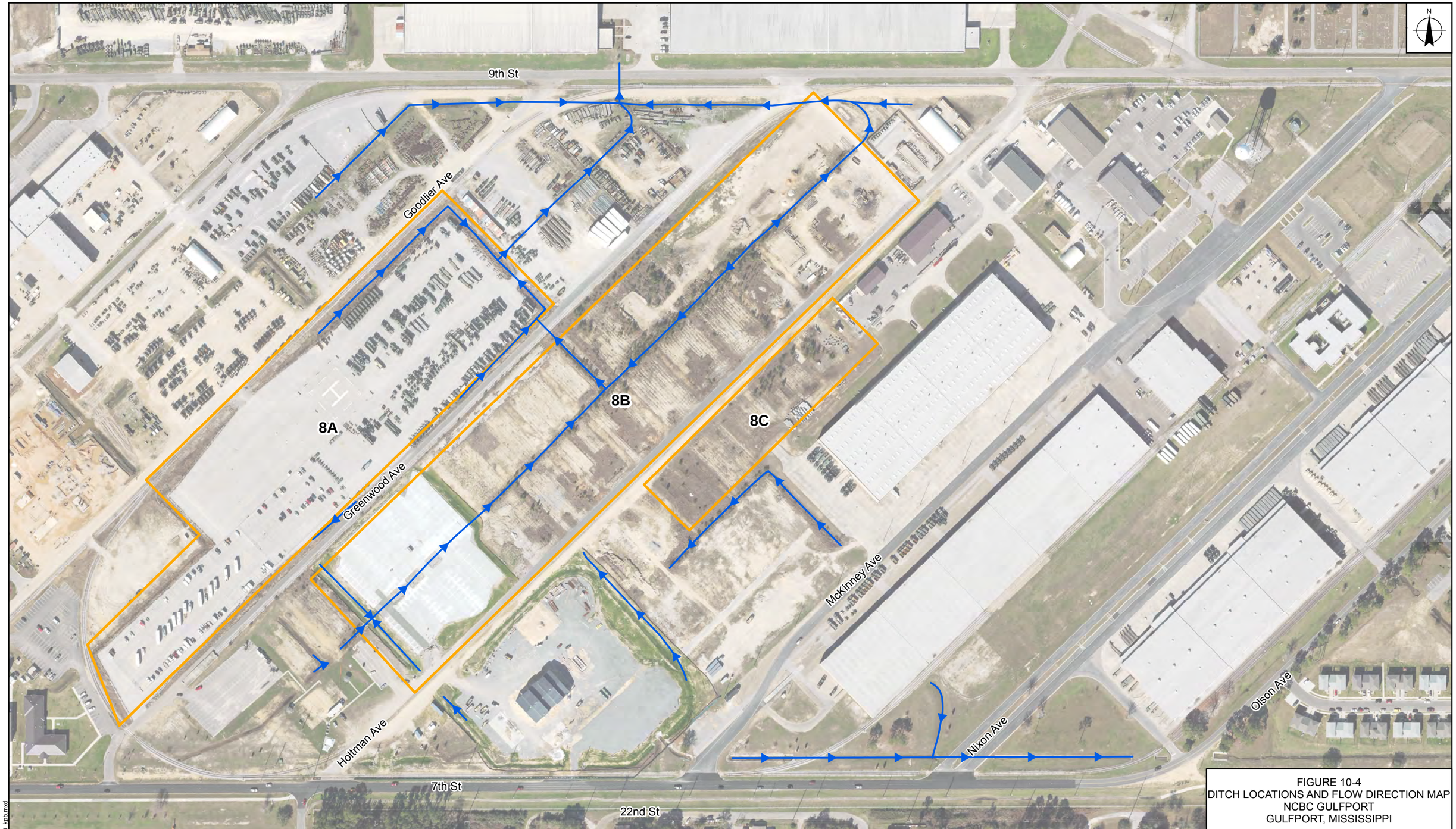

FIGURE 10-4
DITCH LOCATIONS AND FLOW DIRECTION MAP
NCBC GULFPORT
GULFPORT, MISSISSIPPI

Ditch with Flow Direction

Approximate Site Boundary

0 240 480 Feet

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REQUESTED BY: L. HUGHES	DATE: 9/25/2014
DRAWN BY: M. SENNE	TASK ORDER NUMBER: 15282

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Harrison County, MS Remote-Sensing Image is from Sewall Company and downloaded through the USGS Earth Explorer; Some data are from Tetra Tech; Road names were acquired from Esri, DeLorme, HERE, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom.

NCBC Gulfport surface water runoff is collected and transported to several outfalls via a network of drainage ditches. These ditches collect surface water runoff from six drainage areas throughout NCBC Gulfport. Flow throughout the majority of the on-base drainage ditches is perennial. The upgradient drainage ditches are dry for part of the year. Site 8 is located at the head of four of these local drainage basins. Surface water from Site 8A flows northwest and exits the base at Outfalls 1 and 3. Surface water from Site 8B flows north and exits the base through Outfall 4, discharging to the Turkey Creek drainage basin. Surface water from Site 8C flows to the southeast, exiting the base through Outfall 2 (south) into Brickyard Creek.

According to the *Groundwater Monitoring Report Site 8, NCBC Gulfport, MS* (HLA 1999), depending on precipitation quantity, intervals, and intensity, a stream or ditch system may be losing (surface water seeps into groundwater) or gaining (groundwater seeps into ditch).

10.4.2 Contamination Migration Pathways

For this UFP-SAP, dedicated to engineering work, the migration path is the ongoing flux of dioxins into the surface water pathway, primarily from surface sources, resulting in the re-contamination of ditch sediments. That flux is presented on Figure 10-3B.

10.4.3 Receptors and Exposure Pathways

The presumptive remedy for Sites 8B and 8C is an impermeable cap. Once that work has been completed, the future land use of Sites 8B and 8C is expected to be the location where a large solar array will be installed or a paved parking area for NCBC Gulfport. Drainage ditches in the area are expected to continue to serve to drain storm water from NCBC Gulfport.

Potential human receptors at the site include site, maintenance, and construction workers (industrial scenario). Trespassers could have infrequent exposure to soil at the site. Trespassing at NCBC Gulfport is unlikely because of fencing and security measures. Human receptors may be exposed to contaminated media through dermal contact, ingestion, or inhalation.

Ecological receptors may be exposed through direct contact with or ingestion of contaminated media, as well as through the food chain (i.e., by ingesting plants and animals that have been impacted through uptake of sediment contaminants). However, given the urban and highly disturbed nature of the site, the ecological threat is expected to be low.

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

(UFP-QAPP Manual Section 2.6.1)

11.1 Problem Statement

Since dioxin-contaminated sediment was removed from drainage ditches in 2005, TCDD TEQ concentrations have been increasing in sediments found in the drainage ditches in the Site 8 vicinity, suggesting that dioxins are being re-introduced. In 2013, a reported detection above the TCDD TEQ Tier 1 Restricted Soil TRG triggered the need for further action. Follow-up sediment sampling in 2013 and 2014 confirmed the result.

This UFP-SAP is intended to facilitate two sampling tasks associated with engineering work at Sites 8B and 8C designed to:

- Confirm that dioxin-contaminated sediment above the MDEQ Restricted Soil Tier 1 TRG has been removed from the drainage ditches that received runoff from Sites 8B and 8C.

- Show that dioxins will not leach from stabilized sediment.

Fieldwork will be accomplished in three phases. Phase I of the engineering effort will be to perform a treatability study using stockpiled sediments on Site 8B; Phase II will be stabilizing the remaining stockpiled sediment (these stockpiles were previously sampled and determined to be impacted by dioxins). Phase III of the engineering effort will be to excavate dioxin-impacted sediments from drainage ditches and stabilize them on Site 8B.

11.2 Goals of the Study

The sampling tasks will be approached independently of one another. Principal study questions (PSQs) for each task are as follows:

- PSQ1: Stabilization Sampling — Has the stabilization effort minimized dioxins that may be leaching from stabilized sediment?

- PSQ2: Confirmation Sampling — Has the sediment excavation remediated dioxin-contaminated sediments to levels below the MDEQ TCDD TEQ Restricted Soil Tier 1 TRG within the drainage ditches?

11.3 Information Inputs to Problem Resolution

The inputs needed to resolve the project problem statements identified in Section 11.1 include Project Screening Levels (PSLs), TCDD TEQs, and analytical data as described below. Specific informational inputs, to serve as the basis for decisions during the execution of this project, include the following:

- Project Screening Levels: The soil PSL is based on MDEQ TCDD TEQ Restricted Tier 1 TRG of 38.2 ng/kg. Stabilized soil will be prepared and reported via synthetic precipitation leaching procedure (SPLP) and results will be compared to the MDEQ TCDD TEQ Groundwater Tier 1 TRG of 30 pg/L. Worksheet #15 provides a summary of MDEQ TRGs and laboratory detection limits for individual dioxin and furan congeners; however, TCDD TEQs will be calculated and summed to compare against the MDEQ PSLs.

- Sediment Analytical Data: Sediment analytical data will be collected to determine if removal efforts have successfully removed dioxin-impacted material.

- Stabilized Sediment Analytical Data: Samples of the stabilized sediment will be collected and submitted for SPLP analysis to assess post-treatment leachability.

- Sample Location Data: A Global Positing System (GPS) unit capable of sub-meter accuracy will be used to record soil sampling locations. Depth intervals for soil samples will be measured using a tape measure or other device with similar accuracy and precision.

11.4 Define the Study Boundaries

The site area is defined as Sites 8B and 8C and associated drainage ditches that will require re-excavation. These areas are bounded by Olson Avenue on the east, 7th Street on the south, Goodier Avenue on the west, and 9th Street in the north.

Sampling will be performed following ditch excavation activities and soil stabilization actions.

11.5 Analytic Approach

This engineering work will result in dioxin-contaminated sediments, including those presently stockpiled on Site 8B and those to be excavated from Site 8 drainage ditches, stabilized with Portland cement in such a way that dioxins will not leach from them. The Portland-stabilized sediments will be formed into pads on Site 8B, some of which will be used to fill in low areas created in the 1980s when the USAF conducted their remedial activities.

For this work, soil/sediment results will be compared the MDEQ TCDD TEQ Restricted Soil Tier 1 TRG of 38.2 ng/kg. Stabilized soil will be prepared and reported via SPLP for comparison against the MDEQ TCDD TEQ Groundwater Tier 1 TRG of 30 pg/L. This site is has been under investigation since the late 1970s and MDEQ Tier 1 TRGs have been the MDEQ-approved standard for comparison.

Decision Rule 1: Following soil stabilization, if an SPLP TCDD TEQ result is above 30 pg/L then sediment stabilization will be considered insufficient and the NCBC Gulfport Partnering Team will reconvene to discuss a path forward.

Decision Rule 2: If confirmation samples collected from drainage ditches exhibit TEQ above 38.2 ng/kg, then the need for additional excavation and confirmation sampling will be discussed with the NCBC Gulfport Partnering Team.

11.6 Performance 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 sampling design was developed to determine if any further remedial work is required in the drainage ditches and if the stabilization effort has been successful.

Sources of Error — Sources 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 Contaminants of Concern. 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 (discussed in Worksheets #23, #24, and #25) for sample analysis by a competent analytical laboratory certified by the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) to reduce measurement errors.
- Confirm analytical data to identify and control potential laboratory error and sampling error by using spikes, blanks, and replicated samples.

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

Sampling Methodologies and Procedures

Possible decision errors generated by sampling errors will be minimized during sample collection by applying standardized field sampling methodologies (discussed in Worksheets #18, #20, #21, and #22). Sampling activities will be performed in accordance with the Standard Operating Procedures (SOPs) specified in this SAP.

Managing Laboratory Sampling Error

Control of potential laboratory measurement error and sampling error will be minimized using spikes, blanks, and duplicates.

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

Data quality will be evaluated as part of the verification/validation and the data usability processes described in Worksheets #34 through #36. Failure to meet validation targets or limitations on data use identified during a data usability assessment shall be described in the project report. PDF copies of all analytical data packages will be stored on CD-ROM, archived in the NAVFAC Southeast 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 Sampling Design

The sampling design for the site has been developed to optimize resources and generate data to satisfy the data quality objectives.

Confirmation samples will be collected along a 30-foot linear sample grid established along the centerline of the excavated drainage ditches. Stabilized sediment SPLP samples will be collected at a rate of one per 25,000 square feet.

The sampling design, rationale, and locations are summarized in Worksheets #17 and #18. These worksheets identify where confirmation and stabilized sediment samples will be collected and the analyses to be conducted for each sample.

SAP WORKSHEET #12: FIELD QUALITY CONTROL SAMPLES

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table — Field QC Samples				
QC Sample	**Analytical Group**	**Frequency**	**Data quality Indicators**	**Measurement Performance Criteria**
Equipment Rinsate Blank(1)	Dioxins/Furans	One per 20 samples per matrix per sampling equipment	Accuracy/Bias/Contamination	No analytes > ½ LOQ
Field Duplicate	Dioxins/Furans	One per 20 field samples	Precision	RPD ≤50 if both results are ≥5 x LOQ
Matrix Spike/Matrix Spike Duplicate	Dioxins/Furans	One pair per 20 field samples	Accuracy/Bias/ Precision	Percent recoveries — DoD QSM Limits; RPD ≤30
Cooler Temperature Indicator	Dioxins/Furans	One per cooler	Representativeness	Temperature ≤ 6 degrees Celsius.

Notes:

(1) = Equipment rinsate blanks will be collected if decontamination is required and will not apply if dedicated equipment is used.
QC = Quality control
LOQ = Limit of Quantitation
RPD = Relative Percent Difference
DoD QSM = Department of Defense Quality Systems Manual

SAP WORKSHEET #13: SOURCES OF SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

(UFP-QAPP Manual Section 2.7)

Secondary Data Criteria and Limitations Table				
Secondary Data	**Data Source**	**Data Generator(s)**	**How Data Will Be Used**	**Limitations on Data Use**
Historical Background Information, Data	*Summary Report for Remedial Characterization and Soil Remediation Technology Review at Site 8 NCBC Gulfport MS*, 1991	Dames & Moore	Background information was used in planning of the sampling effort	None
Historical Background Information, Data	*A Dioxin Statistical and Graphical Analysis Report, Naval Construction Battalion Center, Gulfport, Mississippi,* 2000	Harding Lawson Associates	Background information was used in planning of the sampling effort	None
Historical Background Information, Data	*Final Letter Report, Site 8B and 8C Verification Sampling and Associated Drainage Systems, ECC Naval Construction Battalion Center, Gulfport, Mississippi*, 2006	Tetra Tech NUS, Inc.	Background information was used in planning of the sampling effort	None
Historical Background Information, Data	*Five-Year Review for Sites 5, 6, 8, and 10 Naval Construction Battalion Center Gulfport, Gulfport, Mississippi*: Contract No. N62467-04-D-0055, 2011	Tetra Tech NUS, Inc.	Background information was used in planning of the sampling effort	None

SAP WORKSHEET #14: SUMMARY OF PROJECT TASKS

(UFP-QAPP Manual Section 2.8.1)

Project-specific SOPs and Field Forms for field tasks referenced in this worksheet are identified by title in Worksheet #21 and copies of each SOP are provided in Appendix A. Phase I of the engineering effort will be perform a treatability study using stockpiled sediments on Site 8B; Phase II will be stabilizing the remaining stockpiled sediment. These stockpiles were previously sampled and determined to be impacted by dioxins. Phase III of the engineering effort will be to excavate dioxin-impacted sediments from drainage ditches and stabilize them on Site 8B. Stabilization work will be conducted in accordance with the approved work plan. Field tasks of the engineering effort are as follows:

- Mobilization/Demobilization
- Utility Clearance/Dig Permit
- Confirmation Sampling
- Stabilized Sediment Sampling
- GPS Locating
- Waste Handling
- Decontamination
- Field Documentation

Additional project-related tasks include:

- Analytical Tasks
- Data Management
- Data Review
- Project Reports

Field Tasks

Mobilization/Demobilization

Mobilization will consist of the delivery, assembly (in satisfactory working order), and secure storage of necessary equipment, materials, and supplies, along with the acquisition of personnel and vehicle base access badges. The Resolution Consultants Field Team Leader (FTL) or designee will coordinate with NCBC Gulfport Point of Contact (POC) to coordinate base access with all personnel and 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 or 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 OSHA 40-hour Hazardous Waste Operations and Emergency Response course and 8-hour refresher, if applicable. Additional health and safety requirements are addressed in greater detail in the site-specific Health and Safety Plan (HASP).

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 which will be coordinated with the NCBC Gulfport Public Works Department.

Utility Clearance/Excavation Permits

Prior to the commencement of any intrusive activities, Resolution Consultants will coordinate with Mississippi One-Call to identify and mark-out utilities that may be present within the investigation area. Utility clearance will be conducted as described in Resolution Consultants SOP-3-01. Additionally, NCBC Gulfport requires that an excavation permit be prepared and submitted to NCBC Gulfport two weeks in advance of field activities. Formal approval (e.g. signed form) will be obtained by the Resolution Consultants FTL prior to beginning intrusive fieldwork.

Confirmation Sampling

The sampling and analysis program is outlined in Worksheets #17 and #18. Soil aliquots will be collected from the bottom and sides of drainage ditch excavations via hand tools and composited into samples. Samples will be collected from the surface of exposed faces; no samples will be collected from deeper intervals. Confirmation sampling frequencies are presented in Worksheets #17 and #18; however, additional samples may be required where initial confirmation samples indicate further excavation and re-sampling is required.

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.

Stabilized Sediment Sampling

The sampling and analysis program is outlined in Worksheets #17 and #18. Stabilized sediment will be formed into pads on Sites 8B and 8C. Samples of stabilized sediment will be collected with a concrete core machine or similar device. Core samples of the stabilized material will be "chipped" in the field. Stabilized sediment cores will be placed in a plastic bag and crushed with a hammer until the average chip size is approximately 1 inch in diameter. During chipping a full face shield, long sleeve shirt and gloves will be worn. Stabilized sediment chips will then be transferred to sample containers. Sample labelling and handling will be in accordance with SOP-3-03A and SOP-3-04A and as described in Worksheet #21.

GPS Locating

A hand-held GPS unit capable of sub-meter accuracy (i.e., Trimble GeoXM or Trimble GeoHX) will be used to locate sampling points in accordance with U.S. EPA SOP SESDPROC-110-R3. 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.

Waste Handing

Solid investigative-derived waste (IDW), in the form of personal protective equipment, including gloves, wipes, discarded paper towels, and disposable equipment will be generated. Aqueous IDW will include decontamination fluids. In accordance with SOP-3-05, IDW will be containerized in adequately labeled 55-gallon department of transportation approved drums. Waste 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 as instructed by the NCBC Gulfport POC. Based on characterization results, IDW will be transported and appropriately disposed of at a Navy-approved offsite disposal facility.

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 decontamination activities and a source of potable water for cleaning will be arranged by the FTL through the base POC.

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.

Additional Project-Related Tasks

Analytical Tasks

Chemical analyses will be performed by Cape Fear Analytical, a DoD ELAP-accredited laboratory. Copies of pertinent laboratory accreditation/certifications are included in Appendix B. Analyses will be performed in accordance with the analytical methods identified in Worksheets #23 and #30. The subcontract laboratory will strive to meet the project action levels in Worksheet #15. Laboratory-specific SOPs identified in Worksheet #23 will be provided upon request.

Soil results will be reported by each laboratory 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, which will eventually be uploaded to the NIRIS database.

The analytical data packages provided by Cape Fear Analytical will be will be fully validatable and contain raw data, summary forms for all sample and laboratory method blank data, and summary forms containing all method-specific QC information (results, percent recoveries [%Rs], relative percent differences [RPDs], relative standard deviations [RSDs], percent differences or percent drifts [%Ds], etc.)

Data Management and Review

The principal data generated for this project will be from field data and laboratory analytical data. The field forms, chain-of-custody, air bills, and logbooks will be placed in the project files after the

completion of the field program. The field logbooks for this project will be used only for this site, and will also be categorized and maintained in the project files after the completion of the field program. All project records will be maintained in a secure location.

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

Resolution Consultants shall submit all Administrative Record Files, Site Files, and Post Decision Files in accordance with the specifications defined in the NAVFAC *Environmental Restoration Recordkeeping Manual* (NAVFAC 2009). Additionally, Resolution Consultants will update 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.

Data Storage, Archiving, and Retrieval — After the data are validated, the data packages are entered into the Resolution Consultants file system and archived in secure files. The field records including field logbooks, sample logs, chain-of-custody records, and field calibration logs will be submitted by the Resolution Consultants FTL to be entered into the file system before archiving in secure project files. Project files will be kept in a secured, limited access area. At the completion of the Navy contract, files will be shipped to the Federal Records Center for storage where the files will remain until 50 years after the last decision document for the facility.

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

Electronic Data — Laboratory data, provided in electronic format, will be verified for accuracy prior to use and during the data validation process. After data are validated, the electronic data results will be uploaded into the Resolution Consultants database for use in data evaluation and subsequent report preparation. The project database will be on a password protected secure

network and access to changing data files will be restricted to qualified personnel. The Resolution Consultants Task Order Manager (or designee) is responsible for the overall tracking and control of data generated for the project. All final electronic data and administrative records will be compiled and uploaded into the NIRIS database for final repository.

Data Review and Validation — After receipt of analytical laboratory results, Resolution Consultants will verify data completeness as specified on Worksheet #34. To ensure that the analytical results meet the project quality objectives, the laboratory data will undergo verification and validation as cited in Worksheets #34 through #36 and described below.

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

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

- Data validation QC elements that need review, compared to control limits stored in the project-specific eQAPP
- Associated sample results for duplicated samples and blanks
- A place to make the necessary qualifications and result updates directly into an electronic format documentation of qualifications using coded reasons
- A list of all samples affected by the qualification

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

Project Reports

A Removal Action Completion Report will be prepared to summarize the project objectives and scope, provide an overview of site background information, describe the field activities, present a screening level evaluation of the data based on appropriate potential receptors and exposure pathways, and conclude whether additional action(s) are warranted or if a no further action determination can be made.

SAP WORKSHEET #15: REFERENCE LIMITS AND EVALUATION TABLES

(UFP-QAPP Manual Section 2.8.1)

Matrix	Soil/Sediment
Analytical Group	Dioxins/Furans
Analytical Method	SW846 8290A

Analyte	CAS No.	Project Action Level[1] (ng/kg)	Project Action Level Reference	Project Quantitation Limit Goal (ng/kg)	Laboratory Specific Limits [2]		
					LOQ (ng/kg)	LOD (ng/kg)	DL (ng/kg)
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	38.2	MDEQ Restricted Tier 1 TRG	12.7	1	0.666	0.333
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822-46-9	3820	MDEQ Restricted Tier 1 TRG	1270	5	3.34	1.67
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227-28-6	382	MDEQ Restricted Tier 1 TRG	127	5	3.34	1.67
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653-85-7	923	MDEQ Restricted Tier 1 TRG	308	5	3.34	1.67
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408-74-3	923	MDEQ Restricted Tier 1 TRG	308	5	3.34	1.67
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	3268-87-9	38,200	MDEQ Restricted Tier 1 TRG	12,700	10	6.66	3.33
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321-76-4	76.3	MDEQ Restricted Tier 1 TRG	25.4	5	3.34	1.67
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	3820	MDEQ Restricted Tier 1 TRG	1270	5	3.34	1.67
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	3820	MDEQ Restricted Tier 1 TRG	1270	5	3.34	1.67
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	3820	MDEQ Restricted Tier 1 TRG	1270	5	3.34	1.67
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	3820	MDEQ Restricted Tier 1 TRG	1270	5	3.34	1.67
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	3820	MDEQ Restricted Tier 1 TRG	1270	5	3.34	1.67
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	3820	MDEQ Restricted Tier 1 TRG	1270	5	3.34	1.67
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	39001-02-0	38,200	MDEQ Restricted Tier 1 TRG	12,700	10	6.66	3.33
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	763	MDEQ Restricted Tier 1 TRG	254	5	3.34	1.67
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	76.3	MDEQ Restricted Tier 1 TRG	25.4	5	3.34	1.67
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	382	MDEQ Restricted Tier 1 TRG	1270	1	0.666	0.333
Total Heptachlorodibenzo-p-dioxins	37871-00-4	NA	NA	NA	5	3.34	1.67
Total Heptachlorodibenzofurans	38998-75-3	NA	NA	NA	5	3.34	1.67

Matrix	Soil/Sediment						
Analytical Group	Dioxins/Furans						
Analytical Method	SW846 8290A						
Analyte	**CAS No.**	**Project Action Level[1] (ng/kg)**	**Project Action Level Reference**	**Project Quantitation Limit Goal (ng/kg)**	**Laboratory Specific Limits [2]**		
					LOQ (ng/kg)	**LOD (ng/kg)**	**DL (ng/kg)**
Total Hexachlorodibenzo-p-dioxins	34465-46-8	NA	NA	NA	5	3.34	1.67
Total Hexachlorodibenzofurans	55684-94-1	NA	NA	NA	5	3.34	1.67
Total Pentachlorodibenzo-p-dioxins	36088-22-9	NA	NA	NA	5	3.34	1.67
Total Pentachlorodibenzofurans	30402-15-4	NA	NA	NA	5	3.34	1.67
Total Tetrachlorodibenzo-p-dioxins	41903-57-5	NA	NA	NA	1	0.666	0.333
Total Tetrachlorodibenzofurans	55722-27-5	NA	NA	NA	1	0.666	0.333

Notes:

[1] All of the above dioxin and furan congeners will be reported by the laboratory. Soil/sediment results will be converted to TCDD TEQs and summed for comparison against the restricted soil TRG of 38.2 ng/kg.

[2] LOQ, LOD, and DLs are provided by Cape Fear Analytical are targets that are achievable under optimal conditions and may vary during the course of the project. Soil results will be reported on a dry weight basis. Physical characteristics, such as moisture content, will affect the actual limits achieved.

MDEQ Restricted Tier 1 TRG = Mississippi Department of Environmental Quality Risk Evaluation Procedures for Voluntary Cleanup and Redevelopment of Brownfield Sites – Soil Restricted (2002).

CAS = Chemical Abstracts Service
LOQ = Limit of quantitation
LOD = Limit of detection
DL = Detection limit
ng/kg = Nanogram per kilogram
TRG = Target remediation goals
NA = Not applicable
TCDD = 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQs = Toxicity equivalents

SAP WORKSHEET #15: REFERENCE LIMITS AND EVALUATION TABLES (continued)

Matrix	Stabilized Material Blend						
Analytical Group	SPLP Dioxins						
Analytical Method	SW-846 Methods 1312 and 8290A						
					Laboratory Specific Limits (2)		
Analyte	**CAS No.**	**Project Action Level(1) (pg/L)**	**Project Action Level Reference**	**Project Quantitation Limit Goal (pg/L)**	**LOQ (pg/L)**	**LOD (pg/L)**	**DL (pg/L)**
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	30	MDEQ Groundwater Tier 1 TRG	10	10.0	6.67	3.33
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822-46-9	44.6	MDEQ Groundwater Tier 1 TRG	14.87	**50.0**	33.3	16.7
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227-28-6	4.46	MDEQ Groundwater Tier 1 TRG	1.49	**50.0**	**33.3**	**16.7**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653-85-7	10.8	MDEQ Groundwater Tier 1 TRG	3.6	**50.0**	**33.3**	**16.7**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408-74-3	10.8	MDEQ Groundwater Tier 1 TRG	3.6	**50.0**	**33.3**	**16.7**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	3268-87-9	446	MDEQ Groundwater Tier 1 TRG	148.67	100	66.7	33.3
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321-76-4	0.893	MDEQ Groundwater Tier 1 TRG	0.30	**50.0**	**33.3**	**16.7**
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	44.6	MDEQ Groundwater Tier 1 TRG	14.87	**50.0**	33.3	16.7
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	44.6	MDEQ Groundwater Tier 1 TRG	14.87	**50.0**	33.3	16.7
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	4.46	MDEQ Groundwater Tier 1 TRG	1.49	**50.0**	**33.3**	**16.7**
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	4.46	MDEQ Groundwater Tier 1 TRG	1.49	**50.0**	**33.3**	**16.7**
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	4.46	MDEQ Groundwater Tier 1 TRG	1.49	**50.0**	**33.3**	**16.7**
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	4.46	MDEQ Groundwater Tier 1 TRG	1.49	**50.0**	**33.3**	**16.7**
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	39001-02-0	446	MDEQ Groundwater Tier 1 TRG	148.67	100	66.7	33.3
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	8.93	MDEQ Groundwater Tier 1 TRG	2.98	**50.0**	**33.3**	**16.7**
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	0.893	MDEQ Groundwater Tier 1 TRG	0.30	**50.0**	**33.3**	**16.7**
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	4.46	MDEQ Groundwater Tier 1 TRG	1.49	**10.0**	**6.67**	3.33
Total Heptachlorodibenzo-p-dioxins	37871-00-4	NA	NA	NA	50.0	33.3	16.7
Total Heptachlorodibenzofurans	38998-75-3	NA	NA	NA	50.0	33.3	16.7

Matrix	Stabilized Material Blend						
Analytical Group	SPLP Dioxins						
Analytical Method	SW-846 Methods 1312 and 8290A						
					Laboratory Specific Limits (2)		
Analyte	**CAS No.**	**Project Action Level(1) (pg/L)**	**Project Action Level Reference**	**Project Quantitation Limit Goal (pg/L)**	**LOQ (pg/L)**	**LOD (pg/L)**	**DL (pg/L)**
Total Hexachlorodibenzo-p-dioxins	34465-46-8	NA	NA	NA	50.0	33.3	16.7
Total Hexachlorodibenzofurans	55684-94-1	NA	NA	NA	50.0	33.3	16.7
Total Pentachlorodibenzo-p-dioxins	36088-22-9	NA	NA	NA	50.0	33.3	16.7
Total Pentachlorodibenzofurans	30402-15-4	NA	NA	NA	50.0	33.3	16.7
Total Tetrachlorodibenzo-p-dioxins	41903-57-5	NA	NA	NA	10.0	6.67	3.33
Total Tetrachlorodibenzofurans	55722-27-5	NA	NA	NA	10.0	6.67	3.33

Notes:
(1) All of the above dioxin and furan congeners will be reported by the laboratory. SPLP results will be converted to TCDD TEQs and summed for comparison against the groundwater TRG of 30 pg/L.
(2) LOQ, LOD, and DLs are provided by Cape Fear Analytical are targets that are achievable under optimal conditions and may vary during the course of the project.
MDEQ Groundwater Tier 1 TRG = Mississippi Department of Environmental Quality Risk Evaluation Procedures for Voluntary Cleanup and Redevelopment of Brownfield Sites, (2002)

SPLP = Synthetic precipitation leaching procedure
CAS = Chemical Abstracts Service
LOQ = Limit of quantitation
LOD = Limit of detection
DL = Detection limit
pg/L = Picograms per liter
TRG = Target remediation goals
NA = Not applicable
TCDD = 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQs = Toxicity equivalents

Bold Highlight = LOQ, LOD, and/or DL does not meet individual MDEQ groundwater Tier 1 TRGs. However, SPLP results will be converted to TCDD TEQs and summed for comparison against the groundwater TRG of 30 pg/L.

SAP WORKSHEET #16: PROJECT/TIMELINE TABLE

(UFP-QAPP Manual Section 2.8.2)

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Complete Planning Documents	Resolution Consultants	1 April 2014	30 November 2014	SAP, HASP, Work Plans	30 November 2014
Organize and Execute Treatability and Pilot Test Activities	Resolution Consultants	December 2014*	February 2015*	None	
Prepare Soil-Sediment Evaluation Report	Resolution Consultants	1 March 2015	31 May 2015	Removal Action Completion Report	31 May 2015

Notes:
SAP = Sampling and Analysis Plan
HASP = Health and Safety Plan
* = Dates are subject to change.

SAP WORKSHEET #17: SAMPLING DESIGN AND RATIONALE

(UFP-QAPP Manual Section 3.1.1)

17.1 General Sampling Design and Rationale

The sampling design and rationale was developed using information on historical operations, the CSM as presented in Worksheet #10, and data generated during previous investigations.

17.1.1 Confirmation Sampling — PSQ 1

During the pilot test, approximately 1,000 CY of sediment from the bottoms and sides of approximately 2,225 linear feet of drainage ditches in the Site 8 area will be excavated to expected depths between 3 and 18 inches. Because dioxins have a strong affinity for organic matter, the excavation will focus on removing those sediments where organic matter has accumulated based on visual observations. The excavated sediment will then be transported to the southern part of Site 8B for stabilization.

Upon completion of excavation activities, confirmation sampling and analysis will be performed to confirm that dioxin concentrations in the base of the ditches are less than the MDEQ TCDD TEQ Tier 1 Restricted TRG of 38.2 ng/kg. Based on MDEQ recommendations and previously accepted SAPs, confirmation samples will be collected along a 30-foot linear sample grid established along the centerline of the excavated drainage ditches.

Within each drainage ditch, samples will be collected from downstream to upstream to prevent disturbance and possible cross-contamination of downstream sediments. All sample locations will be marked using pin flags or survey stakes wrapped with fluorescent ribbon. At each location, equal volumes of sample from the sidewalls and bottom of the ditch will be collected using a stainless steel spoon. Next, the collected material will be mixed in a stainless steel bowl to composite the sample. Once thoroughly mixed, the sample will be placed into the appropriate sample containers, which will then be labeled and placed in a cooler on ice.

All sediment samples collected will be analyzed for dioxins using SW-846 Method 8290A. TCDD TEQ concentrations will be calculated for each sample in accordance with the *Recommended Toxicity Equivalency Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds* (U.S. EPA 2010).

17.1.2 Stabilized Sediment Sampling — PSQ 2

Stabilized sediment will be formed into pads on Site 8B. Some pads will be used to fill in low areas created by the USAF when they removed soils from Site 8 as part of their remedial work. The remaining pads will be constructed across Sites 8B and 8C. Stabilized sediment SPLP samples will be collected at a rate of one per 25,000 square feet. Approximately 14 samples are expected.

Samples of stabilized sediment will be collected with a concrete core machine or similar device. Core samples of the stabilized material will be "chipped" in the field. Stabilized sediment cores will be placed in a plastic bag and crushed with a hammer until the average chip size is approximately 1 inch in diameter. During chipping a full face shield, long sleeve shirt and gloves will be worn. Stabilized sediment chips will then be transferred to sample containers. Chipped samples will be extracted by SPLP using U.S. EPA Method 1312 and analyzed for dioxins by SW-846 Method 8290A to verify that dioxins will not leach from the stabilized material.

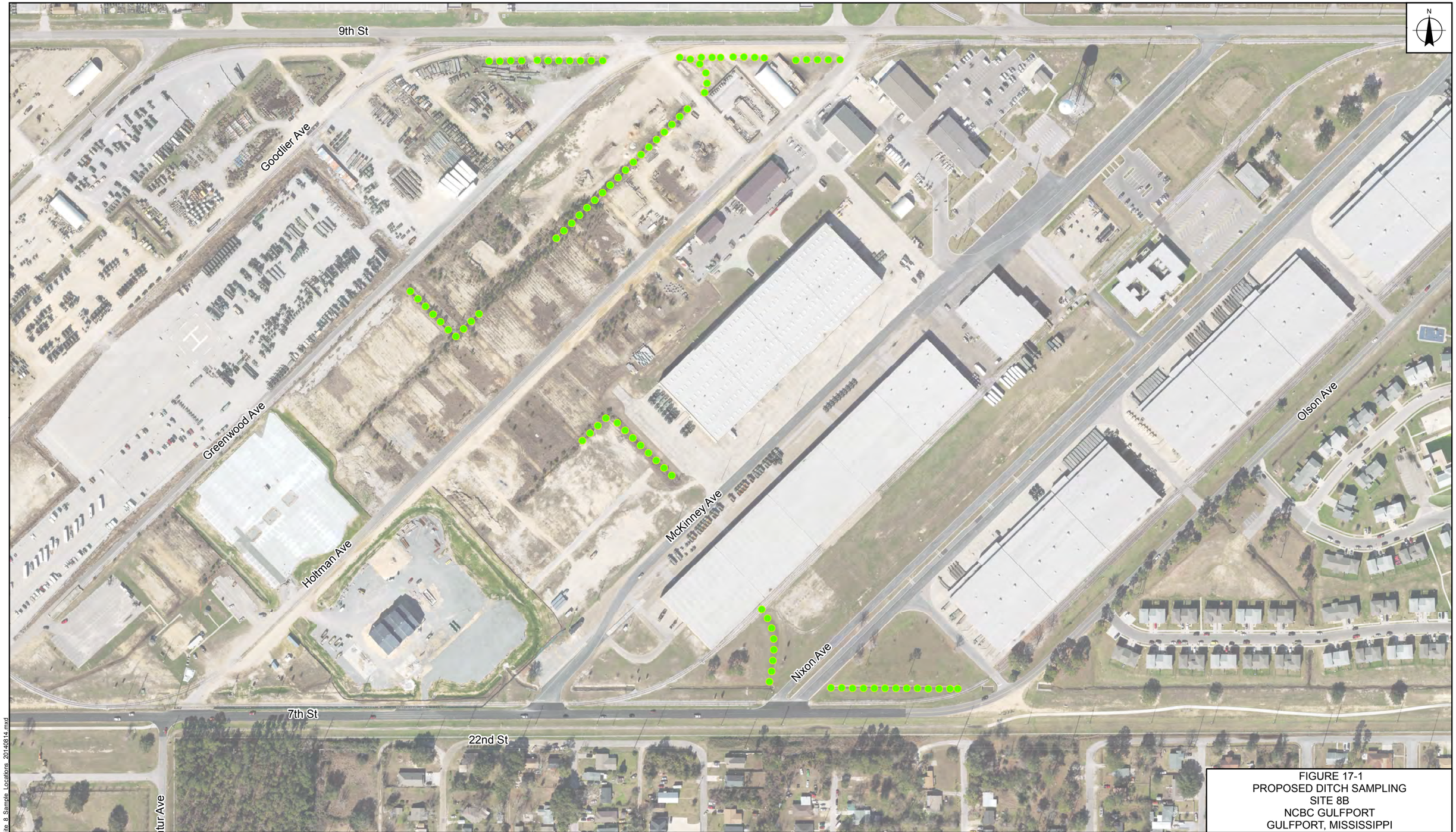

FIGURE 17-1
PROPOSED DITCH SAMPLING
SITE 8B
NCBC GULFPORT
GULFPORT, MISSISSIPPI

Legend

- 30 ft Interval Sample Points

0 250 500 Feet

Note: Sampling locations are approximate.

NAVFAC Naval Facilities Engineering Command

RESOLUTION CONSULTANTS

REQUESTED BY: L. HUGHES	DATE: 9/24/2014
DRAWN BY: K. Burnum	TASK ORDER NUMBER: 15282

X:\Navy\NCBC_Gulfport\Site_8_Sample_Locations_20140914.mxd

Harrison County, MS Remote-Sensing Image is from Sewall Company and downloaded through the USGS Earth Explorer; Some data are from Tetra Tech; Road names were acquired from Esri, DeLorme, HERE, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom

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 A)
GPT-08-CSSB-XXX	GPT-08-CSSB-XX-MMYY	Soil	0-1	Dioxins/Furans	89	SOP-3-03A, SOP-3-04A, SOP-3-21
GPT-08-STB-XXX	GPT-08-STB-XX-MMYY	Sediment	0-1	SPLP Dioxins/Furans	14	
Field Quality Control Samples (To be determined in the field)						
Field Duplicate	TBD	Soil	0-1	Dioxins/Furans	5	SOP-3-03A, SOP-3-04A, SOP-3-21
Field Duplicate	TBD	Sediment	0-1	SPLP Dioxins/Furans	1	
Matrix Spike/ Matrix Spike Duplicate	TBD	Soil	TBD	Dioxins/Furans	5	
Matrix Spike/ Matrix Spike Duplicate	TBD	Sediment	TBD	SPLP Dioxins/Furans	1	
Equipment Blank	EBMMDDYY	Soil	Not Applicable	Dioxins/Furans	5	
Equipment Blank	EBMMDDYY	Sediment	Not Applicable	SPLP Dioxins/Furans	1	

Notes:

bgs = Below ground surface
CSSB = Confirmatory Sampling Soil Boring
STB = Stabilized Sediment
XX = Incremental sample number (e.g., the 34th and 89th samples would be 34 and 89, respectively)
TBD = To be determined
SPLP = Synthetic Precipitation Leaching Procedure
SOP = Standard operating procedure
MMYY = month (MM), year (YY)
MMDDYY = month (MM), day (DD), year (YY)
EB = equipment blank

SAP WORKSHEET #19: ANALYTICAL METHODS/SOP REQUIREMENTS TABLE

(UFP-QAPP Manual Section 3.1.1)

Laboratory Name and Address: Cape Fear Analytical, 3306 Kitty Hawk Road Suite 120 Wilmington, North Carolina 28405
Laboratory Point of Contact/Project Manager: Chris Cornwell, ccornwell@cfanalytical.com, 910-795-0422

Matrix	Analytical Group	Analytical and Preparation Method/ *Cape Fear Analytical SOP Reference*	Containers (number, size, and type)	Sample Volume	Preservation Requirements[1]	Maximum Holding Time[2] (preparation/analysis)
Soil	Dioxins/Furans	SW-846 8290A, *CFA CF-OA-E-001, CF-OA-E-002*	One 8-ounce glass jar with Teflon-lined lid	30 grams	Cool to ≤6 degree Celsius	30 days for extraction, 45 days for analysis
Stabilized Sediment	SPLP Dioxins/Furans	SW-846 Methods 1312 and 8290A, *CFA CF-OA-E-001, CF-OA-E-002*	Three 8-ounce glass jar with Teflon-lined lid	30 grams	Cool to ≤6 degree Celsius	30 days for extraction, 45 days for analysis
Aqueous Blanks	Dioxins/Furans	SW-846 8290A, *CFA CF-OA-E-001, CF-OA-E-002*	Two 1-liter glass amber bottles	1,000 milliliters	Cool to ≤6 degree Celsius	30 days for extraction, 45 days for analysis

Notes:
[1] Chemical, temperature, and light protected
[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.
SOP = Standard operating procedure
SPLP = Synthetic Precipitation Leaching Procedure

SAP WORKSHEET #20: FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Number of Sampling Locations	Number of Field Duplicates	Number of MS/MSDs[1]	Number of Equipment Blanks	Total Number of Samples to Lab
Soil	Dioxins/Furans	89	9	5/5	5	103
Sediment	SPLP Dioxins/Furans	14	1	1/1	1	16

Notes:

[1] Although MS/MSD samples are not typically considered field QC samples, they are included here because location determination is often established in the field. MS/MSD samples are not included in the total number of samples sent to the laboratory. Based on Project Team discussions, no field blanks will be collected.

MS/MSD = Matrix spike/ Matrix spike duplicate
SPLP = Synthetic Precipitation Leaching Procedure

SAP WORKSHEET #21: PROJECT SAMPLING SOP REFERENCES TABLE

(UFP-QAPP Manual Section 3.1.2)

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 A	No	
SOP-3-02	Log Books/Resolution Consultants	Revision 0; May 2012	Appendix A	No	
SOP-3-03A	Record Keeping, Sampling Labeling, and Chain-of-Custody/Resolution Consultants	Revision 0; August 2012	Appendix A	No	
SOP-3-04A	Sample Handling, Storage, and Shipping/Resolution Consultants	Revision 0; May 2012	Appendix A	No	
SOP-3-05	Investigation-Derived Waste Management/Resolution Consultants	Revision 0; May 2012	Appendix A	No	
SOP-3-06	Equipment Decontamination/Resolution Consultants	Revision 0; May 2012	Appendix A	No	
SOP-3-21	Surface and Subsurface Soil Sampling/Resolution Consultants	Revision 0; May 2012	Appendix A	No	
SESDPROC-110-R3	Global Positioning System/Resolution Consultants	Revision 3; April 2011	Appendix A	No	

Note:
SOP = Standard operating procedure

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

(UFP-QAPP Manual Section 3.1.2.4)

No field equipment requiring calibration will be required for this effort.

SAP WORKSHEET #23: ANALYTICAL SOP REFERENCES TABLE

(UFP-QAPP Manual Section 3.2.1)

Laboratory Name and Address: Cape Fear Analytical, 3306 Kitty Hawk Road, Suite 120, Wilmington, North Carolina 28405
Laboratory Point of Contact/Project Manager: Chris Cornwell, ccornwell@cfanalytical.com, 910-795-0422

SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to DoD QSM	Modified for Project Work? (Yes/No)
CF-OA-E-001	*Standard Operating Procedure for Dioxin/ Furan/PCB Congener Sample Processing* (Revision 13, July 2014)	Definitive	Preparation Method Soil, sediment, and aqueous blanks/ Dioxins/Furans	Not applicable	None	No
CF-OA-E-002	*Standard Operating Procedure for the Analysis of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans (PCDDs/PCDFs) by High-Resolution Gas Chromatography/ High-Resolution Mass Spectrometry (HRGC/HRMS)* (Revision 12, September 2013)	Definitive	Soil, sediment, and aqueous blanks/ Dioxins/Furans	*High-Resolution Gas Chromatography/ High-Resolution Mass Spectrometry*	None	No

Notes:
SOP = Standard operating procedure
PCB = polychlorinated biphenyl
DoD QSM = Department of Defense Quality Systems Manual

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
HRGC/HRMS	Tuning	Prior to ICAL and at the beginning of each 12-hour period.	Static resolving power ≥10,000 (10% valley) for identified masses per method and lock-mass between lowest and highest masses for each descriptor and level of reference compound ≤10% full-scale deflection, per method.	Retune instrument and verify. Rerun affected samples. Flagging criteria are not appropriate.	Analyst, Supervisor	CF-OA-E-02
HRGC/HRMS	GC Performance	Prior to ICAL or calibration verification. At the beginning of each 12-hr period during which samples or calibration solutions are analyzed.	Peak separation between TCDD and other isomers: Resolved with a valley of ≤25%, per method; and Identification of all first and last eluters of the eight homologue retention time windows and documentation by labeling on the chromatogram; and absolute retention times for switching from one homologous series to the next ≥10 seconds for all components of the mixture.	Correct problem then repeat column performance check. Flagging criteria are not appropriate.	Analyst, Supervisor	CF-OA-E-02
HRGC/HRMS	ICAL for all analytes identified in method	At instrument setup and after ICV or CCV failure, prior to sample analysis, and when a new lot is used as standard source, sample fortification, or recovery solutions.	Ion abundance ratios in accordance with criteria in Table 8 of the method; and signal to noise ratio ≥10 for all target analyte ions; and RSD ≤20% for the RF for all 17 unlabeled standards; and RSD ≤20% for the RFs for the 9 labeled internal standards.	Correct problem then repeat ICAL. Flagging criteria are not appropriate.	Analyst, Supervisor	CF-OA-E-02
HRGC/HRMS	ICV	Once after each ICAL, analysis of a second source standard prior to sample analysis.	Ion abundance specified in the method must be met. For unlabeled standards, RF within ± 20 %D of RF established in ICAL; and for labeled standards, RF within ± 30 %D of the mean of RF established in ICAL.	Correct problem. Rerun ICV. If that fails, repeat ICAL.	Analyst, Supervisor	CF-OA-E-02

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
HRGC/HRMS	CCV	At the beginning of each 12-hour period, and at the end of each analytical sequence.	Ion abundance ratios in accordance with criteria in Table 8 of the method; and for unlabeled standards, RF within ± 20 %D of RF established in ICAL; and for labeled standards, RF within ± 30 %D of RF established in ICAL.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective action(s) and re-calibrate; then reanalyze all affected samples since the last acceptable CCV. End-of-run CCV: If the RF for unlabeled standards ≤25 RPD and the RF for labeled standards ≤35 RPD (relative to the RF established in the ICAL), the mean RF from the two daily CCVs must be used for quantitation of impacted samples instead of the ICAL mean RF value. If the starting and ending CCV RFs differ by more than 25 RPD for unlabeled compounds or 35 RPD for labeled compounds, the sample may be quantitated against a new initial calibration if it is analyzed within two hours. Otherwise analyze samples with positive detections, if necessary. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable CCV.	Analyst, Supervisor	CF-OA-E-02

Notes:

SOP = Standard operating procedure
HRGC/HRMS = High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry
ICAL = Initial calibration
GC = Gas Chromatograph
TCDD = 2,3,7,8-Tetrachlorodibenzo-p-dioxins
ICV = Initial calibration verification
CCV = Continuing calibration verification
RF = Response factor
RSD = Relative standard deviation
%D = Percent difference
RPD = Relative percent difference

SAP WORKSHEET #25: ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION TABLE

(UFP-QAPP Manual Section 3.2.3)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
HRGC/HRMS	Septa replacement, injection port replacement, solvent replenishment, instrument tuning adjustment	Dioxins/Furans via SW-846 Methods 1312 and 8290A	Instrument resolving power, gas chromatograph performance, and isomer specificity are monitored daily.	As needed	No maintenance is required as long as instrument quality control meets DoD QSM criteria	Correct the problem/ perform maintenance, document corrective action in the instruments maintenance logbook.	Analyst, Supervisor	CF-OA-E-002

Notes:

SOP = Standard operating procedure
HRGC/HRMS = High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry
DoD QSM = Department of Defense Quality Systems Manual

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/Cape Fear Analytical
Sample Custody and Storage (Personnel/Organization):	Sample Receiving Supervisor/Cape Fear Analytical
Sample Preparation (Personnel/Organization):	Extractions, Prep Supervisor/Cape Fear Analytical
Sample Determinative Analysis (Personnel/Organization):	Laboratory Manager/Cape Fear Analytical
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:	Laboratory Manager/Cape Fear Analytical
Number of Days from Analysis:	180 Days from Receipt of Samples

Notes:
FTL = Field Team Leader

SAP WORKSHEET #27: SAMPLE CUSTODY REQUIREMENTS

(UFP-QAPP Manual Section 3.3.3)

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

Sample Nomenclature

Sample labeling will be conducted in general accordance with the procedures outlined in Worksheet #18. Nomenclature for soil/sediment samples includes the site being investigated, location identification number, and sample interval. Field QC will be given the same sample nomenclature as described for soil/sediment appended with the appropriate sample type code. Duplicate samples will be submitted to the laboratory as blind duplicates. Field QC blanks will be labeled sequentially followed by the month, day, and year sampled (i.e., EBMMDDYY). Samples to be used for MS/MSD will be labeled MS/MSD on the container label and noted on the chain-of-custody; however, "MS/MSD" will not be part of the unique sample identifier in order to maintain consistency with the project database. Worksheet #18 provides anticipated sample identifiers for this scope of work.

Sample Collection Documentation

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

Field sample log sheets will be used to document sample collection details and other observations and activities will be recorded in the field logbook.

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

- Site name and location
- Date and time of logbook entries
- Personnel and their affiliations
- Weather conditions
- Activities involved with the sampling

- Subcontractor activity summary
- Site observations including site entry and exit times
- Site sketches made onsite
- Visitor names, affiliations, arrival, and departure times
- Health and safety issues, including personal protective equipment

Sample Handling and Tracking System

Following collection, all samples will be immediately placed on ice in a cooler. The glass sample containers will be enclosed in bubble-wrap in order to protect the bottle ware during shipment. The cooler will be secured using strapping tape along with a signed custody seal. Sample coolers will be delivered to a local courier location for priority overnight delivery to the selected laboratory for analysis. Samples will be preserved as appropriate based on the analytical method. The laboratories will provide pre-preserved sample containers for sample collection. Samples will be maintained at 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.

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

Resolution Consultants personnel will collect the samples. The samplers will take care not to contaminate samples through improper handling. Samples will be sealed in appropriate containers, packaged by Resolution Consultants' personnel and placed into sealed coolers under chain-of-custody in accordance with SOP-3-03A. All coolers will contain a temperature blank. Samples will be transferred under chain-of-custody to a courier as described below. Once received by the laboratory, receipt will be documented on the chain-of-custody form and the samples will be checked in. The samples will remain under chain-of-custody throughout the analysis period to ensure their integrity is preserved. Details are provided below.

Samples to be delivered to the laboratory(s) will be made by a public courier (i.e., FedEx). After samples have been collected, they will be sent to the laboratory(s) within 24 hours. Under no circumstances will sample holding times be exceeded.

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 the Laboratory SOPs.

Laboratory Chain-of-Custody

Laboratory sample custody procedures (receipt of samples, archiving, and disposal) will be used according to Cape Fear Analytical SOPs. Coolers are received and checked for proper temperature. A sample cooler receipt form will be filled out to note conditions and any discrepancies. The chain-of-custody form will be checked against the sample containers for accuracy. Samples will be logged into the laboratory information management system and given a unique log number which can be tracked through processing. The laboratory project manager will notify the Resolution Consultants FTL verbally or via email immediately if any problems are identified. Discrepancies and resolutions will be documented on the sample receiving checklist.

SAP WORKSHEET #28: LABORATORY QC SAMPLES TABLE

(UFP-QAPP Manual Section 3.4)

Matrix	Soil and Sediment
Analytical Group	Dioxins/Furans
Analytical Method	SW-846 Methods 1312 8290A
SOP Reference	CF-OA-E-02

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, run after calibration standards and before samples.	No analytes detected ≥1/2 LOQ or >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, re-prepare and reanalyze method blank and all samples processed with the contaminated blank. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Analyst, Supervisor, QA Manager	Bias Contamination	See Method/SOP QC Acceptance Limit Column
LCS	One LCS per preparatory batch of 20 or fewer samples	Recovery limits specified in Appendix C, Table 29 of DoD QSM Version 5.0.	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Method/SOP QC Acceptance Limit Column
Internal Standards	In all field samples, QC samples, and standards	% recovery for each internal standard in the original sample (prior to dilutions) must be within 40-135%, per method.	Correct problem, then re-prepare and reanalyze the samples with failed internal standard.	Analyst, Supervisor, QA Manager	Accuracy Bias	See Method/SOP QC Acceptance Limit Column
MS/MSD	One per preparatory batch per matrix of 20 or fewer samples	Recovery limits specified in Appendix C, Table 29 of DoD QSM Version 5.0. RPD≤20%	Contact the client to determine if additional measures are required. For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met.	Analyst, Supervisor, QA Manager	Accuracy Bias Precision	See Method/SOP QC Acceptance Limit Column

Notes:

SOP = Standard operating procedure
QC = Quality assurance
LOQ = Limit of quantitation
QA = Quality assurance
LCS = Laboratory control sample
DoD QSM = Department of Defense Quality Systems Manual
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 Field logbook (and sampling notes) Field sample forms (e.g. sample log sheets, drilling logs, etc.) Chain-of-custody records Sample shipment air bills Equipment calibration logs Photographs Sampling and Analysis Plans including field sampling standard operating procedures Safe work permit forms	Sample collection documents and records (may include printed copy as well as electronic information) will be maintained at the Resolution Consultants office at 5724 Summer Trees Drive, Memphis, Tennessee 38134. These files will be retained for fifty (50) years after the last decision document is signed for NCBC Gulfport.
Analytical Results Documents and Records Sample receipt/log-in forms Sample preparation logs Equipment calibration logs Sample analysis run logs Reported field sample results Reported results for standards, quality control checks Reported results for standards, quality control samples Data completeness checklists Data validation memoranda	Analytical results, documents and records will be provided by the laboratory in printed and electronic formats. Although available in the Administrative Record file, laboratory reports are typically filed at a separate location and are available upon request. Printed copies of laboratory data will be stored at a third-party secure professional document storage firm until transfer to the FRC. The records will be transferred to FRC 3 years after completion of a response action. These files will be retained for fifty (50) years after the last decision document is signed for NCBC Gulfport. Electronic analytical results will also be verified, entered, and maintained in a database on a password protected Structured Query Language server. Data qualifiers will be added to the database during data validation. After validation, the validated data files will be transferred to the Navy's NIRIS data management system.

Document	Where Maintained
Other Documents Personnel training records Health and Safety certifications Health and Safety Plan Field Sampling Audit Checklist (if performed) Letter reports, investigation reports, etc. Analytical Audit Checklist	Personnel training records and health and safety certificates will be stored in personnel records and electronically in the Resolution Consultant's training database located at 5724 Summer Trees Drive, Memphis, Tennessee 38134. Plans and reports will be stored in printed version and electronically in the Administrative Record file. Printed copies will be stored at a third-party secure professional document storage firm until transfer to the FRC. The records will be transferred to FRC 3 years after completion of a response action. These files will be retained for fifty (50) years after the last decision document is signed for NCBC Gulfport. Field Audit Checklists are not considered part of the Administrative Record file and will be stored in the Resolution Consultants project file at 5724 Summer Trees Drive, Memphis, Tennessee 38134, and electronically in the server library. Analytical Audit Checklists will be retained by the respective accreditation authorities.
Final Document/Records Repository Administrative Record files Site files Post decision Files Analytical data Spatial data Maps	All final documents/Records repositories will be stored in accordance with in the NAVFAC Environmental Restoration Recordkeeping Manual. Printed copies will be stored at a third-party secure professional document storage firm until transfer to the FRC, and electronic copies will be maintained, verified, and stored on the Navy's NIRIS data management system. The records will be transferred to FRC 3 years after completion of a response action.

Notes:

NCBC = Naval Construction Battalion Center
FRC = Federal Records Center
NIRIS = Naval Installation Restoration Information Solution
NAVFAC = Naval Facilities Engineering Command

SAP WORKSHEET #30: ANALYTICAL SERVICES TABLE

(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Locations/ Numbers	Analytical Method/SOP	Data Package TAT	Laboratory/Organization[1] (name and address, contact person and telephone number)	Backup Laboratory
Soil/Sediment	Dioxins/Furans	See Worksheet #18	SW-846 Method 8290A CFA CF-OA-E-001, CF-OA-E-002	21 Days	Cape Fear Analytical, 3306 Kitty Hawk Road Suite 120 Wilmington, North Carolina, 28405 Chris Cornwell, ccornwell@cfanalytical.com, 910-795-0422	None
Sediment	SPLP Dioxins/Furans	See Worksheet #18	SW-846 Methods 1312 and 8290A CFA CF-OA-E-001, CF-OA-E-002	21 Days	Cape Fear Analytical, 3306 Kitty Hawk Road Suite 120 Wilmington, North Carolina, 28405 Chris Cornwell, ccornwell@cfanalytical.com, 910-795-0422	None

Notes:
(1) Laboratory meets accreditation requirements to support project needs.
SOP = Standard operating procedure
TAT = Turn-around time
SPLP = Synthetic Precipitation Leaching Procedure

SAP WORKSHEET #31: PLANNED PROJECT ASSESSMENTS TABLE

(UFP-QAPP Manual Section 4.1.1)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Action	Person(s) Responsible for Monitoring Effectiveness of Corrective Action
Onsite Laboratory Systems Audit	Every 18 months	External	DoD ELAP	DoD ELAP Auditor	QAO, Cape Fear Analytical	QAO, Cape Fear Analytical	QAO, Cape Fear Analytical
Onsite Field Sampling Systems Audit	Randomly selected program-wide[(1)]	Internal	Resolution Consultants	Tina Cantwell, QAO (or designee), Resolution Consultants	David Felter, TOM, Resolution Consultants	Tina Cantwell, QAO and David Felter, TOM Resolution Consultants	Tina Cantwell, QAO and David Felter, TOM Resolution Consultants
Work Product Peer Review	Draft, Draft Final and Final Documents	Internal	Resolution Consultants	Technical Experts and Technical Editors	Report Author	David Felter, TOM Resolution Consultants	David Felter, TOM Resolution Consultants

Notes:
[(1)] Field Audits are randomly selected at the Resolution Consultants program level and may or may not include this project.
DoD ELAP = Department of Defense Environmental Laboratory Accreditation Program
QAO = Quality assurance officer
TOM = Task order manager

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

(UFP-QAPP Manual Section 4.1.2)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Timeframe for Response
Laboratory Systems Audit	Verbal debriefing, Written audit report	QAO, Cape Fear Analytical Laboratories	Not specified by DoD ELAP	Corrective action plan, Letter	DoD ELAP Accrediting Bodies	Specified by DoD ELAP Accrediting Bodies
Field Sampling Systems Audit(1)	Audit checklist and written audit finding summary	David Felter, TOM, Resolution Consultants; Paul Jobmann, FTL, Resolution Consultants	Dependent on findings; if major, a stop work may be issued immediately; however, if minor, within 1 week of audit	Written memo	Tina Cantwell, QAO, Resolution Consultants	Within 21 days of notification
Field Supervision	Site log book and sample collection logs	David Felter, TOM, Resolution Consultants; Paul Jobmann, FTL, Resolution Consultants	Immediately, when discovered	Entry in site logbook, potential retraining	David Felter, TOM, Resolution Consultants; Paul Jobmann, FTL, Resolution Consultants	Within 24 hours

Notes:
(1) Field Audits are randomly selected at the Resolution Consultants program level and may or may not include this project.
Assessment findings will be communicated with appropriate staff during verbal audit debriefings and in the written audit report and will be documented on audit checklists and audit reports.
DoD ELAP = Department of Defense Environmental Laboratory Accreditation Program
QAO = Quality assurance officer
TOM = Task order manager
FTL = Field team leader

SAP WORKSHEET #33: QUALITY ASSURANCE MANAGEMENT REPORTS TABLE

(UFP QAPP Manual Section 4.2)

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Data Validation	Report per data package	Within 4 weeks of receipt of laboratory data	Resolution Consultants Project Chemist or designee	TOM, project file, Resolution Consultants
Progress Report	Monthly for duration of the project	Monthly	TOM, Resolution Consultants	Navy RPM, program manager, project file, Resolution Consultants
Laboratory Quality Assurance Report	When significant plan deviations result from unanticipated circumstances	Immediately upon detection of problem (within 1 day)	Laboratory quality assurance manager or project manager	TOM, Project Chemist, project file, Resolution Consultants

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

SAP WORKSHEETS #34-36: DATA VERIFICATION AND VALIDATION (STEPS I and IIa/IIb) PROCESS TABLE

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

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

Data Review Input	Description	Responsible for Verification (name, organization)	Step I / IIa / IIb[1]	Internal / External[2]
Verification Electronic data deliverables	Verify the electronic data against the chain-of-custody and hard copy data package for accuracy and completeness before loading into project database. Electronic data deliverable verification will be documented in the DVA workbook.	Data Manager and/or Validator, Resolution Consultants	I	External
Validation Chain-of-custody	Examine the traceability of the data from time of sample collection until reporting of data. Ensure that the custody and integrity of the samples were maintained from collection to analysis and that custody records are complete and any deviations are recorded. Chain-of-custody verification will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa	External
Validation Holding Times	Review that the samples were shipped and stored at the required temperature and sample pH for chemically-preserved samples meet the requirements listed in Worksheet #19. Ensure that the analyses were performed within the holding times. If holding times were not met, confirm that deviations were documented. Holding time examination will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa	External
Validation Sample results for representativeness	Check that the laboratory recorded the temperature at sample receipt and the pH of the chemically preserved samples to ensure sample integrity from sample collection to analysis. Representativeness will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External
Validation Laboratory data results for accuracy	Ensure that the laboratory QC samples were analyzed and that the measurement performance criteria, listed in Worksheet #28, were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed, as listed in Worksheet #12, and that the analytical QC criteria were met. Accuracy will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External
Validation Field and laboratory duplicate analyses for precision	Check the field sampling precision by calculating the RPD for field duplicate samples. Check the laboratory precision by reviewing the RPD or percent difference values from laboratory duplicate analyses; MS/MSDs; and LCS/LCS duplicates. Ensure compliance with the precision goals listed in Worksheets #12 and #28. Precision will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External

Data Review Input	Description	Responsible for Verification (name, organization)	Step I/ IIa/IIb[1]	Internal/ External[2]
Validation Project action limits	Assess and document the impact on matrix interferences or sample dilutions performed because of the high concentration of one or more contaminant on the other target compounds reported as undetected. Project action limit achievement will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External
Validation Data quality assessment report	Summarize deviations from methods, procedures, or contracts. Qualify data results based on method or QC deviation and explain all the data qualifications. Present tabular qualified data and data qualifier codes and summarize data qualification outliers. Determine if the data met the MPC and determine the impact of any deviations on the technical usability of the data. Result qualification will be documented in the in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External
Validation SAP QC sample documentation	Ensure that all QC samples specified in the SAP were collected and analyzed and that the associated results were within acceptance limits. QC sample documentation will be documented in the DVA workbook and data validation report	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External
Validation Analytical data deviations	Determine the impact of any deviation from sampling or analytical methods, and laboratory SOP requirements and matrix interferences effect on the analytical results. Data deviations will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIb	External
Validation Project quantitation limits for sensitivity	Ensure that the project detection limits were achieved. Project quantitation limit achievement will be documented in the DVA workbook and data validation report.	Project Chemist or Data Validators, Resolution Consultants	IIb	External
Validation Dioxins/Furans	Assess organic analytical data against MPC identified in Worksheets #12, #19, #24, and #28. *U.S. EPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review (September 2011)* will be used as a guidance on applying qualifiers when MPC identified in Worksheets #12, #19, #24, and #28 are not met, including identifying when samples will be qualified estimated or rejected and when individual or all samples in a batch will be qualified. Validation will be limited to reviewing laboratory quality control summary information and raw data will not be reviewed.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External

Data Review Input	Description	Responsible for Verification (name, organization)	Step I/ IIa/IIb[1]	Internal/ External[2]
Validation Data qualifiers	Qualifiers that will be applied during the data validation process are summarized below and, as indicated, results will be considered usable unless qualified by an R-flag. Rejected data will be evaluated and may be used in circumstances identified by the Partnering Team.	Project Chemist or Data Validators, Resolution Consultants	IIa/IIb	External

Data Qualifier	Qualifier Definition	Interpret Result As a Detection?	Result Usable?	Potential Result Bias
no qualifier	Acceptable	Yes	Yes	None expected
J	Estimated	Yes	Yes	High or Low
U	Undetected	No	Yes	None expected
UJ	Undetected and Estimated	No	Yes	High or Low
UR	Undetected and Rejected	No	No	Unspecified
R	Rejected	No	No	Unspecified

Notes:
[1] IIa Compliance with methods, procedures, and contracts (see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.)
[1] IIb Comparison with measurement performance criteria in the SAP (see Table 11, page 118, UFP-QAPP manual, V.1, March 2005)
[2] Internal or external (independent) from the data generation activities.
DoD QSM = *Department of Defense Quality Systems Manual for Environmental Laboratories*, Version 4.2, October 2010. DoD QSM Version 4.2 may be updated to Version 5.0 after the laboratory has been audited and accredited for the updated version. Therefore, acceptance and measurement performance criteria may change to reflect the new version during the course of this project.

DVA	=	Data validation assistant			
SAP	=	Sampling and analysis plan	FTL	=	Field team leader
QC	=	Quality control	RPD	=	Relative percent difference
MS/MSD	=	Matrix spike/Matrix Spike duplicate	LCS	=	Laboratory control sample
UFP-QAPP	=	Uniform Federal Policy Quality Assurance Project Plan	SOP	=	Standard operating procedure
U.S. EPA	=	U.S. Environmental Protection Agency	MPC	=	Measurement performance criteria

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 she will consult with the Navy Remedial Project Manager (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 will be accomplished by comparing percent recoveries of Laboratory Control Sample, Laboratory Control Sample Duplicate, MS/MSD, and surrogate compounds to accuracy goals identified in Worksheet #28. This assessment will include an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for surrogates, MS/MSD, and laboratory control samples. If the goals are not met, limitations on the use of the data will be described in the project report. Bias of the qualified results and a description of the impact of identified non-compliances on a specific data package or on the overall project data will be described in the project report.

- Representativeness — A project scientist, identified by the Resolution Consultants TOM and acting on behalf of the Project Team, will determine whether the data are adequately representative of intended populations, both spatially and temporally. This will be accomplished by verifying that samples were collected and analyzed in accordance with this SAP, by reviewing spatial and temporal data variations, and by comparing these characteristics to expectations. The usability report will describe the representativeness of the data for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the project scientist indicates that a quantitative analysis is required.

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

- Sensitivity — The Project Chemist, acting on behalf of the Project Team, will determine whether project sensitivity goals listed in Worksheet #15 are achieved. The overall sensitivity and quantitation limits from multiple data sets for each matrix and analysis will be compared. If sensitivity goals are not achieved, the limitations on the data will be described.

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

After completion of the data validation, the data and data quality will be reviewed to determine whether sufficient data of acceptable quality are available for decision making. In addition to the evaluations described above, a series of inspections and statistical analyses will be performed to estimate these characteristics. The statistical evaluations will include simple summary statistics for target analytes, such as maximum concentration, minimum concentration, number of samples exhibiting non-detected results, number of samples exhibiting positive results, and the proportion of samples with detected and non-detected results. The Project Team members, identified by the Resolution Consultants TOM, will assess whether the data collectively support the attainment of project objectives. They will consider whether any missing or rejected data have

compromised the ability to make decisions or to make the decisions with the desired level of confidence. The data will be evaluated to determine whether missing or rejected data can be compensated by other data.

Identify the personnel responsible for performing the usability assessment:

The Resolution Consultants TOM, Project Chemist, and FTL will be responsible for conducting the listed data usability assessments. The data usability assessment will be reviewed with the Project Team. If deficiencies affecting the attainment of project objectives are identified, the review will take place either in a face to face meeting or a teleconference depending on the extent of identified deficiencies. If no significant deficiencies are identified, the data usability assessment will simply be documented in the project report and reviewed during the normal document review cycle.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

The data will be presented in tabular format, including data qualifications such as estimation (J, UJ) or rejection (R). The project report will identify and describe the data usability limitations and suggest re-sampling or other corrective actions, if necessary. Graphical presentations of the data such as concentration tag maps will be generated as part of the overall data evaluation process.

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— *U.S. EPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review.* Office of Superfund Remediation and Technology Innovation, EPA-540-R-11-016. Washington, DC. September 2011.

Appendix A
Field Standard Operating Procedures

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 Volumen for MS/MSD	HOLD
14	15	16	17	18	19	20	21	22	23									24	25

Turnaround Time(specify): 26 **Final** _____ days **Email** (if applicable) _____ days

Deliverable(check): 27 Level 2_____ Level 3_____ Full/Level 4_____ TX TRRP-13_____

Field **Comments:** 28

Lab **Comments:** 29

Sample Shipment and Delivery Details

Number of coolers in shipment: 30

Relinquished by (signature)	Date	Time	Received by (signature)	Date	Time	
1 31			1 32			Samples Iced?(check) 33 Yes___ No___
2			2			Method of Shipment: 34
3			3			Airbill No: 35
						Date Shipped: 36

(1) **AA**=Ambient air, **AQ**=Air quality control, **ASB**=Asbestos, **CK**=Caulk, **DS**=Storm drain sediment, **GS**=Soil gas, **IC**=IDW Concrete, **IDD**=IDW Solid, IDS=IDW soil, **IDW**=IDW Water, **LF**=Free Product, **MA**=Mastic, **PC**=Paint Chips, **SC**=Cement/Concrete, **SE**=Sediment, **SL**=Sludge, **SO**=Soil, **SQ**=Soil/Solid quality control, **SSD**=Subsurface sediment, **SU**=Surface soil (<6 in), **SW**=Swab or wipe, **TA**=Animal tissue, **TP**=Plant tissue, **TQ**=Tissue quality control, **WG**=Ground water, **WL**=Leachate, **WO**=Ocean water, **WP**=Drinking water, **WQ**=Water quality control, **WR**=Ground water effluent, **WS**=Surface water, **WU**=Storm water, **WW**=Waste water

(2) **Sample Type: AB**=Ambient Blk, **EB**=Equipment Blk, **FB**=Field Blk, **FD**=Field Duplicate Sample, **IDW**=Investigative-Derived Waste, **MIS**=Incremental Sampling Methodology, **N**=Normal Environmental Sample, **PE**=Performance Eval., **TB**=Trip Blk

(3) **Preservative added: HA**=Hydrochloric Acid, **NI**=Nitric Acid, **SH**=Sodium Hydroxide, **SA**=Sulfuric Acid, **AA**=Ascorbic Acid, **HX**=Hexane, **ME**=Methanol, **SB**=sodium bisulfate, **ST**=Sodium Thiosulfate, If **NO preservative** added leave blank

Sample Handling, Storage, and Shipping of Low Level Environmental Samples

Procedure 3-04A

1.0 Purpose and Scope

1.1 This Standard Operating Procedure (SOP) sets forth the methods for use by personnel engaged in handling, storing, and transporting low level environmental samples.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

2.1 To avoid lifting injuries associated with heavy coolers, use the large muscles of the legs, not the back. Use dollies if possible.

2.2 When using tools for cutting purposes, cut away from yourself. The use of appropriate, task specific cutting tools is recommended.

2.3 Wear proper gloves, such as blue nitrile and latex, as defined in the site-specific project health and safety plan, when handling sample containers to avoid contacting any materials that may have spilled out of the sample containers.

3.0 Terms and Definitions

DOT — Department of Transportation

4.0 Training and Qualifications

4.1 The **Contract Task Order** (CTO) **Manager** is responsible for verifying that these procedures are performed prior to the initiation of active subsurface exploration.

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

4.3 The **Field Manager** is responsible for ensuring that sample handling, storage, and shipping are performed in accordance with this procedure.

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

5.0 Procedures

5.1 Handling and Packaging

Environmental samples should be packaged prior to shipment using the following procedures:

1. Allow sufficient headspace in all bottles (except volatile organic analysis containers with a septum seal) to compensate for any pressure and temperature changes (approximately 1 percent of the volume of the container).

2. Ensure that the lids on all bottles are tight (will not leak).

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3. Glass bottles should be wrapped in bubble wrap — preferably sealable bubble wrap sample bags, if available. Place bottles in separate and appropriately-sized polyethylene bags and seal the bags.

4. Select a sturdy cooler in good repair. Secure and tape the drain plug with fiber or duct tape inside and outside. Line the cooler with a large heavy-duty plastic bag.

5. Place cushioning/absorbent material in the bottom of the cooler, if available, and then place the containers in the cooler with sufficient space to allow for the addition of cushioning between the containers.

6. Put "blue ice" (or ice that has been "double bagged" in heavy-duty polyethylene bags and properly sealed) on top of and/or between the containers. Fill all remaining space between the containers with bubble wrap or other suitable absorbent material.

7. Securely fasten the top of the large garbage bag with packaging tape.

8. Place the completed Chain-of-Custody (COC) Record into a sealed plastic bag, and tape the bag to the inner side of the cooler lid.

9. Close the cooler and securely tape (preferably with fiber tape) the top of the cooler shut. COC seals should be affixed to opposing sides of the cooler within the securing tape so that the cooler cannot be opened without breaking the seal.

5.2 Shipping

Follow all appropriate DOT regulations (e.g., 49 Code of Federal Regulations, Parts 171-179) for shipment of air, soil, water, and other samples. Elements of these procedures are summarized in the following subsections.

5.2.1 Non-hazardous Materials Shipment

If the samples are suspected to be non-hazardous based on previous site sample results, field screening results, or visual observations, if applicable, then samples may be shipped as non-hazardous.

When a cooler is ready for shipment to the laboratory, prepare standard air bill paperwork for shipment of the samples to the laboratory. Write the shippers tracking/airbill number on the COC form. Place two copies of the COC form inside a self-sealing bag and tape it to the inside of the cooler. Seal the cooler with waterproof tape and label it with "Fragile," "This-End-Up" (or directional arrows pointing up), or other appropriate notices. Affix a label stating the destination (laboratory address) to each cooler. Personnel should be aware of carrier weight or other policy restrictions.

5.2.2 Hazardous Materials Shipment

Shipment of Hazardous Material is not covered in this SOP; all samples handled under this SOP are anticipated to be non-hazardous or not dangerous goods. The CTO Manager, or designee, is responsible for determining if samples collected during a specific field investigation meet the definitions for dangerous goods. If a sample is collected of a material that is listed in the Dangerous Goods List, Section 4.2, of International Air Transport Authority (IATA), then that sample must be identified, packaged, marked,

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labeled, and shipped according to the instructions given for that material. If the composition of the collected sample(s) is unknown, and the project leader knows or suspects that it is a regulated material (dangerous goods), the sample may not be offered for air transport. If the composition and properties of a waste sample or a highly contaminated soil, sediment, or water sample are unknown, or only partially known, the sample may not be offered for air transport.

6.0 Records

Maintain all copies of chain of custodies and air bills with the project file. .

7.0 Attachments or References

International Air Transport Authority (IATA). Dangerous Goods Regulations

http://www.iata.org/whatwedo/cargo/dangerous_goods/Documents/DGR52-significant-changes.pdf

Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual*. Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.

Author	Reviewer	Revisions (Technical or Editorial)
Ben Brantley	Tina Cantwell	Rev 0 — Initial Issue
Program Manager	QA Officer	

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Investigation Derived Waste Management

Procedure 3-05

1.0 Purpose and Scope

This standard operating procedure (SOP) describes activities and responsibilities of the United States (U.S.) Navy Environmental Restoration (ER) Program, Naval Facilities Engineering Command, Atlantic (NAVFAC Atlantic) with regard to management of investigation-derived waste (IDW). The purpose of this procedure is to provide guidance for the minimization, handling, labelling, temporary storage, inventory, classification, and disposal of IDW generated under the ER Program. This procedure will also apply to personal protective equipment (PPE), sampling equipment, decontamination fluids, non-IDW trash, non-indigenous IDW, and hazardous waste generated during implementation of removal or remedial actions. The information presented will be used to prepare and implement work plans (WPs) for IDW-related field activities. The results from implementation of WPs will then be used to develop and implement final IDW disposal plans.

If there are procedures whether it be from Resolution Consultants, state and/or federal that are not addressed in this SOP and are applicable to IDW then those procedures may be added as an appendix to the project specific SAP.

This procedure applies to all Navy ER projects performed in the NAVFAC Atlantic Area of Responsibility.

This procedure shall serve as management-approved professional guidance for the ER Program and is consistent with protocol in the Uniform Federal Policy-Quality Assurance Project Plan (DoD 2005). As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgment during unforeseen circumstances. Deviations from this procedure while planning or executing planned activities must be approved by both the Contract Task Order (CTO) Manager and the Quality Assurance (QA) Manager or Technical Director, and documented.

This procedure was developed to serve as management-approved professional guidance for the management of IDW generated under the ER Program. It focuses on the requirements for minimizing, segregating, handling, labeling, storing, and inventorying IDW in the field. Certain drum inventory requirements related to the screening, sampling, classification, and disposal of IDW are also noted in this procedure.

2.0 Safety

The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the CTO WP and/or direction from the **Site Safety Officer (SSO)**.

All **Field Personnel** responsible for IDW management must adhere to the HASP and must wear the PPE specified in the site-specific HASP. Generally, this includes, at a minimum, steel-toed boots or steel-toed rubber boots, safety glasses, American National Standards Institute-standard hard hats, and hearing protection (if heavy equipment is in operation). If safe alternatives are not achievable, discontinue site activities immediately.

3.0 Terms and Definitions

None.

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4.0 Training and Qualifications

4.1 The **CTO Manager** is responsible for ensuring that IDW management activities comply with this procedure. The **CTO Manager** is responsible for ensuring that all personnel involved in IDW management shall have the appropriate education, experience, and training to perform their assigned tasks.

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

4.3 The **Field Manager** is responsible for ensuring that all IDW is managed according to this procedure.

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

5.0 Equipment and Supplies

The equipment and supplies required for implementation of this SOP include the following:

- Containers for waste (e.g., [U.S. Department of Transportation] DOT approved 55-gallon open and closed top drums) and material to cover waste to protect from weather (e.g., plastic covering);
- Hazardous /non-hazardous waste drum labels (weatherproof);
- Permanent marking pens;
- Inventory forms for project file;
- Plastic garbage bags, zip lock storage bags, roll of plastic sheeting; and
- Steel-toed boots, chemical resistant gloves, coveralls, safety glasses, and any other PPE required in the HASP.

6.0 Procedure

The following procedures are used to handle the IDW.

6.1 Drum Handling

6.1.1 IDW shall be containerized using DOT approved drums. The drums shall be made of steel or plastic, have a 55-gallon capacity, be completely painted or opaque, and have removable lids (i.e., United Nations Code 1A2 or 1H2). Typically 55-gallon drums are used, however small drums may be used depending on the amount of waste generated. New steel drums are preferred over recycled drums.

6.1.2 Recycled drums should not be used for hazardous waste, PCBs or other regulated shipments. For short-term storage of liquid IDW prior to discharge, double-walled bulk steel or plastic storage tanks may be used. For this scenario, consider the scheduling and cost-effectiveness of this type of bulk storage, treatment, and discharge system versus longer-term drum storage.

6.1.3 For long-term IDW storage at other project locations, the DOT approved drums with removable lids are recommended. Verify the integrity of the foam or rubber sealing ring located on the underside of some drum lids prior to sealing drums containing IDW liquids.

6.1.4 If the ring is only partially attached to the drum lid, or if a portion of the ring is missing, select another drum lid with a sealing ring that is in sound condition.

6.1.5 To prepare IDW drums for labeling, wipe clean the outer wall surfaces and drum lids of all material that might prevent legible and permanent labeling. If potentially contaminated material adheres to the outer surface of a drum, wipe that material from the drum, and segregate the paper towel or rag used to remove the material with visibly soiled PPE and

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disposable sampling equipment. Label all IDW drums and place them on pallets prior to storage.

6.2 Labelling

6.2.1 Containers used to store IDW must be properly labelled. Two general conditions exist: 1) from previous studies or on-site data, waste characteristics are known to be either hazardous or nonhazardous; or 2) waste characteristics are unknown until additional data are obtained.

6.2.2 For situations where the waste characteristics are known, the waste containers should be packaged and labelled in accordance with state regulations and any federal regulations that may govern the labelling of waste.

6.2.3 The following information shall be placed on all non-hazardous waste labels:

- Description of waste (i.e., purge water, soil cuttings);
- Contact information (i.e., contact name and telephone number);
- Date when the waste was first accumulated.

6.2.4 The following information shall be placed on all hazardous waste labels:

- Description of waste (i.e., purge water, soil cuttings);
- Generator information (i.e., name, address, contact telephone number);
- EPA identification number (supplied by on-site client representative);
- Date when the waste was first accumulated.

6.2.5 When the final characterization of a waste is unknown, a notification label should be placed on the drum with the words "waste characterization pending analysis" and the following information included on the label:

- Description of waste (i.e., purge water, soil cuttings);
- Contact information (i.e., contact name and telephone number);
- Date when the waste was first accumulated.

6.2.6 Once the waste has been characterized, the label should be changed as appropriate for a nonhazardous or hazardous waste.

6.2.7 Waste labels should be constructed of a weatherproof material and filled out with a permanent marker to prevent being washed off or becoming faded by sunlight. It is recommended that waste labels be placed on the side of the container, since the top is more subject to weathering. However, when multiple containers are accumulated together, it also may be helpful to include labels on the top of the containers to facilitate organization and disposal.

6.2.8 Each container of waste generated shall be recorded in the field notebook used by the person responsible for labelling the waste. After the waste is disposed of, either by transportation off-site or disposal on-site in an approved disposal area, an appropriate record shall be made in the same field notebook to document proper disposition of IDW.

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6.3 Types of Site Investigation Waste

Several types of waste are generated during site investigations that may require special handling. These include solid, liquid, and used PPE, as discussed further below.

Solid Waste

Soil cuttings from boreholes will typically be placed in containers unless site specific requirements allow for soil cuttings to be placed back into the borehole after drilling is complete. Drilling mud generated during investigation activities shall be collected in containers. Covers should be included on the containers and must be secured at all times and only open during filling activities. The containers shall be labelled in accordance with this SOP. An inventory containing the source, volume, and description of material put in the containers shall be logged on prescribed forms and kept in the project file.

Non-hazardous solid waste can be disposed on-site in the designated site landfill or in a designated evaporation pond if it is liquefied. Hazardous wastes must be disposed off-site at an approved hazardous waste landfill.

Liquid Waste

Groundwater generated during monitoring well development, purging, and sampling can be collected in truck-mounted containers and/or other transportable containers (i.e., 55-gallon drums). Lids or bungs on drums must be secured at all times and only open during filling or pumping activities. The containers shall be labelled in accordance with this SOP. Non-hazardous liquid waste can be disposed of in one of the designated lined evaporation ponds on-site. Hazardous wastes must be handled separately and disposed off-site at an approved hazardous waste facility.

Personal Protective Equipment

PPE that is generated throughout investigation activities shall be placed in plastic garbage bags. If the solid or liquid waste that was being handled is characterized as hazardous waste, then the corresponding PPE should also be disposed as hazardous waste. If not, all PPE should be disposed as non-hazardous waste in the designated on-site landfill. Trash that is generated as part of field activities may be disposed of in the landfill as long as the trash was not exposed to hazardous media.

6.4 Waste Accumulation On-Site

6.4.1 Solid, liquid, or PPE waste generated during investigation activities that are classified as nonhazardous or "characterization pending analysis" should be disposed of as soon as possible. Until disposal, such containers should be inventoried, stored as securely as possible, and inspected regularly, as a general good practice.

6.4.2 Solid, liquid, or PPE waste generated during investigation activities that are classified as hazardous shall not be accumulated on-site longer than 90 days. All hazardous waste containers shall be stored in a secured storage area. The following requirements for the hazardous waste storage area must be implemented:

- Proper hazardous waste signs shall be posted as required by any state or federal statutes that may govern the labelling of waste;
- Secondary containment to contain spills;
- Spill containment equipment must be available;
- Fire extinguisher;
- Adequate aisle space for unobstructed movement of personnel.

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6.4.3 Weekly storage area inspections shall be performed and documented to ensure compliance with these requirements. Throughout the project, an inventory shall be maintained to itemize the type and quantity of the waste generated.

6.5 Waste Disposal

6.5.1 Solid, liquid, and PPE waste will be characterized for disposal through the use of client knowledge, laboratory analytical data created from soil or groundwater samples gathered during the field activities, and/or composite samples from individual containers.

6.5.2 All waste generated during field activities will be stored, transported, and disposed of according to applicable state, federal, and local regulations. All wastes classified as hazardous will be disposed of at a licensed treatment storage and disposal facility or managed in other approved manners.

6.5.3 In general, waste disposal should be carefully coordinated with the facility receiving the waste. Facilities receiving waste have specific requirements that vary even for non-hazardous waste, so characterization should be conducted to support both applicable regulations and facility requirements.

6.6 Regulatory Requirements

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

- Code of Federal Regulations (CFR), Title 40, Part 261;
- CFR, Title 49, Parts 172, 173, 178, and 179.

6.7 Waste Transport

A state-certified hazardous waste hauler shall transport all wastes classified as hazardous. Typically, the facility receiving any waste can coordinate a hauler to transport the waste. Shipped hazardous waste shall be disposed of in accordance with all RCRA/USEPA requirements. All waste manifests or bills of lading will be signed either by the client or the client's designee.

7.0 Quality Control and Assurance

7.1 Management of IDW must incorporate quality control measures to ensure conformance to these and the project requirements.

8.0 Records, Data Analysis, Calculations

8.1 Maintain records as required by implanting the procedures in this SOP.

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

9.0 Attachments or References

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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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NAVFAC NW Standard Operating Procedure Number I-D-1, *Drum Sampling.*

NAVFAC NW Standard Operating Procedure Number I-F, *Equipment Decontamination.*

NAVFAC NW Standard Operating Procedure Number III-D, *Logbooks.*

Author	Reviewer	Revisions (Technical or Editorial)
Mark Kromis Program Chemist	Chris Barr Program Quality Manager	Rev 0 – Initial Issue (May 2012)

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Equipment Decontamination

Procedure 3-06

1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes methods of equipment decontamination, to be used for activities where samples for chemical analysis are collected or where equipment will need to be cleaned before leaving the site or before use in subsequent activities.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

2.0 Safety

It is the responsibility of the **Site Safety Officer (SSO)** to set up the site zones (i.e., exclusion, transition, and clean) and decontamination areas. Generally the decontamination area is located within the transition zone, upwind of intrusive activities, and serves as the washing area for both personnel and equipment to minimize the spread of contamination into the clean zone. Typically, for equipment, a series of buckets are set up on a visqueen-lined bermed area. Separate spray bottles containing cleaning solvents as described in this procedure or the Contract Task Order (CTO) Work Plan (WP) and distilled water are used for final rinsing of equipment. Depending on the nature of the hazards and the site location, decontamination of heavy equipment, such as augers, pump drop pipe, and vehicles, may be accomplished using a variety of techniques.

All **Field Personnel** responsible for equipment decontamination must adhere to the site-specific health and safety plan (HSP) and must wear the personal protective equipment (PPE) specified in the site-specific HSP. Generally this includes, at a minimum, Tyvek® coveralls, steel-toed boots with boot covers or steel-toed rubber boots, safety glasses, American National Standards Institute-standard hard hats, and hearing protection (if heavy equipment is in operation). Air monitoring by the **SSO** may result in an upgrade to the use of respirators and cartridges in the decontamination area; therefore, this equipment must be available on site. If safe alternatives are not achievable, discontinue site activities immediately.

In addition to the aforementioned precautions, the following sections describe safe work practices that will be employed.

2.1 Chemical Hazards associated with Equipment Decontamination

- Avoid skin contact with and/or incidental ingestion of decontamination solutions and water.
- Utilize PPE as specified in the site-specific HSP to maximize splash protection.
- Refer to material safety data sheets, safety personnel, and/or consult sampling personnel regarding appropriate safety measures (i.e., handling, PPE including skin and respiratory).
- Take the necessary precautions when handling detergents and reagents.

2.2 Physical Hazards associated with Equipment Decontamination

- To avoid possible back strain, it is recommended to raise the decontamination area 1 to 2 feet above ground level.
- To avoid heat stress, over exertion, and exhaustion, it is recommended to rotate equipment decontamination among all site personnel.

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- Take necessary precautions when handling field sampling equipment.

3.0 Terms and Definitions

None.

4.0 Training and Qualifications

4.1 The **CTO Manager** is responsible for ensuring that decontamination activities comply with this procedure. The **CTO Manager** is responsible for ensuring that all personnel involved in equipment decontamination shall have the appropriate education, experience, and training to perform their assigned tasks.

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

4.3 The **Field Manager** is responsible for ensuring that all field equipment is decontaminated according to this procedure.

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

5.0 Procedure

Decontamination of equipment used in soil/sediment sampling, groundwater monitoring, well drilling and well development, as well as equipment used to sample groundwater, surface water, sediment, waste, wipe, asbestos, and unsaturated zone, is necessary to prevent cross-contamination and to maintain the highest integrity possible in collected samples. Planning a decontamination program requires consideration of the following factors:

- Location where the decontamination procedures will be conducted
- Types of equipment requiring decontamination
- Frequency of equipment decontamination
- Cleaning technique and types of cleaning solutions appropriate to the contaminants of concern
- Method for containing the residual contaminants and wash water from the decontamination process
- Use of a quality control measure to determine the effectiveness of the decontamination procedure

The following subsections describe standards for decontamination, including the frequency of decontamination, cleaning solutions and techniques, containment of residual contaminants and cleaning solutions, and effectiveness.

5.1 Decontamination Area

Select an appropriate location for the decontamination area at a site based on the ability to control access to the area, the ability to control residual material removed from equipment, the need to store clean equipment, and the ability to restrict access to the area being investigated. Locate the decontamination area an adequate distance away and upwind from potential contaminant sources to avoid contamination of clean equipment.

5.2 Types of Equipment

Drilling equipment that must be decontaminated includes drill bits, auger sections, drill-string tools, drill rods, split barrel samplers, tremie pipes, clamps, hand tools, and steel cable. Decontamination of monitoring well development and groundwater sampling equipment includes submersible pumps, bailers, interface probes, water level meters, bladder pumps, airlift pumps, peristaltic pumps, and lysimeters. Other sampling equipment that requires decontamination includes, but is not limited to, hand trowels,

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hand augers, slide hammer samplers, shovels, stainless-steel spoons and bowls, soil sample liners and caps, wipe sampling templates, composite liquid waste samplers, and dippers. Equipment with a porous surface, such as rope, cloth hoses, and wooden blocks, cannot be thoroughly decontaminated and shall be properly disposed of after one use.

5.3 Frequency of Equipment Decontamination

Decontaminate down-hole drilling equipment and equipment used in monitoring well development and purging prior to initial use and between each borehole or well. Down-hole drilling equipment, however, may require more frequent cleaning to prevent cross-contamination between vertical zones within a single borehole. When drilling through a shallow contaminated zone and installing a surface casing to seal off the contaminated zone, decontaminate the drilling tools prior to drilling deeper. Initiate groundwater sampling by sampling groundwater from the monitoring well where the least contamination is suspected. Decontaminate groundwater, surface water, and soil sampling devices prior to initial use and between collection of each sample to prevent the possible introduction of contaminants into successive samples.

5.4 Cleaning Solutions and Techniques

Decontamination can be accomplished using a variety of techniques and fluids. The preferred method of decontaminating major equipment, such as drill bits, augers, drill string, and pump drop-pipe, is steam cleaning. To steam clean, use a portable, high-pressure steam cleaner equipped with a pressure hose and fittings. For this method, thoroughly steam wash equipment and rinse it with potable tap water to remove particulates and contaminants.

A rinse decontamination procedure is acceptable for equipment such as bailers, water level meters, new and re-used soil sample liners, and hand tools. The decontamination procedure shall consist of the following: (1) wash with a non-phosphate detergent (Alconox®, Liquinox®, or other suitable detergent) and potable water solution; (2) rinse with potable water; (3) spray with laboratory-grade isopropyl alcohol; (4) rinse with deionized or distilled water; and (5) spray with deionized or distilled water. If possible, disassemble equipment prior to cleaning. Add a second wash at the beginning of the process if equipment is very soiled.

Decontaminating submersible pumps requires additional effort because internal surfaces become contaminated during usage. Decontaminate these pumps by washing and rinsing the outside surfaces using the procedure described for small equipment or by steam cleaning. Decontaminate the internal surfaces by recirculating fluids through the pump while it is operating. This recirculation may be done using a relatively long (typically 4 feet) large-diameter pipe (4-inch or greater) equipped with a bottom cap. Fill the pipe with the decontamination fluids, place the pump within the capped pipe, and operate the pump while recirculating the fluids back into the pipe. The decontamination sequence shall include: (1) detergent and potable water; (2) potable water rinse; (3) potable water rinse; and (4) deionized water rinse. Change the decontamination fluids after each decontamination cycle.

Solvents other than isopropyl alcohol may be used, depending upon the contaminants involved. For example, if polychlorinated biphenyls or chlorinated pesticides are contaminants of concern, hexane may be used as the decontamination solvent; however, if samples are also to be analyzed for volatile organics, hexane shall not be used. In addition, some decontamination solvents have health effects that must be considered. Decontamination water shall consist of distilled or deionized water. Steam-distilled water shall not be used in the decontamination process as this type of water usually contains elevated concentrations of metals. Decontamination solvents to be used during field activities will be specified in the CTO WP.

Rinse equipment used for measuring field parameters, such as pH (indicates the hydrogen ion concentration – acidity or basicity), temperature, specific conductivity, and turbidity with deionized or distilled water after each measurement. Also wash new, unused soil sample liners and caps with a fresh

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detergent solution and rinse them with potable water followed by distilled or deionized water to remove any dirt or cutting oils that might be on them prior to use.

5.5 Containment of Residual Contaminants and Cleaning Solutions

A decontamination program for equipment exposed to potentially hazardous materials requires a provision for catchment and disposal of the contaminated material, cleaning solution, and wash water.

When contaminated material and cleaning fluids must be contained from heavy equipment, such as drill rigs and support vehicles, the area must be properly floored, preferably with a concrete pad that slopes toward a sump pit. If a concrete pad is impractical, planking can be used to construct solid flooring that is then covered by a nonporous surface and sloped toward a collection sump. If the decontamination area lacks a collection sump, use plastic sheeting and blocks or other objects to create a bermed area for collection of equipment decontamination water. Situate items, such as auger flights, which can be placed on metal stands or other similar equipment, on this equipment during decontamination to prevent contact with fluids generated by previous equipment decontamination. Store clean equipment in a separate location to prevent recontamination. Collect decontamination fluids contained within the bermed area and store them in secured containers as described below.

Use wash buckets or tubs to catch fluids from the decontamination of lighter-weight drilling equipment and hand-held sampling devices. Collect the decontamination fluids and store them on site in secured containers, such as U.S. Department of Transportation-approved drums, until their disposition is determined by laboratory analytical results. Label containers in accordance with Procedure 3-05, *IDW Management*.

6.0 Quality Control and Assurance

A decontamination program must incorporate quality control measures to determine the effectiveness of cleaning methods. Quality control measures typically include collection of equipment blank samples or wipe testing. Equipment blanks consist of analyte-free water that has been poured over or through the sample collection equipment after its final decontamination rinse. Wipe testing is performed by wiping a cloth over the surface of the equipment after cleaning. These quality control measures provide "after-the fact" information that may be useful in determining whether or not cleaning methods were effective in removing the contaminants of concern.

7.0 Records, Data Analysis, Calculations

Any project where sampling and analysis is performed shall be executed in accordance with an approved sampling and analysis plan. This procedure may be incorporated by reference or may be incorporated with modifications described in the plan.

Deviations from this procedure or the sampling and analysis plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

8.0 Attachments or References

8.1 ASTM Standard D5088. 2008. *Standard Practice for Decontamination of Field Equipment Used at Waste Sites.* ASTM International, West Conshohocken, PA. 2008. DOI: 10.1520/D5088-02R08. www.astm.org.

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

8.3 Procedure 3-05, *IDW Management*.

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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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Region 4
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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

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

TABLE OF CONTENTS

1 General Information 5

1.1 Purpose 5
1.2 Scope/Application 5
1.3 Documentation/Verification 5
1.4 References 6

2 Methodology 7

2.1 General 7
2.1.1 GPS Description 7
2.1.2 GPS Accuracy Factors 8
2.1.3 Differential GPS 9

2.2 Requirements for Locational Information 10
2.2.1 Data Uses 10
2.2.2 Datums and Data formats 12

2.3 Quality Control Procedures 13

2.4 Special Considerations 13
2.4.1 Special considerations for the use of Trimble® Mapping Grade Receivers 13
2.4.2 Special considerations for the use of Garmin® General Use Grade Receivers 15

2.5 Records 16

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.

1.4 References

Rand Corporation, The Global Positioning System, Assessing National Policies, Appendix B, GPS History, Chronology, and Budgets, 1995.

SESD Operating Procedure for Control of Records, SESDPROC-002, Most Recent Version.

Trimble® Navigation Limited, Mapping Systems General Reference, Revision B, 1996.

USEPA, Global Position Systems – Technical Implementation Guidance, Office of Environmental Information (EPA/250/R-03/001), 2003.

USEPA, GIS Technical Memorandum 3. Global Positioning Systems – Technology and It's Application in Environmental Programs, Research and Development (PM-225). EPA/600/R-92/036, 1992.

USEPA, Locational Data Policy, Office of Information Resources Management, IRM Policy Manual 2100 Chapter 13, 1991.

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

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.

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

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

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.

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 B
Laboratory Certification

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

CAPE FEAR ANALYTICAL, LLC
3306 Kitty Hawk Road, Suite 120
Wilmington, NC 28405
W. Michael Larkins Phone: 910-795-0421
mlarkins@cfanalytical.com

ENVIRONMENTAL

Valid To: May 31, 2016 Certificate Number: 3014.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2009 TNI Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 5.0 of the DoD Quality Systems Manual for Environmental Laboratories) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

High Resolution Gas Chromatography / Mass Spectrometry

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Air
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 1613B	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,4,5,6,7,8-Octachlorodibenzo-p-dioxin	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
2,3,7,8-Tetrachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,7,8-Pentachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
2,3,4,7,8-Pentachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,4,7,8-Hexachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,6,7,8-Hexachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
2,3,4,6,7,8-Hexachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,7,8,9-Hexachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,4,6,7,8-Heptachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,4,7,8,9-Heptachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
1,2,3,4,5,6,7,8-Octachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
Total Tetrachlorodibenzo-p-dioxin	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
Total Pentachlorodibenzo-p-dioxin	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
Total Hexachlorodibenzo-p-dioxin	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
Total Heptachlorodibenzo-p-dioxin	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
Total Tetrachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
Total Pentachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
Total Hexachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a

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Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Air
Total Heptachlorodibenzofuran	----------	EPA 1613B/8290A	EPA 1613B/8290A	TO-9a
2-Chlorobiphenyl (1)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3-Chlorobiphenyl (2)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
4-Chlorobiphenyl (3)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2'-Dichlorobiphenyl (4)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3-Dichlorobiphenyl (5)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3'-Dichlorobiphenyl (6)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,4-Dichlorobiphenyl (7)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,4'-Dichlorobiphenyl (8)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,5-Dichlorobiphenyl (9)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,6-Dichlorobiphenyl (10)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,3'-Dichlorobiphenyl (11)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,4-Dichlorobiphenyl (12)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,4'-Dichlorobiphenyl (13)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,5-Dichlorobiphenyl (14)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
4,4'-Dichlorobiphenyl (15)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3-Trichlorobiphenyl (16)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4-Trichlorobiphenyl (17)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',5-Trichlorobiphenyl (18)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',6-Trichlorobiphenyl (19)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3'-Trichlorobiphenyl (20)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4-Trichlorobiphenyl (21)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4'-Trichlorobiphenyl (22)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,5-Trichlorobiphenyl (23)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,6-Trichlorobiphenyl (24)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4-Trichlorobiphenyl (25)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',5-Trichlorobiphenyl (26)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',6-Trichlorobiphenyl (27)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,4,4'-Trichlorobiphenyl (28)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,4,5-Trichlorobiphenyl (29)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,4,6-Trichlorobiphenyl (30)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,4',5-Trichlorobiphenyl (31)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,4',6-Trichlorobiphenyl (32)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2',3,4-Trichlorobiphenyl (33)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2',3,5-Trichlorobiphenyl (34)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,3',4-Trichlorobiphenyl (35)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,3',5-Trichlorobiphenyl (36)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,4,4'-Trichlorobiphenyl (37)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,4,5-Trichlorobiphenyl (38)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,4',5-Trichlorobiphenyl (39)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3'-Tetrachorobiphenyl (40)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4-Tetrachlorobiphenyl (41)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4'-Tetrachlorobiphenyl (42)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,5-Tetrachlorobiphenyl (43)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,5'-Tetrachlorobiphenyl (44)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,6-Tetrachlorobiphenyl (45)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,6'-Tetrachlorobiphenyl (46)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2'4,4'-Tetrachlorobiphenyl (47)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4,5-Tetrachlorobiphenyl (48)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4,5'-Tetrachlorobiphenyl (49)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Air
2,2',4,6-Tetrachlorobiphenyl (50)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4,6'-Tetrachlorobiphenyl (51)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',5,5'-Tetrachlorobiphenyl (52)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',5,6'-Tetrachlorobiphenyl (53)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',6,6'-Tetrachlorobiphenyl (54)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4-Tetrachlorobiphenyl (55)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4'-Tetrachlorobiphenyl (56)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',5-Tetrachlorobiphenyl (57)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',5'-Tetrachlorobiphenyl (58)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',6-Tetrachlorobiphenyl (59)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4,4'-Tetrachlorobiphenyl (60)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4,5-Tetrachlorobiphenyl (61)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4,6-Tetrachlorobiphenyl (62)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4',5-Tetrachlorobiphenyl (63)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4',6-Tetrachlorobiphenyl (64)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,5,6-Tetrachlorobiphenyl (65)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4,4'-Tetrachlorobiphenyl (66)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4,5-Tetrachlorobiphenyl (67)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4,5'-Tetrachlorobiphenyl (68)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4,6-Tetrachlorobiphenyl (69)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4',5-Tetrachlorobiphenyl (70)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4',6-Tetrachlorobiphenyl (71)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',5,5'-Tetrachlorobiphenyl (72)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',5',6-Tetrachlorobiphenyl (73)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,4,4',5-Tetrachlorobiphenyl (74)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,4,4',6-Tetrachlorobiphenyl (75)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2',3,4,5-Tetrachlorobiphenyl (76)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,3',4,4'-Tetrachlorobiphenyl (77)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,3',4,5-Tetrachlorobiphenyl (78)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,3',4,5'-Tetrachlorobiphenyl (79)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,3',5,5'-Tetrachlorobiphenyl (80)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,4,4',5-Tetrachlorobiphenyl (81)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4-Pentachlorobiphenyl (82)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',5-Pentachlorobiphenyl (83)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',6-Pentachlorobiphenyl (84)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4'-Pentachlorobiphenyl (85)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,5-Pentachlorobiphenyl (86)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,5'-Pentachlorobiphenyl (87)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,6-Pentachlorobiphenyl (88)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,6'-Pentachlorobiphenyl (89)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4',5-Pentachlorobiphenyl (90)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4',6-Pentachlorobiphenyl (91)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,5,5'-Pentachlorobiphenyl (92)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,5,6-Pentachlorobiphenyl (93)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,5,6'-Pentachlorobiphenyl (94)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,5',6-Pentachlorobiphenyl (95)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,6,6'-Pentachlorobiphenyl (96)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3',4,5-Pentachlorobiphenyl (97)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3',4,6-Pentachlorobiphenyl (98)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4,4',5-Pentachlorobiphenyl (99)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Air
2,2',4,4',6-Pentachlorobiphenyl (100)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4,5,5'-Pentachlorobiphenyl (101)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4,5,6'-Pentachlorobiphenyl (102)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4,5',6-Pentachlorobiphenyl (103)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4,6,6'-Pentachlorobiphenyl (104)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,4'-Pentachlorobiphenyl (105)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,5-Pentachlorobiphenyl (106)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4',5-Pentachlorobiphenyl (107)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,5'-Pentachlorobiphenyl (108)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,6-Pentachlorobiphenyl (109)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4',6-Pentachlorobiphenyl (110)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',5,5'-Pentachlorobiphenyl (111)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',5,6-Pentachlorobiphenyl (112)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',5',6-Pentachlorobiphenyl (113)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4,4',5-Pentachlorobiphenyl (114)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4,4',6-Pentachlorobiphenyl (115)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4,5,6-Pentachlorobiphenyl (116)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4',5,6-Pentachlorobiphenyl (117)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4,4',5-Pentachlorobiphenyl (118)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4,4',6-Pentachlorobiphenyl (119)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4,5,5'-Pentachlorobiphenyl (120)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4,5',6-Pentachlorobiphenyl (121)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2',3,3',4,5-Pentachlorobiphenyl (122)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2',3,4,4',5-Pentachlorobiphenyl (123)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2',3,4,5,5'-Pentachlorobiphenyl (124)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2',3,4,5,6'-Pentachlorobiphenyl (125)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,3',4,4',5-Pentachlorobiphenyl (126)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,3',4,5,5'-Pentachlorobiphenyl (127)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,4'-Hexachlorobiphenyl (128)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,5-Hexachlorobiphenyl (129)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,5'-Hexachlorobiphenyl (130)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,6-Hexachlorobiphenyl (131)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,6'-Hexachlorobiphenyl (132)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',5,5'-Hexachlorobiphenyl (133)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',5,6-Hexachlorobiphenyl (134)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',5,6'-Hexachlorobiphenyl (135)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',6,6'-Hexachlorobiphenyl (136)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4',5-Hexachlorobiphenyl (137)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4',5'-Hexachlorobiphenyl (138)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4',6-Hexachlorobiphenyl (139)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4',6'-Hexachlorobiphenyl (140)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,5,5'-Hexachlorobiphenyl (141)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,5,6-Hexachlorobiphenyl (142)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,5,6'-Hexachlorobiphenyl (143)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,5',6-Hexachlorobiphenyl (144)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,6,6'-Hexachlorobiphenyl (145)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4',5,5'-Hexachlorobiphenyl (146)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4',5,6-Hexachlorobiphenyl (147)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4',5,6'-Hexachlorobiphenyl (148)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4',5',6-Hexachlorobiphenyl (149)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Air
2,2',3,4',6,6'-Hexachlorobiphenyl (150)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,5,5',6-Hexachlorobiphenyl (151)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,5,6,6'-Hexachlorobiphenyl (152)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4,4',5,5'-Hexachlorobiphenyl (153)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4,4',5',6-Hexachlorobiphenyl (154)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',4,4',6,6'-Hexachlorobiphenyl (155)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,4',5-Hexachlorobiphenyl (156)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,4',5'-Hexachlorobiphenyl (157)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,4',6-Hexachlorobiphenyl (158)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,5,5'-Hexachlorobiphenyl (159)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,5,6-Hexachlorobiphenyl (160)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,5',6-Hexachlorobiphenyl (161)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4',5,5'-Hexachlorobiphenyl (162)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4',5,6-Hexachlorobiphenyl (163)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4',5',6-Hexachlorobiphenyl (164)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',5,5',6-Hexachlorobiphenyl (165)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,4,4',5,6-Hexachlorobiphenyl (166)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4,4',5,5'-Hexachlorobiphenyl (167)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3',4,4',5',6-Hexachlorobiphenyl (168)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
3,3',4,4',5,5'-Hexachlorobiphenyl (169)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,4',5-Heptachlorobiphenyl (170)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,4',6-Heptachlorobiphenyl (171)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,5,5'-Heptachlorobiphenyl (172)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,5,6-Heptachlorobiphenyl (173)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,5,6'-Heptachlorobiphenyl (174)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,5',6-Heptachlorobiphenyl (175)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,6,6'-Heptachlorobiphenyl (176)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4',5,6-Heptachlorobiphenyl (177)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',5,5',6-Heptachlorobiphenyl (178)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',5,6,6'-Heptachlorobiphenyl (179)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4',5,5'-Heptachlorobiphenyl (180)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4',5,6-Heptachlorobiphenyl (181)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4',5,6'-Heptachlorobiphenyl (182)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4',5',6-Heptachlorobiphenyl (183)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4',6,6'-Heptachlorobiphenyl (184)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,5,5',6-Heptachlorobiphenyl (185)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,5,6,6'-Heptachlorobiphenyl (186)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4',5,5',6-Heptachlorobiphenyl (187)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4',5,6,6'-Heptachlorobiphenyl (188)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,4',5,5'-Heptachlorobiphenyl (189)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,4',5,6-Heptachlorobiphenyl (190)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,4',5',6-Heptachlorobiphenyl (191)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,5,5',6-Heptachlorobiphenyl (192)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4',5,5',6-Heptachlorobiphenyl (193)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (194)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,4',5,6-Octachlorobiphenyl (195)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,4',5,6'-Octachlorobiphenyl (196)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,4',6,6'-Octachlorobiphenyl (197)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,5,5',6-Octachlorobiphenyl (198)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,5,5',6'-Octachlorobiphenyl (199)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------

Parameter/Analyte	Potable Water	Nonpotable Water	Solid Hazardous Waste	Air
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (200)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (201)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (202)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4',5,5',6-Octachlorobiphenyl (203)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (204)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,3,3',4,4',5,5',6-Octachlorobiphenyl (205)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (206)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (207)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (208)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (209)	----------	EPA 1668A/1668C	EPA 1668A/1668C	----------
Soxhlet/Dean-Stark Extraction	----------	----------	EPA 3540C	----------
Continuous Liquid-Liquid Extraction	EPA 3520C	----------	----------	----------
Florisil Cleanup	----------	EPA 3620C	EPA 3620C	----------
Silica Gel Cleanup	----------	EPA 3630C	EPA 3630C	----------

American Association for Laboratory Accreditation

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for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2009 TNI Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 5.0 of the DoD Quality System Manual for Environmental Laboratories (QSM); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Presented this 1st day of April 2014.

President & CEO
For the Accreditation Council
Certificate Number 3014.01
Valid to May 31, 2016

For the tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.