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CH2M HILL
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1000 Abernathy Rd
Atlanta, GA 30328
Tel 770.604.9095
Fax 770.604.9183

April 14, 2009

Mr. Mark Davidson
4130 Faber Place Drive
Suite 202
N. Charleston, SC 29405

Subject: **Final Field Sampling and Analysis Plan**
Solid Waste Management Units 7/8 at Naval Activity Puerto Rico
Ceiba, Puerto Rico

Dear Mr. Davidson:

CH2M HILL is pleased to submit the *Final Field Sampling and Analysis Plan* for Solid Waste Management Units 7/8 for your review. Our responses to Navy comments dated April 6, 2009, are attached. Please contact me at 678.530.4033 or email at Tom.Beisel@ch2m.com if you have any questions.

Sincerely,

CH2M HILL

Tom Beisel, P.G.
Project Manager

c: David Criswell/BRAC PMO SE

SAP Worksheet #1—Title and Approval Page

Final
Field Sampling and Analysis Plan
Solid Waste Management Units 7/8 at Naval Activity Puerto Rico
Ceiba, Puerto Rico
April 2009

Prepared for:

Prepared by:

Prepared under:
Small Business Remedial Action Contract N62470-08-D-1006
Task Order No. JM04

REVIEW SIGNATURE:

THERESA ROJAS
AGVIQ-CH2M HILL PROGRAM QA/QC MANAGER

APPROVAL SIGNATURE:

SHERRI ENG
NAVFAC ATLANTIC - CHEMIST/QA OFFICER

OTHER APPROVAL SIGNATURES:

MARK E. DAVIDSON
BRAC PMO SE - REMEDIAL PROJECT MANAGER

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Executive Summary

AGVIQ-CH2M HILL Joint Venture III (AGVIQ-CH2M HILL) has been retained by the Department of the Navy, Naval Facilities Engineering Command Southeast (NAVFAC SE) to address the remediation of soil and groundwater at Solid Waste Management Units (SWMUs) 7 and 8 (SWMU 7/8) located at the Tow Way Fuel Farm (TWFF), Naval Activity Puerto Rico (NAPR) Ceiba, Puerto Rico (Figures 1 through 3 in Appendix A). This work is being performed under Contract Number N62470-08-D-1006, Task Order JM04.

This document is the Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) for the work that will be performed at SWMU 7/8 to remediate soil and groundwater impacted by petroleum hydrocarbons that resulted from over 60 years of fueling operations at the TWFF. Remediation activities at SWMU 7/8 include:

- Excavation of shallow soil from three areas of the site where arsenic and polynuclear aromatic hydrocarbon (PAH) compounds exceeded the approved corrective action objectives (CAOs)
- Recovery of product from the water table using either skimmers or vacuum-enhanced technologies to reduce the thickness of free product in site wells to a thickness of 1/8-inch
- Use of monitored natural attenuation (MNA) to reduce dissolved hydrocarbon concentrations in groundwater to the applicable CAOs

The remedial plan was described in the final Corrective Measures Study (CMS) prepared by Baker Environmental, Inc. (Baker) in November 2005. The final CMS was approved by the U.S. Environmental Protection Agency (EPA) in February 2006.

This SAP focuses on the work that will be preformed to collect soil delineation samples from SWMU 7/8. The principal objective of the delineation sampling is to present our approach to verify the limits of excavation by more accurately determining the extent of benzo(a)anthracene, benzo(a)-pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic in shallow soil. Data obtained from the pre-excavation assessment will be used to:

- Confirm the limits of excavation for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic in soil as presented in the EPA-approved CMS, in order to develop a work plan for the excavation work at SMWU 7/8.
- Collect aqueous samples for waste characterization analysis in advance of the excavation work.

The following additional tasks have been included in this SAP to obtain the data necessary to prepare and complete work plans for product recovery and groundwater monitoring and sampling at SWMU 7/8:

- Locate and mark the location of the existing monitoring and recovery wells using metal stakes with orange flagging.
- Verify the location of all site-wide wells using known well location X,Y coordinates and a handheld GPS unit.
- Measure depth to water and product using an oil/water interface probe.

Following data collection, the information will be evaluated and plans will be prepared for soil excavation, installation of product recovery wells, and MNA wells.

SAP Format

This SAP has been prepared in accordance with the UFP for Quality Assurance Project Plans (UFP-QAPP) (EPA, 2005) and the EPA Guidance for QAPPs, EPA QA/G-5, QAMS (EPA, 2002), and contains the 37 worksheets identified in Part 2A. It also contains several appendices that support the information presented in the worksheets. Appendix A presents the figures used in this document.

Contents

Executive Summary **3**
Acronyms and Abbreviations **7**
References **121**

SAP Worksheet #1—Title and Approval Page 1
SAP Worksheet #2—SAP Identifying Information 9
SAP Worksheet #3—Distribution List 11
SAP Worksheet #4—Project Personnel Sign-Off Sheet 13
SAP Worksheet #5—Project Organizational Chart 15
SAP Worksheet #6—Communication Pathways 17
SAP Worksheet #7—Personnel Responsibilities and Qualifications Table 21
SAP Worksheet #8—Special Personnel Training Requirements Table 25
SAP Worksheet #9a—Project Scoping Session Participants Sheet 27
SAP Worksheet #9b—Project Scoping Session Participants Sheet 28
SAP Worksheet #9c—Project Scoping Session Participants Sheet 29
SAP Worksheet #10—Problem Definition 31
SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements 37
SAP Worksheet #12—Measurement Performance Criteria Table - Field QC Sample 43
SAP Worksheet #13—Secondary Data Criteria and Limitations Table 47
SAP Worksheet #14—Summary of Project Tasks 49
SAP Worksheet #15—Reference Limits and Evaluation Table 57
SAP Worksheet #16—Project Schedule 61
SAP Worksheet #17—Sampling Design and Rationale 63
SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table 65
SAP Worksheet #19—Analytical SOP Requirements Table 69
SAP Worksheet #20—Field Quality Control Sample Summary Table 71
SAP Worksheet #21—Project Sampling SOP Reference Table 73
SAP Worksheet #22—Field Equipment Calibration, Maintenance, Testing, and Inspection Table 75
SAP Worksheet #23—Analytical SOP References Table 77
SAP Worksheet #24—Analytical Instrument Calibration Table 81
SAP Worksheet #25—Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table 87
SAP Worksheet #26—Sample Handling System 89
SAP Worksheet #27—Sample Custody Requirements Table 91
SAP Worksheet #28—Laboratory QC Samples Table 93
SAP Worksheet #29—Project Documents and Records Table 97
SAP Worksheet #30—Analytical Services Table 99
SAP Worksheet #31—Planned Project Assessments Table 103
SAP Worksheet #32—Assessment Findings and Corrective Action Responses 105
SAP Worksheet #32-1—Corrective Action Form 107
SAP Worksheet #32-2—Field Performance Audit Checklist 108
SAP Worksheet #32-3—Safe Work Observation Form 110
SAP Worksheet #33—QA Management Reports Table 111
SAP Worksheet #34—Verification (Step I) Process Table 113

SAP Worksheet #35—Validation (Steps IIa and IIb) Process Table....115
SAP Worksheet #36—Analytical Data Validation (Steps IIa and IIb) Summary Table....117
SAP Worksheet #37—Usability Assessment....119

Appendices

A Figures

1 NAPR Location in Puerto Rico
2 Tow Way Fuel Farm Location
3 SWMU 7/8 Base Map
4 Historical Extent of Free Product
5 Extent of Free Product as of July 2008
6 CMS Soil Delineation Sample Locations and Proposed Excavation Areas
7 Proposed Soil Delineation Sample Locations

B Standard Operating Procedures

C Standard Label and Chain-of-Custody Record

D Waste Management Plan, Environmental Protection Plan, and Quality Control Plan

Tables

1 Soil CAOs
2 Analytical Methodology

Acronyms and Abbreviations

°C	degree Celsius
%D	percent difference
AGVIQ-CH2M HILL	AGVIQ-CH2M HILL Joint Venture III
ASAP	as soon as possible
ATSDR	Agency for Toxic Substances and Disease Registry
Baker	Baker Environmental, Inc.
bgs	below ground surface
BRAC PMO SE	Base Realignment and Closure Program Management Office Southeast
CA	Corrective Action
CAO	Corrective Action Objective
CCB	continuing calibration blank
CCC	calibration check compound
CCV	continuing calibration verification
CMS	Corrective Measures Study
COC	contaminant of concern
CPR	cardiopulmonary resuscitation
CRQL	contract-required quantitation limit
DOD	U.S. Department of Defense
DQE	data quality evaluation
DQI	data quality indicator
DPT	direct-push technology
ECD	electron capture donor
EIS	Environmental Information Specialist
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
FTL	Field Team Leader
GC	gas chromatography
GPS	global positioning system
HP	Hewlett Packard
HSP	Health and Safety Plan
ICB	initial calibration blank
ICP	inductively coupled plasma
ICV	initial calibration verification
ID	identification
L	liter
LCS	laboratory control spike
LIMS	Laboratory Information Management System
MDL	method detection limit
mg/kg	milligram per kilogram
mg/L	milligram per liter
mL	milliliter
MNA	monitored natural attenuation
MS	matrix spike

MSD	matrix spike duplicate
NA	not applicable
NaOH	sodium hydroxide
NAPR	Naval Activity Puerto Rico
NAVFAC SE	Naval Facilities Engineering Command Southeast
Navy	U.S. Department of Navy
ND	non-detect
NELAP	National Environmental Laboratory Accreditation Program
NFESC	Naval Facilities Engineering Service Center
NIRIS	Navy Installation Restoration Information System
oz	ounce
PAH	polynuclear aromatic hydrocarbon
PAL	Project Action Limit
PCB	polychloride biphenyl
PM	Project Manager
POC	point of contact
PQO	project quality objective
PREQB	Puerto Rico Environmental Quality Board
PWR	partially weathered rock
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RF	response factor
RPD	relative percent difference
RPM	Remedial Project Manager
RSD	relative standard deviation
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
SDG	sample delivery group
SPCC	system performance check compound
SSC	Site Safety Coordinator
SVOC	semivolatile organic compound
SWMU	solid waste management unit
SWMU 7/8	Solid Waste Management Units 7 and 8
TAL	target analyte list
TBD	to be determined
TCLP	Toxicity Characteristic Leaching Procedure
TWFF	Tow Way Fuel Farm
UCL	upper-bound confidence limit
UFP	Uniform Federal Policy
UST	underground storage tank
VOC	volatile organic compound

SAP Worksheet #2—SAP Identifying Information

Site Name/Number: NAPR, SWMU 7/8

Operable Unit: 2

Contractor Name: AGVIQ-CH2M HILL

Contract Number: N62470-08-D-1006

Contract Title: JM04 Naval Activity Puerto Rico

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) (U.S. Environmental Protection Agency [EPA], 2005) and EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS (EPA, 2002).
2. Regulatory program: Resource Conservation and Recovery Act (RCRA)
3. This SAP is a project-specific SAP.
4. Dates of scoping sessions:

Scoping Session	Date
Site visit – Ceiba, Puerto Rico	December 16, 2008
Site visit – Ceiba, Puerto Rico	January 19 – 23, 2009
Technical Approach Meeting	February 4, 2009

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

Title	Date
Baker Environmental, Inc. (Baker). *Revised Draft RCRA Facility Investigation for Operable Unit 2 (SWMU 7/8)*	June 16, 1997
Baker Environmental, Inc. (Baker). *Revised Final Corrective Measures Study Final Report, Tow Way Fuel Farm*	November 22, 2005
Baker Environmental, Inc. (Baker). *Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds*	October 16, 2006

6. Organizational partners (stakeholders) and connection with lead organization:
   - **EPA Region II** – Regulatory stakeholder overseeing RCRA Ceiba Environmental Restoration Program (ERP) implemented by lead organization.
   - **Puerto Rico Environmental Quality Board (PREQB)** – Regulatory stakeholder overseeing RCRA Ceiba ERP implemented by lead organization.

- **U.S. Naval Facilities Engineering Command Southeast (NAVFAC SE)** - Performs remedial activities at specified sites at the Naval Activity Puerto Rico (NAPR).

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

   - **U.S. Department of Navy (Navy)**

8. The omitted SAP elements excluded and provide an explanation for their exclusion below:

   Crosswalk table is excluded as all required information is provided in this SAP.

SAP Worksheet #3—Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address	Document Control Number
David Criswell Mark E. Davidson	Base Realignment and Closure Program Management Office Southeast (BRAC PMO SE) Remedial Project Manager (RPM)/Lead Navy Point of Contact (POC)	Navy	(843) 743-2130 (843) 743-2124	david.criswell@navy.mil mark.e.davidson@navy.mil	
To be determined (TBD)	Contracting Officer	Navy	TBD	TBD	
TBD	Librarian and Records Manager/Final document archiving	Navy	TBD	TBD	
Amy Wolff (will distribute to the Program Management Office)	Program Assistant/Document Manager	AGVIQ-CH2M HILL	(678) 530-4393	Amy.Wolff@ch2m.com	
Doug Downey	Senior Technical Consultant	AGVIQ-CH2M HILL	(303) 674-6547	Doug.downey@ch2m.com	
Tom Beisel	Project Manager (PM)	AGVIQ-CH2M HILL	(678) 530-4033	Tom.beisel@ch2m.com	
Camden Robinson	Project Chemist and Data Validator	AGVIQ-CH2M HILL	(678) 530-4292	Camden.robinson@ch2m.com	
Thomas Kessler	Senior Geologist	AGVIQ-CH2M HILL	(678) 530-4197	Thomas.kessler@ch2m.com	
Juan Sepulveda,	Puerto Rican Chemist	Pace Analytical Services, Inc.	(386) 676-4840	8 East Tower Circle Ormond Beach, FL 32174	
Janice Shilling	Laboratory PM	Empirical Laboratories, LLC	(615) 345-1115	jshilling@empirlabs.com	

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SAP Worksheet #4—Project Personnel Sign-Off Sheet

Name	Organization/Title/Role	Telephone Number	Signature/E-mail Receipt	SAP Section Reviewed	Date SAP Read
David Criswell Mark E. Davidson	BRAC PMO SE RPM/Lead Navy POC	(843) 743-2130 (843) 743-2124			
Tim Gordon	EPA/Ceiba RPM/Regulatory POC	(212) 637-4167			
Wilmarie Rivera	PREQB/Ceiba RPM/Regulatory POC	(787) 767-8181, ext. 6141			
Theresa Rojas	AGVIQ-CH2M HILL/Program Quality Assurance (QA)/Quality Control (QC) Manager/SAP Review	(678) 530-4297			
Camden Robinson	AGVIQ-CH2M HILL/Navy Program Chemist/SAP Review	(678) 530-4292			
Nancy Ballantyne	AGVIQ-CH2M HILL/Contractor Environmental Manager/Navy contractor primary POC	(720) 286-5561			
Bethany Garvey Duane Johnson	AGVIQ-CH2M HILL/ Environmental Information Specialist (EIS)/Data Tracking and Management	(678) 530-4124 (678) 530-4185			
Kimberley Coke Thomas Kessler	AGVIQ-CH2M HILL/ Geologists/Field Team Leaders (FTLs)	(678) 530-4073 (678) 530-4197			
Janice Shilling	Empirical Laboratories, LLC/Chemist/Laboratory PM	(615) 345-1115			
Juan Sepulveda	Pace Analytical Services, Inc./Puerto Rican Chemist	(386) 676-4840			
TBD	Geoprobe Contractor/Geosierra				

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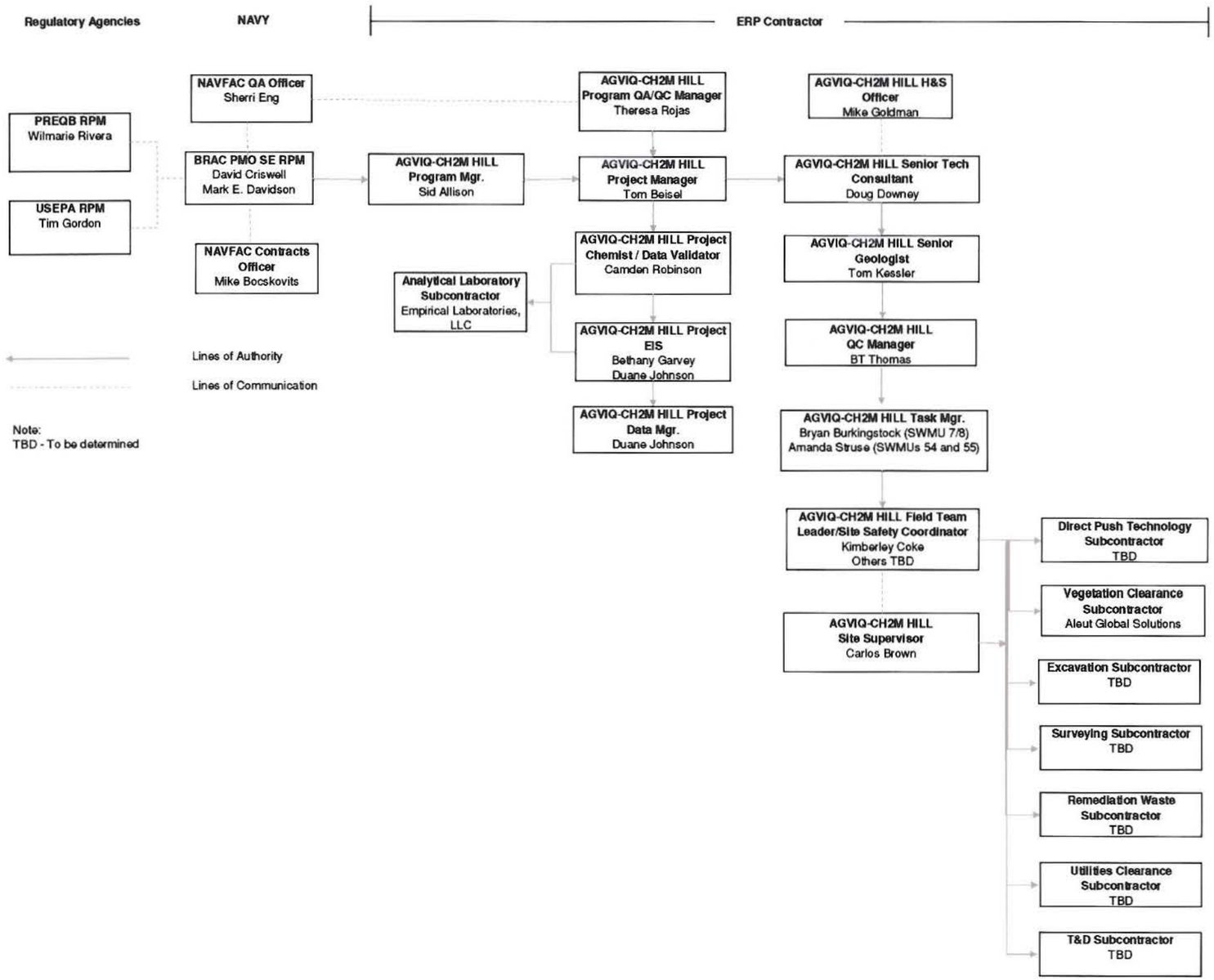
SAP Worksheet #5—Project Organizational Chart



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SAP Worksheet #6—Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-mail	Procedure
Communication to/from Navy (e.g., submission of SAP for review; receipt of regulatory comments, etc.)	Navy RPM	David Criswell Mark E. Davidson	(843) 743-2130/ david.criswell@navy.mil (843) 743-2124/ mark.e.davidson@navy.mil	Primary POC for Navy (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external points of contact.
Communication to/from EPA (e.g., receipt of SAP for review; submission of EPA comments)	EPA RPM	Tim Gordon	(212) 637-4167 Gordon.timothy@epa.gov	Primary POC for EPA (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external points of contact.
Communication to/from PREQB (e.g., receipt of SAP for review; submission of PREQB comments) through Navy POC	PREQB RPM	Wilmarie Rivera	(787) 767-8181, ext. 6141	Primary POC for PREQB (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other internal or external points of contact.
Navy QA/QC input	Navy QAO	Sherri Eng	(757) 322-4366	Provides review comments to Navy contractor on pre-draft SAP via e-mail through Kevin Cloe. Provides overall Navy guidance via direct communication with Navy contractor QAO, as warranted.
Project administration and logistics Communication to/from Navy contractor (e.g., submission of SAP for review; receipt of regulatory comments, updates on project progress, communication of stakeholder expectations, etc.)	AGVIQ-CH2M HILL PM	Tom Beisel	(678) 530-4033	Direct communication (via e-mail, telephone, hardcopy, or in-person, as warranted) to/from Navy contractor project staff to ensure appropriate project implementation. Primary POC for Navy contractor (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other contractor staff, as appropriate.

SAP Worksheet #6—Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-mail	Procedure
Health and safety expectations and procedures	AGVIQ-CH2M HILL Health and Safety Officer	Mike Goldman	(678) 530-4133	Review of Health and Safety Plan (HSP). Direct communication (via e-mail, telephone, hardcopy, or in-person, as warranted) to/from AGVIQ-CH2M HILL project team to ensure implementation of appropriate health and safety procedures.
SAP changes in the field	AGVIQ-CH2M HILL FTL	Kimberley Coke	(678) 530-4073	Documentation of deviations from work plan made in field logbooks and rationale for deviations; deviations made only with approval from AGVIQ-CH2M HILL PM. AGVIQ-CH2M HILL PM will provide written notification to the Navy within 2 days prior to implementation of field change.
Field corrective actions (CAs)	AGVIQ-CH2M HILL FTL	Kimberley Coke	(678) 530-4073	See Worksheets #32 and 32-1. Summary of field CAs taken will be provided to the Navy within 2 days of incident that requires field CA.
Daily Field Progress Reports	AGVIQ-CH2M HILL FTL	Kimberley Coke	(678) 530-4073	FTL will e-mail or fax daily field progress reports to contractor PMs weekly; telephone communication with PMs on as-needed basis
Ensuring staff health and safety in the field	AGVIQ-CH2M HILL Site Safety Coordinator (SSC)	Kimberley Coke	(678) 530-4073	Daily safety tailgates; daily observations; real-time discussions of observations and changes to be implemented with field staff.
Ensuring that the project is meeting the requirements of this SAP and that any problems are corrected and communicated to the project administrator.	AGVIQ-CH2M HILL QC Manager	BT Thomas	(678) 530-4415	Complete daily QC reports and submit to PM and project administrator weekly.

SAP Worksheet #6—Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or E-mail	Procedure
Data tracking from collection through upload to database	AGVIQ-CH2M HILL EIS	Bethany Garvey Duane Johnson	(678) 530-4124 (678) 530-4185	EIS will track data from sample collection through upload to database, ensuring QAPP requirements are met by laboratory and field staff. Tracking involves receipt of electronic and hardcopy data from laboratory and data validator. EIS communicates with AGVIQ-CH2M HILL project chemist, laboratory PM, and data validator PM, as warranted, to ensure adherence to project analysis and validation requirements. EIS also coordinates data upload with contractor database manager.
Uploading project data and maintaining the database to ensure data are stored properly and can be retrieved by the EIS.	AGVIQ-CH2M HILL Database Manager	Duane Johnson	(678) 530-4185	Once contractor chemist ensures data are appropriate for upload to database, EIS submits data electronically to contractor database manager, who uploads data to database.
Reporting lab data quality issues	Laboratory PM	TBD	TBD	All QA/QC issues with project field samples will be reported by the lab to the EIS, Project Chemist, and Contractor QAO via e-mail within 2 business days.
Analytical CAs	AGVIQ-CH2M HILL Project Chemist	Camden Robinson	(770) 439-8363	See Worksheets #24, 25, and 28 for analytical CAs. Summary of analytical CAs will be issued to the Navy within 2 days of the incident that requires CA.
Validated data	Data Validator PM	Camden Robinson	(770) 439-8363	Data validator provides data validation reports (electronic and hardcopy) that provide the data qualifiers and associated explanations.
Release of analytical data for upload to database	AGVIQ-CH2M HILL Project Chemist	Camden Robinson	(770) 439-8363	Upon review of validated data to ensure adherence to project requirements, project chemist communicates via e-mail to EIS that data are ready for release (i.e., upload to database).

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SAP Worksheet #7—Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications[a]
David Criswell Mark E. Davidson	BRAC PMO SE RPM	Navy	ERP activities implemented under this SAP.	
Sherri Eng	QAO	Navy	Navy review of SAP and QA input.	
Pedro Ruiz	Ceiba ERP Site Manager	Navy	On-island Navy liaison; provides logistical support for implementation of ERP activities under this SAP.	
Tom Beisel	PM	AGVIQ-CH2M HILL	Project administration; coordinates staffing; monitors project performance; directs and oversees project staff.	B.S., Geology; over 18 years experience in project management, including staff supervision and project performance monitoring
Theresa Rojas	Program QA/QC Manager	AGVIQ-CH2M HILL	Oversees compliance with program and project-specific quality requirements.	B.S., Chemistry; over 20 years experience in laboratory analysis, sampling, data validation, and field testing; over 15 years experience in construction quality management
Eric Burrell	QC Coordinator	AGVIQ-CH2M HILL	Oversees project-specific QC requirements.	B.S., Civil Engineering; over 5 years experience in construction quality management
Camden Robinson	Project Chemist Data Validator	AGVIQ-CH2M HILL	Establishes laboratory scope of work; ensures selected laboratory can meet project-required analytical protocol; primary communications with laboratory and data validator; performs data quality evaluation (DQE) to determine availability of analytical data. Responsible for validating analytical data in accordance with project-specific UFP-SAP.	B.S., Chemistry; over 5 years experience in chemistry, including laboratory analysis, sampling, data validation, and field testing

SAP Worksheet #7—Personnel Responsibilities and Qualifications Table (continued)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications[a]
Bryan Burkingstock Amanda Struse	Task Manager	AGVIQ-CH2M HILL	Coordinates staffing; directs and oversees project staff; supervises field sampling and coordinates all field activities; ensures onsite compliance with work plan; oversees and ensures safety of onsite personnel.	Mr. Burkingstock has an M.S. and a B.S. in Hydrogeology and over 11 years experience; Ms. Struse has an M.S. in Environmental Engineering, a B.S. in Chemical Engineering, and over 8 years experience in task management, including staff coordination and supervision, project compliance, and safety assurance
Kimberley Coke	FTL and SSC	AGVIQ-CH2M HILL	Supervises field sampling and coordinates all field activities; ensures onsite compliance with work plan; oversees and ensures safety of onsite personnel.	M.S., Hydrogeology, and B.S., Environmental Resource Studies; over 2 years experience in well installation and development, soil characterization, soil and groundwater assessment and data evaluation
BT Thomas	QC Manager	AGVIQ-CH2M HILL	Responsible for daily QC reports, oversight of quality. Monitor and report on subcontractor quality and quantities and audit subcontractors' offsite fabrication. Maintain Submittal Register. Participate in continuous improvement of project team and maintain lessons learned log.	Ph.D., M.S., B.S., Geology; over 7 years experience in environmental remediation, specializing in passive water treatment
Mike Goldman	Health and Safety Officer	AGVIQ-CH2M HILL	Responsible for overall Navy program health and safety performance; reviews project-specific HSP; interacts with SSC to ensure project-specific safety of field personnel.	B.S., Biology; over 22 years experience in health and safety, including preparing, implementing, and ensuring compliance with project-specific HSPs
Duane Johnson	Database Manager	AGVIQ-CH2M HILL	Uploads validated data to environmental database. Manages sample tracking; coordinates assimilation of data from field collection through analysis, validation, and upload to environmental database; performs data queries for data evaluation and report writing.	B.S., Chemistry; over 8 years experience designing data management systems, sample tracking, coordinates e-data deliverables with the laboratory, data validation and quality evaluation, and report preparation

SAP Worksheet #7—Personnel Responsibilities and Qualifications Table (continued)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications[a]
Janice Shilling	QAO, Organics Department Manager, Inorganics Department Manager, and PM	Empirical Laboratories, LLC	Responsible for laboratory QA program and review of QC data. Responsible for oversight, QC, and data review of organics and inorganics laboratory. Laboratory POC and overall manager for analytical work.	
Juan Sepulveda	Puerto Rican Chemist	Pace Analytical Services, Inc.	Responsible for certifying laboratory data	
TBD	TBD	Drilling Subcontractor	Responsible for performing slide-hammer, direct-push, or similar means for soil sampling; responsible for monitoring well installation.	
Aleut	NA	Vegetation Clearance Subcontractor	Responsible for vegetation clearance, as necessary, to access sites and sample locations.	
TBD	TBD	Excavation Subcontractor	TBD	
TBD	TBD	Surveying Subcontractor	Responsible for horizontal coordinate and vertical elevation surveying of newly installed monitoring wells.	
TBD	TBD	Geoprobe subcontractor	Responsible for providing the drill rig, personnel, and equipment necessary to collect the confirmatory soil samples	
TBD	TBD	Remediation Waste Subcontractor	Responsible for transport and disposal of remediation waste deemed necessary for offsite disposal.	

Notes:

[a] Resumes are maintained by the individuals' organizations and are available upon request; upon execution of the project, staff may be removed (if unnecessary to project execution) and other staff may be added or substituted, as necessary and available.

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SAP Worksheet #8—Special Personnel Training Requirements Table

Project Function	Specialized Training by Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/Organizational Affiliation	Location of Training Records/Certificates
Field activities	Cardiopulmonary resuscitation (CPR)/First Aid Training	Various qualified training organizations	Training will be verified as current prior to starting field activities	AGVIQ-CH2M HILL SSC	AGVIQ-CH2M HILL SSC	AGVIQ-CH2M HILL Human Resources
Field activities	SSC-hazardous waste training	Various qualified training organizations	Training will be verified as current prior to starting field activities by SSC	AGVIQ-CH2M HILL SSC	AGVIQ-CH2M HILL SSC	AGVIQ-CH2M HILL Human Resources

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SAP Worksheet #9a—Project Scoping Session Participants Sheet

Project Name: SWMU 7/8	
Projected Date(s) of Sampling: March 2009	**Site Name:** NAPR
PM: Tom Beisel	**Site Location:** Ceiba, Puerto Rico
Dates of Session: December 16, 2008 **Scoping Session Purpose:** Site visit to SWMU 7/8 to familiarize project team with site layout, meet Navy and AGVIQ-CH2M HILL personnel, and gauge select wells.	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Tom Beisel	Project Manger	AGVIQ-CH2M HILL	678-530-4033	Tom.Beisel@ch2m.com	Project Manger
Thomas Kessler	Senior Geologist	AGVIQ-CH2M HILL	678-530-4197	Thomas.Kessler@ch2m.com	Senior Geologist
Bryan Burkingstock	Project Geologist	AGVIQ-CH2M HILL	678-530-4060	Bryan.Burkingstock@ch2m.com	Task Manager for SWMU 7/8
Kimberley Coke	Project Geologist	AGVIQ-CH2M HILL	678-530-4073	Kimberley.Coke@ch2m.com	FTL/SSC
Amanda Struse	Project Engineer	AGVIQ-CH2M HILL	678-530-4339	Amanda.Struse@ch2m.com	Task Manager for SWMUs 54 and 55
BT Thomas	Project Geologist	AGVIQ-CH2M HILL	678-530-4415	BT.Thomas@ch2m.com	QC Manager

Comments/Decisions: Second visit required to locate wells, clear site, and perform a comprehensive round of gauging.

Action Items: Product data will be used to finalize the optimization report and determine an action plan for well installation. Also, determined that clearing of site was necessary to mark soil delineation sample locations.

Consensus Decisions: Scheduled trip to perform clearing, gauging, and staking of delineation sample locations. Date set to complete tasks during the week of January 19, 2009.

SAP Worksheet #9b—Project Scoping Session Participants Sheet

Project Name: SWMU 7/8	
Projected Date(s) of Sampling: March 2009	**Site Name:** NAPR
PM: Tom Beisel	**Site Location:** Ceiba, Puerto Rico

Dates of Session: January 19 – 23, 2009
Scoping Session Purpose: Oversight of clearing operations, marking locations of all wells, comprehensive round of well gauging, stake grids for areas A, B, and C, and interview personnel.

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Thomas Kessler	Senior Geologist	AGVIQ-CH2M HILL	678-530-4197	Thomas.Kessler@ch2m.com	Senior Geologist
Bryan Burkingstock	Project Geologist	AGVIQ-CH2M HILL	678-530-4060	Bryan.Burkingstock@ch2m.com	Task Manager for SWMU 7/8
Kimberley Coke	Project Geologist	AGVIQ-CH2M HILL	678-530-4073	Kimberley.Coke@ch2m.com	FTL/SSC
Philip Jones	Project Engineer	AGVIQ-CH2M HILL	678-530-4191	Philip.Jones@ch2m.com	Field Team Personnel
Doug Downey	Senior Engineer	AGVIQ-CH2M HILL	303-674-6507	Doug.Downey@ch2m.com	Senior Technology Consultant

Comments/Decisions: Test pits maybe necessary to determine if product is present south of Forrestal Drive. The test pits would be located along old fuel system pipeline corridors. Determined some missing wells and found several wells that were not shown on existing figures. Soil sampling will require direct-push technology (DPT) in order to obtain samples in those areas where the soil is too hard to hand auger. Asphalt fragment and debris were located in areas targeted for confirmatory sampling. This may be related to historical polynuclear aromatic hydrocarbon (PAH) exceedences. Also, steep topography may hinder ability to excavate certain areas.

Action Items: Modify sampling approach to include DPT. Sampling team must use discretion when collecting samples to avoid incorporation of asphalt debris with soil sample. Add test pits south of Forrestal Drive to test for the presence of product.

Consensus Decisions:

SAP Worksheet #9c—Project Scoping Session Participants Sheet

Project Name: SWMU 7/8	
Projected Date(s) of Sampling: March 2009	**Site Name:** NAPR
PM: Tom Beisel	**Site Location:** Ceiba, Puerto Rico
Dates of Session: February 4, 2009 **Scoping Session Purpose:** Present and discuss technical approach for delineation sampling.	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
David Criswell	BRAC PMO SE RPM	Navy	843-743-2130	david.criswell@navy.mil	Primary Navy POC
Tom Beisel	Project Manger	AGVIQ-CH2M HILL	678-530-4033	Tom.Beisel@ch2m.com	Project Manger
Doug Downey	Senior Engineer	AGVIQ-CH2M HILL	303-674-6507	Doug.Downey@ch2m.com	Senior Technology Consultant
Thomas Kessler	Senior Geologist	AGVIQ-CH2M HILL	678-530-4197	Thomas.Kessler@ch2m.com	Senior Geologist
Bryan Burkingstock	Project Geologist	AGVIQ-CH2M HILL	678-530-4060	Bryan.Burkingstock@ch2m.com	Task Manager for SWMU 7/8
Kimberley Coke	Project Geologist	AGVIQ-CH2M HILL	678-530-4073	Kimberley.Coke@ch2m.com	FTL/SSC
Theresa Rojas	QA/QC Manager	AGVIQ-CH2M HILL	678-530-4297	Theresa.Rojas@ch2m.com	Program QA/QC Manager
Shruti Shah	Environmental Scientist	AGVIQ-CH2M HILL	678-530-4316	Shruti.Shah@ch2m.com	UFP-SAP Coordinator
Amanda Struse	Project Engineer	AGVIQ-CH2M HILL	678-530-4339	Amanda.Struse@ch2m.com	Task Manager for SWMUs 54 and 55

Comments/Decisions: Technical approach was approved by the Navy RPM.

Action Items: Complete UFP-SAP with technical approach.

Consensus Decisions:

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SAP Worksheet #10—Problem Definition

General

In general, the objective at SWMU 7/8 is to conduct delineation sampling in order to do the following:

- Determine the horizontal extent of excavation for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene.
- Determine if arsenic contamination found in SWMU 7/8 is naturally occurring based on historical background levels.
- Determine soil contamination areas above chemical-specific CAOs that would need to be excavated. Excavation will be conducted until the upper-bound confidence limit (UCL) 95% is below the chemical-specific CAOs.
- Determine handling and disposal of aqueous waste by collecting aqueous samples for waste characterization.
- Confirm the current horizontal extent of free product that was presented in the approved final Corrective Measures Study (CMS) by measuring depth to water and product using an oil/water interface probe.

Background and Potential Release History

The NAPR occupies over 8,600 acres at the northeastern most portion of Puerto Rico along the Vieques Passage (Figure 1). The northern entrance to NAPR is about 35 miles east along the coast road (Route 3) from San Juan. The facility was commissioned in 1943 as a Naval Operations Base, but was re-designated a Naval Station in 1957. The Tow Way Fuel Farm (TWFF) is located on a hillside along Forrestal Road north of Ensenada Honda (Figure 2). The TWFF was constructed prior to 1957 and originally consisted of nine bomb-proof underground storage tanks (USTs). The tanks were used for the storage of marine diesel fuel, jet fuel (JP-5), and Bunker C fuel. Closure for tanks 56A and B was completed in November 1996 by Reliable Mechanical, Inc. Two 10,000-gallon steel tanks were removed, and 329 tons of contaminated soil were bio-remediated and disposed of as non-regulated waste. Seven USTs remain: 82, 83, 84, 85, 1080, 1082, and 1088. However, on March 31, 2004, Base operations, including the storage and distribution of fuel, were discontinued and all USTs were drained and are currently empty. During the facility's operational history, numerous releases have occurred from the various storage tanks resulting in the release of almost one million gallons of petroleum hydrocarbons to the environment.

Regulatory History

The EPA Region II is the primary agency that regulates environmental activities at the NAPR, and site work is performed under RCRA Administrative Order on Consent-7003. However, PREQB also provides regulatory input. The EPA has assigned the following SWMU designations to the TWFF:

- SWMU 7 - Encompasses environmental impacts associated with releases that emanated from the nine original USTs (currently seven in place) located on a hillside along Forrestal Drive north of Ensenada Honda.

- SWMU 8 – Encompasses the TWFF Sludge Disposal; however, previous investigations were unable to locate evidence of the pits. As a result, the EPA combined SMWU 8 with SWMU 7.

Site Geology and Hydrogeology

The geology of NAPR consists of the four geologic units: fill, soil consisting of saprolite and partially weathered rock (PWR), bedrock, and marine sediments. The fill material is comprised of fine to medium grained sand with varying amounts of silt and clay. The fill occurs at ground surface to depths as great as 25 feet below ground surface (bgs) in areas of the site that have been reworked. The fill is a combination of reworked native soil (silt, clay, and sand) and/or dredge material from Ensenada Honda. Soil consisting of saprolite (clayey-silt to silty-clay with rock fragments) and PWR gabbro bedrock underlies the fill. Soil beneath the fill is comprised of clayey-silt and silty-clay, with rock fragments of varying size. The percentage of rock fragments increases with depth and grades into PWR zone that contains weather gabbro rock fragments with occasional clay seams. There is no well-defined contact between the residual soil and bedrock; rather, a gradational change of decreased weathering and fracturing occurs with increasing depth. The thickness of this soil and PWR unit is variable and in some places is over 40 feet. Bedrock underlies the PWR. Bedrock consists of gabbro that is hard and massive in some places; however, a few zones are highly fractured due to tectonic deformation The final zone is a zone of marine sediments located in the lowland area of the site near the Ensenada Honda. The sediments consist of silt with lesser amounts of sand and clay with coral and shell fragments.

Groundwater beneath the site occurs at depths ranging from about 4 to 112 feet bgs. The depth to water is greatest in the upland areas of the site and is shallowest nearest the Ensenda Honda. Water level changes in the upland and lowland areas are likely caused by seasonal variations in precipitation. In the lowland area south of Forrestal Drive, water levels fluctuations are also a result of tidal influence. The primary direction of flow is south towards the Ensenda Honda with an average hydraulic gradient of 0.0063 foot/foot.

Test data collected indicate the hydraulic conductivity of the water table aquifer ranges from 0.113 to 13.685 feet/day (Baker, 2001). Aquifer pumping tests performed at pumping well PW-3 and recovery well RW-4 indicate the yield of the aquifer is extremely low, as pumping rates of 0.009 and 0.13 gallon per minute were achieved in PW-3 and RW-4, respectively. The low permeability of the formation is the primary reason cited by Baker and others for inability to rapidly recover product. (Baker, 1999)

In groundwater, 1,2,4-trimethylbenzene, benzene, ethylbenzene, and product are the primary contaminants of concern (COCs) beneath the TWFF. As of July 2008, product was confined to monitoring wells UGW25 and MTMW01 (Figure 5). AGVIQ-CH2M HILL's review of over 12 years of site data indicates that the majority of the product is present in the saprolite and PWR that mantle bedrock, and given the low permeability of the gabbro, little if any is present in the bedrock. Additionally, the decrease in fractures with increasing depth limits the vertical migration of product within bedrock. Previous data suggest the bedrock acts like a confining or semi-confining unit; therefore, product, if present, most likely occurs in fractures and cracks within the upper portion of bedrock (Baker, 1996).

Synopsis of Secondary Data

Product Distribution

Between the first quarter of 2003 through July 2008, Baker performed additional site work to determine the extent of product, evaluate product recovery rates, conduct a risk assessment, and monitor the configuration of the product plume. The results of their work culminated in the development of the final CMS report that was submitted to the EPA in November 2005. The EPA approved the final CMS on February 9, 2008.

The historical distribution of product is illustrated on Figure 4, which highlights every well that has had product historically detected. Additionally, test data from work performed by McLaren/Hart in 1999/2000 indicated that an area of product exists south of Forrestal Drive.

In July 2008, product was measured in wells UGW25 (thickness = 0.61 foot) and MTMW01 (thickness = 3.39 feet) (Baker, 2008), as shown on Figure 5. However, review of available well construction data and cross-sections shows that many of the wells are screened below the water table and do not allow product a pathway to enter the well. Therefore, it is probable that the actual distribution of product may be greater than depicted on both historical and current product distribution maps. Additionally, the 1999/2000 study performed by McLaren/Hart shows that product was present along Palau Street. This area of product is not addressed by the product recovery remedy proposed by Baker. Lastly, product was also historically detected in UGW10 located near the beachhead.

Review of the hydrogeologic data suggests that most of the product is present in the PWR zone that overlies the Gabbro bedrock. Given the low permeability of the Gabbro bedrock (note Baker's studies suggest the bedrock acts like a confining or semi-confining unit), any remaining product is likely to be present in the fractures and cracks of the PWR described in the next section.

Soil

The Corrective Action Objectives (CAOs) were presented in the final CMS (Baker, 2005). The CAOs listed for surface soil were based on exposure to industrial workers, and the CAOs for total soil were based on exposures to a future construction worker. Table 1 includes the CAOs for the PAHs and arsenic from the final CMS.

TABLE 1
Soil CAOs

Chemical	Surface Soil CAO[a] (milligrams per kilogram [mg/kg])	Total Soil CAO[b] (mg/kg)
Arsenic	2.65	Not applicable (NA)
Benzo(a)anthracene	2.9	73
Benzo(a)pyrene	2.9	7.3
Benzo(b)fluoranthene	2.9	73
Indeno(1,2,3-cd)pyrene	2.9	73

Notes:

[a] Based on industrial worker protection
[b] Based on construction worker protection

As previously indicated, the CAOs were proposed and then approved by the EPA; therefore, these existing CAOs will be used as sampling criteria during the verification sampling discussed later in this section. The CAOs for PAHs are based on a target risk level of 1E-6 for arsenic and all PAHs, except for benzo(a)pyrene, which is based on a target risk level of 1E-5. During the sampling, site-wide UCL 95% will be within these target levels. However, based on 21 background samples previously collected between 1996 and 2004 and literature data collected on soil on the island of Puerto Rico, proposed arsenic levels (Table 1) are within typical background levels for arsenic in natural soil (Baker, 2006). The background surface soil concentrations collected between 1996 and 2004 ranged from non-detect (ND) to 2.5 mg/kg (Baker, 2006). Therefore, during the delineation of arsenic in soil, the limits of excavation will take into account the natural occurrence levels for arsenic for the TWFF area. The chemical-specific technical basis is discussed further in the following text.

Arsenic

Arsenic is a common, naturally occurring inorganic metal present in Puerto Rico soils. Based on publications for Puerto Rico, arsenic occurs at concentrations ranging from less than 1 to 22 mg/kg (Agency for Toxic Substances and Disease Registry [ATSDR], 2003). Also, arsenic is not a specific contaminant of fuel oils, and no other metals (i.e., chromium) were identified as a COC for soil beneath the site.

Soil samples collected by Baker from the TWFF contained arsenic ranging from ND to 3.4 mg/kg. Arsenic results for soil within the TWFF will be estimated for the upper-bound estimate of the mean (e.g., UCL 95%), and these values will be compared against the UCL 95% mean of the background arsenic. This comparison of the UCL 95% background values to the UCL 95% within the TWFF will be used to statistically determine if arsenic is of natural origin or was introduced by past Navy activities at the site. Finally, if the UCL 95% for TWFF exceeds both UCL 95% background levels and the 2.65 mg/kg CAO, these areas will be designated arsenic-impacted soil requiring excavation. Arsenic was not a COC for subsurface soil below a depth of 2 feet; therefore, no additional subsurface soils will be collected for the analysis of arsenic.

Polynuclear Aromatic Hydrocarbons

PAH compounds are present in soil within isolated areas of SWMU 7/8 at levels above CAOs protective of industrial worker exposures in surface soil, and construction worker protection for total soil. These areas will be addressed by excavation of soil where benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene contamination exceed the CAOs.

The PAHs are present in heavy oils and partially burned fuels and oils, are ubiquitous in urban and industrial environments, and are frequently detected in environmental media. They occur at relatively low levels in gasoline, jet fuel and diesel, and occur at higher levels in used motor oil, creosote, asphalt used in road pavements, and sealants of large, older USTs/aboveground storage tanks. Given the numerous releases that have occurred at the TWFF, it is likely that some of the PAH compounds present in soil at SWMU 7/8 are attributable to past releases, as well as from non-point source runoff. Considering that some of the analytical data used to prepare the individual PAH distribution maps presented in the final CMS were greater than 10 years old (note: surface soil PAHs degrade rapidly in tropical environments due to photo-degradation), AGVIQ-CH2M HILL will collect additional soil samples to determine current concentrations of benzo(a)anthracene,

benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene in soil, and determine the extent of soil above the CAOs requiring excavation.

Excavation will be completed when verification soil samples indicate that UCL 95% of the mean for each PAH fall below the site-wide CAO for each PAH. Because PAHs were only identified as COCs in the upper 2 feet of soil, no samples will be collected below a depth of 2 feet.

Problem Definition

The regulatory-approved remedial action for SWMU 7/8, as described in the final CMS, includes the excavation of the upper 2 feet of soil in three areas of the SWMU 7/8. The excavation will avoid future potential exposure to industrial workers by removing concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic that exceed the approved cleanup criteria, as stated in Table 1 (Baker, 2005). The approximate limits of these excavation areas are shown on Figure 6. Baker estimated the aerial extent of contamination through the extrapolation of limited test data using the Natural Neighbor interpolation approach of the computer model "GMS v5.1" (Baker, 2005). Given the speculative nature of contaminant extent and the potential for natural degradation of the PAHs, AGVIQ-CH2M HILL proposes to perform a pre-excavation assessment of SWMU 7/8 to verify the horizontal extent of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic in soil. Because the CAOs in subsurface soil for benzo(a)pyrene (7.3 mg/kg) were not exceeded, the collection of samples below 2 feet is not required.

Current well gauging data indicates that product is limited to UGW25 and MTMW01; however, historical test data indicate the aerial extent of product was much greater (compare Figures 4 and 5). Review of the well construction records suggests that many of the wells that historically contained product were screened below the water table, suggesting that the amount of product surrounding the wells was of sufficient volume to depress the water table to allow product to enter the well, and/or that product entered the well during fluctuations in the water table surface. It is possible that the installation of new wells with screened intervals across the water table will reveal a more widespread area of product and a need for more extensive remediation.

Environmental Questions to be Answered by the Pre-Excavation Work

1. **Are current concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic detected in soil above the CAOs?**
   The additional soil data collected during the delineation sampling event will be compared to the data from 1997 and 2003 in order to determine if concentrations still exceed the CAOs.

2. **Is arsenic naturally occurring at SWMU 7/8?**
   Arsenic is naturally occurring in soils around the SWMU 7/8 area. A background study was previously conducted by collecting soil samples, and arsenic background levels were assessed for surface and subsurface soils in the area. These background arsenic data will be used for comparison against newly collected arsenic samples.

3. **What are the actual limits of excavation in each of the three areas?**
   Data results from the delineation sampling event will define the horizontal extent of contamination. None of the areas of interest will be excavated below 2 feet. No confirmation sampling is planned for the areas after excavation. The samples collected from the evenly

spaced grid locations remaining at the site outside of excavation areas that have concentrations below CAOs will be used as the representative residual concentrations.

4. **What are the characteristics of the aqueous waste?**
   Data results from the pre-excavation sampling event will determine how aqueous waste will be handled and disposed.

5. **What is current distribution of product?**
   A comprehensive round of well gauging will be completed in order to determine the distribution of product. Once evaluated, the data will be used to optimize the approach for product recovery.

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

1. **Who will use the data and what will the data be used for?**
   The Navy, EPA, PREQB, subcontractors, and AGVIQ-CH2M HILL will use the data collected during the delineation sampling event (as well as relevant historical data) to define horizontal excavation limits, determine if PAH and arsenic levels are above CAOs, and determine the current extent of product on the water table. The recent product distribution combined with historical data will also be used to optimize product recovery efforts.

2. **What are the Project Action Limits (PALs)?**
   The approved actions for soil are addressed under Alternatives 1 and 3 in the final CMS (Baker, 2005). Under these alternatives, excavation and disposal of all soil from 0 to 2 feet bgs above the CAOs will be performed. The surface soil CAOs are: arsenic (2.65 mg/kg), benzo(a)anthracene (2.9 mg/kg), benzo(a)pyrene (2.9 mg/kg), benzo(b)fluoranthene (2.9 mg/kg), and indeno(1,2,3-cd)pyrene (2.9 mg/kg). Arsenic has been determined to be naturally occurring at a background level of 2.65 mg/kg for surface soil (Baker, 2006). Action limits for the COCs are the cleanup levels listed in Worksheets #10 and 15. The PALs for product removal is that product thickness in all wells must be less than 0.01 foot. The PALs for waste characterization are provided in Worksheet #15.

3. **What types of data are needed (matrix, target analytes, analytical groups, field screening, onsite analytical or offsite laboratory techniques, sampling techniques)?**
   Worksheets #10 and 17 contain detailed information on the types of data needed for this project. Up to 72 soil borings will be sampled at SMWU 7/8 using either hand tools or DPT. The specific sampling method will be determined based on field conditions. During the collection of delineation samples, soil borings will be offset if refusal occurs before reaching 2 feet bgs, if rock or asphalt fragments are encountered within the upper 6 inches of soil, or if utilities (above or below ground) are encountered. The delineation soil sampling will be conducted according to the following procedure: from five random intervals within the sample interval (0 to 2 feet), collect several spoonfuls of soil and place into a stainless steel bowl to form a composite soil sample. Homogenize the sample using the stainless steel spoon. Fill the appropriate sample jars full with the homogenized sample. Close the jar, label, and package the sample for shipment to the laboratory. The sampling equipment will be decontaminated prior to each borehole sample collected to prevent potential cross-contamination. Samples will be analyzed at an offsite laboratory for COCs, PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene), and inorganic arsenic. At the conclusion of the sampling event, one aqueous waste characterization sample will be collected and analyzed for RCRA compounds (see Worksheet #15 for specific compounds), reactivity (sulfide and cyanide), ignitability, and corrosivity as pH.

   Soil sampling will be done in general accordance with the applicable standard operating procedures (SOPs) in Appendix B. Sample analyses for all sites will be conducted by an offsite laboratory in accordance with Worksheets #15, 19, 23, 24, 25, 28, and 30, and additional details are noted below.

4. **How "good" do the data need to be in order to support the environmental decision?**

Soil samples will be collected in each area using 50-foot evenly spaced grid locations over each of the excavation areas shown on Figure 7 (USEPA, 1992). These grid locations will be used to select the smallest area required for excavation. Excavation will include the area around an elevated concentration to the mid-point between it and the nearest clean sample.

Arsenic results for soil within the TWFF will be estimated for the UCL 95%, and these values will be compared against the UCL 95% mean of the background arsenic. This comparison of the UCL 95% background values to the UCL 95% within the TWFF will be used to statistically determine if arsenic is of natural origin or was introduced by past Navy activities at the site. Finally, if the UCL 95% for TWFF exceeds both UCL 95% background levels and the 2.65 mg/kg CAO, these areas will be designated for soil excavation. Starting with the most highly contaminated areas, excavation will be conducted until the site-wide UCL 95% is below the CAO. Excavation will be conducted from the highest concentration point to the mid-point of the nearest clean sample, until UCL 95% is below the CAO. The nearest clean sample and the clean fill material levels will be used as the residual concentrations for inclusion in the residual UCL 95% estimates to document achieving the CAOs.

The PAHs, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene, in the newly collected samples will also be evaluated for CAO exceedences by comparing the site-wide UCL 95% against the respective CAOs. If the UCL 95% concentration exceeds the respective CAO, the sample locations with the highest concentrations will be identified for excavation. Excavation will be conducted from the highest concentration point to the mid-point of the nearest clean sample, until UCL 95% is below the CAO.

As previously stated, no confirmation soil sampling will be conducted, as the evenly spaced grid sampling combined with existing data will yield a sufficient number of samples for residual levels in surface and subsurface soils. Also, used clean fill will be sampled, and its levels will be used as representative residual concentrations. The clean fill concentration values will be used as the representative concentrations for the excavated highest concentration locations.

All soil data will be validated against QA/QC criteria and measurement performance criteria listed in this SAP and certified by a Puerto Rican chemist, Juan Sepulveda, Pace Analytical Services, Inc. Level IV package and QC sampling are required. Data will be used to evaluate the effectiveness of the CA at SWMU 7/8 as stated in the final CMS. QC data requirements are detailed in Worksheet #20. The waste characterizations data will be evaluated by the project chemist to ensure quantitation limits (QLs) are met. A Level III package is required.

Data need to be sufficient to meet the following:

Visual Observations – Visual observations will be used at various sites to determine the presence or absence of product, hydrocarbon staining, and soil moisture conditions. As such, the data are considered qualitative in that they do not need to provide an exact or quantified value.

Offsite Analytical Data – The data need to be "good" enough to evaluate results of delineation soil sampling at SWMU 7/8. Ensuring data are "good" enough for this purpose is done via employing appropriate analytical protocol, validating the resulting data, including QA/QC samples to verify proper sampling and analysis protocol, and performing a DQE to assess the

availability and usability of the data for the intended purpose. Each of these is further discussed below:

- Appropriate Analytical Protocol - See Worksheets #15, 19, 23, 24, 25, 28, and 30, and Item 5 below.

- Data Validation - Validation of data increases the level of confidence in a data set for a particular data use. The particular type and level of validation necessary to achieve acceptable confidence is subjective. In other words, the appropriate type and level of data validation is not an absolute. Rather, it is data use- and data user-specific. For the pre-excavation assessment sampling event, analyses for potential contaminants will be certified by a Puerto Rican chemist, 90 percent of the data will be validated by an AGVIQ-CH2M HILL data validator, and 10 percent of the data will be validated by a third party validator (eDATApro) using guidance from the validation criteria outlined by the U.S. Department of Defense (DOD) Quality Systems Manual (QSM). The validation criteria and guidance documents are listed in Worksheet #36. These documents will help the validators create a thorough and systematic approach to the validation process. The data validator will also recalculate 100 percent of the results from the raw laboratory data, which may identify laboratory errors in identification or quantification, if present.

- QA/QC Samples - During the delineation sampling event, QA/QC samples will be collected as a check on sampling and analytical protocol. Like data validation, the appropriate type and quantity of QA/QC samples is not an absolute. For the delineation sampling event, field duplicates will be collected at a frequency of 1 per 10 field samples per matrix. Field duplicates help assess sample collection techniques and laboratory precision. Matrix spike/matrix spike duplicates (MS/MSDs) are collected at a frequency of 1 pair per 20 field samples per matrix. The frequency is such that there is one MS/MSD pair per laboratory analytical batch. MS/MSD samples are often required by the analytical method and/or data validation guidance. Equipment blanks are collected at a frequency of 1 per day per decontaminated equipment. Equipment blanks help assess equipment decontamination techniques and identify when contamination may have been carrying over from one sample location to another. It is important to maintain this equipment blank frequency because the equipment blank is collected after visiting the most contaminated location, and it is important to not associate too many locations with the potentially-contaminated equipment blank. Trip blanks are collected at a frequency of one per cooler containing volatiles. Trip blanks accompany the empty sample containers while they are stored at the laboratory or shipped to the site, and while they are full and shipped back to the laboratory. Trip blanks are useful for assessing whether or not there is any contamination during periods of time when the samples are not directly supervised. No field blanks will be collected unless on a particular day of sampling, the ambient conditions suggest airborne particulates may contaminate the samples being collected.

- Data Quality Evaluation - In order to support the environmental decision, each result must be *available* to and *usable* for the project team. All data sets will undergo a DQE prior to using the data to make site-specific determinations. The terms *data availability* and *data usability* and the DQE process in general are described in Worksheet #37.

5. **How much data should be collected (number of samples for each analytical group, matrix, and concentration)?**
   Samples will be collected from evenly spaced grids spanning across each area identified for CA in the CMS, as shown on Figure 7. Detailed information on how much data will be collected is provided in Worksheets #10, 15, and 17. The number of QA/QC samples is detailed in Worksheet #20. Up to 72 soil borings will be collected at SMWU 7/8, based on the grids superimposed on the excavation areas established in the final CMS. Soil boring samples will be collected and analyzed for the COCs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd) pyrene, and arsenic in order to evaluate the effectiveness of the CA at SWMU 7 and 8. At the conclusion of the sampling event, one waste characterization sample will be collected and analyzed for RCRA compounds (see Worksheet #15 for specific compounds), reactivity (sulfide and cyanide), ignitability, and corrosivity as pH.

6. **Where, when, and how should the data be collected/generated?**
   Figure 7 shows the tentative sampling locations for the delineation sampling at SWMU 7/8. The SOPs are provided as Appendix B, and the sampling schedule is outlined in Worksheet #16. Sample collection will occur in March 2009 at SMWU 7/8.

7. **Who will collect and generate the data? How will the data be reported?**
   AGVIQ-CH2M HILL will collect the soil borings and an aqueous waste characterization samples. Analytical data will be generated by Empirical Laboratories, LLC. Two weeks following the certification of the laboratory data by a Puerto Rican chemist, and the validation of the laboratory data, AGVIQ-CH2M HILL will submit a letter-report to the PREQB to document the findings obtained during the pre-excavation assessment. The report will include the following:

   - Tabulated environmental-media analytical data
   - Map(s) illustrating the horizontal extent of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic in soil
   - Figure illustrating excavation dimensions based on pre-excavation assessment data

   The soil data will then be presented to the stakeholders via technical memorandums completed subsequent to the pre-excavation assessment event to summarize results and provide recommendations as appropriate. The aqueous waste characterization data will be presented to the Navy and the receiving facility to determine and ensure appropriate disposal of remediation waste.

8. **How will the data be archived?**
   The electronic data will be loaded into the Navy Installation Restoration Information System (NIRIS) database. Raw data, as well as data summary tables, will be included in the annual reports. Hardcopy data will be released to the Navy following completion of the project.

9. **List the PQOs in the form of if/then qualitative and quantitative statements.**
   The regulatory-approved remedial action for SWMU 7/8, as described in the final CMS (Baker, 2005), includes the excavation of the upper 2 feet of soil in three areas of SWMU 7/8 where benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic concentrations exceed the approved CAOs. The approximate limits of these excavation areas are shown on Figure 6. Baker (2005) estimated the aerial extent of contamination through the

extrapolation of limited test data using the Natural Neighbor interpolation approach of the computer model "GMS v5.1" Given the speculative nature of contaminant extent, AGVIQ-CH2M HILL proposes to perform a pre-excavation assessment of SWMU 7/8 to verify the horizontal extent of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic in soil. Because the CAOs for subsurface soil at 7.3 mg/kg for benzo(a)pyrene were not exceeded, collection of samples below 2 feet is not required.

The principal objective of the decision analysis process is to present our approach to verify the limits of excavation by more accurately determining the extent of benzo(a)anthracene, benzo(a)-pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic in shallow soil. Data obtained from this delineation sampling event will be used to prepare an excavation assessment report that summarizes the work performed and that the appropriate excavation limits were reached and evaluate product data to optimize the approach for product recovery.

The primary study questions for this phase of work at SWMU 7/8 are: What is the aerial extent requiring excavation? What is the current product distribution?

Planned actions include:

- If the delineation sampling data indicate there is no longer contamination present at SWMU 7/8, then no further action will be taken. The presence of contamination will be determined based on site-wide averages, such as the UCL 95%.
- If the site-wide soil UCL 95% value is above the chemical-specific CAO, then excavation will be conducted until the site-wide UCL 95% is below the CAO. The samples for excavation will be identified using the UCL 95% calculation. Excavation will be conducted from the highest concentration point to the mid-point of the nearest clean sample.

If well gauging indicates the product extent is greater than depicted in figures included in the final CMS, an optimization report will be developed to verify product extent and evaluate ways to optimize remedial options for product removal. A total of 80 existing wells will be gauged using an oil/water interface probe to test for the presence of free-product and determine current product distributions. Product thickness measurements will be made to 0.01 foot. The newly acquired data will be used to determine the placement of additional product recovery wells.

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SAP Worksheet #12—Measurement Performance Criteria Table – Field QC Sample

Matrix: Soil

Analytical Group: Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), Pesticides, Herbicides, polychloride biphenyls (PCBs), and Metals

Concentration Level: "Low" (SW-846 8270C)

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
MS/MSD	Select PAHs (benzo(a)anthrancene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene) SW-846 8270C Soil/ Empirical/SOP-201	One MS/MSD per 20 samples	Accuracy/Bias/Precision	DOD QSM limits, 30% relative percent difference (RPD)	A
Field Duplicates		As required per sampling event	Precision	Values greater than 5 times the QL ±50%	S & A
Equipment/Rinsate Blanks		As required per sampling event	Bias/Contamination	No target analytes greater than or equal to QL; with the exception of common field/laboratory contaminants	S
Cooler Temperature Indicator		One per cooler	Accuracy/ Representativeness	Between 2 degrees Celsius (°C) and 6°C	S
Data Completeness Check		NA	Data Completeness	85% Overall	S & A
Comparability Check		As required per sampling event	Comparability	Values greater than 5 times the QL: Field Replicates ±50%	S & A
MS Sample	Metal-Arsenic only SW-846 6010B Soil/ Empirical SOP-100/105	One per digestion batch	Accuracy/Bias	±25% of true value if sample is less than 4 times the spike added	A

SAP Worksheet #12—Measurement Performance Criteria Table – Field QC Sample (continued)

QC Sample	Analytical Group	Frequency	DQIs	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
Field Duplicates	Metal-Arsenic only SW-846 6010B Soil/ Empirical SOP-100/105	As required per sampling event	Precision	Values greater than or equal to 5 times the QL: RPD less than or equal to 50%	S & A
Equipment/Rinsate Blanks		As required per sampling event	Bias/Contamination	No target analytes greater than or equal to QL; with the exception of common field/laboratory contaminants and/or Na, K, and Ca	S
Cooler Temperature Indicator		One per cooler	Accuracy/ Representativeness	Between 2°C and 6°C	S
Data Completeness Check		NA	Data Completeness	85% Overall	S & A
Comparability Check		As required per sampling event	Comparability	Values greater than or equal to 5 times the QL: Field Duplicates; RPD less than or equal to 50%	S & A
MS Sample	SW-846 8260B TCLP/ Empirical/SOP-202	One MS/MSD per 20 samples	Accuracy/Bias/Precision	DOD QSM limits, 30%RPD	A
Equipment/Rinsate Blanks		As required per sampling event	Bias/Contamination	No target analytes greater than or equal to QL; with the exception of common field/laboratory contaminants	S
Cooler Temperature Indicator		One per cooler	Accuracy/ Representativeness	Between 2°C and 6°C	S
Data Completeness Check		NA	Data Completeness	85% Overall	S & A
Comparability Check		As required per sampling event	Comparability	Values greater than 5 times the QL: Field Replicates ±50%	S & A

SAP Worksheet #12—Measurement Performance Criteria Table – Field QC Sample (continued)

QC Sample	Analytical Group	Frequency	DQIs	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
MS Sample	SW-846 8270C TCLP/ Empirical/SOP-201	One MS/MSD per 20 samples	Accuracy/Bias/Precision	DOD QSM limits, 30%RPD	A
Equipment/Rinsate Blanks		As required per sampling event	Bias/Contamination	No target analytes greater than or equal to QL; with the exception of common field/laboratory contaminants	S
Cooler Temperature Indicator		One per cooler	Accuracy/ Representativeness	Between 2°C and 6°C	S
Data Completeness Check		NA	Data Completeness	85% Overall	S & A
Comparability Check		As required per sampling event	Comparability	Values greater than 5 times the QL: Field Replicates ±50%	S & A
MS Sample	SW-846 8081A/8082/8151A TCLP/Empirical/SOP-211/208	One MS/MSD per 20 samples	Accuracy/Bias/Precision	DOD QSM limits, 30%RPD	A
Equipment/Rinsate Blanks		As required per sampling event	Bias/Contamination	No target analytes greater than or equal to QL; with the exception of common field/laboratory contaminants	S
Cooler Temperature Indicator		One per cooler	Accuracy/ Representativeness	Between 2°C and 6°C	S
Data Completeness Check		NA	Data Completeness	85% Overall	S & A

SAP Worksheet #12—Measurement Performance Criteria Table – Field QC Sample (continued)

QC Sample	Analytical Group	Frequency	DQIs	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Comparability Check	SW-846 8081A/8082/8151A TCLP/Empirical/SOP-211/208	As required per sampling event	Comparability	Values greater than 5 times the QL: Field Replicates ±50%	S & A
Field Duplicates		As required per sampling event	Precision	Values less than or equal to 5 times the QL: RPD less than or equal to 50%	S & A
Equipment/Rinsate Blanks		As required per sampling event	Bias/Contamination	No target analytes greater than or equal to QL; with the exception of common field/laboratory contaminants and/or sodium, potassium, and calcium	S
Cooler Temperature Indicator		One per cooler	Accuracy/ Representativeness	Between 2°C and 6°C	S
Data Completeness Check		NA	Data Completeness	85% Overall	S & A
Comparability Check		As required per sampling event	Comparability	Values greater than or equal to 5 times the QL: Field Duplicates; RPD less than or equal to 50%	S & A
Cooler Temperature Indicator	Corrosivity/Reactivity to Cyanide and Sulfide/Ignitability	One per cooler	Accuracy/ Representativeness	Between 2°C and 6°C	S

SAP Worksheet #13—Secondary Data Criteria and Limitations Table

The table below provides general information on how secondary data will be used and the limitations on their use. Following the general table below, secondary data criteria and limitations tables are presented for each site where historical analytical data exist (applicable to the scope of work covered by this SAP), specifically to address the use and limitations of the historical analytical data.

Secondary Data	Data Source	Data Generator(s)	How Data Will Be Used	Limitations on Data Use
Site background information and the EPA- and PREQB-approved soil remedial action for SWMU 7/8	Prepared by: Baker Environmental, Inc. Report Title: Revised Final Corrective Measures Study Final Report, Tow Way Fuel Farm Date: November 22, 2005	Site history for SWMU 7/8	Data will be used to provide site history summaries and to gain an understanding of historical activities that led to the EPA- and PREQB-approved soil remedial action for SWMU 7/8.	More recent information may supersede historical information from this report.
Background study data for arsenic at SWMU 7/8.	Prepared by: Baker Environmental, Inc. Report Title: Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds Date: October 17, 2006	Background study data for arsenic at SWMU 7/8	Data will be used to substantiate that arsenic is naturally occurring at SWMU 7/8.	More recent information may supersede historical information from this report.
TWFF quarterly sampling report.	Prepared by: Baker Environmental, Inc. Report Title: RCRA 7003 Administrative Order on Consent Quarterly Progress Report, May 1, 2008 – July 31, 2008 Date: August 2008	Historical product gauging data	Data will be used to evaluate product distribution and identify areas of intermediate areas of thickest product information.	Based of fact many screens are submerged, product distribution may be inaccurate. Data is also outdated.

SAP Worksheet #13—Secondary Data Criteria and Limitations Table (continued)

Secondary Data	Data Source	Data Generator(s)	How Data Will Be Used	Limitations on Data Use
Surface soil data and subsurface soil data generated during the 1997 RCRA Facility Investigation	Prepared by: Baker Environmental, Inc. Report Title: Revised Draft RCRA Facility Investigation for Operable Unit 2 (SWMU 7/8) Date: June 16, 1997	Fourteen soil samples were collected between 0 and 2 feet bgs within SWMU 7/8. All soil samples were analyzed for VOCs, SVOCs, RCRA metals, and total petroleum hydrocarbon (gas and diesel).	Data will be incorporated, as appropriate, into a comprehensive data set to confirm the limits of excavation for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic in soil, as presented in the EPA- and PREQB-approved final CMS.	Surface and subsurface soil data – Spatial coverage not sufficient to confirm the excavation limits presented in the EPA- and PREQB-approved final CMS without additional data.
Surface soil data and subsurface soil data generated during the 2003 Additional Data Collection Investigation	Prepared by: Baker Environmental, Inc. Report Title: Final Additional Data Collection Investigation Report, Tow Way Fuel Farm Date: April 22, 2003	Fifteen soil samples were collected between 0 and 2 feet bgs within SWMU 7/8. All soil samples were analyzed for VOCs, SVOCs, and metals.	Data will be incorporated, as appropriate, into a comprehensive data set to confirm the limits of excavation for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic in soil as presented in the EPA- and PREQB-approved final CMS.	Surface and subsurface soil data – Spatial coverage not sufficient to confirm the excavation limits presented in the EPA- and PREQB-approved final CMS without additional data.

SAP Worksheet #14—Summary of Project Tasks

General Protocol

Mobilization

Mobilization will include AGVIQ-CH2M HILL staff and subcontractors traveling to the island. Mobilization will include the completion of the following tasks:

- Clearing vegetation at soil sampling site
- Permitting/approvals
- Utility clearances
- Demarcating the work zones
- Staging equipment and material
- Installing erosion control barriers
- Approval of the SAP by the stakeholders

Sampling Locations and Quantities

A systematic sampling protocol will be used for this project. Up to 72 samples (Figure 7) will be collected at SWMU 7/8, based on the grids superimposed on the excavation areas established in the final CMS. The approximate sampling locations designed to verify extent of contamination are illustrated on Figure 7. The samples will be labeled based on the alphabetic coordinate system shown on Figure 7. In addition to the horizontal coordinate information, the task order, sample depth, and sampling date will be added to the sample nomenclature. For example, if at location B10, a sample is collected at an interval of 2.0 feet bgs, the sample identification (ID) would be labeled JM04-B10 (2.0)-mmddyy.

Sampling

For most locations, DPT will be used to obtain the soils samples because the soil is well indurated and use of hand tools would be labor intensive. However, in areas that cannot be accessed using a DPR rig (across utilities or on steep slopes), hand tools will be used to obtain soil samples. SOPs for DPT and use of hand tools to collect soil are presented in Appendix B. The sampling method will be determined based on field conditions. During the collection of delineation samples, soil borings will be offset if refusal occurs before reaching 2 feet bgs, if rock or asphalt fragments are encountered within the upper 6 inches of soil, or if utilities (above or below ground) are encountered. Composite soil samples will be collected from each location from a depth interval of 0 to 2 feet bgs for the analysis of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene using EPA Method 8270C, and/or arsenic using EPA Method 6010B. Worksheet #18 lists the sampling IDs and the analysis that will be performed at each location (arsenic only or arsenic and PAHs). The soil samples will be packed in jars, labeled, and packed on ice at a temperature between 2°C and 6°C for shipment to Empirical Laboratories, LLC. This laboratory is part of the National Environmental Laboratory Accreditation Program (NELAP)-certified and Navy-approved laboratory for chemical analysis. Samples will be held at the laboratory pending analysis if the need arises where supplemental analyses will be required. This will be noted on the chain-of-custody that is shipped with the sample coolers.

During sample collection, sampling personnel will also record a lithologic description of the soil sample and record any observations made during the sampling (i.e., hydrocarbon odor, staining,

presence of suspect debris). At the conclusion of the sampling event, one composite aqueous waste characterization sample will be collected and analyzed for RCRA compounds (see Worksheet #15 for specific compounds), reactivity (sulfide and cyanide), ignitability, and corrosivity as pH. For QA/QC purposes, up to 25 samples will be submitted for QC/QC analysis. These samples will include MS/MSDs, duplicate samples, and equipment blanks.

The delineation soil sampling will be conducted according to the following procedure:

1. From five random intervals within the sample interval (0 to 2 feet), collect several spoonfuls of soil and place into a stainless steel bowl to form a composite soil sample.
2. Homogenize the sample using the stainless steel spoon.
3. Fill the appropriate sample jars full with the homogenized sample.
4. Close the jar, label, and package the sample for shipment to the laboratory.

The composite aqueous waste characterization sample will be collected in the following manner:

1. From each 55-gallon drum containing aqueous waste generated during the decontamination of the sampling equipment, collect a bailer full of aqueous sample, and decant the water into a glass container to form a composite aqueous sample.
2. Gently stir the sample in the container and pour the composite water sample into the appropriate sample jars.
3. Close the jars, label, and package the sample for shipment to the laboratory for chemical analysis.

Sampling Equipment

The following equipment will be used during the work:

- Nitrile or latex gloves
- Durable ice chest (20-gallon) for shipping samples
- Ice for preserving samples
- Laboratory supplied sampling containers (jars/bottles)
- 55-gallon drums (U.S. Department of Transportation-approved) for containerizing waste
- Shovel or DPT
- Oil/water interface probe

Sampling Container, Analytical Methods, Preservatives, and Holding Time

The analytical method, preservative, sampling containers and holding time for the soil samples are described in Table 2. Worksheet #19 presents all of the analytical SOP requirements, including the RCRA compounds (see Worksheet #15 for specific compounds). The sample containers will be provided by a NELAP-certified and Navy-approved laboratory. This laboratory will be responsible for the chemical analysis of the soil samples and QA/QC samples.

TABLE 2
Analytical Methodology

Parameter	EPA Method	Preservative	Container	Holding Time
Arsenic	SW 846-6010B	Cool to 4°C	1-ounce (oz) glass jar	180 days
Benzo(a)anthracene	SW 846-8270C	Cool to 4°C	1 4-oz glass jar	14 days
Benzo(a)pyrene				
Benzo(b)fluoranthene				
Indeno(1,2,3-cd)pyrene				

Well Gauging

AGVIQ-CH2M HILL will perform a comprehensive round of well gauging to determine a horizontal distribution of product beneath SMWU 7/8. Gauging will be performed according to the following procedure:

1. Unlock and uncap the well/piezometer and allow water levels to reach static levels for at least 15 minutes. If the cap has a vent hole, this minimum venting time is not required.
2. Clean the oil/water interface probe following the procedures described in the equipment decontamination procedures discussed below.
3. Turn on the oil/water interface probe, and test the battery to verify proper charge. Verify that the probe is working by wetting the end of the probe. Dry the probe prior to measuring groundwater depth.
4. Measure depth to groundwater and/or product as follows:
   a. Adjust the gain/sensitivity (while probe is dry) to the maximum sensitivity that does not activate the audible sensor.
   b. Lower the probe into the well/piezometer slowly until the audible sensor activates.
   c. Raise and lower the probe slowly to precisely measure the top of the water and/or product. Note that the oil/water interface probe emits a single tone when product is encountered and a pulsating tone when water is encountered.
   d. Hold the tape (indicating depth) against the designated measuring point and read the depth to water or product to the nearest 0.01 foot. Perform a second and third check to verify the reading.
   e. Record the depth to water and/or on the field log. If product is encountered calculate the product thickness by subtracting the measurement made when product was first encountered (single tone) and the measurement recorded when water was encountered (pulsating tone).
5. Measure the total well depth as follows:
   a. Turn the gain/sensitivity off.
   b. Lower the probe until it contacts the bottom of the well/piezometer.

c. Raise and lower the probe slowly so that the probe is vertical and not leaning across the diameter of the well/piezometer.

d. Hold the tape (indicating depth) against the designated measuring point and read the total depth to the nearest 0.01 foot. Perform a second and third check to verify the reading.

6. Record the total well depth on the field log.

7. Recap and lock the well/piezometer.

Equipment Decontamination

An area will be designated for the decontamination of equipment and the storage of all waste. All decontaminated materials will be handled only with new, unused nitrile or latex gloves to avoid contamination.

Sampling Equipment (Shovel, Stainless Steel Spoon, and Interface Probe)

Onsite equipment for soil sampling, water level measuring, and sample preparation will be cleaned prior to and after each use. During cleaning and decontamination, the substitution of higher-grade water for tap water is permitted and does not have to be noted as a variation. The sampling equipment (if not disposable) will be cleaned to prevent the introduction of contaminants according to the following procedure:

1. Wash equipment with a laboratory detergent (i.e., Alquinox, Liquinox, or the equivalent) and hot water, using a brush to remove any particulate matter or surface film.

2. Rinse equipment thoroughly with tap water.

3. Rinse equipment thoroughly with de-ionized or organic-free water.

4. Rinse equipment twice with isopropanol and allow to air dry.

5. Rinse equipment with de-ionized water.

6. Wrap equipment in aluminum foil, with dull side in, to prevent contamination during storage or transport to the field.

DPT Equipment

Before mobilizing to the site, the sampling tools will be cleaned with a high-pressure hot-water power washer or steam jenny, or hand washed with a brush using detergent to remove oil, grease, and hydraulic fluid from the exterior of the unit. The detergent does not have to be laboratory detergent and should not be a degreaser. The drilling equipment and sampling tools will be decontaminated prior to each new Geoprobe boring location. The sampling equipment will be decontaminated prior to each sample being collected within the same borehole. The piping, Geoprobe tools, and similar equipment will be flushed with potable water followed by cleaning with a hot-water pressure washer.

Decontamination of all equipment and tools will consist of hot-water pressure washing to remove all visible evidence of soil, encrustations, or films. Geoprobe tools will be rinsed with de-ionized water after pressure washing and prior to use.

Sample Packaging, Marking, Labeling, Shipping, and Chain-of-Custody

Samples must be preserved to ensure that the samples are received at the laboratory at a temperature less than of equal to 4°C. Ice will be placed on top of sample containers and the ice chest will be wrapped with duct tape. Custody seals will be applied upon completing the inspection of the ice chest integrity and appropriate documentation.

All samples must be identified using a standard tag attached to the sample container and will include the following information (Appendix C):

- Project name
- Project number
- Sample ID
- Date and time of sample collection
- Sampler name(s)
- Analyses
- Preservatives

Chain-of-custody records are used to record the custody of all samples. An example of the chain-of-custody is included as Appendix C. The following information must be supplied in the indicated spaces:

- Client name
- Project number
- Project name and site location
- Sample ID number of all samples included in the shipment
- Sample description
- Date and time of sample collection
- Name, company, and signature of field technician collecting samples
- Name and signature of laboratory custodian receiving the samples

Quality Control

All QC samples are listed in Worksheet #20. In reference to the field tasks, all field work will be overseen by an FTL who is responsible for the QC of the sampling to make sure the proper work plans are followed for each task.

Accuracy and Precision

The QA/QC field program will be continuously implemented during all sampling activities. Prior to beginning any sampling activities, a decontamination area will be designed for cleaning both sampling and storage tools and containers. Upon completion of sampling, samples will be labeled and placed in an ice chest. All of the sampling information will be recorded in the field book and in the chain of-custody. Decontamination procedures are discussed below and will be followed before moving to another sample location.

Improper sample handling may alter the accuracy of the analytical results. Consequently, the samples will only be collected by persons wearing disposable nitrile or latex gloves. At each sampling point, the sampling personnel will wear new pairs of gloves. Samples will be carefully transferred in the field from the shovel sampling or DPT equipment directly into glass containers provided by the laboratory. QA/QC will consist of obtaining equipment blanks, MS/MSDs and field duplicates. Field duplicate samples and equipment blank samples will be collected at a

minimum frequency of 10 percent times the total number of samples collected for an analysis and rounded to the nearest whole number. MS/MSDs will be required at a frequency of one per sampling event or a minimum of 5 percent of the total number of samples collected for an analysis and rounded to the nearest whole number.

Equipment Blanks

One equipment blank sample per 10 soil samples will be prepared in the field between the collection of two separate samples. A jar containing de-ionized water will be opened in the field and poured over or through cleaned sampling equipment before equipment blank sample collection. The flushing water will be collected in a 1-liter (L) amber bottle and sent to the laboratory for analysis. The equipment blank will constitute a test of effectiveness of sampling equipment decontamination.

Field Duplicates

One sample per 10 soil samples will be split into two separate portions. These two portions will be collected at the same time as two separate samples and placed under identical circumstances and treated exactly the same throughout field and laboratory procedures. Analyses of both samples give a measure of the precision associated with sample collection, preservation and storage, as well as with laboratory procedure.

Storage

All analytical data will be stored on AGVIQ-CH2M HILL's SQL Server Data Warehouse, after which the finalized data will be uploaded to the NIRIS database as part of AVGIQ-CH2M HILL final delivery package.

Sample Analysis

The laboratory will maintain, test, inspect, and calibrate analytical instruments (Worksheets #24 and 25). The laboratory will process and prepare samples for analysis. The laboratory will analyze soil samples for various groups of parameters as shown in Worksheets #15 and 18.

Data Management

The Project Database Manager, Duane Johnson, is responsible for data tracking and storage. In addition, a third party data validator will receive 10 percent of all analytical data from the laboratory, and the remaining 90 percent will be validated internally by the AVGIQ-CH2M HILL data validator prior to its use by the Navy.

Procedures for Recording and Correcting Data

All field data will be recorded in field logbooks and updated in the electronic Field Input Sheets to be uploaded in the Database or recorded electronically via the Mobile Integrated Sample Tracking Personal Digital Assistant for upload in the Database.

Project Assessment/Audit: Worksheets #31 and 32.

Data Validation: Worksheets #35 and 36.

Data Usability Assessment: Worksheet #37.

Remediation Waste Management

Remediation waste will be managed and disposed of in accordance with the Waste Management Plan in Appendix D.

Environmental Protection Plan

General controls implemented during remediation-related construction activities to prevent pollution and protect the environment are presented in Appendix D.

Quality Control Plan

QC and the sampling inspections associated with SWMU 7/8 are presented in Appendix D.

Pre-Excavation Assessment Reporting

Following the certification of the laboratory data by a Puerto Rican chemist and the validation of the laboratory data, AGVIQ-CH2M HILL/Aleut Global Solutions will submit a letter-report to the PREQB to document the findings obtained during the pre-excavation assessment. The report will include the following:

- Tabulated environmental-media analytical data
- Map(s) illustrating the horizontal extent of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic in soil
- Figure illustrating excavation dimensions (aerial extent and volumes) based on pre-excavation assessment data
- An isopach map illustrating the current product distribution and thickness
- A potentiometric map illustrating the direction of groundwater flow

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SAP Worksheet #15—Reference Limits and Evaluation Table

Matrix: Soil

Analytical Group: Select PAHs, Arsenic, and RCRA Compounds for Waste Characterization

Analyte	CAS Number	PAL	PAL Reference	Project QL Goal	Laboratory-Specific	
					QLs	Method Detection Limits (MDLs)
Benzo(a)anthracene	56-55-3	2.9 mg/kg	Corrective Measure Study Report	2.9 mg/kg	0.33 mg/kg	0.1 mg/kg
Benzo(a)pyrene	50-32-8	2.9 mg/kg	Corrective Measure Study Report	2.9 mg/kg	0.33 mg/kg	0.1 mg/kg
Benzo(b)fluoranthene	205-99-2	2.9 mg/kg	Corrective Measure Study Report	2.9 mg/kg	0.33 mg/kg	0.1 mg/kg
Indeno(1,2-cd)pyrene	193-39-5	2.9 mg/kg	Corrective Measure Study Report	2.9 mg/kg	0.33 mg/kg	0.1 mg/kg
Arsenic	7440-38-2	2.65 mg/kg	Corrective Measure Study Report	2.65 mg/kg	0.5 mg/kg	0.15 mg/kg
Benzene	71-43-2	0.5 milligrams per liter (mg/L)	40 CFR 261.30 Table 1	0.5 mg/L	0.010 mg/L	0.0033 mg/L
Butanone, 2- (Methyl ethyl ketone)	78-93-3	200 mg/L	40 CFR 261.30 Table 1	200 mg/L	0.1 mg/L	0.016 mg/L
Carbon Tetrachloride	56-23-5	0.5 mg/L	40 CFR 261.30 Table 1	0.5 mg/L	0.010 mg/L	0.0033 mg/L
Chlorobenzene	108-90-7	100 mg/L	40 CFR 261.30 Table 1	100 mg/L	0.010 mg/L	0.0033 mg/L
Chloroform (Trichloromethane)	67-66-3	6 mg/L	40 CFR 261.30 Table 1	6 mg/L	0.010 mg/L	0.0033 mg/L
Dichlorobenzene, 1,4 -	106-46-7	7.5 mg/L	40 CFR 261.30 Table 1	7.5 mg/L	0.050 mg/L	0.010 mg/L
Dichloroethane, 1,2 (1,2-DCA)	107-06-2	0.5 mg/L	40 CFR 261.30 Table 1	0.5 mg/L	0.010 mg/L	0.0033 mg/L
Dichloroethene, 1,1-	75-35-4	0.7 mg/L	40 CFR 261.30 Table 1	0.7 mg/L	0.010 mg/L	0.0033 mg/L
Tetrachloroethene	127-18-4	0.7 mg/L	40 CFR 261.30 Table 1	0.7 mg/L	0.010 mg/L	0.0033 mg/L

SAP Worksheet #15—Reference Limits and Evaluation Table (continued)

Analyte	CAS Number	PAL	PAL Reference	Project QL Goal	Laboratory-Specific	
					QLs	MDLs
Trichloroethene (TCE)	79-01-6	0.5 mg/L	40 CFR 261.30 Table 1	0.5 mg/L	0.010 mg/L	0.0033 mg/L
Vinyl Chloride	75-01-4	0.2 mg/L	40 CFR 261.30 Table 1	0.2 mg/L	0.020 mg/L	0.005 mg/L
Cresol		200 mg/L	40 CFR 261.30 Table 1	200 mg/L	0.050 mg/L	0.010 mg/L
Dinitrotoluene, 2,4-	121-14-2	0.1 mg/L	40 CFR 261.30 Table 1	0.1 mg/L	0.050 mg/L	0.010 mg/L
Hexachlorobenzene	118-74-1	0.1 mg/L	40 CFR 261.30 Table 1	0.1 mg/L	0.050 mg/L	0.010 mg/L
Hexachlorobutadiene	87-68-3	0.5 mg/L	40 CFR 261.30 Table 1	0.5 mg/L	0.050 mg/L	0.010 mg/L
Hexachloroethane	67-72-1	3 mg/L	40 CFR 261.30 Table 1	3 mg/L	0.050 mg/L	0.010 mg/L
Nitrobenzene	98-95-3	2 mg/L	40 CFR 261.30 Table 1	2 mg/L	0.050 mg/L	0.010 mg/L
Pentachlorophenol	87-86-5	100 mg/L	40 CFR 261.30 Table 1	100 mg/L	0.2 mg/L	0.014 mg/L
Pyridine	110-86-1	5 mg/L	40 CFR 261.30 Table 1	5 mg/L	0.050 mg/L	0.010 mg/L
Trichlorophenol, 2,4,5-	95-95-4	400 mg/L	40 CFR 261.30 Table 1	400 mg/L	0.050 mg/L	0.010 mg/L
Trichlorophenol, 2,4,6-	88-06-2	2 mg/L	40 CFR 261.30 Table 1	2 mg/L	0.050 mg/L	0.010 mg/L
Chlordane, technical	57-74-9	0.03 mg/L	40 CFR 261.30 Table 1	0.03 mg/L	0.002 mg/L	0.005 mg/L
Endrin	72-20-8	0.02 mg/L	40 CFR 261.30 Table 1	0.02 mg/L	0.0001 mg/L	0.00003 mg/L
HCH, gamma- (BHC, gamma-) (Lindane)	58-89-9	0.4 mg/L	40 CFR 261.30 Table 1	0.4 mg/L	0.0001 mg/L	0.00003 mg/L
Heptachlor	76-44-8	0.008 mg/L	40 CFR 261.30 Table 1	0.008 mg/L	0.0001 mg/L	0.00003 mg/L
Heptachlor epoxide	1024-57-3	0.008 mg/L	40 CFR 261.30 Table 1	0.008 mg/L	0.0001 mg/L	0.00003 mg/L
Methoxychlor	72-43-5	10 mg/L	40 CFR 261.30 Table 1	10 mg/L	0.0001 mg/L	0.00003 mg/L
Toxaphene	8001-35-2	0.5 mg/L	40 CFR 261.30 Table 1	0.5 mg/L	0.010 mg/L	0.002 mg/L

SAP Worksheet #15—Reference Limits and Evaluation Table (continued)

Analyte	CAS Number	PAL	PAL Reference	Project QL Goal	Laboratory-Specific	
					QLs	MDLs
2,4-D	94-75-7	10 mg/L	40 CFR 261.30 Table 1	10 mg/L	0.0075 mg/L	0.0025 mg/L
2,4,5-TP (Silvex)	93-72-1	1 mg/L	40 CFR 261.30 Table 1	1 mg/L	0.001 mg/L	0.0003 mg/L
Arsenic	7440-38-2	5 mg/L	40 CFR 261.30 Table 1	5 mg/L	0.1 mg/L	0.030 mg/L
Barium	7440-39-3	100 mg/L	40 CFR 261.30 Table 1	100 mg/L	2 mg/L	0.050 mg/L
Cadmium	7440-43-9	1 mg/L	40 CFR 261.30 Table 1	1 mg/L	0.050 mg/L	0.010 mg/L
Chromium (total)	7440-47-3	5 mg/L	40 CFR 261.30 Table 1	5 mg/L	0.1 mg/L	0.020 mg/L
Lead	7439-92-1	5 mg/L	40 CFR 261.30 Table 1	5 mg/L	0.030 mg/L	0.010 mg/L
Mercury	7439-97-6	0.2 mg/L	40 CFR 261.30 Table 1	0.2 mg/L	0.002 mg/L	0.0008 mg/L
Selenium	7782492	1 mg/L	40 CFR 261.30 Table 1	1 mg/L	0.1 mg/L	0.030 mg/L
Silver	7440224	5 mg/L	40 CFR 261.30 Table 1	5 mg/L	0.1 mg/L	0.020 mg/L
Aroclor-1016	12674-11-2	50 mg/L	40 CFR 761.2	50 mg/L	0.005 mg/L	0.0005 mg/L
Aroclor-1221	11104-28-2	50 mg/L	40 CFR 761.2	50 mg/L	0.005 mg/L	0.0005 mg/L
Aroclor-1232	11141-16-5	50 mg/L	40 CFR 761.2	50 mg/L	0.005 mg/L	0.0005 mg/L
Aroclor-1242	53469-21-9	50 mg/L	40 CFR 761.2	50 mg/L	0.005 mg/L	0.0005 mg/L
Aroclor-1248	12672-29-6	50 mg/L	40 CFR 761.2	50 mg/L	0.005 mg/L	0.0005 mg/L
Aroclor-1254	11097-69-1	50 mg/L	40 CFR 761.2	50 mg/L	0.005 mg/L	0.0005 mg/L
Aroclor-1260	11096-82-5	50 mg/L	40 CFR 761.2	50 mg/L	0.005 mg/L	0.0005 mg/L

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SAP Worksheet #16—Project Schedule

ID		Task Name	Duration	Start
1		Vegetation Cleaning for SWMU 78	8 days	Wed 1/7/09
2		Stake Sampling Locations & Gauge Monitoring Wells	5 days	Mon 1/19/09
3		Soil Confirmation Sampling	5 days	Mon 3/16/09

Project: Worksheet 16
Date: Thu 1/22/09

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

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SAP Worksheet #17—Sampling Design and Rationale

Historical releases of nearly 1 million gallons of petroleum hydrocarbons have originated at SWMU 7/8 from the various storage tanks. The aerial extent of contamination has been previously estimated through the extrapolation of limited test data using the Natural Neighbor interpolation approach of the computer model "GMS v5.1" Therefore, further sampling is needed in order to verify the horizontal extent of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic in soil.

The final CMS described excavation as the principal remedy to remediate the upper 2 feet of soil impacted by arsenic and benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene (Baker, 2005). Due to the limited amount of soil test results obtained by Baker to delineate the extent of arsenic and PAHs, AGVIQ-CH2M HILL will collect additional soil samples in each of the three areas to verify the horizontal extent of contamination. Since the size of the initial excavation areas was an estimate and much of the PAH data is greater than 10 years old, it is possible that the excavation areas may be smaller or larger in size or of a different shapes other than those depicted in the final CMS. Given the uncertainty inherent with the data, AGVIQ-CH2M HILL proposes the collection of additional sample analytical data to verify contaminant extent prior to beginning excavation. The following approach is proposed for additional sampling to determine excavation extent at the TWFF site:

1. Survey the area for 50-foot evenly spaced grid locations over each of the excavation areas shown on Figure 7 (USEPA, 1992). These grid locations will be used to select the smallest area required for excavation. Excavation will include the area around an elevated concentration to the mid-point between it and the nearest clean sample.

2. Submit the surface soil samples following the sampling scheme illustrated on Figure 7 and listed in Table 2 for the analysis of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and arsenic. Soil samples will be collected from 0 to 2 feet bgs using a hand tool or DPT.

3. Prepare a pre-excavation assessment report that summarizes the work performed and provide a revised estimate of the size and shape of the excavation areas based on the existing and newly collected analytical results. The revised excavation areas will be based on whether a UCL 95% is above or below the chemical-specific CAO. Specific locations will be excavated until the site-wide UCL 95% is below the chemical-specific CAO.

4. Current well gauging data indicates that product is limited to monitoring wells UGW25 and MTMW01; however, historical test data indicate the aerial extent of product was much greater (compare Figures 4 and 5). Review of the well construction records suggests that many of the wells that historically contained product were screened below the water table, suggesting that the amount of product surrounding the wells was of sufficient volume to depress the water table to allow product to enter the well, and/or that product entered the well during fluctuations in the water table surface. It is possible that the installation of new wells with screened intervals across the water table will reveal a more widespread area of product and a need for more extensive remediation.

For the above corrective measure approaches, the rationale for the matrices to be sampled, the number of samples per matrix, the analytical groups, and the concentration levels are discussed in Worksheets #10, 11, 14, and 15. Sample location figures are provided in Appendix A.

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

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group	No. Samples	Sampling SOP Reference[a]
A1	JM04-A1(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A2	JM04-A2(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A3[b]	JM04-A3(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A4[b]	JM04-A4(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A5[b]	JM04-A5(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A6	JM04-A6(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A7	JM04-A7(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A8	JM04-A8(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A9	JM04-A9(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A10	JM04-A10(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A11	JM04-A11(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A12	JM04-A12(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A13[b]	JM04-A13(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A14	JM04-A14(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A15	JM04-A15(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A16	JM04-A16(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A17	JM04-A17(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A18	JM04-A18(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A19	JM04-A19(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A20	JM04-A20(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A21[b]	JM04-A21(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A22	JM04-A22(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A23	JM04-A23(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A24	JM04-A24(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A25	JM04-A25(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A26	JM04-A26(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B

SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group	No. Samples	Sampling SOP Reference[a]
A27	JM04-A27(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A28	JM04-A28(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A29	JM04-A29(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A30	JM04-A30(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A31	JM04-A31(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A32	JM04-A32(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A33	JM04-A33(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A34	JM04-A34(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A35	JM04-A35(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A36	JM04-A36(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A37	JM04-A37(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A38[b]	JM04-A38(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A39	JM04-A39(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A40	JM04-A40(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A41	JM04-A41(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A42[b]	JM04-A42(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
A43[b]	JM04-A43(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A44[b]	JM04-A44(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
A45[b]	JM04-A45(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B1	JM04-B1(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B2	JM04-B2(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B3	JM04-B3(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B

SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group	No. Samples	Sampling SOP Reference[a]
B4	JM04-B4(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B5	JM04-B5(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B6	JM04-B6(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B7	JM04-B7(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B8	JM04-B8(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B9	JM04-B9(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B10	JM04-B10(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B11	JM04-B11(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B12	JM04-B12(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B13	JM04-B13(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
B14	JM04-B14(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
B15	JM04-B15(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B16[b]	JM04-B16(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B17[b]	JM04-B17(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B18	JM04-B18(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
B19	JM04-B19(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
B20[b]	JM04-B20(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
B21[b]	JM04-B21(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
B22	JM04-B22(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
B23	JM04-B23(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
B24	JM04-B24(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B25	JM04-B25(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B

SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group	No. Samples	Sampling SOP Reference[a]
B26	JM04-B26(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
B27	JM04-B27(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only; Selected PAHs[c]	1	See Appendix B
C1	JM04-C1(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C2	JM04-C2(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C3	JM04-C3(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C4[b]	JM04-C4(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C5	JM04-C5(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C6	JM04-C6(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C7	JM04-C7(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C8	JM04-C8(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C9	JM04-C9(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C10	JM04-C10(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C11	JM04-C11(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C12	JM04-C12(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C13	JM04-C13(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C14	JM04-C14(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C15	JM04-C15(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
C16[b]	JM04-C16(2.0)-mmddyy	Soil	2.0	Metals-Arsenic only	1	See Appendix B
NA	JM04-AQW-mmddyy	Aqueo-us Waste	NA	RCRA compounds (see Worksheet #15 for specific compounds), reactivity (sulfide and cyanide), ignitability, and corrosivity as pH	1	See Appendix B

Notes:

[a] The SOP describes the sample collection procedures.
[b] Sample cannot be collected from this location due to topography or existing structure.
[c] PAH list consists of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluroanthene, and indeno(1,2,3-cd)pyrene.

SAP Worksheet #19—Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Containers	Sample Volume	Preservation Requirements	Maximum Holding Time
Soil	Selected PAHs[a]	SW-846 3541/8270C/ SOP-329/201	One 4-oz amber glass jar	15 grams	Cool to between 2°C and 6°C	14 days extract/ 40 days analysis
Soil	Metals-Arsenic only	SW 8463510/6010B/ 105	One 4-oz amber glass jar	2 grams	Cool to between 2°C and 6°C	180 days
Aqueous	VOCs – RCRA compounds (see Worksheet #15 for specific compounds).	SW 846 8260B/ SOP-202	Two 40-milliliter (mL) amber glass vials	40 mL	Cool to between 2°C and 6°C hydrochloride to pH less than 2	14 days
Aqueous	SVOCs – RCRA compounds (see Worksheet #15 for specific compounds).	SW 846 3510,8270C/ SOP 300/201	1-L amber glass	100 mL	Cool to between 2°C and 6°C	7 days extract/ 40 days analysis
Aqueous	Pesticides – RCRA compounds (see Worksheet #15 for specific compounds).	SW 846 3510,8081A/ SOP302/211	1-L amber glass	100 mL	Cool to between 2°C and 6°C	7 days extract/ 40 days analysis
Aqueous	Herbicides – RCRA compounds (see Worksheet #15 for specific compounds).	SW 846 3510,8151A/ SOP304/208	1-L amber glass	100 mL	Cool to between 2°C and 6°C	7 days extract/ 40 days analysis
Aqueous	Metals – RCRA compounds (see Worksheet #15 for specific compounds).	SW 846 6010B,7470A/ SOP-105/103	250-mL plastic	150 mL	Cool to between 2°C and 6°C, nitric acid to pH less than 2	180 days; 28 days-mercury

SAP Worksheet #19—Analytical SOP Requirements Table (continued)

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Containers	Sample Volume	Preservation Requirements	Maximum Holding Time
Aqueous	PCBs – RCRA compounds (see Worksheet #15 for specific compounds).	SW 846 3510/8082/ SOP 302/211	1-L amber glass	100 mL	Cool to between 2°C and 6°C	7 days extract/ 40 days analysis
Aqueous	Ignitability	Pensky Martens/ SOP-149	250-mL plastic	50 mL	Cool to between 2°C and 6°C	As soon as possible (ASAP)
Aqueous	Corrosivity	SW 846 9045/ SOP-187	250-mL plastic	50 mL	Cool to 4°C	ASAP
Aqueous	Reactive Cyanide	SW 846 9012A/ SOP-164/175	250-mL plastic	100 mL	Cool to between 2°C and 6°C, sodium hydroxide (NaOH) to pH greater than 12	ASAP
Aqueous	Reactive Sulfide	SW 846, Chap.7, Sect.7.3.4/SOP-156	250-mL plastic	100 mL	Cool to between 2°C and 6°C, NaOH to pH greater than 12, zinc acetate	ASAP

Notes:

[a] PAH list will consist of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluroanthene, and indeno(1,2,3-cd)pyrene.

SAP Worksheet #20—Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs	No. of Field Blanks	No. of Equip. Blanks	No. of VOC Trip Blanks	No. of Proficiency Testing Samples	Total No. of Samples to Lab
Soil	Metals-Arsenic only	72	8	4	7 (1 for each day of sample shipment)	10	NA	0	101
Soil	Selected PAHs[a]	72	8	4	7 (1 for each day of sample shipment)	10	NA	0	101
Aqueous	VOCs – RCRA compounds (see Worksheet #15 for specific compounds).	1	0	0	0	0	NA	0	1
Aqueous	SVOCs – RCRA compounds (see Worksheet #15 for specific compounds).	1	0	0	0	0	NA	0	1
Aqueous	Pesticides – RCRA compounds (see Worksheet #15 for specific compounds).	1	0	0	0	0	NA	0	1
Aqueous	Herbicides – RCRA compounds (see Worksheet #15 for specific compounds).	1	0	0	0	0	NA	0	1
Aqueous	Metals – RCRA compounds (see Worksheet #15 for specific compounds).	1	0	0	0	0	NA	0	1

SAP Worksheet #20—Field Quality Control Sample Summary Table (continued)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs	No. of Field Blanks	No. of Equip. Blanks	No. of VOC Trip Blanks	No. of Proficiency Testing Samples	Total No. of Samples to Lab
Aqueous	PCBs – RCRA compounds (see Worksheet #15 for specific compounds).	1	0	0	0	0	NA	0	1
Aqueous	Ignitability	1	0	0	0	0	NA	0	1
Aqueous	Corrosivity	1	0	0	0	0	NA	0	1
Aqueous	Reactive Cyanide	1	0	0	0	0	NA	0	1
Aqueous	Reactive Sulfide	1	0	0	0	0	NA	0	1

Notes:

[a] PAH list consists of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluroanthene, and indeno(1,2,3-cd)pyrene.

SAP Worksheet #21—Project Sampling SOP Reference Table

Reference Number	Title, Revision Date, and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
See Worksheet #18 for all soil sampling locations and Appendix B for soil sampling SOP. Soil sampling SOP taken from *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual* (EPA, 2001),	Shallow Soil Sampling	AGVIQ-CH2M HILL	Hand Tool/DPT	Y	Sample grid has already been staked for soil sampling locations; however, sample location may be offset by a few feet. See Worksheet #14 for the criteria to offset the sample. Global positioning system (GPS) will be used after soil samples have been collected in order to identify the X and Y coordinate location.
See Worksheet #14 for decontamination procedures.	Decontamination of Personnel and Equipment	AGVIQ-CH2M HILL	Decontaminate equipment	N	
See Worksheet #18 for aqueous waste sampling locations and Worksheet #14 for sample collection procedures.	Aqueous Waste	AGVIQ-CH2M HILL	None	N	

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

At this point in the field effort, no field equipment will be used.

Field Equipment	Activity	Frequency	Acceptance Criteria	CA	Resp. Person	SOP Reference
NA	NA	NA	NA	NA	NA	NA

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SAP Worksheet #23—Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Empirical SOP 100	Metals Digestion/Prep methods 3005A,3010A, 3020A, 3030, 3040A, 3050B, EPA CLP ILMO 4.1 Aqueous & Soil/Sediment, EPA Method 200.7 (standard methods) 300C. Rev 19	Definitive	Inorganic/Metals	NA/Metals Digestion	Empirical Laboratories, LLC	N
Empirical SOP 105	Metals Analysis by ICP Technique Methods 200.7, SW846 6010B, SM 19th Edition 2340B, EPA ILMO 4.1, Rev. 14	Definitive	Inorganic/Metals	Inductively coupled plasma (ICP)	Empirical Laboratories, LLC	N
Empirical SOP 103	Mercury Analysis in Water by Manual Cold Vapor Technique methods SW846 7470a & 245.1, CLP-M 4.1, Rev. 15	Definitive	Inorganic/Metals	Flow Injection Mercury System	Empirical Laboratories, LLC	N
Empirical SOP 202	GC/MS Volatiles by method 624 and SW846 method 8260B, Rev. 21	Definitive	Organic/Gas Chromatography (GC)/Mass Spectrometry	Agilent/Hewlett Packard (HP)/GC/Mass Spectrometry	Empirical Laboratories, LLC	N
Empirical SOP 329	Soxhlet Extraction- BNA and pest/PCB using SW846 method 3541, Rev. 16	Definitive	Organic/Extraction	NA/Extraction	Empirical Laboratories, LLC	N
Empirical SOP 300	GC/MS- Semivolatile BNA-Aqueous matrix Extraction using SW846 method 3510C for 8270C/625 analysis, Rev. 17	Definitive	Organic/Extraction	NA/Extraction	Empirical Laboratories, LLC	N
Empirical SOP 201	GC/MS Semivolatiles by method 625 and SW846 method 8270C, Rev. 18	Definitive	Organic/GC/MS	Agilent/HP/GC/ Mass Spectrometry	Empirical Laboratories, LLC	N
Empirical SOP 302	Pesticide/PCBs – Aqueous Matrix Extraction for EPA method 608 and SW846 method 8081A/8082 using SW846 method 3510C, Rev. 16	Definitive	Organic/Extraction	NA/Extraction	Empirical Laboratories, LLC	N

SAP Worksheet #23—Analytical SOP References Table (continued)

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Empirical SOP 211	GC/ECD Organochlorine Pesticides/PCBs by EPA method 608 and SW846 method 8081A/8082, Rev. 19	Definitive	Organic/GC/Electron Capture Donor (ECD)	Agilent/HP/GC/ ECD	Empirical Laboratories, LLC	N
Empirical SOP 304	Herbicides Aqueous Matrix Extraction by EPA method SW846 method 3541, Rev. 16	Definitive	Organic/Extraction	NA/Extraction	Empirical Laboratories, LLC	N
Empirical SOP 208	GC/ECD Chlorinated Herbicides by SW846 method 8150B/8151A, Rev. 13	Definitive	Organic/GC/ECD	Agilent/HP/GC/ ECD	Empirical Laboratories, LLC	N
Empirical SOP 149	Flashpoint/Ignitibility Method SW846 1010, Rev. 3	Definitive	Inorganic	Flashpoint Tester	Empirical Laboratories, LLC	N
Empirical SOP 187	Electrometric Determination of pH, Methods 150.1, Standard Methods 4500H+B and 9040B for waters, liquids and liquid wastes, 9045C for soils and solid wastes, Rev. 6	Definitive	Wet Chem	pH meter	Empirical Laboratories, LLC	N
Empirical SOP 156	Reactive sulfide Method SW846, Chapter 7, Section 7.3.4, Rev. 4	Definitive	Inorganic	NA	Empirical Laboratories, LLC	N
Empirical SOP 164	Distillation of Aqueous/Solid samples for total and non-amenable cyanide analysis methods 335.1/335.4, SW846 9012A/EPA CLP ILMO 4.1, Rev. 13	Definitive	Inorganic	Lachat	Empirical Laboratories, LLC	N
Empirical SOP 175	Post-Distillation analysis for Cyanide by the LACHAT methods 335.4; SW846 9012A; EPA-CLP 4.1; Addendum for EPA CLP ILMO 5.2 aqueous & soil/sediment, Rev. 9	Definitive	Wet Chem	Lachat	Empirical Laboratories, LLC	N
Empirical SOP 404	Laboratory Samples Receiving Log-in and Storage Standard Operating Procedures, Rev. 4	Definitive	Log-in	NA/Log-in	Empirical Laboratories, LLC	N

SAP Worksheet #23—Analytical SOP References Table (continued)

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Empirical SOP 405	Analytical Laboratory Waste Disposal, Rev. 4	Definitive	Log-in	NA/Log-in	Empirical Laboratories, LLC	N
Empirical SOP 410	Standard Operating Procedures for Laboratory Sample Storage, Secure Areas, and Sample custody, Rev. 6	Definitive	Log-in	NA/Log-in	Empirical Laboratories, LLC	N

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SAP Worksheet #24—Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
Gas Chromatograph/ Mass Spectrometer Volatiles	Initial Calibration	Calibrate the instrument when it is received and after a major change or if the daily calibration fails. A minimum 5-point calibration is required.	The percent relative standard deviation (RSD) for each calibration check compound (CCC) must be less than or equal to 30%. The minimum mean response factor (RF) for each system performance check compound (SPCC) must meet that stated in 8260B. If the RSD for an analyte is greater than 15%, use a linear curve (greater than or equal to 0.995 correlation) or quadratic curve (greater than or equal to 0.99 correlation, minimum 6 points) for quantitation.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-202
Gas Chromatograph/ Mass Spectrometer Volatiles	Continuing Calibration Verification (CCV)	Analyze a standard at the beginning of each 12-hour shift after a BFB tune.	The minimum RF for SPCCs must meet that stated in method. The CCCs must be less than 20% difference.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-202
Gas Chromatograph/ Mass Spectrometer Volatiles	Initial Calibration Verification (ICV)	Calibrate once after each initial calibration.	±25% individual compounds	Identify source of problem, correct, repeat calibration, and rerun samples.	Analyst/ Supervisor	Empirical SOP-202

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
Gas Chromatograph/ Mass Spectrometer Semivolatiles	Initial Calibration	Calibrate the instrument when it is received and after a major change or if the daily calibration fails. A minimum 5-point calibration is required.	The RSD for each CCC must be less than or equal to 30%. The minimum mean RF for each SPCC must meet that stated in 8260B. If the RSD for an analyte is greater than 15%, use a linear curve (greater than or equal to 0.995 correlation) or quadratic curve (greater than or equal to 0.99 correlation, minimum 6 points) for quantitation.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-201
Gas Chromatograph/ Mass Spectrometer Semivolatiles	CCV	Analyze a standard at the beginning of each 12-hour shift after a decafluorotriphenyl-phosphine tune.	The minimum RF for SPCCs must meet that stated in method. The CCCs must be less than 20% difference.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-201
Gas Chromatograph/ Mass Spectrometer Semivolatiles	ICV	Analyze ICV once after each initial calibration.	±25% individual compounds	Identify source of problem, correct, repeat calibration, rerun samples	Analyst/ Supervisor	Empirical SOP-201
Pesticides/PCB/ Herbicides GC/ECD	Initial Calibration	Calibrate the instrument when it is received and after a major change or if the daily calibration fails. A minimum 5-point calibration is required.	Minimum 5-point calibration, 20% RSD, Linear correlation greater than 0.995, Quadratic correlation greater than 0.99 min. 6 points for all except toxaphene and chlordane. One point for toxaphene and chlordane.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-211

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
Pesticides/PCB/ Herbicides GC/ECD	CCV	Analyze a standard at the beginning and end of sequence and every 10 samples.	Less than or equal to 15% difference	If the percent difference (%D) is greater than +15% and samples are less than PQL, narrate. If %D is greater than ±15% only on one column, narrate. If %D is greater than ±15% for closing CCV, and is likely due to matrix interference, narrate. Otherwise reanalyze all samples back to the last acceptable CCV.	Analyst/ Supervisor	Empirical SOP-211
Pesticides/PCB/ Herbicides GC/ECD	ICV	Analyze ICV once after each initial calibration.	±20% individual compounds	Identify source of problem, correct, repeat calibration, rerun samples	Analyst/ Supervisor	Empirical SOP-211/208
ICP Spectrometer	Initial Calibration	Calibrate the instrument at the beginning of each day or if the QC is out of criteria.	The instrument is calibrated by a one-point calibration per manufacturer's guidelines. Analytes ran at their calibration levels must fall within 90-110% of the true values.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-105
ICP Spectrometer	CCV	Analyze a standard at the beginning and end of the sequence and after every 10 samples.	The acceptance criterion for the CCV is 90-110% of the true value.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-105
ICP Spectrometer	Initial Calibration Blank (ICB)	Analyze ICB before beginning a sample sequence.	No analytes detected greater than 2 times the MDL.	Correct the problem, then reprep and reanalyze.	Analyst/ Supervisor	Empirical SOP-105

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
ICP Spectrometer	Continuing Calibration Blank (CCB)	Analyze CCB after every 10 samples and at the end of the sequence	No analytes detected greater than 2 times the MDL.	Correct the problem, then reprep and reanalyze calibration blank and previous 10 samples.	Analyst/ Supervisor	Empirical SOP-105
Flow Injection Mercury System	Initial Calibration	Calibrate the instrument at the beginning of each day or if the QC is out of criteria.	The calibration correlation coefficient is greater than or equal to 0.995.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-103/104
Flow Injection Mercury System	CCV	Analyze the CCV at the beginning and end of the sequence and after every 10 samples.	The acceptance criteria are 80-120% of the true value.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-103/104
Flow Injection Mercury System	ICB	Analyze ICB before beginning a sample sequence	No analytes detected greater than 2 times the MDL.	Correct the problem, then reprep and reanalyze.	Analyst/ Supervisor	Empirical SOP-103/104
Flow Injection Mercury System	CCB	Analyze CCB after every 10 samples and at the end of the sequence	No analytes detected greater than 2 times the MDL.	Correct the problem, then reprep and reanalyze calibration blank and previous 10 samples.	Analyst/ Supervisor	Empirical SOP-103/104
Lachat	Initial Calibration	Calibrate the instrument after an instrument change or if QC is outside criteria.	The correlation coefficient is greater than or equal to 0.995.	Recalibrate and/or perform the necessary equipment maintenance. Check calibration standards.	Analyst/ Supervisor	Empirical SOP-175

SAP Worksheet #24—Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
Lachat	Continuing Calibration	Analyze the CCV at the beginning and end of the sequence and after every 10 samples.	The acceptance criteria are 90-110% of the true value.	Recalibrate and/or perform the necessary equipment maintenance. Reanalyze samples not bracketed by passing CCVs.	Analyst/ Supervisor	Empirical SOP-175
Flashpoint Tester	Flashpoint of p-xylene	Calibrate at the beginning and end of each set of 20 samples or less.	Flash at 27°C ± 2.2°C	Check standard.	Analyst/ Supervisor	Empirical SOP-149
pH Meter	Calibration	Calibrate before use with two buffers in the area to be measured. Check with a third buffer.	0.05 pH units	Recalibrate and/or perform the necessary equipment maintenance.	Analyst/ Supervisor	Empirical SOP-187

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference
Gas Chromatograph/ Mass Spectrometer	Clean the source and replace the filaments. Replace the seal, liner and septum. Change the column.	Volatiles/ Semivolatiles	Check the gas supply. Check the seal, liner, and septum.	Source cleaning is performed when the instrument response deteriorates. Other instrument maintenance is done as needed to keep the instrument performing at peak performance.	The minimum RF for SPCCs must meet that stated in method. The CCCs must be less than 20%D.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-201/202
Pesticides/PCB/ Herbicides GC/ECD	Check pressure and gas supply daily. Bake out column, change septa, liner, seal as needed, cut column as needed.	Pest/PCBs/ Herbicides	Liner, seal, septum, column	Prior to initial calibration or as necessary	Less than or equal to 15%D	If %D is greater than +15% and samples are less than PQL, narrate. If %D is greater than ±15% only on one column, narrate. If %D is greater than ±15% for closing CCV, and is likely due to matrix interference, narrate. Otherwise, reanalyze all samples back to the last acceptable CCV.	Analyst/ Supervisor	Empirical SOP-211
ICP Spectrometer	Clean the torch assembly and the spray chamber when they become discolored or when degradation in data quality is observed. Clean the nebulizer, and check the argon supply. Replace the peristaltic pump tubing as needed.	Target analyte list (TAL) metals	Inspect the torch, nebulizer chamber, pump, and tubing.	Maintenance is performed prior to initial calibration or as necessary.	The acceptance criteria for the CCV is 90-110% of the true value	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-105
Flow Injection Mercury System	Change the tubing, filter, clean windows, and check gas flow. Check the reagents and standards.	Mercury	Inspect the tubing, filter, and the optical cell.	Maintenance is performed prior to initial calibration or as necessary.	The acceptance criteria is 80-120% of the true value	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-103/104
Lachat	Degas solutions, change tubing, lamp, clean connectors	Cyanide/ Phenol	Tubing, rollers	Prior to initial calibration or as necessary	The acceptance criteria are 90-110% of the true value.	Recalibrate and/or perform the necessary equipment maintenance. Reanalyze samples not bracketed by passing CCVs.	Analyst/ Supervisor	Empirical SOP-175
Flashpoint Tester	Change propane tank calibrate thermometer	Flashpoint	Tank, thermometer	Before use	Flash at 27°C ± 2.2°C	Check Standard	Analyst/ Supervisor	Empirical SOP-149
pH Meter	Clean, drain, refill reference electrode as needed.	pH	Reference electrode for white crystals. Inspect electrode for damage.	Before use	0.05 pH units	Recalibrate and/or perform the necessary equipment maintenance.	Analyst/ Supervisor	Empirical SOP-187

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SAP Worksheet #26—Sample Handling System

Sample Collection, Packaging, and Shipment
Sample Collection (Personnel/Organization): Kimberley Coke/AGVIQ-CH2M HILL
Sample Packaging (Personnel/Organization): Kimberley Coke/AGVIQ-CH2M HILL
Coordination of Shipment (Personnel/Organization): Kimberley Coke/AGVIQ-CH2M HILL
Type of Shipment/Carrier: Overnight/FedEx
Sample Receipt and Analysis
Sample Receipt (Personnel/Organization): EJ Overby, William Schwab/Empirical Laboratories, LLC
Sample Custody and Storage (Personnel/Organization): EJ Overby, William Schwab/Empirical Laboratories, LLC
Sample Preparation (Personnel/Organization): Roger Burr, Karu Huka, Amanda Fei/Empirical Laboratories, LLC
Sample Determinative Analysis (Personnel/Organization): Roger Burr, Karu Huka, Antonio Monteiro, Jade Holliman/Empirical Laboratories, LLC
Sample Archiving
Field Sample Storage (No. of days from sample collection): 60 days from receipt
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 3 months from sample digestion
Biological Sample Storage (No. of days from sample collection): NA
Sample Disposal
Personnel/Organization: EJ Overby, William Schwab/Empirical Laboratories, LLC
Number of Days from Analysis: 30 days from submittal of final report or 60 days from receipt, whichever is longer

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SAP Worksheet #27—Sample Custody Requirements Table

Sample Labeling

Sample labels will include, at a minimum, client name, site, sample ID, date/time collected, analysis group or method, preservative, and sampler's initials. Labels will be taped to the jar to ensure they do not separate.

Field Sample Custody Procedures (Sample Collection, Packaging, Shipment, and Delivery to Laboratory)

Samples will be collected by field team members under the supervision of the FTL. As samples are collected, they will be placed into containers and labeled, as outlined above. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples below 4°C until they are received by the laboratory. The chain-of-custody will also be placed into the cooler. Coolers will be shipped to the laboratory via FedEx, with the air bill number indicated on the chain-of-custody (to relinquish custody). Upon delivery, the laboratory will log in each cooler and report the status of the samples.

Laboratory Sample Custody Procedures (Receipt of Samples, Archiving, Disposal)

See the laboratory sample handling and disposal SOPs: Empirical SOP 404, Empirical SOP 405, and Empirical SOP 410.

Sample Identification Procedures

Upon opening the cooler, the receiving clerk signs the chain-of-custody and then takes the temperature using the temperature blank (if absent, then a sample container or infrared thermometer is used). The sample containers in the cooler are unpacked and checked against the client's chain-of-custody and any discrepancies or breakage is noted on the chain-of-custody. Next, if any water samples require preservative, the clerk will check the pH values to see if they are in the acceptable pH range. The clerk will deliver the chain-of-custody (and any other paperwork; e.g. temperature or pH QA notice) to the PM for Laboratory Information Management System (LIMS) entry and client contact (if needed).

The field logbook will identify the sample ID with the location, depth, date/time collected, and the parameters requested. The laboratory will assign each field sample a laboratory sample ID based on information in the chain-of-custody. The laboratory will send sample log-in forms to the EIS to check sample IDs and parameters are correct.

Chain-of-Custody Procedures

Chains-of-custody will include, at a minimum, laboratory contact information, client contact information, sample information, and relinquished by/received by information. Sample information will include sample ID, date/time collected, number and type of containers, preservative information, analysis method, and comments. The chain-of-custody will also have the sampler's name and signature. The chain-of-custody will link location of the sample from the field logbook to the laboratory receipt of the sample. The laboratory will use the sample information to populate the LIMS database for each sample.

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SAP Worksheet #28—Laboratory QC Samples Table

Matrix: Soil
Analytical Group: SVOCs
Analytical Method/SOP Reference: SW-846 8270C/Empirical SOP-201

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One per batch of 20 or less	No target compounds should be greater than or equal to ½ the reporting limit except common lab contaminants which should be less than the reporting limit.	Reclean, retest, re-extract, reanalyze, and/or qualify the data.	Analyst, Laboratory Supervisor, and QA Manager	Bias/Contamination	No target compounds should be greater than or equal to ½ the reporting limit except common lab contaminants which should be less than the reporting limit.
Surrogates	6 per sample	DOD QSM limits	Reprepare and reanalyze for delineation of matrix interference when appropriate.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias	DOD QSM limits
Laboratory Control Spike (LCS)	One per batch of 20 or less	DOD QSM limits	(1) Evaluate and reanalyze if possible. (2) If an MS/MSD was performed in the same 12-hour timeframe and is acceptable, narrate. (3) If the LCS recoveries are high but the sample results are less than the reporting limit, narrate. (4) Otherwise, reprep and reanalyze the batch.	Analyst, Laboratory Supervisor. and QA Manager	Precision/Accuracy/Bias	DOD QSM limits
Internal Standard	6 per sample	Retention times for internal standards must be ±30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.	Inspect mass spectrometer or Gas chromatograph for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Supervisor, and QA Manager	Precision/Accuracy/Bias	Retention times for internal standards must be ±30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.
MS/MSD	One per sample delivery group (SDG) or every 20 samples	DOD QSM limits	(1) CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. (2) If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Laboratory Supervisor and QA Manager	Precision/Accuracy/Bias	DOD QSM limits

Matrix: Soil
Analytical Group: TAL Metals
Analytical Method/SOP Reference: SW-846 3050B, 6010B/Empirical SOP-100/105

Method Blank	One per digestion batch or 20 or fewer samples	Contaminants in the method blank must be less than ½ the reporting limit.	(1) Investigate the source of the contamination. (2) Redigest and reanalyze all associated samples if the sample concentration greater than or equal to the reporting limit and less than 10 times the blank concentration.	Analyst, Laboratory Supervisor, and QA Manager	Bias/Contamination	Contaminants in the method blank must be less than ½ the reporting limit.
LCS	One per digestion batch or 20 or fewer samples	Recovery must be within ±20% of the true value, unless vendor-supplied or statistical limits have been established.	(1) Investigate the source of the problem. (2) Redigest and reanalyze all associated samples.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias/ Contamination	Recovery must be within ±20% of the true value, unless vendor-supplied or statistical limits have been established.
Duplicate Sample	One per digestion batch or 20 or fewer samples	The RPD should be less than or equal to 20% for duplicate samples.	Flag results.	Analyst, Laboratory Supervisor, and QA Manager	Precision	The RPD should be less than or equal to 20% for duplicate samples.
MS	One per digestion batch or 20 or fewer samples	Recovery should be ±25% of the true value, if sample is less than 4 times the spike added.	Flag results.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias	Recovery should be ±25% of the true value, if sample is less than 4 times the spike added.

SAP Worksheet #28—Laboratory QC Samples Table (continued)

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
ICP Serial Dilution	One per digestion batch	If original sample result is at least 50 times the instrument detection limit, 5-fold dilution must agree within +10% of the original result.	Flag result or dilute and reanalyze sample to eliminate interference.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias	If original sample result is at least 50 times the instrument detection limit, 5-fold dilution must agree within ±10% of the original result.
Matrix: Aqueous Waste **Analytical Group:** VOCs (RCRA compounds for waste characterization) **Analytical Method/SOP Reference:** SW-846 8260B/Empirical SOP-202						
Method Blank	One per batch of 20 or less	No target compounds should be greater than or equal to ½ the reporting limit except common lab contaminants which should be less than the reporting limit.	Reclean, retest, re-extract, reanalyze, and/or qualify the data.	Analyst, Laboratory Supervisor, and QA Manager	Bias/Contamination	No target compounds should be greater than or equal to ½ the reporting limit except common lab contaminants which should be less than the reporting limit.
Surrogates	3 per sample	DOD QSM limits	Reprepare and reanalyze for delineation of matrix interference when appropriate.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias	DOD QSM limits
LCS	One per batch of 20 or less	DOD QSM limits	(1) Evaluate and reanalyze if possible. (2) If an MS/MSD was performed in the same 12-hour timeframe and is acceptable, narrate. (3) If the LCS recoveries are high but the sample results are less than the reporting limit, narrate. (4) Otherwise, reprep and reanalyze the batch.	Analyst, Laboratory Supervisor, and QA Manager	Precision/Accuracy/Bias	DOD QSM limits
Internal Standard	3 per sample	Retention times for internal standards must be +30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.	Inspect mass spectrometer or Gas chromatograph for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Supervisor, and QA Manager	Precision/Accuracy/Bias	Retention times for internal standards must be ±30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.
MS/MSD	One per SDG or every 20 samples	DOD QSM limits	(1) CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. (2) If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Laboratory Supervisor, and QA Manager	Precision/Accuracy/Bias	DOD QSM limits
Matrix: Aqueous Waste **Analytical Group:** SVOCs (RCRA compounds for waste characterization) **Analytical Method/SOP Reference:** SW-846 8270C/Empirical SOP-300/201						
Method Blank	One per batch of 20 or less	No target compounds should be greater than or equal to ½ the reporting limit except common lab contaminants which should be less than the reporting limit.	Reclean, retest, re-extract, reanalyze, and/or qualify the data.	Analyst, Laboratory Supervisor, and QA Manager	Bias/Contamination	No target compounds should be greater than or equal to ½ the reporting limit except common lab contaminants which should be less than the reporting limit.
Surrogates	6 per sample	DOD QSM limits	Reprepare and reanalyze for delineation of matrix interference when appropriate.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias	DOD QSM limits
LCS	One per batch of 20 or less	DOD QSM limits	(1) Evaluate and reanalyze if possible. (2) If an MS/MSD was performed in the same 12-hour clock and acceptable, narrate. (3) If the LCS recoveries are high but the sample results are less than the reporting limit, narrate. (4) Otherwise, reprep and reanalyze the batch.	Analyst, Laboratory Supervisor, and QA Manager	Precision/Accuracy/Bias	DOD QSM limits
Internal Standard	6 per sample	Retention times for internal standards must be +30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.	Inspect mass spectrometer or Gas chromatograph for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Supervisor, and QA Manager	Precision/Accuracy/Bias	Retention times for internal standards must be +30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.

SAP Worksheet #28—Laboratory QC Samples Table (continued)

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MS/MSD	One per SDG or every 20 samples	DOD QSM limits	(1) CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. (2) If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Laboratory Supervisor, and QA Manager	Precision/Accuracy/Bias	DOD QSM limits
Matrix: Aqueous Waste **Analytical Group:** Metals RCRA compounds for waste characterization) **Analytical Method/SOP Reference:** SW-846 3005A, 6010B/7470A/Empirical SOP-100/103/105						
Method Blank	One per digestion batch or 20 or fewer samples	Contaminants in the method blank must be less than ½ the reporting limit.	(1) Investigate the source of the contamination. (2) Redigest and reanalyze all associated samples if the sample concentration greater than or equal to the reporting limit and less than 10 times the blank concentration.	Analyst, Laboratory Supervisor, and QA Manager	Bias/Contamination	Contaminants in the method blank must be less than ½ the reporting limit.
LCS	One per digestion batch or 20 or fewer samples	Recovery must be within ±20% of the true value, unless vendor-supplied or statistical limits have been established.	(1) Investigate the source of problem. (2) Redigest and reanalyze all associated samples.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias/ Contamination	Recovery must be within ±20% of the true value, unless vendor-supplied or statistical limits have been established.
Duplicate Sample	One per digestion batch or 20 or fewer samples	The RPD should be within less than or equal to 20% for duplicate samples.	Flag results.	Analyst, Laboratory Supervisor, and QA Manager	Precision	The RPD should be less than or equal to 20% for duplicate samples.
MS	One per digestion batch or 20 or fewer samples	Recovery should be ±25% of the true value, if sample less than 4 times the spike added.	Flag results.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias	Recovery should be ±25% of the true value, if sample less than 4 times the spike added.
ICP Serial Dilution	One per digestion batch	If original sample result is at least 50 times the instrument detection limit, 5-fold dilution must agree within ±10% of the original result.	Flag result or dilute and reanalyze sample to eliminate interference.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias	If original sample result is at least 50 times the instrument detection limit, 5-fold dilution must agree within ±10% of the original result.
Matrix: Aqueous Waste **Analytical Group:** Pesticides/Herbicides/PCBs (RCRA compounds for waste characterization) **Analytical Method/SOP Reference:** SW-846 8081A/8082/8151A/Empirical SOP-302/304/211/208						
Method Blank	One per batch of 20 or less	No target compounds greater than or equal to ½ contract-required quantitation limit (CRQL).	Reclean, retest, re-extract, reanalyze, and/or qualify the data.	Analyst, Laboratory Supervisor, and QA Manager	Bias/Contamination	No target compounds greater than or equal to ½ CRQL.
Surrogates	2 per sample/1 for Herbicides	DOD QSM limits	Reprepare and reanalyze for delineation of matrix interference when appropriate.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias	DOD QSM limits
LCS	One per batch of 20 or less	DOD QSM limits	(1) Evaluate and reanalyze if possible. (2) If an MS/MSD was performed in the same 12-hour clock and is acceptable, narrate. (3) If the LCS recoveries are high but the sample results are less than the reporting limit, narrate. (4) Otherwise, reprep and reanalyze the batch.	Analyst, Laboratory Supervisor, and QA Manager	Precision/Accuracy/Bias	DOD QSM limits
MS/MSD	One per 20 samples or less	DOD QSM limits	(1) CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. (2) If both the LCS and MS are unacceptable, reprep the samples and QC.	Analyst, Laboratory Supervisor, and QA Manager	Precision/Accuracy/Bias	DOD QSM limits

SAP Worksheet #28—Laboratory QC Samples Table (continued)

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Matrix: Water **Analytical Group:** Reactivity/Cyanide **Analytical Method/SOP Reference:** SW-846 9012A/Empirical SOP-175						
Distilled Prep Blank	Every batch of 20 samples or less	Less than ½ reporting limit	If instrument problem, reanalyze prep blank. If distillation problem, samples 5 times the prep blank can be reported. If less than 5 times the prep blank, redistill and reanalyze.	Analyst, Laboratory Supervisor, and QA Manager	Bias/Contamination	Less than ½ reporting limit
LCS	Every batch of 20 samples or less	80-120%	Reanalyze when instrument is in control. If low, redigest and reanalyze samples. If high and hits, redigest and reanalyze.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias	80-120%
Distilled Calibration Verification	Every batch of 20 samples or less	90-110%	Check with supervisor before proceeding.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias	90-110%
MS/MSD	Every batch of 20 samples or less	80-120%	Check with supervisor before proceeding.	Analyst, Laboratory Supervisor, and QA Manager	Precision/Accuracy/Bias	80-120%
Calibration Blanks	Check with supervisor before proceeding.	Below MDL	Check with supervisor before proceeding.	Analyst, Laboratory Supervisor, and QA Manager	Bias/Contamination	Below MDL
Matrix: Water **Analytical Group:** Reactivity/Sulfide **Analytical Method/SOP Reference:** SW-846 Chapter 7/Empirical SOP-156						
Method Blank	Every batch of 20 samples or less	Less than ½ reporting limit	Reanalyze, and or qualify data.	Analyst, Laboratory Supervisor, and QA Manager	Bias/Contamination	Less than ½ reporting limit
MS/MSD	Every batch of 20 samples or less	80-120%	Check with supervisor before proceeding.	Analyst, Laboratory Supervisor, and QA Manager	Precision/Accuracy/Bias	75-125%
Matrix: Water **Analytical Group:** Ignitability **Analytical Method/SOP Reference:** SW-846 1010/Empirical SOP-149						
p-xylene flashpoint	At the beginning and end of each set of 20 samples	27°C ± 2.2°C	Reanalyze and/or qualify data.	Analyst, Laboratory Supervisor, and QA Manager	Accuracy/Bias	27°C ± 2.2°C
Matrix: Water **Analytical Group:** pH **Analytical Method/SOP Reference:** SW-846 9040B/Empirical SOP-187						
Laboratory Duplicate	One per prep batch of 10 or fewer samples	±0.09 units	Recalibrate and reanalyze samples.	Analyst, Supervisor, and QA Manager	Precision	±0.09 units
Laboratory Control Sample	Once per 20 samples	±0.25 units	Reanalyze associated samples. If sample is within holding time, reanalyze affected sample batch.	Analyst, Supervisor, and QA Manager	Accuracy/Bias	±0.25 units

SAP Worksheet #29—Project Documents and Records Table

Document	Where Maintained
Field Notebooks	Electronic .pdf copies in the project file. Hardcopy (bound notebook) in the project file. Archived at project closeout[a].
Chain-of-Custody Records	Electronic .pdf copies in the project file. Hardcopy in the project file. Archived at project closeout.
Air Bills	Hardcopy in the project file. Archived at project closeout.
Telephone Logs	Hardcopy in the project file. Archived at project closeout.
CA Forms	Electronic .pdf copies in the project file. Hardcopy in the project file. Archived at project closeout.
Electronic Field Data Deliverables	Loaded in the Field Database then transferred to the SQL Data Warehouse as the final repository.
Various field measurements	Recorded in Field Notebook and stored in SQL Data Warehouse.
All field equipment calibration information	Recorded in Field Notebook.
Pertinent telephone conversations	Recorded in Field Notebook.
Field equipment maintenance records	Inspected by FTL. Not maintained.
Sample Receipt, Custody, and Tracking Records	Electronic .pdf copies in the project file. Hardcopy in the full data package and stored in SQL sample tracking database.
Standard Traceability Logs	Hardcopy in the full data package. Archived at project closeout.
Equipment Calibration Logs	Hardcopy in the full data package. Archived at project closeout.
Sample Prep Logs	Hardcopy in the full data package. Archived at project closeout.
Run Logs	Hardcopy in the full data package. Archived at project closeout.
Equipment Maintenance, Testing, and Inspection Logs	Hardcopy in the full data package. Archived at project closeout.
Reported Field Sample Results	Electronic .pdf copies in the project file. Hardcopy in the data package. Archived at project closeout.
Reported Results for Standards, QC Checks, and QC Samples	Hardcopy in the full data package. Archived at project closeout.

SAP Worksheet #29—Project Documents and Records Table (continued)

Document	Where Maintained
Instrument Printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples	Hardcopy in the full data package. Archived at project closeout.
Data Package Completeness Checklists	Hardcopy in the data validation report. Archived at project closeout.
Sample Disposal Records	Maintained by the laboratory.
Extraction/Cleanup Records	Maintained by the laboratory.
Raw Data	Hardcopy in the full data package. Archived at project closeout. Hard copies at Iron Mountain and DVD/CD backups onsite at AGVIQ-CH2M HILL.
Field Sampling Audit Checklists	Hardcopy in the project file. Archived at project closeout.
Fixed Laboratory Audit Checklists	If completed, hardcopy in the project file. Archived at project closeout.
Data Validation Reports	Electronic .pdf copies in the project file. Hardcopy stored with the data package. Archived at project closeout. Hard copies at Iron Mountain and DVD/CD backups onsite at AGVIQ-CH2M HILL.
Electronic Data Deliverables and Electronic Login Deliverables	EDDs are loaded into the SQL Data Warehouse as the final repository. The ELDs are loaded into the SQL Sample Tracking DB as the final repository.

Notes:

[a] Data archiving will be done in accordance with Navy requirements. AGVIQ-CH2M HILL will provide the Navy (currently Bonnie Capito) all data and reports for archiving.

SAP Worksheet #30—Analytical Services Table

All samples will be shipped to Empirical Laboratories, LLC, in Nashville, Tennessee for analysis. The data package will include hardcopy data (including raw data), a CD-ROM containing portable document format (PDF) versions of the data package, and an electronic data deliverable. The data package will be due within 14 calendar days of sample receipt.

Matrix	Analytical Group	Sample Locations/ID Number	Analytical Method	Data Package Turnaround Time	Laboratory/Organization[a]	Backup Laboratory/ Organization[a]
Soil	Arsenic only	See Worksheet #18 and Figure 7 for sample grid)	6010B	14 days	Empirical Laboratories, LLC 227 French Landing Dr. Nashville, TN 37228 Marcia McGinnity 615-345-1119	TBD
Soil	Selected PAHs[b]	See Worksheet #18 and Figure 7 for sample grid)	8270C	14 days	Empirical Laboratories, LLC 227 French Landing Dr. Nashville, TN 37228 Marcia McGinnity 615-345-1119	TBD
Aqueous Waste	VOCs – RCRA compounds (see Worksheet #15 for specific compounds).	See Worksheet #18	8260B	14 days	Empirical Laboratories, LLC 227 French Landing Dr. Nashville, TN 37228 Marcia McGinnity 615-345-1119	TBD
Aqueous Waste	SVOCs – RCRA compounds (see Worksheet #15 for specific compounds).	See Worksheet #18	8270C	14 days	Empirical Laboratories, LLC 227 French Landing Dr. Nashville, TN 37228 Marcia McGinnity 615-345-1119	TBD

SAP Worksheet #30—Analytical Services Table (continued)

Matrix	Analytical Group	Sample Locations/ID Number	Analytical Method	Data Package Turnaround Time	Laboratory/Organization[a]	Backup Laboratory/ Organization[a]
Aqueous Waste	Pesticides/PCBs – RCRA compounds (see Worksheet #15 for specific compounds).	See Worksheet #18	8081A/8082	14 days	Empirical Laboratories, LLC 227 French Landing Dr. Nashville, TN 37228 Marcia McGinnity 615-345-1119	TBD
Aqueous Waste	Herbicides – RCRA compounds (see Worksheet #15 for specific compounds).	See Worksheet #18	8151A	14 days	Empirical Laboratories, LLC 227 French Landing Dr. Nashville, TN 37228 Marcia McGinnity 615-345-1119	TBD
Aqueous Waste	Metals – RCRA compounds (see Worksheet #15 for specific compounds).	See Worksheet #18	6010B/ 7470A	14 days	Empirical Laboratories, LLC 227 French Landing Dr. Nashville, TN 37228 Marcia McGinnity 615-345-1119	TBD
Aqueous Waste	Corrosivity	See Worksheet #18	9040B	14 days	Empirical Laboratories, LLC 227 French Landing Dr. Nashville, TN 37228 Marcia McGinnity 615-345-1119	TBD
Aqueous Waste	Ignitability	See Worksheet #18	1010	14 days	Empirical Laboratories, LLC 227 French Landing Dr. Nashville, TN 37228 Marcia McGinnity 615-345-1119	TBD

SAP Worksheet #30—Analytical Services Table (continued)

Matrix	Analytical Group	Sample Locations/ID Number	Analytical Method	Data Package Turnaround Time	Laboratory/Organization[b]	Backup Laboratory/ Organization
Aqueous Waste	Reactive Cyanide/Sulfide	See Worksheet #18	9012A/ Chapter 7, Section 7.3.4	14 days	Empirical Laboratories, LLC 227 French Landing Dr. Nashville, TN 37228 Marcia McGinnity 615-345-1119	TBD

Notes:

[b] PAH list consists of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluroanthene, and indeno(1,2,3-cd)pyrene.

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SAP Worksheet #31—Planned Project Assessments Table

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 CA	Person(s) Responsible for Monitoring Effectiveness of CA
Field Performance Audit	One during sampling activities	Internal	AGVIQ-CH2M HILL	BT Thomas, QC Manager AGVIQ-CH2M HILL	Project Field Team AGVIQ-CH2M HILL	Tom Beisel, PM AGVIQ-CH2M HILL	Theresa Rojas, Program QA/QC Manager AGVIQ-CH2M HILL
Safe Work Observation	One per week during field activities	Internal	AGVIQ-CH2M HILL	Kimberley Coke, SSC AGVIQ-CH2M HILL	Project Field Team AGVIQ-CH2M HILL	Mike Goldman, H&S Officer AGVIQ-CH2M HILL	Kimberley Coke, SSC AGVIQ-CH2M HILL
Offsite Laboratory Technical Systems Audit	Laboratory must have current Naval Facilities Engineering Service Center (NFESC) evaluation letter which will identify the period of performance. The laboratory must be re-evaluated prior to expiration of period of performance	External	U.S. Navy (NFESC)	Theresa Rojas, Program QA/QC Manager AGVIQ-CH2M HILL	Randy Ward, Laboratory QA Officer Empirical Laboratories, LLC	Randy Ward, Laboratory QA Officer Empirical Laboratories, LLC	Camden Robinson, Project Chemist AGVIQ-CH2M HILL

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SAP Worksheet #32—Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of CA Response Documentation	Individual(s) Receiving CA Response	Timeframe for Response
Field Performance Audit	Field Performance Audit Checklist	Field Team Tom Beisel, PM Theresa Rojas, Program QA/QC Manager AGVIQ-CH2M HILL	Within 1 day of audit	Verbal and CA Form	Kimberley Coke, FTL AGVIQ-CH2M HILL	Within 1 day of receipt of CA Form
Safe Work Observation	Safe Work Observation Form	Field Team Kimberley Coke, FTL Tom Beisel, PM AGVIQ-CH2M HILL	Immediately (person involved or observed person). Following day (field team). Within 1 week if worthy of elevation (H&S officer)	On Safe Work Observation Form	Kimberley Coke, FTL, and individual being observed, and Tom Beisel, PM, and if elevated to Mike Goldman, H&S officer. AGVIQ-CH2M HILL	Corrected in the field immediately, and within 1 week if elevated.
Offsite Laboratory Technical Systems Audit	Written Audit Report	Randy Ward, Laboratory QA Officer Empirical Laboratories, LLC	Within 2 months of audit	Memorandum	NFESC Auditor, TBD	Within 2 months of receipt of initial notification.

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SAP Worksheet #32-1—Corrective Action Form

Person initiating CA _____ **Date** _____

Description of problem and when identified: _____

_____

_____

_____

_____

Cause of problem, if known or suspected: _____

_____

_____

_____

Sequence of CA: (including date implemented, action planned and personnel/data affected) _

_____

_____

_____

_____

_____

_____

_____

CA implemented by: _____ **Date:** _____

CA initially approved by: _____ **Date:** _____

Follow-up date: _____

Final CA approved by: _____ **Date:** _____

Information copies to:

_____

_____

_____

SAP Worksheet #32-2—Field Performance Audit Checklist

Project Responsibilities

Project No.: **Date:**

Project Location: **Signature:**

Team Members:

Yes No 1) Is the approved work plan being followed?
Comments:

Yes No 2) Was a briefing held for project participants?
Comments:

Yes No 3) Were additional instructions given to project participants?
Comments:

Sample Collection:

Yes No 1) Is there a written list of sampling locations and descriptions?
Comments:

Yes No 2) Are samples collected as stated in the Master SOPs?
Comments:

Yes No 3) Are samples collected in the type of containers specified in the work plan?
Comments:

Yes No 4) Are samples preserved as specified in the work plan?
Comments:

Yes No 5) Are the number, frequency, and type of samples collected as specified in the work plan?
Comments:

Yes No 6) Are QA checks performed as specified in the work plan?
Comments:

Yes No 7) Are photographs taken and documented?
Comments:

Document Control:

Yes No 1) Have any accountable documents been lost?
Comments:

Yes No 2) Have any accountable documents been voided?
Comments:

Yes No 3) Have any accountable documents been disposed of?
Comments:

Yes No 4) Are the samples identified with sample tags?
Comments:

Yes No 5) Are blank and duplicate samples properly identified?
Comments:

Yes No 6) Are samples listed on a chain-of-custody record?
Comments:

Yes No 7) Is chain-of-custody documented and maintained?
Comments:

SAP Worksheet #32-3—Safe Work Observation Form

Project:		**Observer:**	**Date:**
Position/Title of worker observed:		**Background Information/comments:**	
Task/Observation Observed:			

- Identify and reinforce safe work practices/behaviors
- Identify and improve on at-risk practices/acts
- Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current and accurate Pre-Task Planning/Briefing (Project Safety Plan, Safety Task Analysis Card, Activity Hazard Analysis, Pre-Task Safety Plan, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's CAs/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's CAs/Comments:**
Other…			

SAP Worksheet #33—QA Management Reports Table

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Field Audit Report	One during sampling activities	Submitted with report in which data is analyzed and presented	Tom Beisel, PM AGVIQ-CH2M HILL	AGVIQ-CH2M HILL Regional Health, Safety, Environment, and Quality Manager, Included in project files
Field Progress Reports (during construction activities, only)	Daily	Weekly or daily reporting will be submitted the following Monday during construction activities.	Site Superintendent	Reports will be included as an attachment to the Construction Completion Report. Construction Completion Report distribution will include the Navy and EPA
QA Management Report/Technical Memorandum	Once results are received from data validator	TBD	AGVIQ-CH2M HILL	AGVIQ-CH2M HILL, EPA Region II, PREQB, NAVFAC SE

The following will be addressed in the QA/QC section of QA Management Report/Technical Memorandum:

- Summary of project QA/QC programs and trainings
- Conformance of project activities to SAP requirements and procedures
- Status of project and schedule delays
- Deviations from approved SAP and approved amendments to SAP
- Description and findings of audits
- Results of data review activities in terms of amount of usable data generated (results of the Chemist's QC check on data prior to loading into AGVIQ-CH2M HILL's database)
- Required CAs and effectiveness of CA implementation
- Data usability assessments in terms of accuracy, precision, representativeness, completeness, comparability and sensitivity
- Limitations on use of measurement data generated

The report will also include data quality concerns:

- Narrative and timelines of project activities summary of PQO development
- Reconciliation of project data with PQOs
- Summary of major problems encountered and their resolution
- Data summary, including tables, charts, graphs, with appropriate sample ID or station location numbers, concentration units, percent solids (NA), and data quality flags
- Conclusions and recommendations

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

Verification Input	Description	Internal/ External	Responsible for Verification
Field Notebooks	Field notebooks will be reviewed internally and placed into the project file for archival at project closeout.	Internal	Kimberley Coke/AGVIQ-CH2M HILL
Chains of Custody and Shipping Forms	Chain-of-custody forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the chain-of-custody will be initialed by the reviewer, a copy of the chain-of-custody retained in the site file, and the original and remaining copies taped inside the cooler for shipment.	Internal	Kimberley Coke/AGVIQ-CH2M HILL
Sample Condition upon Receipt	Any discrepancies, missing, or broken containers will be communicated to the project chemist or designee in the form of laboratory logins.	Internal	Project Chemist or designee: Camden Robinson/AGVIQ-CH2M HILL
Sample Chronology	Holding times from collection to extraction or analysis and from extraction to analysis will be considered by the data validator during the data validation process.	External and Internal	Third Part Data Validator: Mike Stewart/ eDATApro Project Chemist: Camden Robinson/ AGVIQ-CH2M HILL
Documentation of Laboratory Method Deviations	Laboratory method deviations will be discussed and approved by the project chemist. Documentation will be incorporated into the case narrative which becomes part of the final hardcopy data package.	Internal	Project Chemist: Camden Robinson/ AGVIQ-CH2M HILL
Electronic Data Deliverables	Electronic data deliverables will be compared against hardcopy laboratory results.	Internal	Project Data Coordinator: Kama White/ AGVIQ-CH2M HILL
Case Narrative	Case narratives will be reviewed by the data validator during the data validation process.	External and Internal	Third Party Data Validator: Mike Stewart/ eDATApro Project Chemist: Camden Robinson/ AGVIQ-CH2M HILL

SAP Worksheet #34—Verification (Step I) Process Table (continued)

Verification Input	Description	Internal/ External	Responsible for Verification
Laboratory Data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal. All received data packages will be verified internally by the project chemist. 10% of data packages received will be verified externally by the third party validator.	Internal and External	Respective Laboratory QA Officer Third Party Data Validator: Mike Stewart/ eDATApro Project Chemist: Camden Robinson/ AGVIQ-CH2M HILL
Audit Reports	Upon report completion, a copy of all audit reports will be placed in the site file. If CAs are required, a copy of the documented CA taken will be attached to the appropriate audit report in the QA site file. Periodically, and at the completion of site work, site file audit reports and CA forms will be reviewed internally to ensure that all appropriate CAs have been taken and that CA reports are attached. If CAs have not been taken, the site manager will be notified to ensure action is taken.	Internal	PM: Tom Beisel/ AGVIQ-CH2M HILL QC Manager: Eric Burrell/ AGVIQ-CH2M HILL Program QA/QC Manager: Theresa Rojas/ AGVIQ-CH2M HILL
CA Reports	CA reports will be reviewed by the project chemist or PM and placed into the project file for archival at project closeout.	Internal	Project Chemist: Camden Robinson/ AGVIQ-CH2M HILL PM: Tom Beisel/AGVIQ-CH2M HILL

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

Step IIa/IIb	Validation Input	Description	Responsible for Validation
IIb	Onsite Screening	Ensure that all field data meet SAP requirements for completeness and accuracy based on the field calibration records.	Kimberley Coke/AGVIQ-CH2M HILL
IIa	SOPs	Ensure that all sampling and analytical SOPs were followed.	Kimberley Coke/AGVIQ-CH2M HILL Randy Ward/Empirical Laboratories, LLC
IIa	Method QC Results	Ensure that all required QC samples were run and met method and/or project required limits.	Mike Stewart/eDATApro Camden Robinson/AGVIQ-CH2M HILL
IIb	SAP QC Sample Results	Ensure that all required SAP QC samples were run and met required limits.	Camden Robinson/AGVIQ-CH2M HILL Mike Stewart/eDATApro
IIb	QLs	Ensure all sample results met the project quantification limit specified in the SAP.	Camden Robinson/AGVIQ-CH2M HILL
IIa	Raw Data	Ten percent review of raw data to confirm laboratory calculations	Mike Stewart/eDATApro
IIa	Raw Data	Review all raw data to confirm laboratory calculations.	Camden Robinson/AGVIQ-CH2M HILL

Notes:

IIa = compliance with methods, procedures, and contracts
IIb = comparison with measurement performance criteria in the SAP

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

Step IIa/IIb	Matrix	Analytical Group	Validation Criteria	Data Validator
IIa	Soil	Selected Semivolatiles	Analytical methods and laboratory SOPs as presented in this SAP (Worksheets #19 and #23) will be used to evaluate compliance against QA/QC criteria. Should adherence to QA/QC criteria yield deficiencies, data may be qualified. The data qualifiers that may be used are those presented in EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA540/R-99/008, October 1999 using guidance from DoD QSM - Version 3 Final, DoD, January 2006 (Based On NELAC Voted Version – 5 June 2003).	Mike Stewart/ eDATApro Camden Robinson/ AGVIQ-CH2M HILL
IIa	Soil	Metals-Arsenic only	Analytical methods and laboratory SOPs as presented in this SAP (Worksheets #19 and #23) will be used to evaluate compliance against QA/QC criteria. Should adherence to QA/QC criteria yield deficiencies, data may be qualified. The data qualifiers that may be used are those presented in EPA Contract Laboratory Program National Functional Guidelines for In-Organics, EPA540-R-04-004, October 2004 using guidance from DoD QSM - Version 3 Final, DoD, January 2006 (Based on NELAC Voted Version – 5 June 2003).	Mike Stewart/ eDATApro Camden Robinson/ AGVIQ-CH2M HILL
IIa	Aqueous	VOC, SVOC, Pesticides, Herbicides, PCB, Metals, Reactivity, Corrosivity, Ignitability	Data will be reviewed against the analytical methods for outstanding QA/QC issues and anomalies by the laboratory. Issues will be summarized in the case narrative. AGVIQ-CH2M HILL chemist and PM will review the analytical results and case narrative before the data is loaded to ensure no major problems exist.	Empirical Laboratories, LLC Camden Robinson/ AGVIQ-CH2M HILL Tom Beisel/ AGVIQ-CH2M HILL
IIb	Soil	Selected Semivolatiles and Metal-Arsenic	Results will be compared to PALs as specified in Worksheet #15.	Camden Robinson/ AGVIQ-CH2M HILL
IIb	Aqueous	VOC, SVOC, Pesticides, Herbicides, PCB, Metals, Reactivity, Corrosivity, Ignitability	Results will be compared to PALs in Worksheet #15.	Camden Robinson/ AGVIQ-CH2M HILL Tom Beisel/ AGVIQ-CH2M HILL

Notes:

IIa = compliance with methods, procedures, and contracts
IIb = comparison with measurement performance criteria in the SAP

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SAP Worksheet #37—Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

- Non-detected site contaminants will be evaluated to ensure that project-required QLs in Worksheet #15 were achieved. If project QLs were achieved and the verification and validation steps yielded acceptable data, then the data is considered usable.
- During verification and validation steps, data may be qualified as estimated with the following qualifiers: J, UJ, B, or JB. These qualifiers represent minor QC deficiencies which will not affect the usability of the data. When major QC deficiencies are encountered, data will be qualified with an R or UR and in most cases is not considered usable for project decisions.
- For statistical comparisons ND values will be represented by a concentration equal to one-half the sample reporting limit. For duplicate sample results, the most conservative value will be used for project decisions.
- Analytical data will be checked to ensure the values and any qualifiers are appropriately transferred to the electronic database. These checks include comparison of hardcopy data and qualifiers to the electronic data deliverable. Once the data has been uploaded into the electronic database, another check will be performed to ensure all results were loaded accurately.
- Field and laboratory precision will be compared as RPD between the two results.
- Deviations from the UFP-SAP will be reviewed to assess whether CA is warranted and to assess impacts to achievement of project objectives.

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

- To assess whether a sufficient quantity of acceptable data are available for decision making, the data will be reconciled with measurement performance criteria following validation and review of DQI.
- If significant biases are detected with laboratory QA/QC samples it will be evaluated to assess impact on decision making. Low biases will be described in greater detail as they represent a possible inability to detect compounds that may be present at the site.
- If significant deviations are noted between lab and field precision the cause will be further evaluated to assess impact on decision making.

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

The following will be prepared by AGVIQ-CH2M HILL and presented to and submitted to the Tier I Partnering Team for review and decisions on the path forward for the site.

- Data tables will be produced to reflect detected and non-detected site COCs. Data qualifiers will be reflected in the tables and discussed in the DQE.

- Graphical representations will be produced to reflect increasing and/or decreasing concentrations of COCs and geochemical parameters.
- Maps will be produced to reflect increasing and/or decreasing areas of soil contamination.
- A DQE considering all of the above will be provided as part of presentations to the Tier I Partnering Team, followed by the technical memorandum prepared to assess remedy effectiveness. The technical memorandum will identify any data usability limitations and make recommendations for CA if necessary.

Identify the personnel responsible for performing the usability assessment.

The AGVIQ-CH2M HILL team, including the PM, Project Chemist, and Senior ERD Technologist, will review the data and compile a presentation for the Partnering Team. The Tier I Partnering Team as a whole will assess the usability of the data.

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APPENDIX A

Figures

City

Major Road

Naval Station Roosevelt Roads Boundary

N

0 5 10 20 Miles

FIGURE 1
NAPR Location in Puerto Rico
Naval Station Roosevelt Roads, Puerto Rico

CH2MHILL

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Road

Expressway

Naval Station Roosevelt Roads Boundary

FIGURE 2
Tow Way Fuel Farm Location
Naval Station Roosevelt Roads, Puerto Rico

CH2MHILL

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Fence

Former Fuel Tank

N

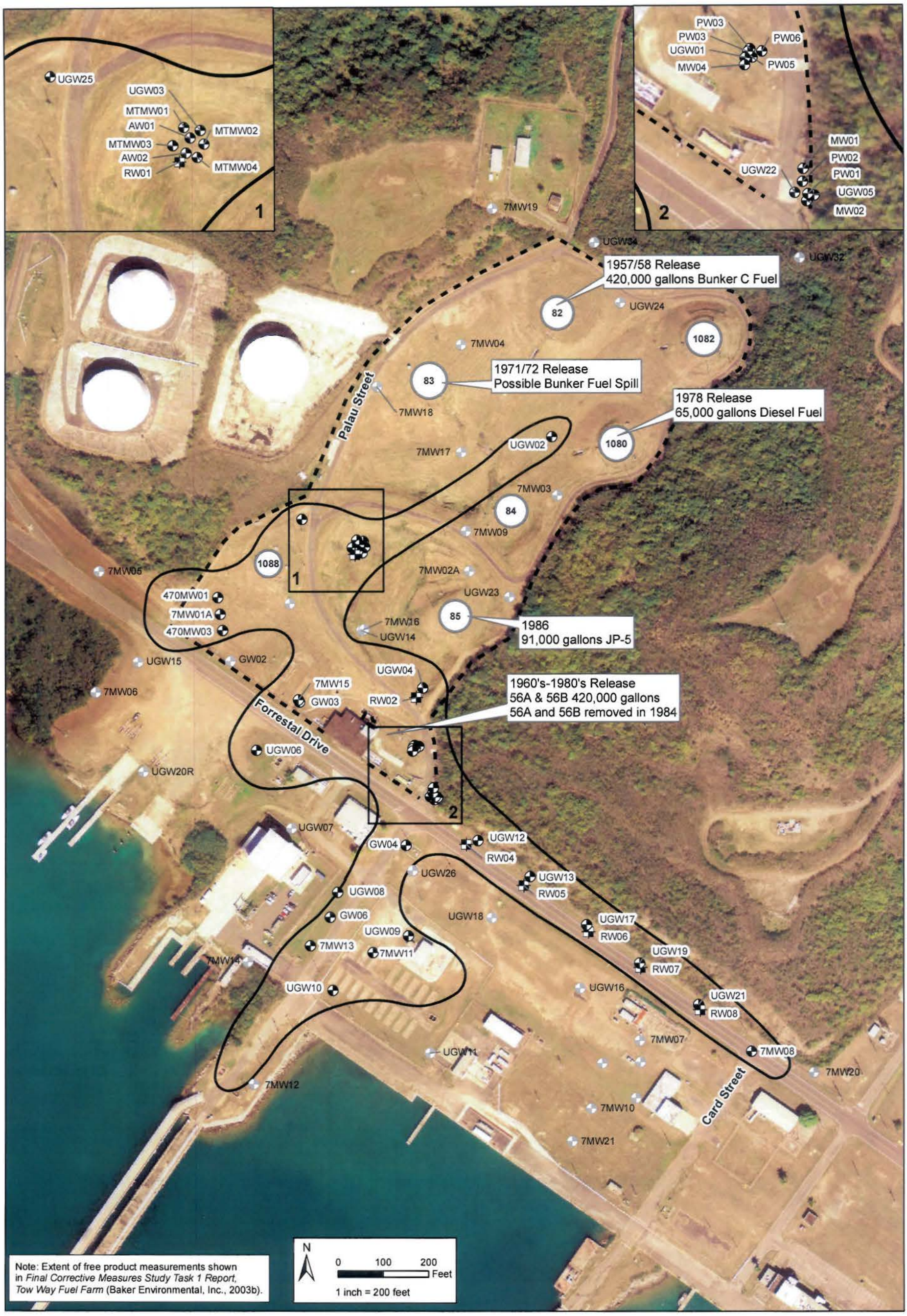
0 100 200 Feet

1 inch = 200 feet

FIGURE 3
SWMU 7/8 Base Map
Tow Way Fuel Farm
Naval Station Roosevelt Roads, Puerto Rico

CH2MHILL

File Path: E:\Projects\USNavy\378718_PuertoRico\GIS\MapFiles\Basemap.mxd, Date: February 18, 2009, User: DDickman



Wells

- Monitoring and Observation Well
- Recovery Well
- Historical Extent of Phase Separated Hydrocarbons (PSH)
- Fence
- Former Fuel Tank

UGW12	Well with measurable amount of free product on 2/2/2002.
UGW18	Well with no measurable amount of free product on 2/2/2002.

FIGURE 4
Historical Extent of Free Product
Tow Way Fuel Farm
Naval Station Roosevelt Roads, Puerto Rico

CH2MHILL

File Path: E:\Projects\USNavy\378718PuertoRico\MapFiles\Historic_Free_Product.mxd, Date: February 2, 2009, User: DDickman

Note: Extent of free product measures shown in *RCRA 7003 Administrative Order on Consent Quarterly Progress Report, May 1, 2008 – July 31, 2008* (Baker Environmental, Inc., 2008).

Wells

- Monitoring and Observation Well
- Recovery Well
- Fence
- Well ID and PSH Thickness

N

0 100 200 Feet

1 inch = 200 feet

FIGURE 5
Extent of Free Product as of July 2008
Tow Way Fuel Farm
Naval Station Roosevelt Roads, Puerto Rico

CH2MHILL

File Path: E:\Projects\USNavy\378718PuertoRico\MapFiles\Extent_Free_Product.mxd, Date: 2/2/2009, User: DDickman

Existing Soil Sampling Location for SVOC

Existing Soil Sampling Location for Arsenic

Fence

Assumed Impacted Soil Area (See Note)

8TP02

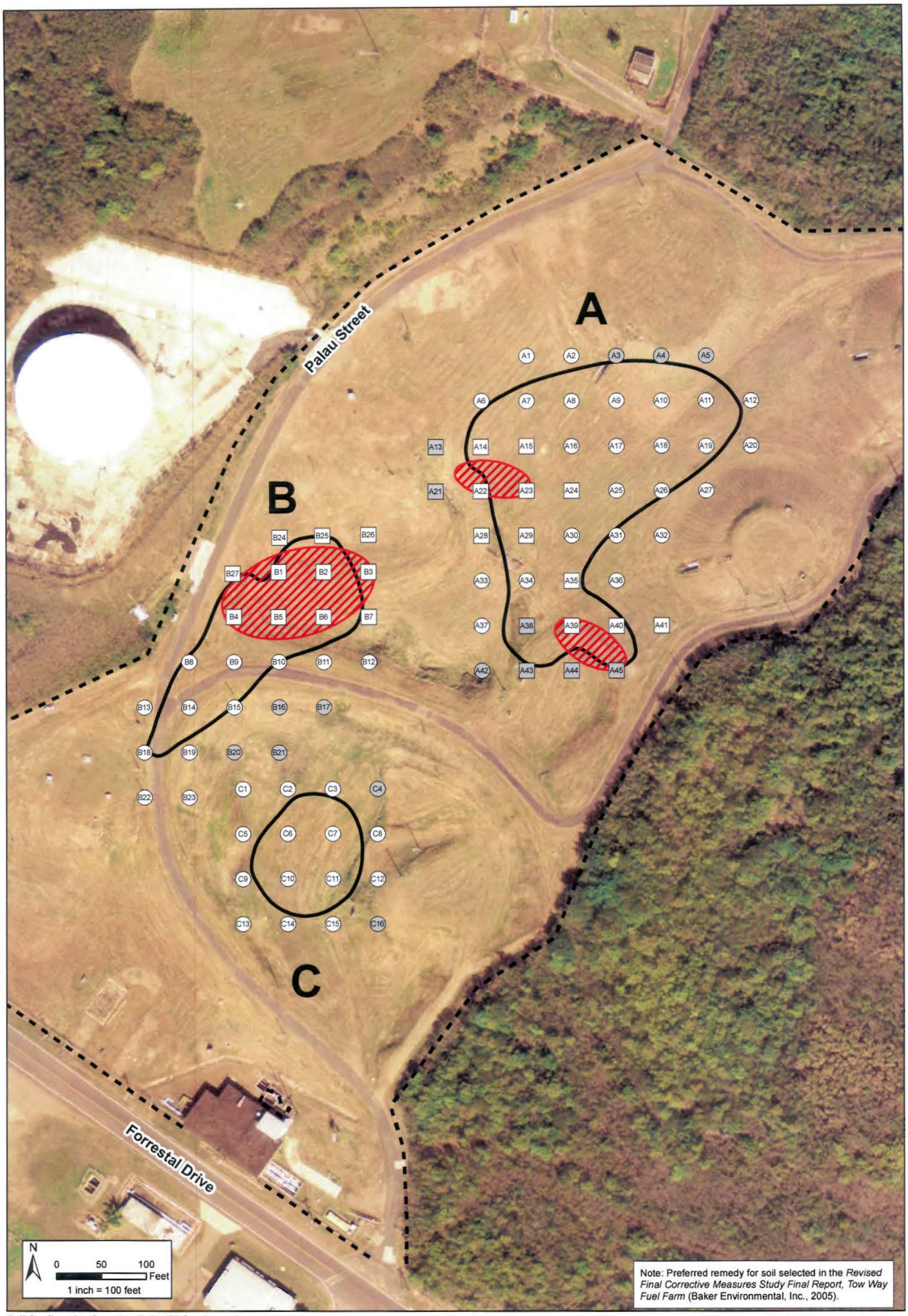
Soil sample with levels (in mg/kg) above cleanup criteria:
Arsenic: 2.65 mg/kg
Benzo(a)anthracene: 2.9 mg/kg
Benzo(a)pyrene: 2.9 mg/kg
Benzo(b)fluoranthene: 2.9 mg/kg
Indeno(1,2,3-cd)pyrene: 2.9 mg/kg
J = estimated detected value

FIGURE 6

CMS Soil Delineation Sample Locations and Proposed Excavation Areas
Tow Way Fuel Farm
Naval Station Roosevelt Roads, Puerto Rico

CH2MHILL

File Path: \\boomer\E\Projects\USNavy\378718PuertoRico\MapFiles\Contamination_in_Soil.mxd, Date: 2/18/2009, User: DDickman



Soil Confirmation Sampling Point (50-foot intervals)

- Arsenic
- Arsenic and PAHs

PAHs = Benzo(a)anthracene, Benzo(a)Pyrene, Benzo(a) fluoranthene, Benzo(1,2,3-cd)Pyrene

Grayed sample locations indicate areas where samples cannot be collected due to topography or existing structures

- Fence
- Assumed Arsenic Impacted Soil Area (See Note)
- PAH Excavation Area (See Note)

FIGURE 7
Proposed Soil Delineation Sample Locations
Tow Way Fuel Farm
Naval Station Roosevelt Roads, Puerto Rico

CH2MHILL

File Path: E:\Projects\USNavy\378718_PuertoRico\GIS\MapFiles\ConfirmationSamples.mxd, Date: February 18, 2009, User: DDickman

APPENDIX B

Standard Operating Procedures

Standard Operating Procedures

The following Standard Operating Procedures (SOPs) will be used, as applicable, during the confirmation sampling event to ensure that consistent methods are used and that defensible data are collected. Any deviations from these SOPs will be approved by the U.S. Department of Navy (Navy) and properly documented.

Documentation

These procedures conform to the applicable U.S. Environmental Protection Agency (EPA) Quality Assurance Requirements.

Soil Sampling

Soil Samplers

The most common devices for collecting soil samples are hand tools or split spoons (either standard size or large units used for continuous sampling). All samplers will be decontaminated according to the standards in Worksheet #14.

Hand Tools

Disturbed soil samples at shallow depths may be taken using a decontaminated spoon, trowel, or other hand tool, generally made of stainless steel. The cutting edge, tip, or blade of the hand tool is inserted repeatedly into the soil until the desired depth and amount of sample are obtained. The hole is backfilled when sample collection is completed.

Direct-Push Technology and Geoprobe™

Direct-push technology (DPT) and Geoprobe™ technology sampling involve advancing a sampling probe using direct hydraulic pressure or a slide or rotary hammer. Samples may be collected continuously or at specific depths. The samples are collected in brass/steel sleeves lined with acetate tubes. The acetate liner may be cut open to collect analytical soil samples.

The DPT and Geoprobe™ units are rugged, lightweight hydraulic and/or hammer driven systems utilized to advance soil borings with minimal lithological disturbance, minimal investigation-derived waste (IDW) production, and minimal time for evaluation of contaminant extent.

Drilling and sampling procedures for DPT and Geoprobe are similar:

- DPT and Geoprobe™ units are generally operated from a station mounted at the rear of a truck, bobcat, or four-wheeler-mounted unit. The probing unit is hydraulically and/or hammer driven using a power takeoff pump mounted directly to the truck's transmission.

- Soil samples may be obtained by using a wide variety of devices. Sampling devices range from 2-inch outside diameter tubes to sampling systems that allow for the collection of continuous soil samples.
- The samplers are threaded onto the leading edge of the DPT drive rods and advanced to depth using the direct push systems.
- Soil samples are retrieved by retracting the probe rod and sampler to the surface and disassembling the sampler.
- Samples are obtained in sleeves made of brass, stainless steel, Teflon®, or acetate. The sleeves are removed from the sampler, containerized, and transported to the laboratory for analysis.
- Groundwater samples are obtained utilizing a Hydropunch-type of drop down sampler, covered with a stainless steel well screen. Groundwater samples are obtained using one of the following: inert nylaflow tubing and a sampling syringe, a stainless steel bailer, or a peristaltic pump. Groundwater samples may also be collected using temporary or permanent piezometer/monitoring wells installed using Geoprobe™ or DPT methods. The samples can be collected at any time using bailers, jiggle tubes, pumps, or other methods.

Hand Augers

Hand augers are typically used to collect soil samples from depths up to 10 feet below ground surface (bgs), but can sometimes be used to a depth of 30 feet bgs. With the exception of cohesionless and hard or cemented soils, hand augers are useful for collecting a wide range of soil types. A hand auger is used as follows:

1. Attach a decontaminated auger bit to an auger rod extension and the crossbar.
2. Press the auger into the ground using body weight while turning the crossbar to advance the hole. Remove accumulated soils periodically to prevent loose material from falling back down into the borehole. Add additional auger flights as the hole is advanced. (Decontaminate and/or replace augers with clean augers at intervals in order to prevent downward migration of contamination.) Collect all soils and handle as IDW.
3. When the desired depth is reached, slowly and carefully remove auger from the hole.
4. In direct sampling, collect the sample after the bucket is removed from the boring. Discard the top of the core (approximately 1 inch) and shave the sides of the core to obtain a representative sample of the central core. Place the core sample in the appropriate containers.

APPENDIX C

Standard Label and Chain-of-Custody Record

Project Name: _____ Project No: _____

Sample ID: _____

Sample Date: _____ Sample Time: _____

Sampler(s): _____

Analyses: _____

Preservatives: _____

CHAIN-OF-CUSTODY RECORD

Project/Contact Information	
Project #	
Project Name	
Report Copy to	
Company Name/Contact	

Sampling		Type		Matrix			Client Sample ID (9 Characters Max)	LAB QC	Total Number of Containers	Requested Analysis	Preservative
Date	Time	Comp	Grab	Water	Soil	Air					

THIS AREA FOR LAB USE ONLY		
Lab #	Pg 1	of 1
Lab PM	Custody Review	
Log In	LIMS Verification	
pH	Cust Seals Y N Ice Y N	
QC Level 1 2 3		
Cooler Temperature		
Alternate Description		Lab ID

Sampled By		Relinquished By	
Received By		Relinquished By	
Received By		Date/Time	
Special Instructions			

APPENDIX D

Waste Management Plan, Environmental Protection Plan, and Quality Control Plan

Waste Management Plan

At Solid Waste Management Units 7 and 8 (SMWU 7/8), Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene, and arsenic are considered the constituents of concern due to the releases associated with the Tow Way Fuel Farm.

It is anticipated that the following wastes will be generated during the sampling activities:

- Arsenic- and petroleum-contaminated decontamination water

Waste Characterization

Delineation sampling-derived waste from SMWU 7/8 wastes will be characterized according to this Field Sampling Analysis Plan (SAP).

For decontamination water characterization, Toxicity Characteristic Leaching Procedure (TCLP) extraction (SW-846 Method 1311) will be utilized for waste containing a filterable solids quantity greater than 0.5 percent. When the filterable solids are less than 0.5 percent, the waste itself may be considered the extract for purposes of determining the toxicity characteristics, as indicated in 40 Code of Federal Regulations (CFR) 261.24(a). Total results for liquids will be provided in appropriate units (milligram per liter [mg/L]) for comparison to 40 CFR 261.24, Table 1.

Waste characterization information for wastes will be documented on a waste profile form provided by the offsite treatment or disposal facility as part of the waste acceptance process. AGVIQ-CH2M HILL Joint Venture III (AGVIQ-CH2M HILL) will provide analytical data from the characterization sampling and analysis event. The profile will be reviewed and approved by the AGVIQ-CH2M HILL Waste Coordinator prior to submission to the U.S. Department of Navy (Navy) for generator signature. Where generator certification and/or signature is required, Navy personnel will provide. The signed profile will then be submitted to the disposal facility for acceptance approval.

Information typically required in the profile includes, but is not limited to, the following:

- Generator (Navy) information, including name, address, contact, and phone number
- Site name, including street/mailing address
- Process generating waste (e.g., decontamination of sample equipment)
- Source of contamination (e.g., above-ground storage tank [AST] fueling lines)
- Historical use for area
- Waste composition (e.g., 95 percent soil, 5 percent debris)
- Physical state of waste (e.g., solid, liquid, etc.)
- Applicable hazardous waste codes

A facility-approved copy of the waste profile will be received prior to scheduling of offsite transportation of the waste.

Waste Management

Waste Storage Time Limit

Hazardous wastes will be removed from the site within 90 days of generation. Other wastes will be removed from the site as soon as possible.

For the delineation sampling event, decontamination water will be placed in a United Nations specification 5-gallon pail, characterized, and transported to an approved disposal facility.

Labels

The labeling of waste containers will be in accordance with 49 Code of Federal Regulations (CFR) 172, 173 and 178. Labels will include the type of waste, location from which the waste was generated, and accumulation start date. Containers and tanks used to store/accumulate waste (including soil) will include one of the following labels:

- "Analysis Pending" or "Waste Material" – Temporary or handwritten label until analytical results are received and reviewed. This label will include the accumulation start date.
- "Hazardous Waste" – Preprinted hazardous waste labels with the following information:
  - Accumulation start date
  - Generator Name:
  - U.S. Environmental Protection Agency (USEPA) ID number:
  - Waste codes

  Prior to transport the Manifest number must be added for containers with less than 110-gallon capacity.
- "Non-Hazardous Waste" – Preprinted labels with the following information:
  - Accumulation start date
  - Generator name:
  - USEPA ID number:
  - Waste-specific information (e.g., contaminated soil)

Where applicable, the major hazards (e.g., flammable, oxidizer, and carcinogen) will be included on the label.

It is expected labels required at SMWU 7/8 will be the "Analysis Pending" and/or the "Non-Hazardous Waste" labels.

General Waste Management Requirements

Hazardous wastes will be segregated from non-hazardous wastes. Additionally, incompatible wastes (e.g., flammable and corrosive wastes) will be segregated. Wastes of the same matrix, contamination, and source may be aggregated to facilitate storage and disposal.

Wastes will be accumulated in an area identified or approved by the Navy. If an accumulation area is not designated, AGVIQ-CH2M HILL will accumulate wastes in an area that is not accessible to the general public and that can be secured.

Waste accumulation areas will contain appropriate emergency response equipment. Hazardous waste accumulation areas will include fire extinguishers (in areas where wastes are known or suspected to be flammable or ignitable), decontamination equipment, and an alarm system (if radio equipment is not available to all staff working in accumulation area). Spill control equipment (e.g., sorbent pads) will be available in the waste accumulation areas, and where liquids are transferred from one vessel to another.

All containers will be inspected upon arrival at the site for disrepair and any contamination or contents. If container contains waste upon arrival or is in disrepair, it will be immediately rejected and documented.

Drums/Small Containers

The following guidelines relate to drums and small containers:

- Drums and small containers will be transported to the temporary accumulation areas on wooden pallets and will be secured together with non-metallic banding.
- Drums will be inspected and inventoried upon arrival onsite for signs of contamination and/or deterioration.
- Adequate aisle space (e.g., 30 inches) will be provided for containers, such as 55-gallon drums, to allow the unobstructed movement of personnel and equipment. A row of drums should be no more than two drums wide.
- Each drum will be provided with its own label, and labels will be visible.
- Drums will remain covered, except when removing or adding waste to the drum. Covers will be properly secured at the end of each workday.
- Drums will be disposed of with their contents. If the contents are removed from the drums for offsite transportation and treatment or disposal, the drums will be decontaminated prior to re-use or before leaving the site.
- Drums containing liquids or hazardous waste will be provided with secondary containment.

Inspection of Waste Storage Areas

Waste accumulation areas will be inspected for malfunctions, deterioration, discharges, and leaks that could result in a release. The inspection schedule will consist of at least a weekly inspection of containers, tanks, and roll-off containers for leaks, corrosion, or general deterioration.

Any deficiencies observed or noted during an inspection will be rectified immediately. Appropriate measures may include transfer of waste from a leaking container to a new container, replacement of a liner or cover, or repair of a containment berm.

Inspections will be recorded in the daily Quality Control (QC) Report and will include any deficiencies and how the issue was rectified. Copies of the report will be maintained onsite and will be available for review.

If operations will be suspended for more than 7 days, the AGVIQ-CH2M HILL Regulatory Compliance Manager will be contacted to make alternate inspection arrangements.

Shipping Documentation

Prior to offsite disposal of any waste, AGVIQ-CH2M HILL will provide the Navy with a waste approval package for each waste stream. This package will include a waste profile naming the Navy as the generator of the waste, analytical summary table(s) applicable to the waste, Land Disposal Restriction (LDR) notification for any hazardous wastes, a completed waste manifest, and any other applicable information necessary for the Navy to complete its review of the disposal package and signature as the generator.

The signed profile will then be submitted to the disposal facility for acceptance and approval. Once the approval letter is received from the disposal facility, transportation can be scheduled.

Each load of waste material will be manifested prior to leaving the site. At a minimum, the manifest form will include the following information:

- Generator information, including name, address, contact, phone number, and USEPA ID number
- Transporter information, including name, address, contact, phone number, and USEPA ID number
- Facility information, including name, address, phone number, and USEPA ID number
- Site name, including street/mailing address
- U.S. Department of Transportation (DOT) Proper Shipping Name (e.g., Hazardous Waste Solid, n.o.s., 9, UN 3077, PG III [D008])
- Type and number of containers
- Quantity of waste (volumetric estimate)
- Task Order or job number
- Profile number
- 24-hour emergency phone number

Additionally, each shipment of waste will have a weight ticket. LDR notification/ certification is required for **hazardous wastes only**. This form requires the generator signature and submission to the disposal facility.

The generator (Navy) and the transporter must sign the manifest prior to the load of waste leaving the site. A copy of the manifest will be retained on site and included with the daily QC Report. The original signed manifest will be returned to the address of the generator.

The facility will provide a copy of this signed manifest to AGVIQ-CH2M HILL for the final report. The final report will include copies of the facility-signed manifest, weight ticket, LDR notification/certificate (if applicable), and the Certificate of Disposal/Destruction/Recycle.

If the signed hazardous waste manifest from the designated offsite facility is not received within 35 days, AGVIQ-CH2M HILL will contact the transporter or the designated facility to determine the status of the waste. If the signed hazardous waste manifest has not been received within 45 days, AGVIQ-CH2M HILL, in coordination with the Navy, will issue an "Exception Report" to the State of Georgia, as required under 40 CFR 262.42.

Transportation

Each transportation vehicle and load of waste will be inspected before leaving the site and will be documented. The quantities of waste leaving the site will be recorded, and at a minimum, documented on the Waste Tracking Log. A contractor licensed for commercial transportation will transport non-hazardous wastes. In the event that wastes are hazardous, the transporter will have a USEPA ID number and comply with transportation requirements outlined in 49 CFR 171-179 (DOT) and 40 CFR 263.11 and 263.31 (Hazardous Waste Transportation). A copy of the documentation indicating that the selected transporter has appropriate licenses will be received and approved by AGVIQ-CH2M HILL prior to the transport of any waste.

Transporter Responsibilities

The transporter will be responsible for weighing loads at a certified scale. For each load of material, weight measurements will be obtained for each full and empty container, dump truck, or tanker truck. Disposal quantities will be based on the difference of weight measurements between the full and empty container, dump truck, or tanker truck. Weights will be recorded on the waste manifest. The transporter will provide copies of weight tickets to AGVIQ-CH2M HILL.

The transporter will observe the following practices when hauling and transporting wastes offsite:

- Minimize impacts to general public traffic.
- Repair road damage caused by construction and/or hauling traffic.
- Clean up waste spilled in transit.
- Line and cover trucks/trailers used for hauling contaminated waste to prevent releases and contamination.
- Decontaminate vehicles prior to re-use, other than hauling contaminated waste.
- Seal trucks transporting liquids.
- All personnel involved in offsite disposal activities will follow safety and spill response procedures outlined in the Health and Safety Plan (HSP).
- No materials from other projects will be combined with materials from this site.

Spill Reporting

In the event of a spill or release of any waste, the transporter must immediately notify AGVIQ-CH2M HILL. The following pertinent facts and information about the spill will be reported to AGVIQ-CH2M HILL and will be recorded:

- Type of material (e.g., soil, sludge, water) and contaminant
- Location
- Estimated volume
- Media affected (e.g., spilled on concrete pad or soil)
- Time of spill/release
- Final disposal of spilled material

The transporter will also report any spill or release of hazardous waste, as required by 49 CFR 171.15, to the National Response Center (NRC) at 800-424-8802 or 202-426-2675. The transporter must also report in writing, as required by 49 CFR 171.16, to the Director, Office of Hazardous Materials Regulations, Materials Transportation Bureau, Department of Transportation, Washington, DC 20590.

For any spill of hazardous waste water from a bulk shipment (e.g., tanker), the transporter will immediately notify the NRC (800-424-8802 or 202-267-2675), as required in 40 CFR 263.30.

Spill Response

The transporter will clean up any spill or release of waste (including soil or water) that occurs during transportation or take such action as may be required or approved by federal, State, or local officials. Spilled waste will be immediately cleaned up, including soils on the outside of the trucks or other container (e.g., rail car) and on the ground or road surface. Where appropriate, the spilled material (e.g., soil) will be returned to the original waste container. In any case, the spilled material will be properly contained and disposed.

Disposal of Waste Streams

Offsite treatment or disposal facilities will use the waste profile and supporting documentation (e.g., analytical data) to determine whether they will accept a waste.

- Any waste that is classified as hazardous will be sent to an offsite, permitted, Resource Conservation and Recovery Act (RCRA) Subtitle C treatment, storage, or disposal facility.

- Non-hazardous aqueous wastes will be disposed at a permitted waste water treatment facility. Contaminated aqueous wastes will be disposed or discharged to a permitted facility. If analysis determines aqueous wastes are not contaminated and approved for onsite discharge by the Remedial Project Manager (RPM), non-contaminated aqueous wastes will be discharged onsite

The treatment or disposal facility will be responsible for providing a copy of the final facility-signed waste manifest and a certificate of treatment or disposal for each load of waste received. The original final facility-signed manifest will be provided directly to the generator.

Waste Tracking Log

The Waste Tracking Log is used to track waste from generation to final disposition. Wastes will be logged into the Waste Tracking Log the day waste is generated and placed into containers. Transportation of wastes will be inventoried the day of transportation from the site using the Waste Tracking Log. Final disposal will be documented on the Waste Tracking Log.

Environmental Protection Plan

The scope of this plan includes general controls implemented during remediation-related construction activities to prevent pollution and protect the environment. These controls and procedures also ensure that work is performed in a manner that meets the intent of federal and local environmental regulations.

Regulatory Drivers

This project will be completed under the applicable sections of the RCRA Part B Permit, issued for the Defense Reutilization and Marketing Office (DRMO) at Naval Activity Puerto Rico (NAPR) Corrective Action Objectives.

Protection of Air Resources

Construction activities will be kept under surveillance, management, and control to minimize the discharge of any air pollutants. The following general practices will be implemented to protect air resources:

- Construction equipment will be maintained within manufacturer's design limits to ensure minimal discharge of exhaust emissions.
- Dust emissions will be controlled during earth disturbing activities using water truck or hose nozzle spray applications of water.
- Traffic routes will be designated to limit the area that is disturbed.
- Haul roads will be maintained and watered to reduce dust, as necessary.
- Travel speeds over unpaved areas will be limited to reduce dust levels.
- Completed areas will be seeded or otherwise stabilized to reduce dust levels.
- Burning will not be allowed as a means of clearing.
- Equipment will be operated in such a manner as to minimize airborne particulates whenever possible (e.g., the drop height of excavators will be limited).

Protection of Water Resources

The primary water resource concern during construction activities is the control of stormwater run-on and run-off. Other water resource issues, such as construction activities in a floodplain, wetlands, or streambed (and associated permits and permitting requirements), are to be determined.

To reduce erosion and control stormwater run-on and run-off during any activity that will disturb that land, the following structural and non-structural controls will be implemented as appropriate:

- Minimizing the area of bare soil exposed at one time (i.e., phased grading)
- Stabilizing cut-and-fill slopes
- Perimeter controls (e.g., drainage diversions)
- Stormwater retention basins
- Sediment basins and traps
- Silt fences at excavations
- Covers for stockpiles (to prevent leaching of contaminants from stockpiles)
- Site restoration (e.g., regrading, mulching, and seeding, or repaving with asphalt or concrete)

Protection of Land Resources

Land resources (e.g., trees and shrubs) will be preserved in their present condition or restored as near as possible to their natural appearance. Trees outside of any clearing limits will be protected during excavation or filling activities within the root zone, wherever possible. No ropes, cables, or guy lines will be fastened to or attached to any existing trees for anchorage unless specifically authorized by the Navy. Where authorized, the trunk will be wrapped with sufficient thickness of a material, such as burlap or rags, over which softwood cleats will be tied before any rope, cable, or wire is placed. Where trees may be defaced, bruised, injured, or otherwise damaged by equipment or construction operations, boards, planks, or poles may be placed around them for protection. Rocks that are displaced into uncleared areas will be removed. Monuments, markers, or other similar structures will be protected before beginning construction operations.

Protection of Fish and Wildlife

Construction operations will be managed in such a manner as to minimize interference with fish and wildlife habitat. Care will be taken to ensure that temporary erosion and sediment controls are installed to prevent stormwater discharges to any adjacent ponds or wetlands. Construction operations will be monitored and reorganized as necessary to prevent negative effects to identifiable wildlife activity.

Spill Prevention and Control

The provisions for spill prevention and control establish minimum site requirements. All spills will be reported by AGVIQ-CH2M HILL. **Refer to the HSP for emergency response procedures and further reporting requirements.**

In the event of a 'release' of any potentially hazardous waste, chemical, or material, AGVIQ-CH2M HILL will record and report it to the Contracting Officer or designated representative **as indicated in the HSP**. The definition of release includes any "spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed containers)" of any potentially hazardous chemical, substance, and/or material. The HSP identifies the hazardous chemicals and materials anticipated to be used in work at the site. The AGVIQ-CH2M HILL Regulatory Compliance Manager will be contacted for questions on other chemicals and/or materials.

Spill Prevention

All fuel, chemical, and waste storage areas will be properly protected from on- and offsite vehicle traffic. All tanks (including fuel storage and waste storage) must be equipped with secondary containment. These tanks must be inspected daily for signs of leaks. Accumulated water must be inspected for signs of contamination (e.g., product sheen, discoloration, and odor) before being discarded. Fire protection provisions outlined in the HSP must be adhered to.

Chemical products must be properly stored, transferred, and used. Should chemical product use occur outside areas equipped with spill control materials, adequate spill control materials must be maintained at the local work area.

Spill Containment and Control

Spill control materials will be maintained in the support zone, at fuel storage and dispensing locations, and at waste storage areas. Incidental spills will be contained with sorbent and disposed of properly. Spilled materials must be immediately contained and controlled. Spill response procedures include:

- Immediately warn any nearby workers and notify supervisor.
- Assess the spill area to ensure that it is safe to respond.
- Evacuate area if spill presents an emergency.
- Ensure any nearby ignition sources are immediately eliminated.
- Stop source of spill.
- Establish site control for spill area.
- Contain and control spilled material through use of sorbent booms, pads, or other material.
- Use proper personal protective equipment in responding to spills.

Spill Cleanup and Removal

All spilled material, contaminated sorbent, and contaminated media will be cleaned up and removed as soon as possible. Contaminated spill material will be drummed, labeled, and properly stored until material is disposed of. Contaminated spill material will be managed as waste (see Waste Management Plan) and disposed of according to applicable, federal, State, and local requirements.

Site Restoration

In general, site restoration activities will include the following activities:

- Decontaminate facilities, equipment, and materials prior to final removal from the site.
- Upon completion of final decontamination, remove any decontamination support features (such as a pad and wash units). Properly dispose of any items that cannot be decontaminated and/or materials used in decontamination activities (such as plastic sheeting).
- Remove all temporary construction features, such as haul roads, work areas, stockpiles, structures, fencing, and waste staging or storage areas, in accordance with project requirements and directions provided by Navy representative.

The physical restoration of the construction area generally involves the following activities:

- Backfill placement
- Completed filling and grading
- Topsoil placement and amendments
- Seeding

If necessary, AGVIQ-CH2M HILL may consult the county extension office for direction on appropriate seed mixtures and soil amendments for the site.

Erosion Control

During those excavation activities that have the potential to disturb the land, AGVIQ-CH2M HILL will adhere to the following practices:

- The smallest practical area will be disturbed.
- Trees outside the excavation area will be protected from any construction activity. No ropes, cables, or guy lines will be fastened or attached to any existing trees.
- Temporary erosion and sediment controls will be used to prevent sediment from discharging to any ponds or wetland areas. Structural controls may include the use of straw bales, silt fences, earth dikes, drainage swales, sediment traps, and sediment basins.

Material staging areas will be properly barricaded for containment and to control run-off.

Quality Control Plan

This Quality Control Plan details the quality administrators, the project organization, and the sampling inspections associated with the work to be completed at SWMU 7/8.

The Submittal Register, included in Attachment 1, documents submittals. AGVIQ CH2M HILL, the Navy, or others will approve submittals as identified in the Submittal Register. All approved submittals will be distributed by CH2M HILL to the appropriate Navy personnel (Contracting Officer, Resident Officer in Charge of Construction [in duplicate], etc.), the project site, and to the project file.

The project organization chart (Figure 1-1) depicts the chain-of-command for this Task Order and the individuals responsible for executing the work as indicated. Individual roles and responsibilities of personnel are summarized in Table 1-1. Table 1-2 provides contact information for these personnel.

Project QC Manager

The Project QC Manager for this project is BT Thomas/CH2M HILL (Atlanta), and the Alternate Project QC Manager is Shruti Shah/CH2M HILL (Atlanta). The appointment letters for BT Thomas and Shruti Shah are included in Attachment 2.

Testing Requirements

This section describes construction testing and environmental analysis laboratories and their certifications, environmental sampling and analysis, and test control. The Testing Plan and Log is provided in Attachment 3.

Laboratories performing analytical analysis of environmental samples will demonstrate compliance the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories. The selected laboratory will possess an approved Quality Assurance Project Plan.

Definable Features of Work

The project tasks for this Task Order project are grouped into definable features of work (DFOWs), which are work activities that are significant enough to warrant distinct plans and specifications. The DFOWs for this project are:

- Mobilization and Site Preparation
- Field Sampling
- Waste Management
- Decontamination and Demobilization

The definable features of work will be inspected in accordance with the three phases of control. The three phases include Preparatory, Initial, and Follow-up. An overview of the inspection provisions is outlined in the subsections that follow.

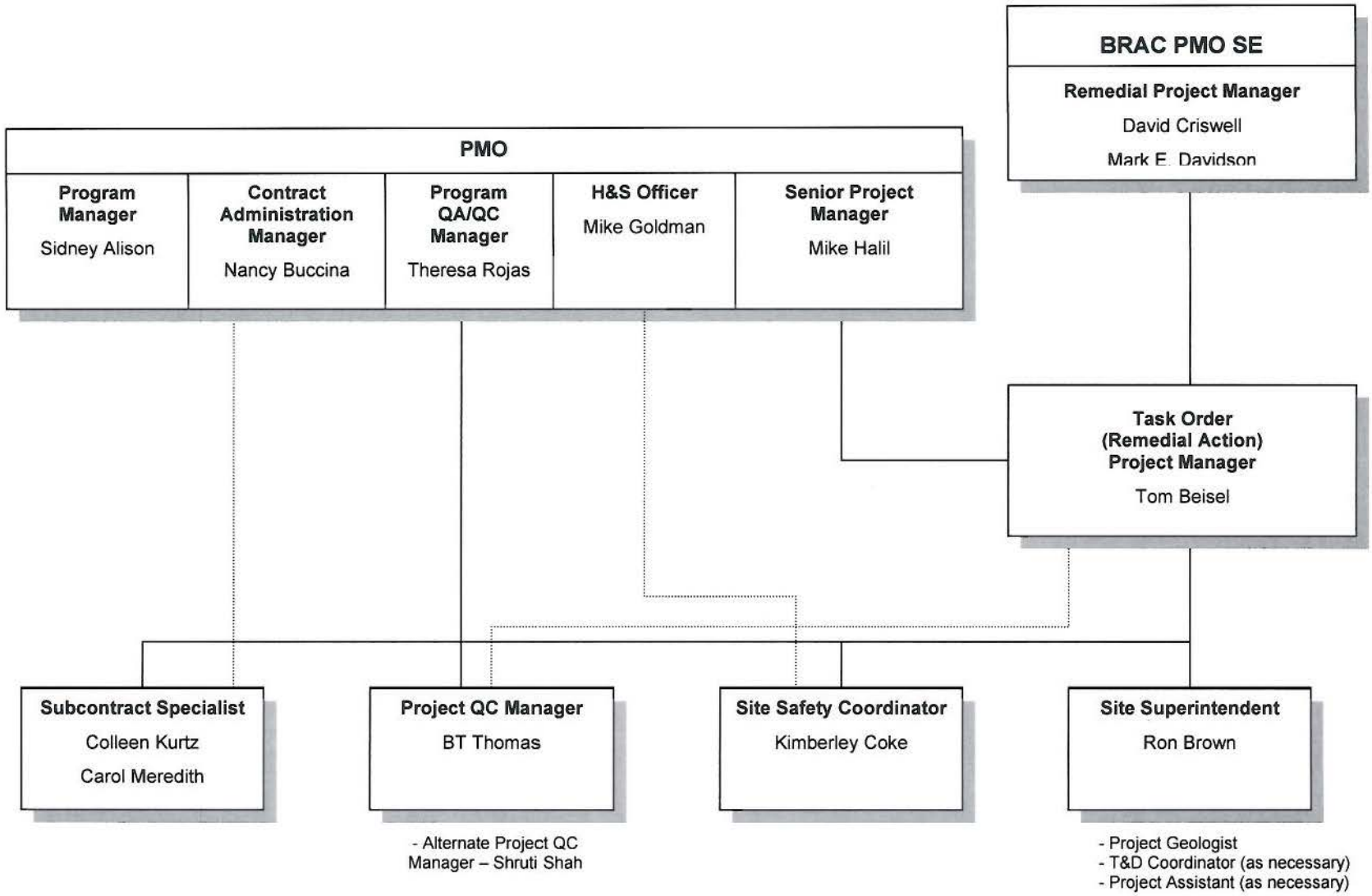


FIGURE 1-1
Project Organization Chart

TABLE 1-1
Roles, Responsibilities, and Authorities of Key Project Personnel

Role	Responsibility	Authority
Project Manager	• Manage and provide technical direction of work • Communicate with NAVFAC SE RPM and Navy Technical Representative • Oversee subcontractor performance • Select Task Order staff • Develop Task Order Work Plan and supporting plans • Meet Task Order Performance Objectives • Prepare status reports	• Approve subcontractor selection • Approve invoices to NAVFAC SE • Approve Task Order baseline schedule • Stop work at the site for any reason • Approve payment to vendors and suppliers • Approve payment to subcontractors
Site Superintendent	• Responsible for all site activities • Provide direction to subcontractors • Act on behalf of Project Manager • Provide daily status reports • Prepare Task Order Work Plan • Conduct daily safety meetings • Review subcontractor qualifications	• Stop work for subcontractors • Stop work for unsafe conditions or practices Approve corrective action for site work-arounds • Approve materials and labor costs for site operations • Resolve subcontractor interface issues • Approve daily and weekly status reports
Project QC Manager/ QC Inspector(s)	• Monitor and report on subcontractor quality and quantities • Audit subcontractors' offsite fabrication • Maintain Submittal Register • Participate in continuous improvement of project team • Maintain Lessons Learned Log	• Stop work for non-compliant operations • File daily quantities report • File Lessons Learned Log Sheet • Approve resumption of work for resolved quality issues
Site Health and Safety Specialist	• Monitor and report on subcontractor safety and health performance • Record and report safety statistics • Conduct needed site safety and health orientation • Maintain Environmental Log	• Stop work for unsafe practices or conditions • Approve subcontractor site specific health and safety plan • Set weekly safety objectives • Approve resumption of work for resolved safety issues

TABLE 1-2
Project Personnel Contact Information

Name	Company	Phone Number	E-mail
Sid Alison	AGVIQ-CH2M HILL	(843) 242-8018 (office) (843) 813-2672 (cell)	Sidney.allison@ch2m.com
Nancy Ballantyne	AGVIQ-CH2M HILL	(720) 286-5561 (office) (303) 885-9954 (cell)	nancy.ballantyne@ch2m.com
Tom Beisel	AGVIQ-CH2M HILL	(678) 530-4033 (office) (678) 429-8273 (cell)	Tom.Beisel@ch2m.com
Carlos Brown	AGVIQ-CH2M HILL	(787) 435-6086 (office) (787)885-9026 (home)	Sebi@isla.net Cbrown@tikigag.com
Bryan Burkingstock	AGVIQ-CH2M HILL	(678) 530-4060 (office) (404) 414-2762 (cell)	Bryan.burkingstock@ch2m.com
Eric Burrell	AGVIQ-CH2M HILL	(678) 530-4061 (office) (678) 296-0920 (cell)	Eric.Burrell@ch2m.com
Tom Cherrix	AGVIQ-CH2M HILL	(757) 417-5506 (office)	Tcherrix@tikigag.com
Kimberley Coke	AGVIQ-CH2M HILL	(678) 530-4073 (office) (404) 790-8143 (cell)	Kimberley.coke@ch2m.com
Doug Downey	AGVIQ-CH2M HILL	(303) 674-6547 (office)	Doug.downey@ch2m.com
Philip Jones	AGVIQ-CH2M HILL	(678) 530-4191 (office) (706) 540-9285 (cell)	Philip.jones@ch2m.com
Tom Kessler	AGVIQ-CH2M HILL	(678) 530-4197 (office) (404) 216-5073 (cell)	Tom.kessler@ch2m.com
Carol Meredith	AGVIQ -CH2M HILL	(757) 318-9422 (office)	Cmeredith@tikigag.com
Camden Robinson	AGVIQ-CH2M HILL	(770) 439-8363 (office)	Camden.robinson@ch2m.com
Theresa Rojas	AGVIQ-CH2M HILL	(678) 530-4297 (office) (678) 642-7030 (cell)	theresa.rojas@ch2m.com
Pedro Ruiz	Navy	(787) 534-0933, ext 459 (office)	Ruizp@napr.navy.mil
Amanda Struse	AGVIQ-CH2M HILL	(678) 530-4339 (office) (404) 889-4906 (cell)	Amanda.struse@ch2m.com
BT Thomas	AGVIQ-CH2M HILL	(678) 530-4415 (office) (770) 335-2078 (cell)	BT.thomas@ch2m.com
Shruti Shah	AGVIQ-CH2M HILL	(678) 530-4316 (office) (404) 353-3334 (cell)	Shruti.Shah@ch2m.com

Mobilization and Site Preparation

As part of the mobilization activity, a pre-construction meeting will be held to review the preparedness to begin the project, the overall project scope and schedule, communications, and reporting. The preparedness check will verify that site preparation provisions, such as permitting/approvals, utility clearances, demarcating the work zones, staging of equipment and material, and installation of erosion and sediment transport controls, as necessary, are in place to begin the intrusive work activities. Additionally, equipment and materials will be verified functional and in good working condition prior to starting the project.

Preparatory Phase

The preparatory phase will include a review of the relevant activity hazard analyses (AHAs), the project SAP, communications matrix, project schedule, submittal status, and confirmation of appropriate materials and equipment.

Initial Phase

Inspections will be made as necessary to ensure construction limits are defined, utilities marked, and material staged in the designated areas.

Follow-up Phase

The Project QC Manager will provide continuous oversight of the site preparation activities to verify that the work is completed in accordance with the requirements provided in the SAP. Deficiencies will be noted and corrected.

Table 1-3 lists the quality controls that will be implemented during mobilization and site preparation activities.

TABLE 1-3
QC Procedures for Mobilization and Site Preparation

Task	Procedures/Construction Details
Pre-construction Meeting	• Verification of excavation permit and utility clearance. • Verification of designated locations of equipment layout, material and waste staging, and decontamination
Site Walk	• Verification of site layout plan • Verification of Environmental Conditions Report
Temporary Facilities	• Verification of temporary facilities for conformance with facility requirements • Verification of temporary utility hookups for conformance with the utility and the base requirements • Verify implementation of environmental protection measures (erosion and sediment control)

Field Sampling

Soil and waste characterization samples will be collected. Environmental samples will be collected in accordance with USEPA and procedures included within the SAP. Other controls will include, but are not limited to, maintaining a chain-of-custody; proper handling, packing, and shipping; sampling performed by qualified persons; and the use of certified laboratories.

Preparatory Phase

The preparatory phase for sample collection activities includes a review of the relevant AHAs, a review of sampling procedures provided in the SAP, verifying acceptance of the selected laboratory, and confirming that the appropriate equipment and materials are available to perform the sampling activities.

Initial Phase

Soil and waste characterization samples will be collected and subsequently analyzed at an approved laboratory in accordance with methods outlined in the SAP. Sample collection activities, including proper chain-of-custody documentation, will follow the protocols outlined in the SAP.

Follow-up Phase

The Project QC Manager will observe sample collection activities and the associated documentation records throughout each sampling event. Analytical reports from the approved laboratory will be reviewed for accuracy and quality. If required, data validation information from the laboratory will be reviewed to resolve discrepancies in the analytical data. AGVIQ-CH2M HILL Quality Assurance personnel will validate laboratory data and field sampling results.

Table 1-4 lists the quality controls that will be implemented during field sampling activities.

TABLE 1-4
QC Procedures for Field Sampling

Task	Procedures/Construction Details
Field Sampling	• Verify laboratory and credentials • Verify appropriate sampling equipment • Verify equipment decontamination • Verify appropriate facilities and testing equipment are available and comply with testing standards • Verify the field instruments are calibrated in accordance with manufacturers' recommendations • Verify recording forms, including all of the test documentation requirements, have been prepared, and are accurate and complete

Attachment 1

Submittal Register

Contract Number: N62470-08-D-1006	TO No.: JM04	TO Title: Pre-Excavation Assessment (Delineation Sampling) SWMU 7/8	Location: Ceiba, Puerto Rico	Contractor: AGVIQ CH2M HILL

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Spec Section	Item Description	Para. Number	Approving Authority	Other Reviewers	Submittal Number	Scheduled Submission Date	CCI Review Date	CCI Disposition	CCI Transmit Date	QC Admin Received Date	QC Disposition	QC Admin Transmit Date	Contracting Officer Received	Contracting Officer Disposition	Contracting Officer Return	Remarks
	SD-01 **Data**															
	SD- UFP-SAP (WMP, EPP,Quality Plan, Schedule, HSP)															
	SD- Environmental Survey															
	SD- Environmental Conditions Report															
	SD-															
	SD-															
	SD-02 **Manufacturer's Catalog Data**															
	SD-															
	SD-															
	SD-															
	SD-04 **Drawings**															
	SD- As-builts															
	SD- Sampling Maps															
	SD-															
	SD-09 **Reports**															
	SD- Laboratory Analytical Data															
	SD-															
	SD-															
	SD-															
	SD-															
	SD-12 **Field Test Reports**															
	SD- Depth to Water/Product															
	SD- Sample locations with GPS															
	SD-															
	SD-13 **Certificates**															
	SD- Chemical Laboratory															
	SD-															
	SD-															
	SD-															
	SD-															
	SD-18 **Records**															
	SD- Waste Manifests															
	SD- Certificate of Disposal/Recycling															
	SD- Instrument Calibration Data															
	SD- Waste Disposal Log															
	SD- Contractor Production Report															
	SD- Contract Quality Control Report															
	SD- Rework Items List															
	SD- Photo Log															
	SD- Photographs															
	SD- Testing Plan and Log															
	SD- Monthly Summary of Field Tests															
	SD- Weight Tickets															

Submittal Register

Contract Number: N62470-08-D-1006	TO No.: JM04	TO Title: Pre-Excavation Assessment (Delineation Sampling) SWMU 7/8	Location: Ceiba, Puerto Rico	Contractor: AGVIQ CH2M HILL

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Spec Section	Item Description	Para. Number	Approving Authority	Other Reviewers	Submittal Number	Scheduled Submission Date	CCI Review Date	CCI Disposition	CCI Transmit Date	QC Admin Received Date	QC Disposition	QC Admin Transmit Date	Contracting Officer Received	Contracting Officer Disposition	Contracting Officer Return	Remarks
	SD- Meeting Minutes															
	SD- Navy Environmental Data Transfer Standards (NEDTS) Deliverables															
	SD- Laboratory Electronic Data Daliveralbes (EDDs) in NIRIS Eletronic Data Deliverable (NEDD) Format															
	SD- Living CD															
	SD- Permits															
	SD- Emergency and Hazardous Chemical Inventory Forms															
	SD- Contractor and Subcontractor Personnel List															
	SD- MSDS Sheets															
	SD-															
	SD-															
	SD-															
	SD-20 **Closure Report**															
	SD- Project Completion Report															
	SD-															
	SD-															
	SD-															
	SD-21 **Sampling and Analysis Plan**															
	SD- Sample Log															
	SD- UFP-SAP															

Attachment 2

AGVIQ ENVIRONMENTAL SERVICES
CH2M HILL JOINT VENTURE

January 21, 2009

Mr. BT Thomas
CH2M HILL
1000 Abernathy Road
Suite 1600
Atlanta, Georgia 30328

RE: Contract No. N62470-08-D-1006
Task Order No. JM04
Naval Activity (NA) Puerto Rico – Ceiba, Puerto Rico
Project Quality Control Manager Letter of Appointment

Dear Mr. Thomas:

Herein describes the responsibilities and authority delegated to you in your capacity as the Project QC Manager at the Naval Activity Puerto Rico, Task Order (TO) No. JM04 under the Navy LANT Small Business (SB) RAC Contract No. N62470-08-D-1006.

In this position, you assist and represent the QC Program Manager in continued implementation and enforcement of the Project QC Plans. Your primary role is to ensure all requirements of the contract are met. Consistent with this responsibility, you will: (i) implement the QC program as described in the Navy LANT SB RAC contract; (ii) manage the site-specific QC requirements in accordance with the Project QC Plans; (iii) attend the coordination and mutual understanding meeting; (iv) conduct QC meetings; (v) oversee implementation of the three phases of control; (vi) perform submittal review and approval; (vii) ensure testing is performed; (viii) prepare QC certifications and documentation required in the Navy LANT SB RAC Contract; and, (ix) furnish a Completion Certificate to the Contracting Officer or designated representative, upon completion of work under a contract task order , attesting that "the work has been completed, inspected, and tested, and is in compliance with the contract."

Your responsibilities further include identifying and reporting quality problems, rejecting nonconforming materials, initiating corrective actions, and recommending solutions for nonconforming activities.

You have the authority to control or stop further processing, delivery, or installation activities until satisfactory disposition and implementation of corrective actions are achieved. You have the authority to direct the correction of non-conforming work. All work requiring corrective action will be documented on daily reports, and, in the event non-conforming work is not immediately corrected you are required to submit a non-conformance report to the PM and

copy the QC Program Manager. A status log will be kept of all non-conforming work. You shall immediately notify the QC Program Manager in the event of any stop work order.

It is imperative that you comply with all terms of the basic contract. In particular, Section C, Paragraph 6.5.2, which states:

> "No work or testing may be performed unless the QC Program Manager or Project QC Manager is on the work site."

In the event that you are not able to be at the work site when work or testing is to be performed, it is your responsibility to inform the QC Program Manager and Project Manager, in advance, so that other arrangements can be made.

Further, if you are requested to perform the duties of the Site Supervisor, it is your responsibility to inform the QC Program Manager so that approval can be obtained in advance from the Contracting Officer or designated representative, in accordance with Section C Paragraph 6.6.2.1 of the contract.

You are a key member of the Project Manager's team. You ensure that work meets the specific requirements and intent of the work plan, the Navy's scope of work and the basic contract. Should you have any questions regarding this role, you should immediately contact the QC Program Manager, Theresa Rojas. Your day-to-day activities on the site should be coordinated with all site personnel and the Project Manager. In event of any deficient items, the Superintendent and Project Manager should be advised immediately so they have opportunity to remedy the situation.

Sincerely,

CH2M HILL Constructors, Inc.

Michael D. Halil

Michael Halil
Deputy Program Manager

cc: Project File No. 378718

4610 Westgrove Court • Virginia Beach, Virginia 23455 • tel. (757) 318-9420 • fax (757) 318-9421
Northpark 400, 1000 Abernathy Road, Suite 1600 • Atlanta, Georgia 30328 • tel (770) 604-9095 • fax (770) 604-9282

February 11, 2009

Ms. Shruti Shah
CH2M HILL Constructors, Inc.
1000 Abernathy Road
Suite 1600
Atlanta, GA 30328

RE: Contract No. N62470-08-D-1006
Task Order No. JM04
Naval Activity (NA) Puerto Rico – Ceiba, Puerto Rico
Alternate Project Quality Control Manager Letter of Appointment

Dear Ms. Shah:

Herein describes the responsibilities and authority delegated to you in your capacity as the alternate Project QC Manager at NA Puerto Rico, Task Order (TO) No. JM04 under the Navy Atlantic Small Business (SB) RAC Contract No. N62470-08-D-1006.

In this position, you assist and represent the Project QC Manager in the event that she is not on the project site and the Program QC Manager in continued implementation and enforcement of the Project QC Plans. Your primary role is to ensure all requirements of the contract are met. Consistent with this responsibility, you will: (i) implement the QC program as described in the Navy LANT SB RAC; (ii) manage the site-specific QC requirements in accordance with the Project QC Plans; (iii) attend the coordination and mutual understanding meeting; (iv) conduct QC meetings; (v) oversee implementation of the three phases of control; (vi) perform submittal review and approval; (vii) ensure testing is performed; (viii) prepare QC certifications and documentation required in the Navy LANT SB RAC Contract; and, (ix) furnish a Completion Certificate to the Contracting Officer or designated representative, upon completion of work under a contract task order , attesting that "the work has been completed, inspected, and tested, and is in compliance with the contract."

Your responsibilities further include identifying and reporting quality problems, rejecting nonconforming materials, initiating corrective actions, and recommending solutions for nonconforming activities.

You have the authority to control or stop further processing, delivery, or installation activities until satisfactory disposition and implementation of corrective actions are achieved. You have the authority to direct the correction of non-conforming work. All work requiring corrective action will be documented on daily reports, and, in the event non-conforming work is not immediately corrected you are required to submit a non-conformance report to the PM and

copy the Program QC Manager. A status log will be kept of all non-conforming work. You shall immediately notify the Program QC Manager in the event of any stop work order.

It is imperative that you comply with all terms of the basic contract. In particular, Section C, Paragraph 6.5.2, which states:

> "No work or testing may be performed unless the QC Program Manager or Project QC Manager is on the work site."

In the event that you are not able to be at the work site when work or testing is to be performed, it is your responsibility to inform the Program QC Manager and Project Manager, in advance, so that other arrangements can be made.

Further, if you are requested to perform the duties of the Site Supervisor, it is your responsibility to inform the Program QC Manager so that approval can be obtained in advance from the Contracting Officer or designated representative, in accordance with Section C Paragraph 6.6.2.1 of the contract.

You are a key member of the Project Manager's team and ensure that work meets the specific requirements and intent of the work plan, the Navy's scope of work and the basic contract. Should you have any questions regarding this role, you should immediately contact the Program QC Manager, Theresa Rojas. Your day-to-day activities on the site should be coordinated with all site personnel and the Project Manager. In event of any deficient items, the Superintendent and Project Manager should be advised immediately so they have opportunity to remedy the situation.

Sincerely,

CH2M HILL Constructors, Inc.

Michael D. Halil

Michael Halil
Deputy Program Manager

cc: Project File No. 378718

4610 Westgrove Court • Virginia Beach, Virginia 23455 • tel. (757) 318-9420 • fax (757) 318-9421
Northpark 400, 1000 Abernathy Road, Suite 1600 • Atlanta, Georgia 30328 • tel (770) 604-9095 • fax (770) 604-9282

Attachment 3

Testing Plan and Log

Contract No.: N62470-08-D-1006		TO No.: JM04	TO Title: Pre-Excavation Assessment (Delineation Sampling) SWMU 7/8				Location: Ceiba, Puerto Rico		Contractor: AECOM CH2M HILL	
A	B	C	D	E	F	G	H	I	J	K
Spec Section and Paragraph	Test Required	Proposed Lab	Sampled By	Tested By	Test Location	Frequency	Date Test Made	Test Results	Date Results Forwarded	Remarks