DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

REPLY TO
ATTENTION OF

NOV 23 2016

CESAJ-PM-M

MEMORANDUM FOR SEE DISTRIBUTION LIST

SUBJECT: Final Uniform Federal Policy - Quality Assurance Project Plan (UFP-QAPP) for Time Critical Removal Action (TCRA), Congressionally Authorized Areas within the Northwest Peninsula, Culebra Island, Puerto Rico, Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS) Project No. I02PR006816, Culebra, Puerto Rico

The Jacksonville District, U.S. Army Corps of Engineers (Corps) is enclosing for your records the Final UFP-QAPP for TCRA at the Congressionally Authorized Areas within the Northwest Peninsula associated with the DERP-FUDS Project No. I02PR006816, Culebra, Puerto Rico.

Should you need additional information, please contact Wilberto Cubero, Project Manager, at 904-232-1426 or by email at Wilberto.Cubero-delToro@usace.army.mil. You may also contact the undersigned at (904) 232-1758 or by e-mail at John.E.Keiser@usace.army.mil.

Sincerely,

Encl

John E. Keiser, P.E.
FUDS Program Manager
Military/Interagency & International
Services Branch

Distribution List Final UFP-QAPP for TCRA at the Congressionally Authorized Areas within the Northwest Peninsula, Culebra, Puerto Rico	
Mr. Juan Baba Peebles Federal Facilities Coordinator PR Environmental Quality Board 1375 Ponce de León Avenue San Juan, PR 00926-2604	Ms. Marelisa Rivera US Fish and Wildlife Service Road 301, Km 5.1 Boquerón, PR 00622
Dr. Lisamarie Carrubba NOAA Fisheries Caribbean Field Office Road 301, Km 5.1 Boquerón, PR 00622	Dr. Craig Lilyestrom Director, Marine Resources Division Department of Natural & Environmental Resources PO Box 366147 San Juan PR 00936-6147
Mr. Julio Vazquez US EPA Region 2 Special Project Branch/Federal Facilities Section 290 Broadway – 18th Floor New York, NY 10007-1866	Ms. Diane E. Wehner NOAA Office of Response and Restoration 290 Broadway Rm 2059 New York, NY 10007
Ms. Ana Roman US Fish and Wildlife Service Culebra National Wildlife Refuge Manager Road 301, Km 5.1 Boquerón, PR 00622	Ms. Coral Parrilla Executive Director Autoridad de Conservación y Desarrollo de Culebra P.O. Box 217 Culebra, PR 00775
Mr. Jose Rivera NOAA Fisheries Annex Building Fundacion Angel Ramos 2nd Floor, Suite 202 Franklin Delano Rooselvelt Ave. # 383 San Juan, Puerto Rico 00918	

FINAL
UNIFORM FEDERAL POLICY
QUALITY ASSURANCE PROJECT PLAN (UFP-QAPP)

TIME CRITICAL REMOVAL ACTION (TCRA)
SPECIFIC AREAS WITHIN THE NORTHWEST PENINSULA
CULEBRA ISLAND, PUERTO RICO

DERP-FUDS Project No. I02PR006816

Contract No. W912DY-10-D-0023
Task Order No. 0022
HGL Project No. H10022

Prepared for

U.S. Army Corps of Engineers

November 2016

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Revision Log

Revision No.	Revision Date	Comments

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FINAL
UNIFORM FEDERAL POLICY
QUALITY ASSURANCE PROJECT PLAN (UFP-QAPP)

TIME CRITICAL REMOVAL ACTION (TCRA)
SPECIFIC AREAS WITHIN THE NORTHWEST PENINSULA
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HGL Project No. H10022

Prepared for

U.S. Army Corps of Engineers

Prepared by:

HydroGeoLogic, Inc.
5030 Bradford Drive, Building 1, Suite 230
Huntsville, Alabama 35805

November 2016

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FINAL QUALITY ASSURANCE PROJECT PLAN

EXECUTIVE SUMMARY

ES.1 This Quality Assurance Project Plan (QAPP) has been prepared by HydroGeoLogic, Inc. (HGL) to support the Time Critical Removal Action (TCRA) at specific Congressionally-authorized locations within the Northwest Peninsula (NWP) of Culebra Island (Defense Environmental Restoration Program-Formerly Used Defense Site [DERP-FUDS] Project No. I02PR006816), Puerto Rico, specifically within portions of Carlos Rosario Beach, Flamenco Beach, Tamarindo Beach, the Flamenco Campground, and the Carlos Rosario Trail. This work is being conducted for the U.S. Army Corps of Engineers (USACE) under Contract No. W912DY-10-D-0023, Task Order No. 0022.

ES.2 Previous investigations have indicated that munitions and explosives of concern (MEC) is present on the NWP, resulting from its use between 1935 and 1975 for aerial gunnery training, bombing, and naval gunfire support training using live-fire and practice munitions. These materials present an unacceptable risk from explosive hazards to ACDEC, DNER, and FWS personnel and recreational users. The objective of the TCRA is to identify and dispose of MEC within specific areas of the NWP where receptors may come into contact with explosive hazards.

ES.3 DGM and advanced classification (AC) followed by intrusive investigation of anomalies will be completed in areas accessible to the equipment. Analog metal detections will be used in a mag and dig approach elsewhere. In a pond at the campground area, an underwater investigation will be completed. Advanced geophysical classification will be used to (1) detect anomalies resulting from discarded military munitions (DMM), unexploded ordnance (UXO), and other metallic debris and (2) classify anomalies so that informed decisions can be made as to whether the anomaly is a TOI and should be removed, or is a non-TOI and may be left in place. Geophysical data collected using electromagnetic induction (EMI) sensors in a dynamic mode will be used to initially detect and document the locations of subsurface anomalies. Geophysical data collected using advanced EMI sensors in a cued (static) mode will then be used to classify each anomaly as follows: (1) highly likely to be TOI; (2) highly unlikely to be TOI; or (3) Inconclusive. Detected items classified as "TOI" and "inconclusive" will be targeted for removal. Items classified as non-TOI will be left in place. Analog survey data will be used to detect anomalies resulting from DMM, UXO, and other metallic debris. For analog survey areas, all subsurface anomalies will be investigated and MEC/material potentially presenting an explosive hazard (MPPEH)/munitions debris (MD) will be removed.

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LIST OF ACRONYMS/ABBREVIATIONS

%D	percent difference
%R	percent recovery
ACDEC	Authority of Conservation and Development of Culebra
ASR	Archives Search Report
BDU	Bomb Dummy Unit
BIP	blown-in-place
CA	Corrective Action
CCB	continuing calibration blanks
CCV	Continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESAJ	U.S. Army Corps of Engineers, Jacksonville District
cm	centimeters
CoC	chain-of-custody
COPC	chemicals of potential concern
COR	Contracting Officer Representative
CSM	conceptual site model
DDESB	DoD Explosives Safety Board
DERP	Defense Environmental Restoration Program
DFW	definable features of work
DGM	digital geophysical method
DID	data item description
DL	detection limit
DMM	discarded military munitions
DoD	Department of Defense
DQI	data quality indicators
DQO	data quality objective
DUA	data usability assessment
EB	equipment blank
EE/CA	Engineering Evaluation/Cost Analysis
Ellis	Ellis Environmental Group
EM	Engineer Manual
EMI	electromagnetic induction
EPA	Environmental Protection Agency
ESE	Environmental Science and Engineering, Inc.
ESS	Explosives Safety Submission
FS	Feasibility Study
FUDS	Formerly Used Defense Site

GIS	geographic information system
GPS	global positioning system
H&S	Health and Safety
HAZMAT	hazardous material
HE	high explosive
HGL	HydroGeoLogic, Inc.
IAW	in accordance with
ICB	initial calibration blanks
ICV	initial calibration verification
IDQTF	Intergovernmental Data Quality Task Force
INPR	Inventory Project Report
ISO	industry standard object
IVS	instrument verification strip
LCL	lower control limit
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
MB	method blank
MC	munitions constituents
MD	munitions debris
MDAS	material documented as safe
ME	marginal exceedance
MEC	munitions and explosives of concern
MM	MetalMapper
MMRP	Military Munitions Response Program
MPC	measured performance criteria
MPPEH	material potentially presenting an explosive hazard
MRS	munitions response site
MS	matrix spike
MSD	matrix spike duplicate
MTA	MTA, Inc.
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWP	Northwest Peninsula
PAL	project action level
PDF	portable document format
PDT	project delivery team

PM	Project Manager
PR DNER	Puerto Rico Department of Natural and Environmental Resources
PREQB	Puerto Rico Environmental Quality Board
PWS	performance work statement
QA	quality assurance
QAPP	Quality Assurance Project Plan
QASP	Quality Assurance Surveillance Plan
QC	quality control
QSM	Quality Systems Manual
RAC	Risk Assessment Code
RCA	root cause analysis
RI	Remedial Investigation
RPD	relative percent difference
RRD	range-related debris
RSL	Residential Screening Levels
SI	Site Inspection
SNR	signal-to-noise ratio
SOP	standard operating procedure
SSFR	Site-Specific Final Report
SUXOS	Senior UXO Supervisor
TB	trip blank
TCRA	time critical removal action
TOI	target of interest
UCL	upper control limit
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer
WERS	Worldwide Environmental Remediation Services

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FINAL
QUALITY ASSURANCE PROJECT PLAN

INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by HydroGeoLogic, Inc. (HGL) to support the Time Critical Removal Action (TCRA) at specific Congressionally-authorized locations within the Northwest Peninsula (NWP) of Culebra Island (Defense Environmental Restoration Program-Formerly Used Defense Site [DERP-FUDS] Project No. I02PR006816), Puerto Rico, specifically within portions of Carlos Rosario Beach, Flamenco Beach, Tamarindo Beach, the Flamenco Campground, and the Carlos Rosario Trail. This work is being conducted for the U.S. Army Corps of Engineers (USACE) under Contract No. W912DY-10-D-0023, Task Order No. 0022.

The QAPP provides information on five areas: (1) Project Management and Objectives, (2) Measurement and Data Acquisition, (3) Field Sampling Rationale, (4) Assessment and Oversight, and (5) Data Review. This document meets the requirements and elements set forth in the *Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories (QSM)*, Version 5.0 (DoD, 2013), and the Intergovernmental Data Quality Task Force (IDQTF) *Uniform Federal Policy for Quality Assurance Project Plan Manual (UFP-QAPP)* (IDQTF, 2005) and the UFP-QAPP optimized worksheets (IDQTF, 2012); the Geophysical Classification for Munitions Response-QAPP template produced by the Interstate Technological and Regulatory Council (ITRC) (ITRC, 2015); and the UFP-QAPP for Advanced Geophysical Classification for Munitions Response (Version 1.0) (IDQTF, 2016). This QAPP provides a process for obtaining data of sufficient quality and quantity to satisfy project needs. It describes the functional activities, data quality objectives (DQOs), and measures necessary to obtain adequate data for a given purpose. Data acquisition, reporting, and evaluation will be completed in accordance with (IAW) this QAPP. As any new procedures are required, addenda to this document will be issued.

All staff participating in project/field efforts are required to read this plan and become familiar with the analytical procedures and the implementation of these procedures to ensure that analytical/sample goals are met consistently. In addition, key personnel are responsible for mentoring assigned staff in aspects of this QAPP that would have a potential impact on the work assigned to them.

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WORKSHEETS #1 AND #2
TITLE AND APPROVAL PAGE

Appendix E: Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP), Time Critical Removal Action (TCRA) for Specific Congressionally Authorized Areas Within the NWP, Culebra Island, Puerto Rico, Formerly Used Defense Site Property Number I02PR0068
Document Title

USACE
Lead Organization

Kenneth Rapuano, HGL
Preparer's Name and Organizational Affiliation

11107 Sunset Hills Road, Suite 400, Reston, Virginia 21090; 703-73-4546, krapuano@hgl.com
Preparer's Address, Telephone Number, and Email Address

November 2016
Preparation Date

Approval Signatures:

Investigative Organization's Senior Chemist:	Kenneth F. Rapuano Digitally signed by Kenneth F. Rapuano DN: cn=Kenneth F. Rapuano, o=HydroGeoLogic, Inc., ou=ECD-Reston, email=krapuano@hgl.com, c=US Date: 2016.11.17 12:15:02 -05'00' Signature/Date Kenneth F. Rapuano, CHMM, CQA, HGL Printed Name/Organization
Investigative Organization's Program Manager:	Janardan J Patel Digitally signed by Janardan J Patel DN: cn=Janardan J Patel, o=HGL, ou=ECD, email=jpatel@hgl.com, c=US Date: 2016.11.17 13:12:28 -05'00' Signature/Date Janardan Patel, PMP, HGL Printed Name/Organization
Investigative Organization's Program Quality Assurance (QA)/Quality Control (QC) Manager:	Jan Kool Signature/Date Jan Kool PhD, P.G., HGL Printed Name/Organization
Investigative Organization's Health and Safety Manager:	Steve Davis Digitally signed by Steve Davis DN: cn=Steve Davis, o=HGL, ou=EHS, email=sdavis@hgl.com, c=US Date: 2016.11.17 18:16:34 -05'00' Signature/Date Stephen Davis, CIH, CSP, HGL Printed Name/Organization

WORKSHEETS #1 AND #2 (CONTINUED)
TITLE AND APPROVAL PAGE

Approval Signatures:

Lead Organization's Contracting Officer Representative (COR) USAESCH COR:	Signature/Date Rebecca Terry, USAESCH Printed Name/Organization
HGL PM:	Digitally signed by Derek R. Anderson DN: cn=Derek R. Anderson, o=HydroGeoLogic, Inc, ou, email=danderson@hgl.com, c=US Date: 2016.11.18 09:44:53 -05'00' Signature/Date Derek Anderson, P.E., HGL Printed Name/Organization

WORKSHEETS #1 AND #2 (CONTINUED)
TITLE AND APPROVAL PAGE

Site Name/Project Name: TCRA, Northwest Peninsula, Culebra Island
Site Location: Culebra Island, Puerto Rico
Contractor Name: HGL
Contract Number: W912DY-10-D-0023
Contract Title: Huntsville Center - Worldwide Environmental Services Contract (WERS)
Task Order Number: 0022

1. Identify guidance used to prepare the QAPP: Uniform Federal Policy for Quality Assurance Project Plans (IDQTF, 2005 and 2012; ITRC, 2015; IDQTF, 2016); DoD QSM Version 5.0; EPA QA/G-5; and EM 200-1-15

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act of 1986, and National Contingency Plan.

3. Identify approval entities: USACE

4. The QAPP is (select one): $\boxed{\textbf{project-specific}}$ Generic

5. List dates of scoping sessions that were held: Project Kickoff Meeting held July 12, 2016.

6. List dates and titles of QAPP documents written for previous site work, if applicable: None.

7. List organizational partners (stakeholders): USACE (lead agency), Puerto Rico Environmental Quality Board (PREQB) (lead regulator), Puerto Rico Department of Natural and Environmental Resources (PR DNER), U.S. Fish and Wildlife Service (USFWS), Authority of Conservation and Development of Culebra (ACDEC), National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), and US Environmental Protection Agency (EPA) Region 2.

8. List data users: HGL, USACE, PREQB

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below.

All QAPP worksheets are applicable.

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WORKSHEETS #3 AND #5
PROJECT ORGANIZATION AND QAPP DISTRIBUTION

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address
Rebecca Terry	Contracting Officer's Representative (COR)	USAESCH	(256) 895-1788	Rebecca.K.Terry@usace.army.mil
Kelly Longberg	Technical Manager	USAESCH	(256) 895-1408	Kelly.D.Longberg@usace.army.mil
Kelly Enriquez	Geophysicist	USAESCH	(256) 895-1373	Kelly.D.Enriquez@usace.army.mil
John Keiser	Program Manager	USACE Jacksonville District	(904) 232-1758	John.E.Keiser@usace.army.mil
Wilberto Cubero	Project Manager	USACE Jacksonville District	(904) 232-1426	Wilberto.Cubero-deltoro@usace.army.mil
Michael D'Auben	Chemist	USAESCH	(256) 895-1460	Michael.J.D'Auben@usace.army.mil
Paul DeMarco	Biologist	USACE Jacksonville District	(904) 232-1897	Paul.M.DeMarco@usace.army.mil
Janardan Patel	Program Manager	HGL	(703) 300-8406	jpatel@hgl.com
Derek Anderson	Project Manager	HGL	(706) 372-5138	danderson@hgl.com
Scott Schroepfer	Deputy Project Manager	HGL	(707) 330-6411	sshroepfer@hgl.com
Jan Kool	Program QA Manager	HGL	(703) 736-4545	jkool@hgl.com
Tim Deignan	Project AC QC Geophysicist	HGL	(303) 524-3473	tdeignan@hgl.com
Ken Rapuano	Project Chemist	HGL	(703) 736-4546	krapuano@hgl.com
Jeff Martin	Database Manager	HGL	(703) 736-4533	jmartin@hgl.com
TBD	Senior Unexploded Ordnance (UXO) Supervisor (SUXOS)	HGL	TBD	TBD
TBD	UXO Quality Control Specialist (UXOQCS)	HGL	TBD	TBD
TBD	UXO Safety Officer (UXOSO)	HGL	TBD	TBD
Rolando Soler	Project Biologist	Caribbean Marine Services	(787) 220-1185	
TBD	Field Team Leader (FTL, sampling)	Parsons	TBD	TBD
Steve Rembish	Risk Assessor	Parsons	(512) 719-6067	Steve.J.Rembish@parsons.com
Patti Berry	AC Project Manager	Parsons	(678) 969-2410	Patricia.Berry@parsons.com
John Baptiste	Senior AC Geophysicist	Parsons	(303) 764-6067	John.Baptiste@parsons.com
Jae Yun	Field AC Geophysicist	Parsons	(678) 969-2463	Jae.Yun@parsons.com
Amek Carter	Laboratory PM	Lancaster	(717) 556-7252	amekcarter@eurofinsus.com
Tammy Chang	Data Validation PM	Parsons	(512) 719-6092	Tammy.Chang@parsons.com

Lancaster = Eurofins Lancaster Laboratories, Inc.
TBD = to be determined

Project Organization:

The project organizational chart is presented in Figure 3.1 (Appendix B).

WORKSHEETS #4, #7, AND #8
PROJECT PERSONNEL QUALIFICATIONS AND SIGN-OFF SHEET

Organization: HGL

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Janardan Patel	Program Manager	M.S. Environmental Engineering Management Experience: 27 years	PMP	
Derek Anderson	PM	B.S. Agricultural Engineering (Environmental Focus) Experience: 18 years	P.E. Civil Engineering, North Carolina, AZ LEED-AP	
Jan B. Kool, Ph.D.	Program QA Manager	B.S., Geology and Soil Science, M.S., Geology and Soil Science Ph.D., Soil Physics Experience: 32 years	P.G. CMQ/OE	
Tim Deignan	Project AC QC Geophysicist	B.S. Geophysical Engineering Experience: 26 years AC Experience: 1 year experience with AC at Pole Mountain, Spencer Range, and Southwest Proving Ground; experience in designing blind seed programs and interfacing with subcontractors and other project delivery team (PDT) members during work plan, technical project planning, and execution of field activities.	RPGp, State of California; Oasis Montaj Geophysical Data Processing for UXO 3 day -UXAnalyze- instruction by ESTCP; UX Analyze, annual training	
Ken Rapuano	Project Chemist	B.S., Chemistry M.S., Chemistry Experience: 29 years	Certified Hazardous Materials Manager; Certified Quality Auditor	
TBD	SUXOS	TBD	DoD Explosives Safety Board (DDESB) Technical Paper 18	
TBD	UXOQCS	TBD	DDESB Technical Paper 18	
TBD	UXOSO	TBD	DDESB Technical Paper 18	
TBD	Field Personnel	TBD	DDESB Technical Paper 18 (if applicable)	
TBD	Field Personnel	TBD	DDESB Technical Paper 18 (if applicable)	

Worksheets #4, #7, and #8 (Continued)
Project Personnel Qualifications and Sign-Off Sheet

Organization: Parsons

Name	Project Title/Role	Education/Experience	Specialized Training/ Certifications	Signature/Date
Steve Rembish, Ph.D.	Risk Assessor	B.S., Biochemistry; Ph.D., Toxicology Experience: 20 years	--	
Patti Berry	AC Project Manager	B.S., Engineering Science and Mechanics; M.S., Management Experience: 15 year AC Experience: 1-year experience PM for the Camp Sibert Remedial/ Removal Action AC project.	PMP	
John Baptiste	AC Senior Geophysicist	B.A., Geology Experience: 16 years AC Experience: 4 years experience using advanced geophysical sensors; experience with theoretical and practical aspects of detecting and selecting TOI to include 4 types of grenades, 37-mm through 155-mm projectiles, 4 types of mortars, 6 types of rockets and motors, general purpose and practice bombs, spotting charges, various fuzes, and Livens projectiles; non-TOI include ordnance fragments, rocket fins, mortar base plates, 4.2-inch mortar half-shells, non-hazardous fuzes, fuze couplers, venturis, nose cones, and horseshoes; expert in use of EM61-MK2, MetalMapper (MM) advanced EMI sensor, TEMTADS 2X2 advanced EMI sensor, and MM 2X2 advanced EMI sensor as well as high-precision GPS, inertial motion sensors, and control/integration software such as Geosoft Oasis Montaj; Project/Senior Geophysicist for Camp Beale Pilot Study and Demonstration Project, Marpi Field RI/FS Treatability Study, and Camp Sibert Remedial/Removal Action projects using the MM and/or TEMTADS 2X2 where responsibilities included data processing and analysis and development of the classifier for the project and all classification decisions.	Registered Geophysicist, CA; Oasis Montaj Geophysical Data Processing for UXO 3 day -UXAnalyze-instruction by ESTCP	

WORKSHEETS #4, #7, AND #8 (CONTINUED)
PROJECT PERSONNEL QUALIFICATIONS AND SIGN-OFF SHEET

Organization: Parsons (Continued)

Name	Project Title/Role	Education/Experience	Specialized Training/ Certifications	Signature/Date
Jae Yun	AC Field Geophysicist	B.S., Soil and Water Engineering Experience: 15 years AC Experience: 2 years experience using advanced geophysical sensors; Field Geophysicist for the Camp Sibert Remedial/Removal Action AC project using the MM where responsibilities included overseeing and/or conducting digital geophysical method (DGM) survey using towed array and man-portable EM61-MK2 configurations, analysis of DGM data, MM cued survey using the MM, and managing field QC of anomaly investigation, data collection, and processing; managed field operations for the first ESTCP Pilot Program at Camp Sibert Site 18 using classification and advanced sensors; site managed 5 ESTCP demonstration projects involving advanced sensors.	Oasis Montaj Geophysical Data Processing for UXO 3 day UXAnalyze instruction by ESTCP	
TBD	Field Personnel	TBD	TBD	
TBD	Field Personnel	TBD	TBD	

Organization: Lancaster

Name	Project Title/Role	Education/Experience	Specialized Training/ Certifications	Signature/Date
Amek Carter	Project Manager	B.S., Biology Experience: 24 years	--	
Dorothy Love	QA Director	B.S., Environmental Health Experience: 36 years	--	
Rick Karam	Director of Operations	B.S., Environmental Studies Experience: 16 years	--	

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WORKSHEET #6
COMMUNICATION PATHWAYS

Communication Driver	Initiator (role) (1)(2)	Recipient(s) (role) (1)	Procedure
General communication between USACE and other PDT members	USACE PM or designee	Appropriate PDT member(s)	Communicates directly as needed (verbally and/or in writing).
ACDEC and Regulatory interface	USACE CESAJ PM	Regulators (PREQB, PR DNER, USFWS, NOAA, and EPA) ACDEC	All materials and information about the project will be forwarded to PREQB, PR DNER, USFWS, NOAA, NMFS, and EPA by the CESAJ PM, or by the HGL PM with permission from the COR and CESAJ PM.
Regulatory oversight	Regulators (PREQB, PR DNER, USFWS, NMFS, NOAA, and EPA)	USACE CESAJ PM, USACE PM	Communicate directly as needed (verbally and/or in writing).
Project management, Task Order administration and logistics	HGL PM	USACE PM, USACE CESAJ PM, and appropriate PDT member(s)	Communicate directly as needed (verbally and/or in writing). The PM will communicate project related issues, including changes in schedule, changes in scope of fieldwork or delays, and recommendations to stop work, to the USAESCH PM by phone, email, or fax by Close of Business, next business day. The PM will also provide project information to the USAESCH PM through monthly progress reports, email updates, teleconference calls, and meetings. They will document deviations from QAPP and corrective action (CA) in memoranda to USAESCH PM, and will notify USACE of laboratory CA within 24 hours of notification from the laboratory or project chemist.
Mobilization and surface clearance activities are complete	HGL PM	Parsons AC PM	Upon completion of surface clearance activities, the HGL PM informs the Parsons AC PM.
Daily reports	HGL SUXOS	HGL PM and Parsons lead technical and site personnel	Documents progress in daily report and submits to HGL PM for onward distribution to PDT. Daily reports will be submitted to USACE PM within 24 hours of work completion that day whenever possible. Field progress reports will vary based on the objectives of each definable feature of work (DFW). Examples of these reports are geophysical surveying, intrusive investigation, and daily production reports.

WORKSHEET #6 (CONTINUED)
COMMUNICATION PATHWAYS

Communication Driver	Initiator (role) (1)(2)	Recipient(s) (role) (1)	Procedure
Stop work due to safety issues	HGL UXOSO (or USACE OESS)	HGL SUXOS, USACE OESS, and other field personnel	If unsafe work conditions are noted, the UXOSO will stop work immediately. Work will not be allowed to resume until the unsafe condition is corrected. The UXOSO will notify the Corporate H&S Officer immediately when a stop work situation is encountered. In some cases, such as inclement weather (for example, lightning or high winds), no CA is required and work may resume when the UXOSO and Corporate H&S Officer determine that conditions allow.
	HGL SUXOS	HGL PM	Verbally notify HGL PM as soon as possible after work stoppage.
	HGL PM	USACE PM	Notify USACE PM verbally or via e-mail as soon as possible after work stoppage.
QAPP changes before fieldwork	HGL Chemist	USACE PM	If errors or changed conditions require the modification of the QAPP before fieldwork begins, the Project Chemist will prepare revised text. All changes to the QAPP will require final approval from USACE and regulatory agencies.
QAPP changes during project execution	HGL SUXOS HGL PM Parsons AC PM	USACE PM Regulatory Agencies	The SUXOS and sample team will notify the Project Chemist of field deviations from QAPP within 2 business days and provide rationale for changes. The AC PM will notify the PM of field deviations from QAPP within 2 business days and provide rationale for changes. He or she will document changes in field daily progress reports and memoranda to the PM, review field operations daily and evaluate need for field CAs (in collaboration with PM), and document CA in the daily logs and in memoranda to PM and USAESCH PM. All changes to the QAPP will require final approval from USACE and regulatory agencies.
Geophysical QC variances	HGL QC Geophysicist	HGL Project Geophysicist, HGL Corporate QC Manager, and HGL PM	QC Geophysicist notifies HGL Project Geophysicist and PM immediately.
	HGL PM	USACE PM and USACE Project Geophysicist	HGL PM notifies USACE within 24 hrs. USACE PM notifies regulator as necessary.

WORKSHEET #6 (CONTINUED)
COMMUNICATION PATHWAYS

Communication Driver	Initiator (role) (1)(2)	Recipient(s) (role) (1)	Procedure
Geophysical QA Concerns	USAESCH PM, USAESCH Geophysicist	HGL PM, Parsons AC PM, and technical personnel	HGL and Parsons respond to geophysical QA concerns within 24 hours with a CA plan.
Field team finds MEC item(s)	HGL SUXOS	HGL PM, USACE OESS	Verbally notifies HGL PM and USACE OESS immediately and then awaits permission to respond and/or conduct disposal operation
	HGL PM	USACE PM, USACE CESAJ PM	Verbally notifies USACE and USACE CESAJ immediately.
	USACE CESAJ PM	Regulator and other PDT members	Notify other PDT members as necessary.
Field team ready to conduct MEC disposal operations	HGL SUXOS	HGL PM and personnel listed in 17A.16	Notifies personnel listed in 17A.16; and organizations.
	HGL PM	USACE PM, and PDT	HGL PM notifies USACE PM verbally and other USACE PDT members via e-mail.
Field corrective actions	HGL SUXOS	HGL PM	CA resulting from either failure to follow QAPP requirements or due to changes in site conditions will be documented by the SUXOS; the SUXOS will communicate the need for CA to the PM on the same business day. SUXOS may initiate interim CA in the field subject to final approval by the PM and Program QA Manager.
Sample receipt discrepancies (for example, broken or missing samples, improper preservation, or missing analysis requests)	Lancaster PM	HGL PM	The laboratory PM will communicate discrepancies in sample receipt to the HGL PM on the same business day that the discrepancy is identified. The PM, in consultation with the Project Chemist, will instruct the laboratory PM on the appropriate course of action.
Laboratory QC variances	HGL Chemist	HGL PM, USAESCH PM, USACE CESAJ PM	The Project Chemist will prepare variance requests in collaboration with laboratory PMs for transmittal to USACE for approval.
Analytical CAs	HGL Chemist	HGL PM, USAESCH PM, USACE CESAJ PM	Need for laboratory CAs will be determined by the Project Chemists and/or laboratory PM or QA Manager and will be documented in memoranda to PM and USAESCH PM.

WORKSHEET #6 (CONTINUED)
COMMUNICATION PATHWAYS

Communication Driver	Initiator (role) (1)(2)	Recipient(s) (role) (1)	Procedure
Data verification issues (for example, incomplete records)	HGL Chemist	HGL PM	The Data Validators will contact the laboratory directly in cases where the discrepancy is a simple report generation error (such as a skipped page or data missing for a subcontracted analytical method). For systematic problems, such as incorrectly formatted data reports or failure to include required data QC elements, the Data Validators will contact the Project Chemists. The Project Chemists will work with the laboratory PM to ensure that properly formatted data reports are delivered to the data validators on a timely basis.

(1) Names and contact information for personnel provided on Worksheets #4, 7, & 8.
(2) The initiator may designate another qualified individual to communicate with the recipient(s); however, the initiator shown is responsible for the communication being made.

WORKSHEET #9
PROJECT SCOPING SESSION PARTICIPANTS SHEET

Planning Session: Kickoff Meeting
Date: July 12, 2016
Time: 1330-1430 CT
Location: Teleconference
Purpose: Discuss the overall goals, implementation of the project tasks, and general approach for the Time Critical Removal Action at the NWP.

Attendees:

Name	Org	Role	Number	Email
John Keiser	CESAJ	FUDS Program Manager	(904) 232-1758	John.E.Keiser@usace.army.mil
Rebecca Terry	USAESCH	COR	(256) 895-1788	Rebecca.K.Terry@usace.army.mil
Kelly Longberg	USAESCH	TM	(256) 895-1408	Kelly.D.Longberg@usace.army.mil
Kelly Enriquez	USAESCH	Project Geophysicist	(256) 895-1373	Kelly.D.Enriquez@usace.army.mil
Mike D'Auben	USAESCH	Project Chemist	(256) 895-1460	Michael.J.D'Auben@usace.army.mil
Wilberto Cubero	CESAJ	District PM	(904) 232-1426	Wilberto.Cubero-Deltoro@usace.army.mil
Amanda Parker	CESAJ	PAO	(904) 232-1576 (904) 614-2240	Amanda.D.Parker@usace.army.mil
Donna West-Barnhill	CESAJ	PAO - Contractor	(803) 713-7174 (803) 622-9773	Donna.L.West2@usace.army.mil
Derek Anderson	HGL	PM	(706) 372-5138	danderson@hgl.com
Scott Schroepfer	HGL	Deputy PM	(256) 970-2120 (707) 330-6411	sschroepfer@hgl.com
Justin Kirk	HGL	TM	(210) 546-2140	jkirk@hgl.com
Tim Deignan	HGL	Project AC Geophysicist	(303) 524-3473	tdeignan@hgl.com
Patti Berry	Parsons	AC PM	(678) 969-2410	patricia.berry@parsons.com
John Baptiste	Parsons	Project AC Geophysicist	(303) 579-0909	John.E.Baptiste@parsons.com

Mr. Cubero, CESAJ, provided the Action Memorandum for team review. He was tasked with checking with USFWS regarding nesting areas for beach monitoring requirements, reviewing and revising the Commonwealth and regulatory points of contacts, and checking with the Mayor of Culebra whether a restriction can be placed on camping permits issued during TCRA fieldwork, or whether evacuating the site during working hours would be preferred. Ms. Terry, USAESCH, was tasked with confirming whether QA sampling would be required. Mr. Anderson, HGL, was tasked with providing the project schedule.

USFWS has confirmed sea turtle nesting areas on the portions of Flamenco, Tamarindo and Carlos Rosario beaches that are part of the TCRA. The biologist (or sea turtle monitor) was not present during the meeting to confirm the zone classification. However, Mr. Cubero was informed that more than 4 nests per year have occurred in these areas/beaches. Therefore, these areas would need to be surveyed twice a week, 75 days prior to initiation of fieldwork activities as per the SOPs. Mr. Cubero requested the nest area classifications and will provide them to the team as soon as Mr. Cubero have received them.

Also, it was confirmed that ACDEC cannot close the entire campground during the TCRA work. Close coordination with ACDEC and USACE PAO will be conducted during any fieldwork activities and keep them informed during the planning and progress of the project. ACDEC is willing to close or not allow camping in some areas/zones during fieldwork activities as well as to evacuating the campground, when necessary. It is possible that project representation will be required in a meeting with ACDEC to discuss with the tenants of the kiosks the TCRA work and the coordination process to be followed. ACDEC provided PDT with a map showing how the campground is divided by zones/areas and completed initial planning of the TCRA fieldwork.

Additionally, Ms. Terry later confirmed that QA splits were not needed, and Mr. Anderson provided a project schedule.

WORKSHEET #10
CONCEPTUAL SITE MODEL

10.1 OVERVIEW

10.1.1 The primary purpose of this worksheet is to describe the conceptual site model (CSM) for the project site. In order to provide the basis for this, this worksheet also summarizes observations from previous investigations, secondary data, information from site reports, and other relevant supporting information.

10.2 SITE DESCRIPTION AND BACKGROUND

10.2.1 Site Location

10.2.1.1 The site is located on Culebra Island, Commonwealth of Puerto Rico, approximately 17 miles east of the main island of Puerto Rico (Figure 10.1 in Appendix B). The southern portion of the NWP is located in the northwestern point of the main island of Culebra; also known as Lot 91. This portion of the peninsula is approximately 408 acres in size and is bounded by the Caribbean Sea to the northeast and southwest, and bounded to the northwest by a portion of the USFWS Culebra Island National Wildlife Refuge and to the southeast by the remainder of the island. NWP TCRA areas are under munitions response site (MRS) 16.

10.2.2 Topography

10.2.2.1 Culebra Island is comprised of sandy beaches, irregular rugged coastlines, lagoons, coastal wetlands, steep mountains, and narrow valleys. Ninety percent of the island is mountainous; the island has volcanic origins. The southern portion of the NWP has irregular, rugged coastlines with sandy beaches, lagoons, coastal wetlands, and mountainous terrain.

10.2.3 Vegetation

10.2.3.1 Vegetation is moderately to extremely dense within the NWP. Hazardous vegetation include the Mesquite acacia or thorny brush, which may be present on NWP. Also the poisonous Manchineel tree (also called Manzanillo Tree on Culebra) is known to be present on NWP and near Flamenco Lagoon. Threatened and endangered vegetation consists of fifty species listed in Appendix E.

10.2.4 Geology

10.2.4.1 Culebra is underlain primarily by volcanic and plutonic rocks of Late Cretaceous age. Andesite lava, lava breccia, and tuffs are the dominant volcanic rocks with intrusions by diorite and diorite porphyry; these rocks are characterized by fractures formed in a joint pattern. Some faulting is also present, with major faults aligned in a northwest-southeast direction. Alluvium, predominately composed of silt and clay with minor quantities of sand and gravel, is deposited in the few existing river valleys near the coast. Alluvium interfingers with coral, beach, and mangrove habitat deposits along the coast (USGS, 1996).

10.2.5 Soils

10.2.5.1 The soil cover is homogeneous with only one soil association, the Descalabrado-Guayama. This association is described as composed of shallow, well drained, strongly sloping to very steeply sloping soils derived from the underlying volcanic rocks. Permeability is moderate and ranges from 0.6 to 2.0 inches per hour (USGS, 1996). Loamy organic-rich soils are found in areas of dense vegetation and grasses, while sandy soils are found on tidal flats or areas near the beach. Many of the beaches on Culebra, including Flamenco Beach and Carlos Rosario Beach have clean white to tan sand, while other beaches are rocky with a mix of cobbles and pieces of dead coral reef.

10.2.6 Hydrology

10.2.6.1 There are no permanently flowing surface water streams on Culebra; potable water is obtained from a utility pipeline from the main island by way of Vieques Island (Parsons, 2007). Three large ephemeral streams drain the hills north of Great Harbor to the south, and one large ephemeral stream has developed along an old, washed-out jeep road on the north side of the island toward Brava Beach. These ephemeral streams generally only carry water after heavy precipitation. There are many small ephemeral gullies and ditches throughout the island.

10.2.7 Hydrogeology

10.2.7.1 Ground water in Culebra occurs in alluvial deposits and in the volcanic and plutonic rocks. Alluvial deposits are located along major stream valleys that reach the coast. The alluvium is mostly composed of silt and clay with limited quantities of sand and gravel (USGS, 1996). The total estimated thickness of the unconsolidated deposits in the embayments (alluvium and weathered rock) is less than 18 m (Gómez-Gómez, et al, 2014). Fractures and joints within the volcanic and plutonic rock formations store water in small quantities. Most of these fractures and joints diminish in number and size with depth and pinch out at about 300 feet below land surface. Water-table conditions prevail in the bedrock aquifer. The specific yield for the bedrock aquifer was estimated at less than 1 percent by comparing changes in water levels with records of pumpage and estimates of recharge (USGS, 1996).

10.2.7.2 A 1995 study listed 77 wells on the island of Culebra, of which only 16 were being used for any purpose. The report stated that well water from 10 wells was being used to flush toilets, water and clean horses, water livestock, and water plants. The remaining six wells were listed as owned by the Puerto Rico Aqueduct and Sewer Authority; however, only two were listed as being pumped, and no information was provided about the use of this water (Parsons, 2007).

10.2.7.3 Direct rainfall is the only source of recharge for the Culebra aquifer system. However, recharge from rainfall only occurs during storms that last 2 to 4 days. Such storms take place only two to three times a year. About 1 percent of the rainfall infiltrates to the aquifer during these events. Annual recharge ranges from 0 to 6.8 percent of annual rainfall (USGS, 1996).

10.2.7.4 The depth to the water table beneath the ridges may be 100 feet or more, and may be less than 10 feet in the lower part of the valleys. The water flows toward the sea; however, evaporation prevents much of the water from being discharged. In coastal embayments, the water table usually is 1 to 2 feet AMSL. Salt water encroachment is common due to low heads and proximity to the sea (USGS, 1996). Most wells on the island of Culebra are shallow, dug wells that supply water to livestock. To augment the water supply of the island, several wells were drilled within an upland depression; however, the sustained yield of these wells was less than 20 m^3/d (Gómez-Gómez, et al, 2014).

10.2.7.5 Groundwater is characterized by naturally high mineral concentrations, with dissolved-solids concentrations ranging from 500 to 1,000 milligrams per liter (mg/L). This condition is a result of airborne particulates that fall on the land surface and infiltrate the aquifer during periods of recharge. High mineral concentrations on Culebra exceed USEPA standards for drinking water in most cases; therefore, the public water supply on Culebra is provided by a utility pipeline from the main island of Puerto Rico by way of Vieques Island. In some households, municipal water is supplemented with rooftop cisterns or groundwater for non-drinking water uses.

10.2.8 Endangered Species, Sensitive Habitats, and Historical or Cultural Resources

10.2.8.1 The main island of Puerto Rico and its associated islands support many federally listed threatened and endangered species (see Appendix E). Among this diverse group of fauna and flora are multiple species, such as migratory birds, that are known to exist, potentially exist, or temporarily use areas within the Culebra Island. According to the National Wildlife Refuge System, portions of Culebra Island are considered National Wildlife Refuge area. According to the PR DNER, the conservation priority areas within the southern portion of NWP are as follows:

- All of the lagoons
- All beaches
- The designated critical habitat area for the Virgin Islands Boa
- Flamenco Peninsula

10.2.8.2 There are no known cultural or archeological resources within this project site (Parsons, 2007).

10.2.9 Site Access

10.2.9.1 The site is accessible via boat or existing roads. Local workers are regularly present within the site to manage recreational areas. The Flamenco Beach Campground consists of commercial vendor structures and an expansive tent-camping area. Additionally, Flamenco Beach, Carlos Rosario Trail and Beach, and Tamarindo Beach receive thousands of visitors yearly. Access to the site is unrestricted to the public.

10.2.9.2 Digital geophysical mapping (DGM) data collection will not be performed in heavily vegetated areas due to limitations on vegetation removal. Analog geophysical instruments will be used in heavily vegetated areas. Otherwise, no other impediments to geophysical data collection (such as electromagnetic interference) are present.

10.3 HISTORICAL DOD USE

10.3.1 The public lands in the Culebra Island Archipelago were placed under the control of the U.S. Department of Navy in 1901. The Culebra Island Archipelago was used for training purposes by the U.S. Navy and U.S. Marines, and the North Atlantic Treaty Organization (NATO). The U.S. Marines used portions of Culebra Island as a training facility from 1902 through 1941. The NWP was used as a bombing and gunnery range from 1935 through 1975. Aircraft bombing and strafing of the NWP ended around 1970, while the use of live-fire naval gunfire support training ended in 1971. Subsequent naval support training was conducted using practice rounds until ordnance use was terminated on September 30, 1975. Between 1975 and 1982, the facilities were turned over to the General Services Administration. In 1982, the Quit Claim Deed was executed that transferred the NWP lands from the U.S. Department of the Interior to the Commonwealth of Puerto Rico.

10.4 CURRENT AND PROJECTED LAND USE

10.4.1 Currently, the southern portion of NWP of Culebra Island includes wildlife conservation and recreational areas. The Culebra Conservation and Development Authority manages the land comprising the southern portion of NWP. Limited receptor access is present on northern portion of Flamenco Beach; fencing and natural barriers such as dense vegetation and rocky cliffs make access to many areas difficult beyond the Flamenco Beach and Campground areas. Receptor access is also present on the western beach area, Carlos Rosario Beach, by the Carlos Rosario Trail that runs along the southern side of the southern portion of NWP from the Flamenco Beach area. The site is expected to continue to be used for wildlife conservation and for recreation in the future.

10.4.2 The potential presence of large, high explosive (HE) munitions in, or near, heavily used public beaches (e.g., Flamenco, Carlos Rosario and Tamarindo beaches), trails, and nearby businesses pose a significant imminent risk to public health, safety, and the environment.

10.5 PREVIOUS INVESTIGATIONS

10.5.1 1991 Inventory Project Report

10.5.1.1 An Inventory Project Report (INPR) was signed on December 24, 1991, establishing the Culebra Island site as a FUDS, defining a site boundary, and assigning FUDS Project No. I02PR006800 (USACE, 1991). The Findings and Determination of Eligibility concluded that "the site, except for 87.5 acres still under control of the Navy, has been determined to be formerly used by the DoD. It is therefore eligible for the DERP."

10.5.2 1995 Archives Search Report

10.5.2.1 The Archives Search Report (ASR) was completed by the USACE Rock Island District in February 1995 (USACE, 1995) after reviewing available records, photographs, and reports that documented the history of the site. As part of the ASR, a site visit was conducted in October 1994, during which the team identified munitions debris (MD) on Flamenco Beach, Flamenco Peninsula.

10.5.3 1995 Interim Remedial Action

10.5.3.1 In 1995, MTA, Inc. (MTA) completed an interim remedial action on 3.66 acres of the Flamenco Beach Campground near Flamenco Beach to dispose of munitions and explosives of concern (MEC) within 2 feet of the ground surface at the campground (MTA, 1995). Work was conducted on the site between 12 May and 26 May 1995. MTA found 11 MEC (UXO) items including 5” HE naval projectiles, 40mm tracer rounds, Bomb Dummy Unit (BDU)-33s, and various flares.

10.5.4 1997 Final Engineering Evaluation/Cost Analysis

10.5.4.1 The 1997 Engineering Evaluation/Cost Analysis (EE/CA) investigation included surface and subsurface sample grids on NWP, Isla Culebrita, Cayo Botella, Cayo del Agua, Cayo Lobo, and Cerro Balcon (Environmental Science and Engineering [ESE], 1997). MEC items were found in all areas except Cayo Lobo and Cerro Balcon, where only ordnance-related scrap was identified. Items found included 20mm high-explosive incendiary devices, Mk76 practice bombs, Mk50 5-inch projectiles, 37mm projectiles, 5-inch rockets, 76mm projectiles, 3- and 6-inch naval projectiles, 81mm mortars, and a grenade. The MEC items found in grids located specifically in the southern portion of NWP are listed in Table 10.1 and identified on Figure 10.2 (Appendix B).

10.5.5 2004 UXO Construction Support

10.5.5.1 The 2004 UXO Construction Support Report, Culebra Island Wildlife Refuge (Ellis Environmental Group [Ellis], 2004) documented clearance efforts conducted by Ellis on NWP. Ellis performed four phases of clearance from January 2001 to February 2004. Phase I consisted of construction support by clearing roadways, a wind generator foundation, a desalination plant foundation, and re-grading the site. Phase II of the construction support was not exercised because of a stop in funding for the construction project. Phase III included surface clearance of 70 acres of bird nesting area and 4-foot-depth subsurface clearance of roadways, firebreaks, and an observation post. Phase IV consisted of demilitarization of scrap, construction of a fence and information kiosk, and development of public awareness information.

10.5.5.2 During the UXO Construction Support project, Ellis excavated 6,121 holes and recovered 15,479 pounds of scrap metal and 249 MEC items. Fifteen (15) of the 249 MEC items were found within the boundary of the southern portion of NWP. Table 10.1 includes a list of the MEC items found during the UXO Construction Support project.

Table 10.1
MEC Items Found During Previous Investigations

Item[1]	Quantity	Reference	Location/ID
.50-caliber cartridge cases	1	ASR	Flamenco Peninsula
5-inch rocket	1	ASR	Flamenco Peninsula
11.75-inch tiny tim aerial rocket	1	ASR	Flamenco Beach
Candle, illumination, from 5”/ 38 naval projectile	1	1995 MTA TCRA	NWP Grid No. 1
Bomb, practice, 25 pound, MK 76/BDU-33	1	1995 MTA TCRA	NWP Grid No. 2
Projectile, 40mm, M81A1 TP-T	1	1995 MTA TCRA	NWP Grid No. 2
Projectile, 40mm, M81A1 TP-T	1	1995 MTA TCRA	NWP Grid No. 2
BLP, 3 inch, with tracer	1	1995 MTA TCRA	NWP Grid No. 2

Table 10.1 (Continued)
MEC Items Found During Previous Investigations

Item[1]	Quantity	Reference	Location/ID
Projectile, 3”/ 50 HE	1	1995 MTA TCRA	NWP Grid No. 2
Projectile, 40mm, M81A1 TP-T	1	1995 MTA TCRA	NWP Grid No. 2
Fuze, BD, from 5”/ 38 projectile	1	1995 MTA TCRA	NWP Grid No. 3
Fuze, BD, from 5”/ 38 projectile	1	1995 MTA TCRA	NWP Grid No. 4
Fuze, BD, from 5”/ 38 projectile	1	1995 MTA TCRA	NWP Grid No. 4
Projectile, 40mm, Bofors	1	1995 MTA TCRA	NWP Grid No. 4
Candle, illumination, from 5”/ 38 naval projectile	1	1995 MTA TCRA	NWP Grid No. 4
Naval gun fire, 3 inch	2	1997 EE/CA	NWP NP-3
Candle, illumination, 3 inch	3	1997 EE/CA	NWP NP-4
Naval gun fire, 5 inch	9	1997 EE/CA	Flamenco Beach FB-6, NWP NP-16, NP-17, NP-18, NP-20
Naval gun fire, 6 inch	1	1997 EE/CA	NWP NP-21
Projectile, 37mm HE	1	1997 EE/CA	Flamenco Beach FB-6
Warhead, rocket, 5-inch	1	1997 EE/CA	Flamenco Beach FB-6
Candle, illumination, 5-inch	11	1997 EE/CA	Flamenco Beach FB-6, NWP NP-4, NP-15, NP-19, NP-22
Grenade, w/o fuze	1	1997 EE/CA	NWP NP-17
Fuze, projectile base	1	1997 EE/CA	NWP NP-21
Various UXO	15	2001-2002 UXO Construction Support, Ellis	NWP
Candle, illumination, 5-inch	1	2002 Ellis Grid Log	2029724.479N 2529724.682E
Bomb, 100 pound	1	2002 Ellis Grid Log	2029921.471N 25279.397E
Bomb, 1,000 pound	1	2002 Ellis Grid Log	2029922.685N 252796.915E
Candle, illumination, 5-inch	1	2002 Ellis Grid Log	2029922.685N 252796.915E
Mortar, 81mm	1	2002 Ellis Grid Log	2029924.127N 252920.989E
MK 80 series bomb body	1	2007 SI Report - Recon	NWP
MK 76 practice bomb body	25+	2007 SI Report - Recon	NWP
Aircraft flare tray	2	2007 SI Report - Recon	NWP
MK 80 series bomb body	1	2007 SI Report - Recon	NWP
5” Projectile	1	2008-2009 USACE NTCRA	Flamenco Beach
5" HE Projectile	1	Congressional Study Fieldwork	ID No. 2
BDU-13	1	Congressional Study Fieldwork	3
2.75" Rocket WH	1	Congressional Study Fieldwork	5
20mm HE Projectile	1	Congressional Study Fieldwork	6
BDU-13	1	Congressional Study Fieldwork	7
5" HE Projectile	1	Congressional Study Fieldwork	8
2.75" Rocket WH	1	Congressional Study Fieldwork	9
5" MK41Projectile	1	Congressional Study Fieldwork	10

Table 10.1 (Continued)
MEC Items Found During Previous Investigations

Item[1]	Quantity	Reference	Location/ID
5"APHE Projectile	1	Congressional Study Fieldwork	11
75mm Projectile	1	Congressional Study Fieldwork	12
75mm Projectile	1	Congressional Study Fieldwork	13
5" HE Projectile	1	Congressional Study Fieldwork	14
Signal Flare	1	Congressional Study Fieldwork	16
100lbs GP Bomb	1	Congressional Study Fieldwork	17
5" MK39 Projectile	1	Congressional Study Fieldwork	19
Candle, illumination	1	Congressional Study Fieldwork	21
Candle, illumination	1	Congressional Study Fieldwork	22
3" APHE Projectile	1	Congressional Study Fieldwork	23
Candle, illumination	1	Congressional Study Fieldwork	24
5" APHE Projectile	1	Congressional Study Fieldwork	26
5" HE Projectile	1	Congressional Study Fieldwork	27
5" HE Projectile	1	Congressional Study Fieldwork	28
5" HE Projectile	1	Congressional Study Fieldwork	29
5" HE Projectile	1	Congressional Study Fieldwork	30
100lbs GP Bomb	1	Congressional Study Fieldwork	31
Candle, illumination	1	Congressional Study Fieldwork	32
5" HE Projectile	1	Congressional Study Fieldwork	33
5" HE Projectile	1	Congressional Study Fieldwork	34
Flare	1	Congressional Study Fieldwork	35
3" HE Projectile	1	Congressional Study Fieldwork	36
81mm White Phosphorous Mortar	1	Congressional Study Fieldwork	37
Partial 81mm White Phosphorous Mortar	1	Congressional Study Fieldwork	38

Table 10.1 (Continued)
MEC Items Found During Previous Investigations

Item[1]	Quantity	Reference	Location/ID
Partial 3" HE Projectile	1	Congressional Study Fieldwork	39
500 lb Bomb MPPEH	1	Congressional Study Fieldwork	40
Signal Flare	1	Congressional Study Fieldwork	41
Signal Flare	1	Congressional Study Fieldwork	42
Unknown - Young girl was reportedly burned from small 5"-6" long cylindrical item.	4	2013 - Reported by Local Authorities	NWP
Unknown - Tentatively Identified as High Velocity Aircraft Rocket Warhead	1	2014 - Reported by Local Authorities	NWP
(1) Projectile 3" and (3) unknown items	4	2015 - Reported by Local Authorities	NWP (Playa Blanca)

(1) Not all items listed in Table 10.1 are shown on Figure 10.2.

10.5.6 2004 Archives Search Report Supplement

10.5.6.1 The ASR Supplement was completed by the USACE Rock Island District as an addition to the 1995 ASR (USACE, 2004). No site visit was conducted in support of the ASR Supplement. This report provides detail of aerial training conducted by the Navy between 1935 and 1975 and identifies 20 range/sub-range areas. Figure 10.4 depicts Navy sub-range areas. The boundaries of the following sub-ranges encompass areas within the southern portion of NWP:

- Naval Gunfire Target Area: This range was a naval gunfire and air-to-ground range with its target located on NWP. Munitions included general small arms, .50-caliber small arms, Mk80s series general purpose bombs, M1 105mm HE, Mk21 8-inch armor piercing, Mk5 16-inch AP, 2.75-inch rockets, and the 11.75-inch Tiny Tim rocket.
- Agua Cay: This area, also known as Water Key, was used as a target for bombing and rocket fire. Munitions include Mk80s series general purpose bombs and 2.75-inch rockets.
- Air-to-Ground North: This target was located at the northern tip of NWP. Munitions used include general small arms, .50-caliber small arms, Mk82 500-pound general purpose bombs, 2.75-inch rockets, and 11.75-inch Tiny Tim rockets.
- Air-to-Ground South: This target was located at the southern portion of NWP. Munitions used include general small arms, .50-caliber small arms, Mk82 500-pound general purpose bombs, 2.75-inch rockets, and 11.75-inch Tiny Tim rockets.

10.5.7 2005 Revised Inventory Project Report

10.5.7.1 A Revised INPR was completed in June 2005 (USACE, 2005a). The Revised INPR further clarified the military use of the Island of Culebra and divided the original site, Property No I02PR0068, into 14 separate MRSs. One hazardous and toxic waste project was identified and assigned the number 00, and 13 Military Munitions Response Program (MMRP) project areas were identified and assigned Risk Assessment Code (RAC) scores. The southern portion of NWP and the portion of Flamenco Beach are contained within the boundaries of MRS 02 (Culebra Island and Cays), which was given a RAC score of 1.

10.5.8 2005 Supplemental Archives Search Report

10.5.8.1 The Supplemental ASR was completed by the USACE St. Louis District in 2005 as an addition to the 1995 and 2004 ASRs (USACE, 2005b). The Supplemental ASR provided historical information pertaining to site operations and identified the key areas of focus for the SI. This document provided a detailed summary of military activities conducted on Culebra Island and the surrounding cays. The document summarized planned and/or executed maneuvers and training conducted at the site, including specific time periods, locations, and munitions used.

10.5.9 2007 Site Inspection

10.5.9.1 A Site Inspection (SI) of Culebra Island and the surrounding cays was completed in 2007 (Parsons, 2007). The objective of the 2007 SI was to determine whether the MRSs delineated in the 2005 Revised INPR warranted further investigation under the MMRP. The southern portion of NWP and a portion of Flamenco Beach are contained within the boundaries of MRS 02. IAW Public Law 93-166, SI data were not collected from the NWP portion of MRS 02. However, due to the presence of MD and MEC previously found within the southern portion of NWP, the 2007 SI recommendation was to proceed to Remedial Investigation (RI)/Feasibility Study (FS) status for MRS 02.

10.5.10 2009 Non-Time Critical Removal Action, Flamenco Beach

10.5.10.1 In 2008-2009, a Non-TCRA Action on Flamenco Beach (USAE, 2009). USAE performed digital geophysical mapping of 12.3 acres and reacquired target anomalies. Findings included 6 MD items and one MEC (UXO) item (a 5” projectile) on Flamenco Beach.

10.5.11 2012 Congressional Study Report

10.5.11.1 The study was conducted between June 2011 and December 2011, pursuant to PL 111-383, SEC. 2815, “Former Naval Bombardment Area, Culebra Island, Puerto Rico” that requires the Secretary of Defense to conduct a study, at the request of the Commonwealth of Puerto Rico. The study included a geophysical/intrusive investigation (transects/grids) of the Study Area, or the southern portion of the NWP, as well as an munitions constituent (MC) investigation. During the geophysical investigation, the field team recovered 36 UXO items. UXO encountered included 5-inch HE naval projectiles, 2.75-inch rockets, 3-inch naval projectiles, 40mm projectiles, 75mm projectiles, 81mm mortars, 100-pound General Purpose (GP) bombs, a 500-pound GP bomb, and BDU-33 practice bombs. A list of UXO items recovered during the field work is included in Table 10.1. The study confirmed that there was potentially hazardous MEC presence within the southern portion of the NWP, and recommended further evaluation (DoD, 2012).

10.5.11.2 In addition to the geophysical investigation, over 100 soil, surface water, and sediment samples were collected within the Study Area. All samples were analyzed for MC, including explosives and metals, and analytical results were compared to preliminary screening values to determine if there was evidence of an MC release (DoD, 2012).

10.5.11.3 MC detected in soil and evaluated in the risk assessment included metals (antimony, chromium, copper, lead and zinc) and explosives (2-amino-4,6-dinitrotolune, 4-amino-2,6-dinitrotoluene, 2,4,6-trinitrotoluene, and methyl-2,4,6-trinitrophenyl-nitramine [tetryl]). Copper in sediment, and copper, lead, and zinc in surface water were also evaluated in the risk assessment (DoD, 2012).

10.5.11.4 Copper and 2,4,6-trinitrotoluene were detected in soil above their human health preliminary screening values, and results indicated that they may pose an unacceptable human health risk in soil at the Study Area. However, the study determined that an unacceptable human health risk from MC would not be expected through exposure to surface water or sediment within the Study Area (DoD, 2012).

10.5.11.5 Five metals (antimony, chromium, copper, lead, zinc) and four explosives (2-amino-4,6-dinitrotolune, 4-amino-2,6-dinitrotoluene, 2,4,6-trinitrotoluene, and methyl-2,4,6-trinitrophenylnitramine [tetryl]) were present in soil above their preliminary ecological screening values. Additionally, one metal (copper) was detected in sediment and three metals (copper, lead, and zinc) were detected in surface water above their preliminary ecological screening values. The study indicated that exposure to these compounds in soil, sediment, and surface water may pose an unacceptable risk to ecological receptors within the Study Area (DoD, 2012).

10.5.12 2016 TCRA Action Memorandum

10.5.12.1 In May 2016, CESAJ completed a TCRA Action Memorandum for Specific Congressionally Authorized Areas within the NWP. The specific areas covered within the Action Memorandum were portions of Carlos Rosario Beach, Flamenco Beach, Tamarindo Beach, the Flamenco Campground, and Carlos Rosario Trail. The Action Memorandum selected response actions to be performed under the TCRA including surface and subsurface removal of MEC by conducting identification (visual and geophysics), confirmation, surface and subsurface removal, and disposal of recovered munitions. The primary objective of the TCRA is to mitigate and minimize the threat posed by the potential proximity of munitions to recreational users of the beach and campground, whose activities may present exposure to and potentially trigger an unintentional detonation of an item.

10.6 CONCEPTUAL SITE MODEL

10.6.1 The CSM for the NWP is summarized in Table 10.2. This table describes the known or suspected contamination sources, potential/suspected location and distribution of contamination, contamination source or exposure medium, current and future receptors, and potentially complete exposure pathways. The CSM is a “living document” based on existing knowledge that will be updated as more information becomes available.

Table 10.2
Preliminary Conceptual Site Model, NWP Culebra

Site Details	Known or Suspected Contamination Source(s)	Potential/Suspected Location and Distribution[1]	Source or Exposure Medium	Current and Future Receptors	Potentially Complete Exposure Pathway
NAME: Specific Areas, NWP, Culebra Island **Acreage**: 31.83-acre clearance area within 408-acre area of interest **Suspected Past DoD Activities (*release mechanisms*)**: Aerial bombing, maneuvers, naval gun and artillery firing, and amphibious training **Current and Future Land Use**: Wildlife conservation and recreation	MEC and MD from the following munitions types have been recovered on site: General small arms .50-cal small arms Mk80 general purpose bombs M1 105mm HE Mk21 8-in AP Mk5 16-in AP 2.75-in rockets 5-in rockets 11.75-in Tiny Tim Rocket Mk82 500-lb bombs M43 81mm mortar 3-in to 16-in projectiles 20mm projectiles 75mm projectiles 76mm projectiles Pyrotechnic Rounds 81mm White Phosphorous Mortar Various HE, incendiary, and practice bombs MC from MEC and MD on site.	Flamenco Beach (4.3 acres): anomaly densities ranging from 786-1,040 anomalies per acre.	Surface or subsurface soil	Current and Future: Site workers, recreational users, trespassers, and ecological receptors.	Exposure of human receptors to surface and/or subsurface MEC
		Flamenco Campground (17.06 acres): 786-1,040 anomalies per acre.	Surface or subsurface soil, sediment, and surface water		Exposure of human and ecological receptors to MC within soil, sediment, and surface water at concentrations above relevant screening criteria
		Carlos Rosario Trail (3.67 acres): 0-785 anomalies per acre			
		Carlos Rosario Beach (5 acres): 0-785 anomalies per acre.			
		Tamarindo Beach (1.8 acres): 0-785 anomalies per acre.			

[1] Anomaly densities are based on the 2012 Congressional Study Report.

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WORKSHEET #11A
MEC DATA QUALITY OBJECTIVES

This worksheet describes the MEC DQOs developed for the project, including the environmental problem, the related decisions that need to be made, the type and quantity of data, and level of data quality needed to ensure that those decisions are based on sound scientific data. The following DQO elements are based on the EPA's seven-step DQO process defined in EPA *Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4*, EPA/240/B-06/001, February 2006, and the USACE *Technical Project Planning Process (TPP)*, Engineer Manual (EM) 200-1-2, February 29, 2016.

1. State the problem.	Previous investigations (listed in WS #10) have indicated that MEC in the form of UXO (Table 10.1) may be present on the NWP, resulting from its use between 1935 and 1975 for aerial bombing, maneuvers, naval gun and artillery firing and amphibious training using live-fire and practice munitions. As shown in the CSM, these materials present an unacceptable risk from explosive hazards to ACDEC, DNER, and FWS personnel and recreational users.
2. Identify the goal of the study.	<u>Identify the principal study goal</u>: The goal of the TCRA is to identify and dispose of MEC within specific areas of the NWP. <u>Identify alternative outcomes</u>: AC will be conducted to the maximum extent practicable, in areas designated for DGM. In DGM areas where AC is conducted, a subsurface anomaly will be classified as a target of interest (TOI) and removed, or will be classified it as non-TOI and left in place. In DGM areas not conducive to AC, subsurface anomalies meeting agreed upon threshold values will be intrusively investigated. In areas where analog methods are used for survey, all subsurface anomalies will be investigated and MEC/material potentially presenting an explosive hazard (MPPEH)/MD will be removed. <u>State how the data will be used in solving the problem</u>: Advanced geophysical classification will be used to 1) detect anomalies resulting from discarded military munitions (DMM), UXO, and other metallic debris and 2) classify anomalies so that informed decisions can be made as to whether the anomaly is a TOI and should be removed, or is a non-TOI and may be left in place. Geophysical data collected using electromagnetic induction (EMI) sensors in a dynamic mode will be used to initially detect and document the locations of subsurface anomalies. Geophysical data collected using advanced EMI sensors in a cued (static) mode will then be used to classify each anomaly as follows: 1) highly likely to be TOI; 2) highly unlikely to be TOI; or 3) Inconclusive. Detected items classified as "TOI" and "inconclusive" will be targeted for removal. Items classified as non-TOI will be left in place. Analog survey data will be used to detect anomalies resulting from DMM, UXO, and other metallic debris. For analog survey areas, all subsurface anomalies will be investigated and MEC/MPPEH/MD will be removed. The results of geophysical detection and classification and analog surveys, and the subsequent intrusive investigation must meet established DQOs to allow the anticipated land reuse to take place after the removal of TOI or anomalies.
3. Identify information inputs.	The primary data required to guide or support choices during the DQO process are: (1) Up-to-date CSM summarizing site conditions based on previous studies (e.g., INPR, ASR, Supplemental ASR) including: a. Removal action MEC objectives (WS #11A.2) b. Site history and uses (WS #10.3 and 10.4) c. Removal action boundaries (WS #10.2) d. Types and quantities of MEC known or suspected to be present (WS #10.5) e. Expected distribution of MEC present

	f. MEC incident reports (if any) g. Topography, geology, vegetation (WS #10.2) h. Land use considerations (WS #10.4) i. Reasonably anticipated future uses (WS #10.4) j. Current and future receptors (WS #10.4) k. Exposure pathways (WS #10.6) l. Access restrictions or other obstacles to investigation (WS #10.2) m. Endangered species, sensitive habitats, and historic or cultural resources that could be affected by traffic or other disturbances occurring during the investigation or subsequent removal action (WS #10.2) n. Assumptions, data gaps, and sources of uncertainty (WS #10.6) (2) Surface clearance results, including: a. Surface clearance results (database) b. Photos (photo log) c. Disposal records d. Updated CSM (3) Detection survey results, including: a. Areas covered (Standard Operating Procedure [SOP] DGM-04 and/or AC-04 and/or SOP 505.10.01) b. System QC test results (SOP DGM-01 and/or AC-02 and/or SOP 506.10.01) c. Instrument Verification Strip (IVS) results (IVS Technical Memorandum) d. Surveyed validation seed and QC seed locations (QC and QA Production Area Seed Reports) e. Data collection point responses and locations (SOP DGM-04 and/or AC-04 and/or SOP 505.10.01) f. Data analysis results, including i. Anomaly locations (cued target list) ii. Unique anomaly identification numbers (cued target list) iii. Z-component amplitude and/or dipole response for each anomaly (cued target list) iv. Detection survey data validation report v. Detection survey data usability evaluation (4) Cued survey results, including: a. System QC results (project QC database) b. IVS results (project QC database) c. Background data (advanced classification [AC] data files) d. Surveyed validation seed and QC seed locations and types (QC and QA seed tracking logs) e. Unique anomaly identification numbers and locations (cued target list) f. Site-specific munitions library (geophysical data deliverable) g. Definition of items representing unacceptable explosive hazard h. Classification of anomalies with confidence metric (ranked dig list) i. Cued survey data validation report j. Cued survey data usability evaluation (5) Intrusive investigation results, including a. Excavation results (database) b. Photos (photo log) c. Disposal records d. Stop-dig threshold verification (Verification and Validation Report) e. Comparison of excavated “validation digs” to predictions (Verification and Validation Report) f. Final data usability evaluation g. Updated CSM

<table>
<tr><td>4. Define the boundaries of the study.</td><td><u>Target Population:</u> The target population for this study includes the following MEC confirmed or suspected to exist in the study area provided in Table 11A.1.

<u>Characteristics of interest</u>: The characteristics of interest are those characteristics (e.g., size, symmetry, aspect ratio, object density, and wall thickness) that will allow classifiers to determine whether an anomaly is a likely TOI or non-TOI.

<u>Spatial and temporal boundaries and scale</u>: This study is designed to detect and correctly classify all TOI exceeding the detection threshold and meeting measurement criteria within the established spatial boundaries. Based on the performance work statement (PWS) performance standard of finding all MEC 37mm diameter or greater down to a depth of 8 times the item's diameter, the detection threshold for the project will be evaluated for a horizontal 37mm projectile at 12 inches bgs since that is the most difficult of all munitions items expected at the site to detect. While 20mm projectiles are smaller, they are expected to be located at much shallower depths and produce higher responses than a 37mm projectile at 12 inches bgs. The detection threshold for the project will be specified in the Target Selection Technical Memorandum.

The horizontal boundaries of the project are defined by the clearance areas shown on Figure 10.3 (Appendix B). The vertical boundary for each munition is the munition-specific maximum depth of detection based on the detection threshold discussed above. Vertical boundaries for each munition are shown on Table 11A.1. There are no established temporal boundaries for this project.

The scale of the DGM surveys are 100 ft by 100 ft grids and smaller for trail areas with 100% DGM coverage at 0.6 m line spacing that would meet the objective of not missing an anomaly that could indicate a TOI (a horizontal 37mm projectile at 12 inches bgs).</td></tr>
<tr><td>5. Develop the analytic approach.</td><td>The project approach involves using the results from dynamic geophysical surveys and cued data acquisition to detect and classify geophysical anomalies as "TOI" (i.e., highly likely to be a munition) and "non-TOI" (i.e., highly unlikely to be a munition). Anomalies that cannot be classified as either likely TOI or likely non-TOI will be classified as "inconclusive." Anomalies on the list will be ranked in order of greatest likelihood to be a TOI to greatest likelihood to be a non-TOI, based on their confidence metrics. All anomalies classified as either "TOI" or "inconclusive" will be designated for intrusive investigation and subsequent removal if the item is found to be MEC.

Areas of the removal footprint inaccessible to dynamic geophysical surveys or high anomaly density areas will be addressed using analog instruments and intrusive investigation (i.e., "mag and dig"). "High anomaly density areas" are those areas where the elevated anomaly density makes cued data acquisition impractical or impossible based on a quantitative analysis of the detection data and cued analysis capabilities.

The project approach involves three primary components: Dynamic Surveys, Cued Data Acquisition, and Analog Removal. The decision rules for these components are listed below.

(1) Decision Rules for Dynamic Surveys:
• If a detected anomaly exceeds the selection threshold (details on WS #17A), then it will be identified for intrusive investigation (Carlos Rosario and Tamarindo Beaches) or evaluation using Cued Data Acquisition (Flamenco Beach and open areas of Flamenco Campground).

(2) Decision Rules for Cued Data Acquisition and Intrusive Investigation:
• If any of the following four criteria are met, the anomaly will be selected as a TOI:
1. The polarizability matches (within specifications established on Worksheet #22) that of an item in the project-specific TOI library,
2. Estimates of the size, shape, symmetry, and wall thickness calculated from the polarizability indicate the item is a long, cylindrical, and thick-walled, or
3. There is a group of anomalies having similar polarizabilities that, after investigation, are discovered to be TOI.</td></tr>
</table>

	4. Anomalies with poor inversion fit coherence that, after considering all available information, cannot be ruled as non-TOI will be considered "inconclusive" and added to the dig list. • If an anomaly is classified as a TOI (i.e., highly likely to be a munition) based on a high decision statistic indicating a good match to a TOI in the classification library (details on WS #17A**)**, then it will be labeled as a dig target on the ranked dig list and it will be intrusively investigated. • If an anomaly is classified as inconclusive based on low fit confidence or other criteria indicating unreliable inversion results (details on WS #17A**)**, then it will be labeled as a dig target on the ranked dig list and it will be intrusively investigated. • All intrusive results will be reviewed with regard to classification decisions by an AC data analyst. If intrusive results do not agree with the source(s) predicted by the AC data, the dig team will be sent back to confirm that no additional sources remain in the predicted location. • If an anomaly is classified as a non-TOI (i.e., highly unlikely to be a munition) based on low decision statistic indicating poor matches to all TOI in the classification library (details on WS #17A**)**, then it will be identified as a non-dig target on the ranked dig list and it will not be intrusively investigated. • If the intrusive investigation locates MEC, then the item(s) will be removed and disposed of by demolition (details on WS #17A). • If a dynamic detection data indicate a portion of the site has more sources than cued classification techniques can reliably estimate polarizabilities (details on WS #17A), then the anomaly density will be reduced using analog methods. (3) Decision Rules for Analog Removal: • If a subsurface anomaly is detected using the analog detection instrument, then it will be intrusively investigated (details on WS #17A). • If the intrusive investigation locates MEC, MD, or other debris, then the item(s) will be removed and disposed of as detailed on WS #17A.
6. Specify performance or acceptance criteria.	Measured performance criteria (MPCs) are the criteria that collected data must meet to satisfy the DQOs. Project-specific MPCs are presented in WS #12A. Geophysical and intrusive investigations shall achieve applicable MPCs as confirmed/modified by the IVS Report. Failure to achieve the MPCs may have an impact on end uses of the data, which will be discussed in the Data Usability Assessment (DUA) Report WS #37A.
7. Develop the plan for obtaining data.	Steps 1 through 6 of the DQO process were used to develop the overall project design. The design is broken down into a series of specific elements, termed DFW. WS #17A includes more detailed descriptions of each DFW. For dynamic detection surveys, cued classification, and intrusive investigation, the site will be broken into multiple survey units: Flamenco Beach (4.3 acres) and Flamenco Campground Open Area (9.06 acres) and Carlos Rosario Beach (1.61 acres) and Tamarindo Beach (0.67 acres) to be surveyed by DGM; Flamenco Campground Vegetated Area (8 acres), Carlos Rosario Trail (3.67 acres), Carlos Rosario Vegetated Area (3.39 acres), and Tamarindo Vegetated Area (1.13 acres) for analog survey and removal. The area that will require Analog Removal will be determined after the dynamic detection data has been evaluated. It will be divided into approximately 1-acre survey units at that time. A survey unit is a portion of the site for which survey data, including QC results and results for blind QC seeds and validation seeds, will be collected and reported as a unit, for evaluation by the project team.

Table 11A.1
Target Munitions (Confirmed and Suspected)

Munition (including nomenclature if known)	MEC Type (UXO, DMM, or both)	Expected Depth of Penetration (inches) [1]
20mm projectile HE	N/A	Near surface
37mm projectile HE	UXO	12
2.75-inch rocket warhead	UXO	22
BDU-33	UXO	31
5-inch projectile[2]	UXO	40
5-inch rocket warhead	UXO	40
Flare	UXO	Near surface

[1] Expected detection depths are stated as 8 times the item's diameter, as per the PWS. Both the 20mm projectiles and flares are expected to be found near the surface.
[2] Total of 7 found: 3 HE; 1 MK39; 1 MK41; 1 Illumination Candle; and 1 Naval gun fire.

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WORKSHEET #11B
MC DATA QUALITY OBJECTIVES

This worksheet describes the MC DQOs developed for the project, including the environmental problem, the related decisions that need to be made, the type and quantity of data, and level of data quality needed to ensure that those decisions are based on sound scientific data. The following DQO elements are based on the EPA's seven-step DQO process.

1. State the problem.	The potential presence of MEC within specific areas of the NWP, is a safety hazard. MC contamination may result from on-site detonation of MEC items during the TCRA. It is not known whether the condition presents an unacceptable risk that will require remedial response.
2. Identify the goal of the study.	The goal of the TCRA is to identify and dispose of MEC within specific areas of the NWP. If MEC/MPPEH is identified during the investigation that requires disposal, soil adjacent to the demolition location will be sampled to evaluate potential MC impact to soil.
3. Identify information inputs.	Informational inputs for MC are analytical results from post-demolition sampling and EPA Residential Screening Levels (RSLs). The analytical results will be the average concentration at each location for a 6.3 cubic foot volume sample (a 2 ft radius CRREL 7-pt wheel sample, with a depth 0 to 6 inches). RSLs are risk-based screening levels applicable to evaluate exposure to an average concentration over a volume of soil reasonably anticipated in a residential scenario (typically one quarter to one half acre in area).
4. Define the boundaries of the study.	The boundary of the MC sampling is the proposed clearance areas within portions of Carlos Rosario Beach, Flamenco Beach, Tamarindo Beach, the Flamenco Campground, and the Carlos Rosario Trail as shown in Figure 10.3 (Appendix B). The vertical boundary of MC sampling will be 0 to 6 inches. The scale of decision making (the smallest unit for which a decision will be made) is approximately 6.3 cubic feet.
5. Develop the analytic approach.	The analytic approach involves collecting a composite soil sample using the CRREL 7-point wheel method at post-detonation locations. The decision rules are as follows: (1) If no MEC is detonated, no MC sampling will be conducted. (2) An MC soil sample will be collected at post-detonation locations and analyzed for explosives (see WS #15 for list of explosives). Samples will be collected from a depth interval of 0 to 6 inches in areas where sufficient media is present. If only rocks or bedrock are present, no samples will be collected. (3) If an MC analyte is undetected or is detected at concentrations less than 100 times the screening levels, then it will be assumed that there is no immediate risk due to MC contamination, and there will be no further action taken as part of the TCRA. (4) If an MC analyte is detected at concentrations equal to or greater than 100 times the screening levels, the analyte will be referred to the USACE for coordination with the project Stakeholders to determine if follow-on action as part of the TCRA is required. The intent of the TCRA is to address the immediate threat of MEC related hazards, if follow on actions are recommended, the USACE will address them under the CERCLA process.
6. Specify performance or acceptance criteria.	Soil sample data for explosives (Method 8330B) will be required to be of definitive quality, and MC investigation data collected during the TCRA will be performed and accepted IAW the procedures specified in the DoD QSM.
7. Develop the plan for obtaining data.	WS #17B includes the detailed plan for obtaining MC sample data.

WORKSHEET #12A
METHOD MEASUREMENT PERFORMANCE FOR MEC-RELATED TASKS

Measurement Performance Activity (or DFW)	Data Quality Indicator	Specification	Activity Used to Assess Performance
QC Seeding (Analog)	Representativeness	UXOQCS or designee places small and large industry standard objects (ISOs) as blind seeds and coverage seeds in analog removal area(s) IAW Table 22A.1.	Review of Production Area QC Seeding Report
QC Seeding (DGM)	Representativeness	Blind QC seeds will be placed at the site by the contractor. Blind QC seeds must be detectable as defined by the DQOs (11A.4) and located throughout the horizontal and vertical survey boundaries defined in the DQOs (11A.4). Seed items will consist of small schedule 80 ISOs; medium schedule 40 ISOs; and inert 37mm projectiles and 2.75-in Rocket warheads, as available. Blind QC seeds will be distributed such that the field team can be expected to encounter between one and three per team per day.	Review of Production Area QC Seeding Report
Site Preparation	Completeness/Accuracy	Staking grid corners and removal area boundaries Performing surface clearance for MEC/MPPEH: Remove surface metal as necessary to reduce the interference with the geophysical survey. Performing vegetation removal.	Review of QC reports.
Analog Removal	Sensitivity	Ability to detect a horizontal 37mm projectile at a depth of 12 inches bgs	Function tests at an instrument test strip will be used to validate the proper operation of handheld detectors by personnel on a daily basis
Analog Removal	Completeness/Accuracy/ Comparability	100% of blind seeds must be recovered	Review of seed recovery results
Detection Survey (DGM)	Completeness	100% of the site is surveyed	Verification of conformance to measurement quality objectives (MQOs) for in-line spacing and cross-line spacing (see Worksheet #22A)
Detection survey (DGM)	Sensitivity	The EM61-MK2 detection threshold will be set to detect a horizontal 37mm projectile at a depth of 12 inches bgs or 5X the local average background noise, whichever is higher.	Initial and ongoing function tests and IVS surveys Validation/QC seed detection Analysis of background variability across the site

WORKSHEET #12A (CONTINUED)
METHOD MEASUREMENT PERFORMANCE FOR MEC-RELATED TASKS

Measurement Performance Activity (or DFW)	Data Quality Indicator	Specification	Activity Used to Assess Performance
Detection survey (DGM)	Accuracy/Completeness	100% of validation seeds must be detected	Review of validation seed detection results per 100 ft by 100 ft grid
Detection survey (DGM)	Completeness/ Comparability	Complete project-specific databases and target lists delivered.	Data verification/data validation
Reacquisition	Completeness/ Comparability	If the reacquired anomaly cannot be located within a 1-meter radius of the location provided on dig sheets, the locations will be rechecked by the QC Geophysicist and a CA may be determined.	The reacquisition team will use RTK GPS to flag the location of the reacquired anomaly within a 1-meter radius of the location provided on dig sheets.
Classification survey	Completeness/ Comparability	Library must include signatures for all munitions known or suspected to be present at the site, as listed in the CSM (Table 10.2)	Verification of site-specific library
Classification survey	Representativeness/ Accuracy	Background data will be collected at least once every two hours of cued survey data collection. Background locations will be selected such that background data will be representative of the various subsurface conditions expected to be encountered within each grid at the site	Data verification/data validation
Classification survey	Completeness	All detected anomalies classified as: 1. TOI 2. Non-TOI 3. Inconclusive	Data verification
Classification survey	Accuracy/ Comparability	Cued survey must correctly classify 100% of validation seeds	Review of validation seed classification results
Classification survey	Completeness/ Comparability	Background data, cued target data, munitions libraries, modeling results and any other supporting documentation used to make classification decisions are delivered	Data verification Data validation
Classification survey	Accuracy/Completeness	100% of predicted non-TOI that are intrusively investigated are confirmed to be non-TOI	Visual Inspection of recovered items
Intrusive Investigation (AC)	Accuracy	100% of recovered object sizes qualitatively match predicted size	Visual inspection of recovered items for items classified as TOI

WORKSHEET #12A (CONTINUED)
METHOD MEASUREMENT PERFORMANCE FOR MEC-RELATED TASKS

Measurement Performance Activity (or DFW)	Data Quality Indicator	Specification	Activity Used to Assess Performance
Classification analysis / Intrusive Investigation	Accuracy	Inversion results correctly predict one or more physical properties (e.g. size, symmetry, or wall thickness) of the recovered non-TOI items	Visual inspection and qualitative evaluation of recovered items from the validation digs (see Worksheet #22)
Intrusive Investigation	Completeness/ Comparability	Complete Microsoft Access intrusive results database delivered including records reconciling inversion results to the physical properties of the recovered items	Data verification Data validation
MEC/MPPEH Handling	Accuracy	Should MPPEH be encountered, only UXO-qualified personnel (UXO Technician II or higher) will perform identification of the item and ascertain its condition. The SUXOS and UXOSO must be in agreement on the nature and condition of a MEC item before any action is taken.	Joint SUXOS and UXOSO determination that a MEC item is acceptable to move. After determining an item is acceptable to move, the SUXOS and UXOSO will determine the most expeditious route for safe movement of the MEC item to the disposal point. UXOQCS verifies that MDAS is properly documented in a DoD Form 1348-1A.

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WORKSHEET #12B
METHOD MEASUREMENT PERFORMANCE CRITERIA TABLES

12.0 MEASUREMENT PERFORMANCE CRITERIA

12.0.1 The overall QC objective for this project is to develop and implement procedures for sample collection, laboratory analysis, field measurement, and data reporting that will provide data of a degree of quality consistent with its intended use as described in the DQO process (Worksheet #11A). Worksheet #12 and the associated tables present the performance criteria for the analytical measurements performed in support of this project.

12.1 DATA QUALITY INDICATORS

12.1.1 Measurement performance criteria usually are expressed in terms of the data quality indicators (DQIs) precision, accuracy, representativeness, completeness, comparability, and sensitivity, which are known collectively as PARCCS. Of the PARCCS, parameters, precision, accuracy, completeness, and sensitivity can be quantitatively measured and assessed. The parameters of comparability and representativeness are primarily qualitative in nature.

12.1.1 Quantitative Data Quality Indicators

12.1.1.1 Quantitative DQIs can be measured and assessed by performing QC checks and evaluating the results against numerical acceptance criteria. Where available, the method- and matrix-specific measurement performance criteria presented in the QSM will be used by the off-site laboratories to control quantitative DQIs. Where the QSM does not list QC criteria, the control limits for routine analyses generated by the project laboratory will be used. These QC limits will be sufficient to ensure that the analytical methods are performed under acceptable conditions and that results can be used as reported for the intended purposes, as described in Worksheet #37.

12.1.2 Qualitative Data Quality Indicators

12.1.2.1 The DQIs of representativeness and comparability have only a limited ability to be evaluated using QC analysis results. These DQIs are primarily controlled by project planning and execution. Performance requirements for these DQIs will be addressed based on the existing site data and conditions.

12.1.2.1 Representativeness

12.1.2.1.1 Representativeness is the degree to which data accurately and precisely expresses a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Although representativeness is a qualitative measurement, it is evaluated through a multi-step process beginning with evaluation of precision and accuracy data. Project design (see Worksheets #14 and #16) is one of the critical inputs that determine if the data collected is representative of the population sampled.

12.1.2.1.2 Representativeness of individual samples will be controlled by sample collection and handling IAW the requirements of Worksheets #14 and #16 and the HGL SOPs (identified in

Worksheet #21 and provided in Appendix I of the Work Plan). The sample containers and preservation methods presented in Worksheets #19 and #30 will be used to ensure that samples arriving at the laboratory retain the appropriate degree of representativeness. The holding times presented in Worksheets #19 and #30 have been established to ensure that samples retain representativeness at the time of extraction and analysis.

12.1.2.1.3 Representativeness will also be assessed using field and laboratory blank samples. A method blank (MB) will be analyzed with every analytical or preparation batch (as appropriate to the analytical method) to determine potential contamination introduced during routine laboratory procedures. Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) will be analyzed as required by analytical methods. Field blanks such as trip blanks (TBs) and equipment blanks (EBs) are used to assess potential contamination due to field and transport conditions. The assessment of blank samples will determine if compounds detected in the environmental samples are site-related or have been introduced through shipping, storage, field procedures, or laboratory procedures.

12.1.2.2 Comparability

12.1.2.2.1 Comparability expresses the confidence with which one data set can be compared to another. Comparability also involves a multi-step evaluation and can be related to accuracy and precision as these quantities are measures of data reliability. Data is comparable if site considerations, collection techniques, and measurement procedures, methods, and sensitivity limits are equivalent for the samples within a sample set.

12.2 DATA QUALITY CATEGORIES

There are two general categories of data that will be generated for use in project decision making: (1) screening data and (2) definitive data. The data validation requirements for each matrix and analytical parameter and matrix are specific to each project data source and end use. These requirements are summarized in Worksheet #11 of each site-specific QAPP. The full process is described in the format presented in Worksheet #36. The screening and definitive data validation protocols for this project are presented in Appendix Q. The data usability evaluation procedures are presented in Worksheet #37.

12.2.1 Screening Data

Screening data is generated by rapid methods of analysis with less rigorous sample preparation, calibration, or QC requirements than are necessary to produce definitive data. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent instead of elaborate extraction/digestion and cleanup. Screening data may provide analyte identification and quantitation, although the quantitation may be relatively imprecise. Screening data may be considered of unknown quality without corresponding definitive confirmation data. Several screening methods identified for use in this project have no corresponding definitive method and results from these methods will not require confirmation.

Some methods that routinely produce definitive data can also produce screening level data if the data validation process is not performed or is reduced. This does not necessarily indicate a lower level of data quality; it is an indication of the usability of the affected results. This reduced level of data validation will depend on the end use of the data and this determination will be made on a site-specific basis. The analytical methods that will only be required to produce screening level data and the associated sample matrices are indicated in Worksheets #11, Worksheet #23, and Worksheet #36. The data QC elements that correspond to a screening level of data review are identified in the method-specific Worksheet #12 tables. Data that are of screening level quality will receive no validation or validation that includes only these screening level elements up through those that correspond to Stage 2A data review as defined by *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA, 2009).

12.2.2 Definitive Data

Definitive data is generated using rigorous analytical methods, such as approved EPA reference methods. The data can be generated in a mobile or fixed-base laboratory. Definitive data is analyte-specific, and both identification and quantitation are confirmed for each analyte. Definitive analytical methods have standardized QC and documentation requirements and produce data for which analytical error (bias) can be determined. For data to be classified as definitive, the data must be validated after the results are reported in order to verify that the appropriate QC measures were taken and were in control. Also, the sample must be collected in a manner that is representative of current site conditions, as described in the field SOPs (Worksheet #21 and Appendix I). Definitive data is not restricted in its use unless quality problems identified in the validation process require data qualification. The analytical methods that will be required to produce definitive level data are indicated in Worksheet #11, Worksheet #23, and Worksheet #36. The data QC elements that are required to complete a definitive level of data review are identified in the method-specific Worksheet #12 tables. The minimum for definitive data is validation that includes both the screening level elements (up through Stage 2A) and definitive level elements included in Stage 2B. For this project, definitive data validation will also include Stage 3 and Stage 4 review elements and the final data validation level will correspond to a Stage 4 data review as defined by *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA, 2009). Stage 4 data validation corresponds with the former EPA designation of Level IV.

12.3 MEASUREMENT PERFORMANCE CRITERIA TABLES

12.3.1 The data quality elements presented in the Worksheet #12 tables are divided into two broad categories: screening level elements and definitive level elements. Each data quality element is associated with one or more of the DQIs discussed in Section 12.1. In addition to the PARCCS parameters, some methods also include analyte identification as a DQI. Analyte identification is an essential performance component of those methods and is included even though is not a PARCCS parameter.

12.3.2 The analytical acceptance criteria presented in the Worksheet #12 tables are linked to the data validation protocols presented in Attachment A. Each project laboratory is required to ensure compliance with method and SOP requirements regardless of the level of data validation that will be performed on the resulting data. If a QC element does not meet control criteria, the appropriate qualifier, as defined in Attachment A, will be applied to all associated results. The overall impact of QC discrepancies, including data gaps resulting from rejected data points, will be assessed IAW Worksheet #37.

12.3.3 The analytical methods presented in the Worksheet #12 tables are from the EPA's SW-846 methods compendium (EPA, 2015). The DQIs presented in these tables are from the analytical methods as modified by the requirements presented in QSM version 5.0.

12.3.1 Blank Evaluation

12.3.1.1 It should be noted that the Worksheet #12 tables present acceptance criteria for reporting data associated with low levels of blank contamination. It is acceptable for the laboratory to report analytical data with low levels of blank contamination meeting the Worksheet #12 acceptance criteria. However, during the data validation process, *all* detected values in blanks will be used to evaluate the associated sample data, *regardless of whether the reported blank results meet the acceptance criteria presented in Worksheet #12*. This is the one of the few cases where QC data that meets *reporting* acceptance requirements may still result in qualification of the associated data.

12.3.2 SOP Reference Structure

12.3.2.1 To simplify internal referencing, HGL uses a numbering system to designate sampling, extraction, and analytical method SOPs. Field sampling SOPs are designated using the HGL SOP reference numbers; the corresponding SOPs are identified in Worksheet #21 and are presented in Appendix I of the Work Plan. Laboratory SOPs are designated "L-[number]" for analytical methods and "P-[number]" for sample preparation methods. The laboratory SOPs that correspond to these SOP references are identified in Worksheet #23. All laboratory SOPs identified in Worksheet #23 are included in Attachment J to this QAPP.

WORKSHEET #12B.1
MEASUREMENT PERFORMANCE CRITERIA TABLE – EXPLOSIVES BY SW-846 METHOD 8330B

Analytical Group	HPLC
Analytical Method/SOP[1]	L-1
Matrix	Soil
Sampling Procedure[2]	ENV-01.03

DQI	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	Frequency of QC Check	QC Sample Assesses Errors for Sampling (S), Analytical (A), or Both (S&A)
Screening Level Data Quality Elements (EPA Stage 2A)				
Accuracy/Bias	Analyte-specific (see Worksheet #15.1)	Laboratory control sample (LCS) recoveries	1 per preparation batch (maximum of 20 samples)	A
		Matrix spike/matrix spike duplicate (MS/MSD) recoveries	1 per 20 field samples (selected by field team)	S&A
	Method-specific (see Worksheet #15.1)	Surrogate spikes	Every sample, blank, and standard	A
Precision	Relative percent difference (RPD) ≤20%	MS/MSD RPD	1 per 20 field samples (selected by field team)	S&A
		LCS/laboratory control sample duplicate (LCSD[3]) RPD	1 per preparation batch (maximum of 20 samples)	A
	RPD ≤50%	Field duplicate analyses[4]	1 per 10 field samples (selected by field team)	S&A
Accuracy/Bias and Representativeness	No analytes detected >½ limit of quantitation (LOQ) or >1/10 the amount measured in any sample or 1/10 the PAL (whichever is greater)	MB	1 per preparation batch (maximum of 20 samples)	A
Sensitivity	DL for each analyte < limit of detection (LOD)	DL study	Preliminary determination, confirmed quarterly	A
	LOQ for each analyte below associated regulatory limits, preferably by a factor of ≥3	LOQ study	Preliminary determination, confirmed quarterly	A

WORKSHEET #12B.1 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE – EXPLOSIVES BY SW-846 METHOD 8330B

Analytical Group	HPLC
Analytical Method/SOP[1]	L-1
Matrix	Soil
Sampling Procedure[2]	ENV-01.03

DQI	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	Frequency of QC Check	QC Sample Assesses Errors for Sampling (S), Analytical (A), or Both (S&A)
Sensitivity (continued)	LOD ≤ LOQ for each analyte	LOD study and LOQ study	Preliminary determination, confirmed quarterly	A
Completeness	≥95%	Data completeness check	After sampling and analysis complete	S&A
Definitive Level Data Quality Elements (EPA Stages 2B, 3, and 4)				
Accuracy/Precision	For each analyte, %RSD ≤15% for mean RF or r^2 ≥0.99 for curve	Five-point calibration for all analytes (minimum of six points required if using r^2 to evaluate)	Prior to sample analysis and recalibration as required	A
Accuracy/Precision	%D ≤20% for each analyte	Second source calibration verification	1 per initial calibration	A
Accuracy/Precision	%D ≤20% for each analyte	Continuing Calibration Verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence	A
Sensitivity	LOQ for each analyte	At or above low concentration of calibration curve	Each initial calibration	A
Analyte Identification	Position shall be set using the midpoint standard of the calibration curve; on days when initial calibration is not performed, the initial CCV is used	Retention time window position establishment for each analyte and surrogate	Once per initial calibration and at the beginning of the analytical shift	A
	Results between primary and second column RPD ≤40%	Confirmation column	All positive results must be confirmed	A

1 Reference number from QAPP Worksheet #23.
2 Reference number from QAPP Worksheet #21.
3 LCSDs are not a method requirement; however, if this information is provided, it will be evaluated.
4 For low-level results (detected value ≤5x LOQ) or when one result is a nondetection, the control limit is absolute difference ≤LOQ. Nondetected values will be assigned the nominal value of the LOD for making this comparison.

WORKSHEET #13
SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

Secondary Data	Data Source	Data	How Data Will Be Used	Limitations on Data Use
2012 MEC/MD and soil data	2012 Congressional Study Report	Data will be used to update the CSM.	Geophysical and intrusive investigation data was collected over 6.5 acres. Extensive surface/subsurface soil, sediment and surface water sampling was conducted. Copper and lead were identified as chemicals of potential concern (COPC) in the surface water. Copper was identified as a COPC in the sediment. The study concluded that human and ecological receptors may come into contact with COPCs in the soil via dermal contact or incidental ingestion, but human receptors are not anticipated to be performing intrusive activities at the site, so the subsurface soil exposure pathways were indicated as incomplete. The study also concluded that ecological receptors are not expected to be in contact with the subsurface soil, so the subsurface soil exposure pathways are incomplete for ecological receptors.	None

WORKSHEET #13 (CONTINUED)
SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

Secondary Data	Data Source	Data	How Data Will Be Used	Limitations on Data Use
2007 MEC/MD and soil data, Physical profile (geology, soil, surface water, hydrogeology)	*Site Inspection Report, Northwest Peninsula of Culebra Island, Puerto Rico* (Parsons, 2007)	Data will be used to update the CSM.	Soil samples were collected using incremental sampling methods, whereas TCRA MC samples will be collected from discrete locations. TCRA samples will be limited to explosives analysis to demonstrate that no additional MC is deposited from disposal operations. The SI demonstrated that the MC exposure pathway is incomplete. Analytical data are assumed to meet appropriate quality standards as stated in the RI. Locations of MEC/MD were used to demonstrate that a TCRA was required.	MEC/MD data was limited to surface observations only.
2005 Archive Search Report Supplement	Archives Search Report Supplement, Findings, Ordnance and Explosive Waste, Culebra Island Archives Search Report Supplement, Findings, Ordnance and Explosive Waste, Culebra Island National Wildlife Refuge, Culebra, Puerto Rico (USACE, Rock Island District, 2005b).	Data will be used for identification of the types of MC/MEC potentially present on the NWP.	Historical use of munitions	None

WORKSHEETS #14 AND #16
PROJECT TASKS AND SCHEDULE

The activities to be conducted on the NWP to achieve the project DQOs (Worksheet #11) comprise five primary components: surface clearance, QC seeding, detection survey, classification survey, and intrusive investigation. While these five primary components are the focus of the project, the field operations involve multiple elements, or "definable features of work," that will be required to achieve the project goals. This subchapter provides a summary of these definable features of work and the associated component tasks. A detailed discussion of each of the primary project components and the related definable features of work is included on Worksheet #17, and the specific field procedures to be used for the activities described in this summary are included in the various SOPs appended to this UFP-QAPP (Appendix I). The project schedule is provided in Appendix K.

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Table 14.1
Definable Features of Work and Associated Tasks

Definable Feature of Work (Activity)	Associated Tasks	Planned Duration	Related SOPs (*see Worksheet #21*)	Deliverable(s)	Deliverable Due Date
DFW 1: Mobilization	Complete readiness review. Mobilization of equipment and personnel to the site.	3 days	All SOPs	Not applicable.	Not applicable.
DFW 2: Environmental Survey and Beach Monitoring	Qualified and independent Project Biologist will conduct an initial environmental survey prior to fieldwork and beach surveys 75 days before clearance activities begin, including vegetation removal and removal of UXO, and until ordnance or vegetation removal actions are completed.	75 days Prior to intrusive 90 Days Intrusive		Daily Biologist Survey Reports.	7 days after completion All in Final Report
DFW 3: Site Preparation (Grid Installation and Surface Clearance)	Staking grid corners and removal area boundaries Performing surface clearance for MEC/MPPEH: Remove surface metal as necessary to reduce the interference with the geophysical survey Vegetation removal	14 days	Procedures described in Worksheet 17A 505.01.1 510.01.1	Grid coordinates and maps Surface Clearance Memorandum QC Results (Daily QC Report) Team Leader Grid Sheet - (MEC/MPPEH Only) (or electronic equivalent), Team Leader Grid Sheet - (MD, range-related debris [RRD], and Other Debris) (or electronic equivalent), Project QC database	1 day after completion of installation for all elements 1 day after collection 7 days after completion 7 days after completion 7 days after completion
DFW 4: Conduct Validation Seeding, QC Seeding, and Construct IVS	Bury validation seed items according to the Verification and Validation Plan Bury QC seed items IAW the QC Seed Plan with QC seed information controlled as described in the QC Firewall Plan	8 days	DGM-02 AC-02	QC Seed Plan, QC Seed Firewall Plan, Draft Verification and Validation Plan Production Area QC Seed Report	Upon completion 7 days after completion

Table 14.1 (Continued)
Definable Features of Work and Associated Tasks

Definable Feature of Work (Activity)	Associated Tasks	Planned Duration	Related SOPs (*see Worksheet #21*)	Deliverable(s)	Deliverable Due Date
DFW 5: Assemble and Verify Correct Operation of Geophysical Sensor to Be Used for the Detection Survey (IVS Data Collection)	Assemble and perform initial checks on EM61-MK2 man portable unit Conduct survey of the IVS for the EM61-MK2 Prepare IVS Technical Memorandum	10 days	DGM-01	Raw and processed data IVS Technical Memorandum	1 day after collection 7 days after completion
DFW 6: Conduct Detection Survey	Conduct DGM survey over select areas to identify the locations of metallic objects for the follow-on cued surveys using AC Collect data in parallel lines, spaced at 0.6 meters RTK global positioning system (GPS) used for data location Correct data points for yaw, pitch, and roll based on orientation sensor data collected with dynamic data	8 days	DGM-03 506.01.1 510.01.1	Raw data files, field notes Access database with dig results	Friday following collection Daily updates; final 7 days after completion
DFW 7: Conduct Detection Survey Processing and Target Selection	Process DGM data for grids and generate cued target and proposed background location lists Evaluate target selection criteria and describe final selection method in Target Selection Technical Memorandum Validate DGM data and select targets for cued survey areas (Flamenco Beach and Campground) and the direct intrusive investigation areas (Carlos Rosario and Tamarindo Beaches) Document QC evaluations, root cause analyses, and corrective actions	10 days	DGM-04	Weekly QC Report Processed data files and maps, processing notes, target list Project QC Database Target Selection Technical Memorandum	Weekly Friday following collection Friday following collection/upon request 5 days after start of detection data collection

Table 14.1 (Continued)
Definable Features of Work and Associated Tasks

Definable Feature of Work (Activity)	Associated Tasks	Planned Duration	Related SOPs (*see Worksheet #21*)	Deliverable(s)	Deliverable Due Date
DFW 8: Validate Dynamic Survey and Cued Target List	Determine detection data usability with regard to MPCs. A DUA completed for the dynamic data, following project team's acceptance of the final cued target list	7 days	No SOP procedures are described in Worksheet 17A	Dynamic DUA	7 days after acceptance of cued target list
DFW 9: Assemble Advanced Geophysical sensor and Test Sensor at IVS	Assemble and perform initial checks on advanced EMI sensor Conduct initial cued IVS testing for the advanced EMI sensor Incorporate results in IVS Technical Memorandum (see DFW 5)	5 days	AC-01 AC-02	Raw and processed data IVS Technical Memorandum	1 day after collection 7 days after completion
DFW 10: Collect Cued Data	Collect Cued data at DGM survey anomaly locations at Flamenco Beach and in the open areas of Flamenco Campground and background data Validate cued data	25 days	AC-05 AC-06	Raw data files, field notes Project QC Database	Friday following collection Friday following collection/upon request
DFW 11: Conduct Cued Data Processing	Process cued data Conduct QC evaluation of cued data Document QC evaluations, root cause analyses, and corrective actions	30 days	AC-07	Weekly QC Reports Processed data, processing notes, supporting classification images Project QC Database	Per report Friday following collection Friday following collection/upon request
DFW 12: Classify Anomalies and Make Dig/No-Dig Decisions	Rank and classify target list using the best library fit as the decision metric Make dig/no dig decisions for all cued targets	5 days	AC-07	Access database with training dig results Ranked dig list	Daily updates; final 7 days after completion 14 days after completion of cued processing
DFW 13: Validate Cued Survey and Classification	Determine cued data usability with regard to MPCs Select 10% (not to exceed 200) targets classified as non-TOI that will be excavated with the targets classified as TOI.	5 days	AC-09	Cued DUA	7 days after acceptance of ranked dig list

Table 14.1 (Continued)
Definable Features of Work and Associated Tasks

Definable Feature of Work (Activity)	Associated Tasks	Planned Duration	Related SOPs (*see Worksheet #21*)	Deliverable(s)	Deliverable Due Date
DFW 14: Intrusive Investigation	Reacquire dig list anomalies Record reacquisition data and mark anomaly for investigation Excavate training digs for AC areas Intrusively investigate reacquired anomalies per intrusive guidelines Conduct QC evaluation of intrusive data; reinvestigate anomalies if necessary	22 days	501.01.1 502.01.1 504.01.1 505.01.1 506.01.1 DGM-05	Daily QC Report, Weekly QC Report, disposal reports Access database with reacquisition, and dig results	Per report Daily updates; final 7 days after completion
DFW 15: Verify Intrusive Results	Review dig results versus predicted results	7 days	AC-08 AC-09	Comparison results	7 days after completion of intrusive investigation
DFW 16: Conduct Final DUA	Determine data usability with regard to MPCs, performed after the completion of intrusive investigation Include analysis of the instrument and classification performance and recommendations for improving the process within report	7 days	No SOP, procedures are described in Worksheet 17A	Final DUA	7 days after acceptance of intrusive results
DFW 17: Analog Removal	Conduct analog removal in areas where terrain or extensive tree canopy prevents DGM methods from reliably detecting 37mm projectiles to a depth of 12 inches bgs. Remove vegetation as required IAW Section 17A.4.2. Identify subsurface anomalies for immediate investigation or mark for subsequent investigation Intrusively investigate and resolve detected and/or flagged anomalies Identify/classify MPPEH Remove MEC and MD found Document removal results and record grid status.	23 days	501.01.1 502.01.1 504.01.1 505.01.1	QC Results (Daily QC Report) Team Leader Grid Sheet - (MEC/MPPEH Only) (or electronic equivalent), Team Leader Grid Sheet - (MD, RRD, and Other Debris) (or electronic equivalent), Grid Drawing Sheet (or electronic equivalent), Access database with analog removal results, Project QC database	1 day after collection 7 days after completion 7 days after completion 7 days after completion 7 days after completion 7 days after completion

Table 14.1 (continued)
Definable Features of Work and Associated Tasks

Definable Feature of Work (Activity)	Associated Tasks	Planned Duration	Related SOPs (*see Worksheet #21*)	Deliverable(s)	Deliverable Due Date
DFW 18: MPPEH/MEC Handling, Certification, and Disposal	Conduct demolition operations IAW approved Explosives Safety Submission (ESS) Perform any necessary site restoration Inspect, certify, and verify MPPEH Package material documented as safe (MDAS) and store in secure location pending disposal Ship MDAS offsite to approved disposal facility and obtain necessary disposal documentation	121 days	501.01.1 502.01.1 504.01.1	DD Form 1348-1A Explosives Usage Records Magazine Data Cards Demolition Summary Sheets Demolition Shot Records MDAS Disposal Documentation	All in Final Report
DFW 19: Demobilization	MPPEH/Explosives Records Assessment MDAS documentation (DD Form 1348-1a)	1 day	501.01.1	MPPEH/Explosives Records	All in Final Report
DFW 20: MC Sampling	Collect samples for MC analysis at post-detonation locations Record GPS coordinates of sample locations	TBD	ENV-01.03	Daily QC Reports Field logbooks Chain-of-Custody forms Air Bills Sample Log-in, Instrument print-out and raw data Laboratory review checklists, PM Checklists, Data Validation Reports.	1 day after collection All in Final Report

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WORKSHEET #15
REFERENCE LIMITS AND EVALUATION TABLES

The following tables provide the comprehensive analyte lists for the analytical methods that will be addressed by this project. The associated limits for sensitivity and accuracy are also included in each table. IAW the project DQOs presented in Worksheet #11B, the project action levels (PALs) presented in Worksheet #15.1 are set at 100 times the residential soil Regional Screening Levels (RSLs) established by the EPA (May 2016). The RSLs used as a basis for the PALs correspond to a risk level of 1×10^{-6} for carcinogenic chemicals and to a hazard index of 0.1 for non-carcinogenic chemicals. All target chemicals have LODs that are lower than the corresponding PAL. In order to maintain consistency with QAPPs for other projects on Culabra, the ecological screening values (ESVs) developed by the Los Alamos National Laboratory (LANL) (EcoRisk Database v.3.3, 2015) are also presented in Worksheet #15.1; however, these ESVs will not be used to determine if additional cleanup is required within the context of this TCRA.

The accuracy control limits presented in the Worksheet #15 tables are based on those presented in the 2013 DoD QSM for Environmental Laboratories, version 5.0. Lancaster provided its statistical limits for explosives in soil for review. Although the Lancaster statistical limits were wider than the QSM limits for all target analytes, Lancaster takes no exceptions to using the DoD limits for soil as presented in QSM version 5.0. For organic methods, HGL has adopted a convention of using a default minimum lower control limit (LCL) of 10 percent to establish a minimum non-zero standard of performance. Organic data will also use the default minimum upper control limit (UCL) of 120 percent (aqueous) or 125 percent (solid). In those cases where the QSM lists an LCL or UCL below the default minimum, the default has been used. If the QSM marginal exceedance (ME) limit for an analyte is at or below the default LCL or UCL, no ME limit is allowed for that analyte at the affected end of the control limit range. Where the control limits are not specified in the QSM, the project laboratory's internally derived control limits or method-specified control limits are presented. This is indicated by underlining the non-QSM limits in the method-specific Worksheet #15 tables. Laboratory-derived control limits and the ME limits calculated from them are also subject to the default minimum LCL and UCL requirements.

Note that the following method-specific worksheets include ME limits; however, all the analytes listed in Worksheet #15.1 are designated as target analytes of concern. When discrepancies are observed in QC analyses associated with these analytes, the laboratory is required to perform an investigation and CA even if the discrepancy in other ways meets the frequency and magnitude criteria for an ME, unless the discrepancy introduces a potential high bias and all associated results are non-detections. The ME limits presented in Worksheet #15.1 are only to be used to support the data validation protocols described in Appendix Q and should be consulted by the data validator when evaluating the effect of nonconforming LCS data where CA is not performed or is not effective.

In all cases, the laboratory is required to report concentrations at or greater than the detection limit (DL) as detected results. Results reported as detections with quantitation below the corresponding LOQ will be reported by the laboratory with the qualification of J to indicate that the result is considered an estimate due to being quantified below the calibrated range.

Nondetected results and results below the corresponding DL will be reported by the laboratory as nondetected results quantitated as the LOD and qualified U. Laboratory-assigned qualifiers may be subsequently modified during the data validation process (see Worksheet #36 and Appendix Q).

The laboratory-specific sensitivity limits and control limits are presented in Worksheet #15.1 are subject to change over time based on periodic review at the laboratory. When sensitivity or control limits are updated, the laboratory will present the most up-to-date limits in the associated data reports. Where Worksheet #15.1 indicates control limits stipulated by the QSM, these limits are required and cannot be altered without prior review and consent from HGL and USACE.

WORKSHEET #15.1
REFERENCE LIMITS AND EVALUATION TABLE, EXPLOSIVES IN SOIL BY SW-846 METHOD 8330B

Analyte	CAS Number	Lancaster Sensitivity Limits (µg/kg)			PAL (µg/kg)	LANL ESV (µg/kg)(1)	Accuracy Control Limits (%)	Marginal Exceedance (%R)	
		DL	LOD	LOQ				Upper Limit	Lower Limit
1,3,5-Trinitrobenzene	99-35-4	40	80	120	22,000,000	10,000	80-125	74	No ME
1,3-Dinitrobenzene	99-65-0	40	80	120	63,000	73	73-125	65	127
2,4,6-Trinitrotoluene	118-96-7	40	80	120	360,000	7,600	71-125	63	128
2,4-Dinitrotoluene	121-14-2	40	80	120	170,000	290	75-125	68	128
2,6-Dinitrotoluene	606-20-2	40	80	120	36,000	4,100	79-125	73	No ME
2-Amino-4,6-dinitrotoluene	35572-78-2	40	80	120	1,500,000	14,000	71-125	62	132
2-Nitrotoluene	88-72-2	40	80	120	320,000	9,900	70-125	61	133
3-Nitrotoluene	99-08-1	40	80	120	63,000	12,000	67-129	57	139
4-Amino-2,6-dinitrotoluene	19406-51-0	40	80	120	1,500,000	12,000	64-127	53	138
4-Nitrotoluene	99-99-0	40	80	120	2,500,000	22,000	71-125	62	133
HMX	2691-41-0	100	200	300	39,000,000	16,000	74-125	66	132
Nitrobenzene	98-95-3	100	200	300	510,000	2,200	67-129	57	139
Nitroglycerin	55-63-0	800	2200	2400	63,000	13,000	73-125	64	132
PETN	78-11-5	800	2200	2400	1,300,000	100,000	72-128	63	137
RDX	121-82-4	40	80	120	610,000	2,300	67-129	57	139
Tetryl	479-45-8	100	200	300	1,600,000	1,500	68-135	57	146
Surrogate									
3,4-Dinitrotoluene	610-39-9	NA	NA	NA	NA	NA	<u>62-133</u>	NA	NA

Underlining indicates laboratory-specific control limits for compounds with no limits presented in the QSM.

(1) Los Alamos National Laboratory (LANL), EcoRisk Database v.3.3, 2015.

CAS – Chemical Abstracts Service
µg/kg – micrograms per kilogram
ME – marginal exceedance
NA – not applicable

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WORKSHEET #17A
SAMPLING DESIGN AND RATIONALE FOR MEC-RELATED TASKS

This worksheet describes the project design and the tasks that will be required to successfully complete field operations during this project and achieve the DQOs described on WS #11A. A surface and subsurface removal action will be performed within specific areas of the 31.83-acre TCRA boundary shown on **Figure 14.1** in Appendix B using the survey methods indicated in Table 17A.1. DGM and intrusive investigation of the pond within the Flamenco Campground is anticipated to be conducted during the dry season of 2017. Investigation of the pond will be addressed in a separate QAPP update. The following subsections specify HGL's technical approach, broken down into a series of DFWs, for completion of the MEC and MPPEH clearance. Figure 17.1 in this section provides a decision tree for preliminary tasks and anomaly detection (DFW 3 through DFW 8). Figure 17.2 in this section provides a geophysical classification decision tree for cued surveys (DFW 9 through DFW 13). Figure 17.3 in this section provides a geophysical classification decision tree for intrusive investigation (DFW 14 through DFW 16).

Table 17A.1
Survey Methods for NWP TCRA

Location	Estimated Acreage	Survey Method	Advanced Classification
Flamenco Beach	4.30	Digital Geophysical Mapping (DGM)	Yes
Flamenco Campground Open Areas	9.06	DGM	Yes
Flamenco Campground Vegetated	8.00	Analog	No
Carlos Rosario Trail	3.67	Analog	No
Carlos Rosario Beach	1.61	DGM	No
Carlos Rosario Vegetated Area	3.39	Analog	No
Tamarindo Beach	0.67	DGM	No
Tamarindo Vegetated Area	1.13	Analog	No

- Flamenco Beach (4.30 acres): From the mean low water line to the vegetation line.
- Flamenco Campground (17.06 acres): From the vegetation line to the campground fence line.
- Carlos Rosario Trail (3.67 acres): 20 feet (ft) from either side of the trail centerline, excluding areas that cannot be reached due to physical constraints such as steep slopes or existing fences.
- Carlos Rosario Beach (5.00 acres): From the mean low water line to the vegetation line and extended 50 ft into the vegetation line (tree line).
- Tamarindo Beach (1.8 acres): From the mean low water line to the vegetation line and extended 50 ft into the vegetation line (tree line).
- Anomalies will be detected within the paved parking lot and road leading into the campground. Excavations will be determined based on results of detection surveys.

17A.1. THREE-PHASE INSPECTION PROCESS

17A1.1 Preparatory Phase

17A.1.1.1 The preparatory phase will be completed before beginning each DFW. A meeting will be scheduled in advance of the work activity, if necessary, to ensure that there is sufficient time for any necessary corrective actions. The following will be completed during this phase:

- Review specifications, references, and plans;
- Check field equipment to ensure that it is appropriate for intended use and has been tested, submitted, and approved;
- Assign responsibilities and ensure that field staff have necessary knowledge, training, expertise, and information to perform jobs;
- Verify arrangements for support services;
- Inspect work area to verify that required preliminary work has been completed;
- Review appropriate activity hazard analyses (AHAs); and
- Ensure that applicable process and procedures have been approved by the contracts officer.

17A.1.1.2 QAPP and operating procedures will be reviewed by the UXOQCS during this phase to ensure that they describe the prequalifying requirements or conditions, equipment, materials, methodology, and QC provisions. Discrepancies between existing conditions and approved plans and procedures will be resolved or corrective actions will be taken for unsatisfactory and nonconforming conditions identified during a preparatory phase inspection. This will be verified by the UXOQCS or his designee before approval to begin work is granted.

17A.1.1.3 The UXOSO will review the APP (Appendix D) and the appropriate AHAs to ensure that applicable safety requirements have been achieved. Preparation phase inspection results will be documented using the Preparatory Phase Checklist and will be summarized in the DQCR. The personnel qualifications checklist will be used to ensure that personnel meet or exceed the training standards outlined by DoD, USACE, and OSHA, including applicable hazardous waste operator training. HGL forms and checklists associated with the completion of the preparatory phase activities are presented in Appendix F.

17A.1.2 Initial Phase

17A.1.2.1 This phase will be performed when the fieldwork has been initiated for a given DFW. The purpose of this phase will be to accomplish the following:

- Inspect the work in progress for compliance with QC requirements;
- Verify adequacy of QC controls to ensure full contract compliance;
- Establish an acceptable level of workmanship;
- Review field operations for compliance with appropriate SOPs;

- Verify that documentation related to field activities is complete;
- Verify that required PPE and other safety procedures are in compliance with the QC specifications contained in the APP and AHA; and
- Resolve differences of interpretation that may affect the quality of work.

17A.1.2.2 Additional preparatory and initial phases may be conducted on the same work being performed if (1) the quality of ongoing work is unacceptable, (2) there are changes in the on-site production supervision or work crew, (3) work is resumed after a substantial period of inactivity (2 weeks or more), or (4) other problems develop.

17A.1.2.3 The UXOQCS will be responsible for ensuring that all discrepancies between site practices and approved plan specifications are identified, documented, and resolved. Corrective actions for unsatisfactory conditions or practices will be verified by the UXOQCS or his designee before granting approval to proceed. Initial phase results will be documented on the Initial Phase Checklist and summarized in the DQCR. A copy of HGL Form 15.11, Initial Phase Checklist, is included in Appendix F.

17A.1.3 Follow-up Phase

17A.1.3.1 This phase will be conducted for each DFW until it has been completed. The purpose of this phase is to ensure compliance with contract requirements and will include the following:

- Verify that the work has been completed in compliance with contract requirements and applicable standards;
- Ensure that the quality of workmanship was maintained and achieved;
- Validate all fieldwork to ensure that no data gaps exist and schedule additional field activities to address any existing data gaps;
- Verify that analytical work was performed by the approved laboratory; and
- Verify that safety inspections were performed.

17A.1.3.2 The UXOQCS is responsible for on-site monitoring of the practices and operations taking place, and for verifying continued compliance with the specifications and requirements of the contract, approved project plans, and procedures. The UXOQCS will oversee and observe activities as specified in the initial inspection and will verify that corrective actions for unsatisfactory or nonconforming conditions have been taken before granting approval to continue work. Final follow-up phase checks will be conducted and all deficiencies corrected before starting additional features of work. Final follow-up checks will be documented and summarized in the DQCR.

17A.2 DFW 1: Mobilization

17A.2.1 The PM will conduct a readiness review with technical staff to ensure that the team has the proper tools, equipment, and safety gear to complete field tasks IAW the work plan. Following successful completion of the readiness review, tools, equipment, and safety gear will be sent to the site and personnel will travel to the site. Table 17A.2 summarizes the anticipated staffing for the project field team.

Table 17A.2
Project Field Team

HGL Team Composition	Parsons Team Composition	Subcontractors
SUXOS UXOSO/UXOQCS Geophysicist QC UXO Technician III UXO Technician II (3 Each) UXO Technician I (3 Each)	Geophysicist AC (2 Each) UXO Technician II (2 Each)	Biologist Surveyor Vegetation Removal (12 Each) Security

17A.3 DFW 2: Initial Environmental Survey and Beach Monitoring

17A.3.1 Prior to beginning intrusive activities, the SUXOS, UXOSO, and Project Biologist, along with representatives of DNER and USFWS and the USACE OE Safety Specialist, will conduct a joint environmental survey, and develop a layout plan of the operating area to document conditions of areas in and adjacent to the site of the work, storage areas, and access routes. The following items shall also be identified on the layout plan: wetlands, endangered and protected species or habitats, and cultural or historical resource areas.

17A.3.2 A fully qualified and independent Project Biologist will conduct beach monitoring surveys 75 days before clearance activities begin, including vegetation removal and removal of UXO, IAW the Environmental Protection Plan (Appendix E). If sea turtle nests are found on beaches being cleared of MEC, the biologist, the SUXOS, and/or monitoring personnel will communicate daily with the USFWS Boqueron Endangered Species Specialist and the Culebra Islands NWR Manager as to whether new nests have been located, and if so, their locations within the work area. If agreed upon by USFWS, nest locations will be clearly marked to ensure clearance personnel avoid nests and no clearance activities will take place in the area until the hatchlings emerge and vacate the nest. Otherwise, nests will be relocated to a safe beach within 6-12 hours following nesting. The Project Biologist will train beach clearance crews before beginning vegetation removal, digital geophysical mapping (DGM), and MEC clearance activities regarding the importance of endangered species, in particular the status of sea turtles at this location, the potential penalties associated with violations of the ESA, measures for crawl and nest identification, and sea turtle biology. The Biologist or SUXOS will include photographic documentation of natural resource conditions and vegetation conditions prior to (and after) any necessary removal of vegetation.

17A.3.3 *Documentation*: The project Biologist will document activities and inspections in Daily Biologist Survey Reports.

17A.4 DFW 3: Conduct Site Preparation (HGL)

17A.4.1 Site preparation will consist of staking the grid corners, removing area boundaries, and performing a surface clearance. Vegetation will be removed to improve visibility for detection of surface MPPEH and to reduce interference with the DGM and analog teams and their instruments. HGL personnel will mark the grid corners and site boundaries with wooden stakes or other visible markers using an RTK GPS with sub-meter accuracy and/or traditional total station surveying when a GPS signal cannot be obtained. The Project Biologist will conduct environmental surveys until ordnance or vegetation removal actions are completed.

17A.4.2 No trees, shrubs, or turf will be removed, cut, or disturbed unless specifically necessary for investigation purposes. Vegetation removal will be conducted in compliance with the *Final Supplemental SOPs for Endangered Species Conservation and their Critical Habitat, Addendum 1 – February 2015, CESAJ* (see Appendix I) and only to the extent required to support the clearance objectives of each grid. The SUXOS, or authorized designee, will identify the areas requiring vegetation clearance. Vegetation will be cleared to a degree that permits reliable MEC detection without disturbing or destroying plant root structures. The preferred distance from ground level is approximately 6 inches for both manual and mechanical vegetation clearance. MEC avoidance will be practiced during all vegetation clearance operations. A team comprising a Biologist to assist with threatened and endangered species avoidance, brush clearance personnel, and a UXO escort to assist with avoidance will conduct operations under supervision of the SUXOS, or designee. Any surface MPPEH located will be marked and dealt with IAW the procedures described in SOP 502.01.1 and 504.01.1 (Appendix I) and the section below titled "MPPEH/MEC Handling, Certification, and Disposal." Large pieces of surface metal unrelated to MPPEH will be removed during vegetation removal or identified and located for later removal prior to geophysical data collection.

17A.4.3 The surface clearance will be accomplished within the TCRA boundary (See Figure 14.1 and Table 17A.1) in areas designated for DGM survey and according to the procedures described in SOP 505.01.1 (Appendix I). The surface clearance team will remove all visible metallic items as necessary to reduce the interference with the DGM survey. All MD and/or MEC recovered during the surface sweeps will be dealt with IAW the procedures described in SOP 502.01.1 and 504.01.1 (Appendix I) and the section below titled "MPPEH/MEC Handling, Certification, and Disposal."

17A.4.4 All surface clearance operations will be performed under the direct supervision of the UXO Technician III team leader. Before any surface removal operations are performed, the members of the MEC removal team will check their analog instrument function using the MPCs listed on WS #12A. MEC teams will use basic sweep techniques by forming a sweep line and marking lanes with pin flags or lines to establish 5-foot lanes within each grid, and sweeping the area using analog instrumentation. The SUXOS will determine which technique will be used to mark the sweep boundaries based on site conditions. Individual sweep lanes will be established at a maximum of 5-foot intervals. Team members will locate surface MPPEH and remove visible metallic items as necessary to reduce the interference with the geophysical survey. The Team Leader will record the locations and photograph any discovered and document information on the items found in the Project database or on the Team Leader Grid Sheet (Appendix F) if electronic records are not accessible. Coordinates will be recorded using a handheld GPS.

17A.4.5 Any MEC or MPPEH encountered on the surface within the designated surface removal footprint will be handled and disposed of as described in the section below titled "MPPEH/MEC Handling, Certification, and Disposal."

17A.4.6 The Team Leader will record the following surface clearance information for each grid surveyed:

- General Grid Information
  - Grid ID
  - Team number
  - Date(s) of removal
  - Sketch of grid conditions
  - Comment
- MEC Information
  - Grid ID
  - Location ID
  - Date found
  - Item type
  - MEC type (UXO, DMM, MC)
  - Photo ID
  - Nomenclature
  - Description
  - Quantity
  - Depth
  - Final disposition
  - Number of MEC/MPPEH logged on MEC/MPPEH grid sheet

- MD, Range Related Debris, and Other Debris Information
  - Grid ID
  - Team number
  - Team leader
  - Date
  - MD/munitions types found (frag, munitions component, debris description)
  - Seed items found
  - Total weight of MD in grid
  - Total weight of other debris in grid

17A.4.7 This information will be logged in the electronic database or on the Team Leader Grid Sheet (MEC/MPPEH only), Team Leader Grid Sheet (MD, RRD, and other debris), and Grid Drawing Sheet (Appendix F) if electronic records are not available. Following completion of the grid, the team leader will log the progress on the Grid Status Sheet (Appendix F), or electronic equivalent. Documentation for each grid designated to be surface cleared by the UXO Team Leader will be subjected to verification by the UXOQCS or designee using the MPCs described on WS #12A.

17A.4.8 *Documentation*: Surface Clearance Memorandum, Daily QC Reports, Team Leader Grid Sheet (MEC/MPPEH only) (or electronic equivalent), Team Leader Grid Sheet (MD, RRD, and other debris) (or electronic equivalent), Grid Drawing Sheet (or electronic equivalent), Grid Status Sheet (or electronic equivalent) Project QC database.

17A.5 DFW 4: Conduct Validation Seeding, Quality Control Seeding, and Construct IVS (HGL and USACE)

17A.5.1 Government personnel will bury validation seeds according to the Validation Seed Plan to be developed by the Government. HGL personnel will develop the QC Seed Plan, and bury QC seeds as described in SOP DGM-02.01 (Appendix I). All QC seeds will be located using an RTK GPS when possible (tree cover), and members of the seed team will have no further role in the collection, processing, or analysis of the geophysical data. QC seed information will be controlled as described in the QC Seed Firewall Plan. Generally, QC seeds will be 2-inch-long, 5/8-inch-diameter bolts; small and medium schedule 80 ISOs; and inert 20mm, 37mm and 57mm projectiles, as available.

17A.5.2 A single IVS will be constructed for this TCRA IAW SOPs AC-02 and DGM-01.01 (Appendix I). It will be designed for use by the advanced EMI sensor in static mode and by the EM61-MK2 sensor in dynamic mode. Three ISOs will be buried in the IVS ideally including a small and medium ISO, and 37mm projectile. Cued data will only be collected over the center line of the IVS, which will include a cleared blank space to be used for background corrections in addition to the three seed items. Seeds will be buried at approximately five times their inner diameters (i.e., 15 centimeters [cm] for the small ISO and 25 cm for the medium ISO) in horizontal orientations. Items in the IVS will be separated by at least 5 meters.

17A.5.3 *Documentation*: Validation Seed Plan (USACE); QC Seed Plan (HGL); QC Seed Firewall Plan; seeding results (spreadsheet, maps(s), and photographs); IVS Technical Memorandum (combined for detection and cued surveys); Draft Verification and Validation Plan (for cued surveys); and Production Area Seeding Report.

17A.6 DFW 5: Verify Correct Operation of Geophysical Sensor to Be Used for the Detection Survey (Parsons)

17A.6.1 The IVS will be surveyed with the EM61-MK2 as described in **SOP DGM-01.01** (Appendix I). After completing the initial static and dynamic IVS testing, an IVS Technical Memorandum will be prepared detailing the IVS setup, surveys, and results including documentation of compliance with the dynamic IVS MQOs provided in WS #22A. The IVS Technical Memorandum will be provided to the project team for review and concurrence. It is expected that the cued IVS survey for the advanced EMI sensor (DFW 9) will be performed at the same time as the EM61-MK2 IVS survey, and the discussion/results for both surveys will be combined into one IVS Technical Memorandum.

17A.6.2 *Documentation*: IVS Technical Memorandum (combined for detection and cued surveys)

17A.7 DFW 6: Conduct Detection Surveys (Parsons)

17A.7.1 DGM data will be collected at Flamenco Beach (4.30 acres), open areas of Flamenco Campground (9.06 acres), Carlos Rosario Beach (1.61 acres), and Tamarindo Beach (0.67 acres) as specified in Table 17A.1 and identified on Figure 14.1 in Appendix B to identify the locations of metallic objects in the subsurface for follow-on intrusive investigation (Carlos Rosario and

Tamarindo Beaches) and cued survey (Flamenco Beach and Flamenco Campground). The detection surveys will be performed using the EM61-MK2 as described in SOP DGM-03.01 (Appendix I). Survey lines will be collected using a 0.6-meter line spacing, with survey coverage required to meet the MQO in WS #22A. Based on an effective 1-meter sensor footprint, the line spacing should be more than sufficient to meet this objective and to detect all potential TOI, including 37mm projectiles, even if the operator deviates slightly from the intended line path. DGM data will be collected in conjunction with RTK GPS data.

17A.7.2 Vegetated areas of the Flamenco Campground (8.0 acres), Carlos Rosario Beach (3.39 acres), and Tamarindo Beach (1.13 acres), and the steep terrain of Carlos Rosario Trail (3.67 acres) will prevent the use of the EM61-MK2 for DGM data collection. Therefore, these areas will be cleared with analog metal detectors as described in SOP 505.01.1 (Appendix I). The exact extent of analog removal will be based on the areas where the EM61-MK2 cannot gain access or is not effective because of the overhead tree canopy. DFW 15 describes the analog subsurface removal process. Any MPPEH recovered during this clearance will be dealt with according to the procedures outline in SOPs 502.01.01 and 504.01.1 (Appendix I) and the section below titled "MPPEH/MEC Handling, Certification, and Disposal."

17A.7.3 *Documentation*: Raw data (.TEM and .CSV format), Daily QC Reports, Project QC Database, Database containing mag and dig results.

17A.8 DFW 7: Conduct Data Processing and Document Locations of Anomalies – (HGL, Parsons, and USACE)

17A.8.1 Dynamic EM61-MK2 data will be processed as described in **SOP DGM-04** (Appendix I). The data processor will assess the data to identify any areas where the anomaly density is too high to select individual anomalies for intrusive investigation and cued surveys. Areas with excessive anomaly density will be considered for analog removal methods as described in SOP 505.01.1 (Appendix I).

17A.8.2 Anomalies will be identified using a threshold based on the expected EM61-MK2 response of a 37mm projectile at a depth of 12 inches bgs. The amplitude threshold will be set below the lowest peak response value (by two standard deviations of the noise) to account for noise due to cart bounce, etc. The selection threshold will also take into consideration that the signal-to-noise ratio (SNR) is good enough to reliably detect items at the site. Use of a size filter for additional screening will also be evaluated. A Target Selection Memorandum will be prepared and submitted to the project team for review and concurrence after site specific conditions and some EM61-MK2 DGM data have been evaluated. Validation of the dynamic data will be performed through comparison of the data to the MQOs specified in WS #22A and as described in WS #35A. Two lists of anomalies – one for the cued survey areas (Flamenco Beach and Campground) and the other for the direct intrusive investigation areas (Carlos Rosario and Tamarindo Beaches) – will be delivered following the completion of target selection along with the Dynamic Data Validation Report.

17A.8.3 Background data collection locations for the cued survey will be selected using the DGM survey results. Background locations will be selected to meet the requirements described in SOP AC-05 (Appendix I). Each background location selected will be checked by collecting five cued advanced EMI sensor points, at the selected location and offset approximately 0.35 m in each cardinal direction. If comparison of the decays for any of those five cued data points indicate the presence of metallic objects, that location will either be cleared and rechecked or will not be used for background data collection during the cued survey.

17A.8.4 Cued data acquisition will not commence until after the cued target list has been reviewed and approved by the project team. Any anomalies added to the cued target list based on the project team's review of the Target Selection Memorandum, the data validation results, and the data anomaly list will be collected before the cued data collection team demobilizes from the site. A DUA will be completed for the DGM data using the four step process described in WS #37A following the project team's acceptance of the final cued target list.

17A.8.5 *Documentation*: Target Selection Technical Memorandum, processed data files and maps, processing notes, project QC database, Weekly QC Reports

17A.8.6 *Decision point*: Is anomaly density acceptable for cued survey? Have MQOs been achieved?

17A.9 DFW 8: Validate Detection Survey (HGL, Parsons, and USACE)

17A.9.1 DGM data will be validated as described in WS #35A. Intrusive investigation and cued data acquisition will not commence until after the applicable target lists have been reviewed and approved by the project team. Any anomalies added to the cued target list based on the project team's review of the Target Selection Memorandum, the data validation results, and the DGM data anomaly list will be collected before the cued data collection team demobilizes from the site. A DUA will be completed for the DGM data using the four step process described in WS #37A following the project team's acceptance of the final target lists.

17A.9.2 *Documentation*: DGM Data Validation Report and Detection Survey DUAs

17A.9.3 *Decision point*: Is DGM data acceptable for use in developing cued target lists?

17A.10 DFW 9: Assemble Advanced Geophysical Sensor and Test Sensor at IVS (Parsons)

17A.10.1The advanced EMI sensor will be assembled as described in SOP AC-01 (Appendix I).

17A.10.2 To test the advanced EMI sensor and verify that it is functioning correctly, an initial cued IVS survey will be performed as described in SOP AC-02 (Appendix I). After performance of the initial IVS testing, an IVS Technical Memorandum will be prepared detailing the IVS setup, surveys, and results including documentation of compliance with the cued IVS MQOs provided in WS #22A. The IVS Technical Memorandum will be provided to the project team for review and concurrence. It is expected that the cued IVS survey will be performed at the same time as the EM61-MK2 IVS survey (DFW 5), and the discussion/results for both surveys will be combined in one IVS Technical Memorandum.

17A.10.3 *Documentation*: IVS Technical Memorandum (combined for detection and cued surveys)

17A.11 DFW 10: Collect Cued Data (Parsons)

17A.11.1 Cued data will be collected at DGM survey anomaly locations at Flamenco Beach and in the open areas of Flamenco Campground as described in SOP AC-06 (Appendix I), with background data collected as described in SOP AC-05 (Appendix I).

17A.11.2 After the cued data are downloaded from the data acquisition computer, the data processor will review the dataset to validate that it meets the MQOs listed on WS #22A, including the following:

- Instrument function test
- IVS derived polarizabilities
- IVS derived positions
- GPS quality
- Offset from selected to measured position
- Production area background measurements
- Transmit current levels
- Offset between multiple sensors
- Valid inertial measurement unit function

17A.11.3 The results of these checks will be summarized in the project QC database and Weekly QC Reports.

17A.11.4 *Documentation*: Raw data (UX-Analyze compatible file format), project QC database, Weekly QC Reports

17A.11.5 *Decision point*: Have MQOs been achieved?

17A.12 DFW 11: Conduct Cued Data Processing (Parsons and HGL)

17A.12.1 Cued data will be processed using UX-Analyze-Advanced as described in SOP AC-07 (Appendix I).

17A.12.2 Both single and multiple object inversion routines are used to determine intrinsic and extrinsic parameters for potential sources that closely match the collected cued data. Once these parameters have been determined for potential sources, the intrinsic parameters (polarizabilities) modeled for potential sources can be compared to the same parameters for library objects to determine the degree of match between the two. Output from data processing will include all inversion results and decision metrics derived from library matching. The decision metrics will give a reasonable indication of whether a given target will be classified as TOI or not, but specific decisions for each target will be performed under DFW 12.

17A.12.3 *Documentation*: Backgrounds, raw/leveled data, and inversion/library comparison results

17A.12.4 *Decision point*: Have MQOs been achieved?

17A.13 DFW 12: Classify Anomalies and Make Dig/No-Dig Decisions (Parsons, HGL, and USACE)

17A.13.1 Classification of cued data will generally be performed as described in SOP AC-07 (Appendix I) in that comparisons of the collected data to the munitions library compiled for the project will be the primary metric used to guide the dig/no-dig decision on the ranked dig list to be submitted following classification.

17A.13.2 The site specific library will consist of polarizabilities from the standard 2x2 library included with UX-Analyze and polarizabilities collected by Parsons as part of an ESTCP library update. The site specific library will be updated as necessary based on the results of training digs performed, based on comparison of targets to a more comprehensive library, and on the cluster/feature space analysis, such that most targets identified as digs are based on a threshold-based metric match to the library. However, some targets may be classified as digs at the analyst's discretion regardless of library match metric. Justification will be provided for any analyst-added digs.

17A.13.3 Objects will be classified into one of the following three categories:

- **Category 1**: TOI (highly likely to be MEC)
- **Category 2**: Non-TOI (highly unlikely to be MEC)
- **Category 3**: Inconclusive (data cannot be analyzed)

17A.13.4 Objects will be placed on a ranked anomaly list, arranged in order from highest likelihood the object is a TOI to highest likelihood the object is a non-TOI. A stop-dig threshold between TOI and non-TOI (i.e., the last TOI on the dig list) will be defined by the analyst. The USACE will review the classification results with regard to the validation seeds and other pertinent validation data prior to acceptance. Changes may be made to the classifier used and the dig list as a result, as necessary, prior to acceptance. A cued survey DUA will be completed using the four step process described in Worksheet #37 following the project team's acceptance of the final ranked dig list.

17A.13.5 *Documentation*: Ranked dig list figures and maps, Database containing training dig results

17A.13.6 *Decision point*: Are all QC seeds classified as digs? Are all validation seeds classified as digs? Have MPCs been achieved?

17A.14 DFW 13: Validate Cued Survey and Classification (Parsons and USACE)

17A.14.1 Cued data will be validated as described in WS #35A. A DUA will be completed using the four step process described in WS #37 following the project team's acceptance of the final ranked dig list. As part of the validation process, the project team will select 10% (not to exceed 200) targets classified as non-TOI that will be excavated with the targets classified as TOI. Prior to the intrusive investigation, a data analyst will provide a short description as to why each of the selected targets was classified as a non-TOI (e.g. too small, too thin-walled, asymmetric) as described in SOP AC-09 (Appendix I).

17A.14.2 *Documentation*: Cued Data Validation Report and Cued Survey DUAs

17A.14.3 *Decision point*: Is cued data acceptable for use in separating TOI from non-TOI?

17A.15 DFW 14: Excavate Buried Objects (HGL)

17A.15.1 Detailed descriptions of the anomaly excavation procedures and intrusive results documentation required for this project are included in SOPs 505.01.1 and 506.01.1 (Appendix I). Training digs for the AC areas will be excavated first to allow for concurrent modification of the classification results, as necessary. Anomalies will be excavated in order to maximize the efficiency of the intrusive process. All intrusive investigation will be performed using an EM61-MK2 for anomaly reacquisition and hole clearance and an RTK GPS (Trimble R8 or similar) for source location. A Schonstedt Model GA-52Cx magnetometer and/or Whites All-Metal detector (or equivalent analog instruments) may be used to pinpoint source locations within open holes, but is not necessary for this investigation. The Whites All-Metal detector (or equivalent analog instrument) may be used to reduce the amount of "hot-rock" digs. Prior to intrusive operations, HGL will coordinate with ACDEC to evacuate campgrounds and beach areas IAW the ESS.

17A.15.2 For the AC areas, the intrusive investigation will include the excavation of the 10% (not to exceed 200) validation targets described above as well as at least 10% (not to exceed 200) verification targets. The final number of verification digs and their relation to classifier decision points (decision metric stop-dig threshold, cluster boundaries, analyst-added digs, etc.) will be determined after consultation amongst the project team.

17A.15.3 For the non-AC areas (Carlos Rosario and Tamarindo Beaches), all anomalies on the final list for these areas will be excavated.

17A.15.4 If water is encountered while excavating buried objects that impacts the safety of the operation, low-volume pumps or water diversion may be used to dewater excavations.

17A.15.5 The anomaly resolution requires the intrusive investigation process to conclude once the signal is removed or identified, thus ensuring no MEC or MPPE is left.

17A.15.6 *Documentation*: Database of excavation results, photographs, Daily QC Reports, Weekly QC Reports, disposal reports.

17A.16 DFW 15: Verify Recovered Non-TOI Are Consistent with Predictions Based on Advanced Sensor Data (Parsons and project team)

17A.16.1 All sources recovered during the intrusive investigation will be compared to the predicted results as described in SOPs AC-08 and AC-09 (Appendix I); verification targets will be excavated as described above.

17A.16.2 *Documentation*: Comparison results

17A.16.3 *Decision point*: Was the stop-dig threshold correct?

17A.17 DFW 16: Conduct Final DUA (Parsons)

17A.17.1 The final DUA will be performed after the completion of intrusive investigation as described on WS #37A. The report will include an analysis of the instrument and classification performance. It will also include lessons learned during the collection/classification process and recommendations for improving the process, as applicable.

17A.17.2 *Documentation*: Final DUA

17A.18 DFW 17: Analog Removal

17A.18.1 Analog surveys will be used to locate subsurface anomalies for intrusive investigation in areas where terrain or extensive tree canopy prevents DGM methods. The subsurface analog removal will be performed according to the procedures described in SOP 505.01.1 (Appendix I). Subsurface Analog Removal will be conducted using handheld sensors – the Whites All-Metal detector (or equivalent analog instruments) with the capability of ground balancing to reduce detection of magnetic soils/and or rocks ("hot rocks") to identify subsurface anomalies based on the audible output to the analog sensor. Analog geophysical instruments will arrive on site in a ready state. Analog geophysical instruments will be operationally tested on a test plot to ensure that adequate instrument settings for their tasks are achieved. As anomalies are identified by the instrument operator(s), they will be investigated as detected ("mag and dig") or marked for subsequent intrusive investigation ("mag and flag"). Prior to intrusive operations, HGL will coordinate with ACDEC to evacuate campgrounds and beach areas IAW the ESS.

17A.18.2 All subsurface removal operations will be performed under the direct supervision of the UXO Technician III Team Leader. Before any analog subsurface removal operations are performed, the members of the MEC removal team will check their analog instrument function according to the MQOs listed on WS #22A. Prior to conducting subsurface removal in a grid, the removal team will mark approximately 5-foot-wide removal lanes throughout the grid using survey tape or similar. Team members will locate anomalies for intrusive investigation, investigating them using either "mag and dig" or "mag and flag" methods.

17A.18.3 Detected anomalies will be intrusively investigated by UXO-qualified personnel using either hand digging or mechanical methods (e.g., mini-excavator). The minimum separation distances. presented in the approved ESS will be enforced during all intrusive MEC operations. When multiple teams are working in proximity to one another, the team separation distance specified in the approved ESS will be maintained during intrusive activities. All minimum separation distances are based on the appropriate munitions with the greatest fragmentation distance, which are also presented in the approved ESS.

17A.18.4 During subsurface activities, the UXO technicians will use handheld geophysical instruments to locate and pinpoint anomalies. The UXO technicians will carefully remove the earth overburden to expose the source of a subsurface metallic anomaly, and positively identify the source of the anomaly. Excavations using heavy equipment will be conducted offset laterally for the suspected MEC item or anomaly being investigated and will not be conducted within one foot of the anomaly source. Following this initial excavation, the excavation team will conduct a visual and instrument-assisted examination of the excavation. This process will be repeated until the audible signal from the handheld magnetometer indicates the anomaly source is close to the surface of the excavation. Once this determination has been made, additional soil will be removed by hand until the anomaly is located. Excavations will be continued until the anomaly source is resolved.

17A.18.5 The UXOQCS will conduct a 25% instrument-assisted re-sweep of each analog area in random patterns and 5% meandering digital data coverage using the PDM8. If the PWS clearance criteria are not achieved, the grid will fail and it will be re-swept.

17A.18.6 Each Team Leader will mark the locations of and photograph any MEC discovered and document information in the project database or on the Team Leader Grid Sheet for MEC/MPPEH (Appendix F) if electronic records are not accessible. Any MPPEH encountered during intrusive activities will be handled and disposed of as described in Section 17A.16, MPPEH/MEC Handling, Certification, and Disposal. Once the source of an anomaly has been identified and any necessary MEC operations have been completed, the excavation will be filled in and tamped to the approximate consistency and grade of the surrounding soil and any removed sod will be replaced. To the greatest extent possible, the excavation site will be restored to its original condition.

17A.18.7 The Team Leader will record the following analog removal information for each grid surveyed:

- General Grid Information
  - Grid ID
  - Team number
  - Team leader
  - Date(s) of removal
  - Sketch of grid conditions
  - Comment
- MEC Information
  - Grid ID
  - Location ID
  - Coordinates
  - Date found
  - Item type
  - MEC type (UXO, DMM, MC)
  - Photo ID
  - Nomenclature
  - Description
  - Quantity
  - Depth
  - Final disposition
- MD, RRD, and Other Debris Information
  - Grid ID
  - Team number

- Team leader
- Date
- MD/munitions types found (frag, munitions component, debris description)
- Seed items found
- Total weight of MD in grid
- Total weight of other debris in grid
- Number of MEC/MPPEH logged on MEC/MPPEH grid sheet

17A.18.8 This information will be logged in the electronic database or on the Team Leader Grid Sheet (MEC/MPPEH Only), Team Leader Grid Sheet (MD, RRD, and Other Debris), and Grid Drawing Sheet (Appendix F) if electronic records are not available. Following completion of the grid, the team leader will log the progress on the Grid Status Sheet (Appendix I), or electronic equivalent. Documentation for each grid deemed to be completed by the UXO Team Leader will be subjected to verification by the UXOQCS or designee using the MPCs described on WS #12A.

17A.18.9 *Documentation*: Team Leader Grid Sheet (MEC/MPPEH Only) (or electronic equivalent), Team Leader Grid Sheet (MD, RRD, and Other Debris) (or electronic equivalent), Grid Drawing Sheet (or electronic equivalent), Grid Status Sheet (or electronic equivalent), project QC database.

17A.18.10 *Decision point*: Have MPCs been achieved?

17A.19 DFW 18: MPPEH/MEC Handling, Certification, and Disposal

17A.19.1 MEC Identification

17A.19.1.1 Any MPPEH that cannot be verified to be free of explosive hazards or is suspected to present an explosive hazard will be considered to be MEC. Any MEC encountered during excavation will be clearly marked and its position will be recorded by RTK GPS (Trimble R8 or similar) or handheld GPS. Data regarding type, size, depth, condition, location, etc. of MEC located during the removal action will be recorded and all MEC encountered will be photographed. The UXO supervisor/team leader (UXO Technician III) will evaluate the item(s) found and immediately report the condition of the item(s) to the SUXOS and UXOSO. The SUXOS and UXOSO must be in agreement on the nature and condition of a MEC item before any action is taken.

17A.19.2 MEC Removal

17A.19.2.1 If the source of an excavated anomaly is considered to be MPPEH, it will be uncovered sufficiently to obtain a positive identification of the item. If the item is identified as MEC, a determination will subsequently be made as to whether the item is acceptable to move. Only the SUXOS and UXOSO, jointly, will make the determination if a MEC item is acceptable to move. After determining if an item is acceptable to move, the SUXOS and UXOSO will determine the most expeditious route for safe movement of the MEC item to an approved consolidation point. The location for a consolidation point will be determined by the SUXOS and

UXOSO based on safety considerations, and approved by the USACE OESS and documented in daily production reports.

17A.19.2.2 MEC items deemed acceptable to move may, IAW the approved ESS, be moved for consolidation or to move the item further from public roadways for detonation. No MEC identified for destruction will be removed outside the project site boundary. Any consolidated shots will be conducted IAW the approved ESS.

17A.19.2.3 MEC items not deemed acceptable to move will be blown-in-place (BIP). If a MEC item cannot be safely BIP under the existing conditions, the PM, SUXOS, and UXOSO will be notified, and a determination will be made how to resolve the situation safely.

17A.19.3 MEC Storage

17A.19.3.1 MEC will not be stored at the site. If demolition of MEC items cannot be completed on the day the item is found, it will be guarded until demolition can occur.

17A.19.4 Disposal of MEC/MPPEH

17A.19.4.1 *General MEC Disposal Procedures*

17A.19.4.2 During disposal of MEC and related material, safety will be the primary concern. The primary requirements are to protect personnel, the public, and the environment from fire, blast, noise, fragmentation, and toxic releases. Planned detonation of explosives will be conducted IAW the requirements outlined in DoD 6055.9-M and the applicable Fragmentation Data Review Forms, which are included in the approved ESS.

17A.19.4.3 Explosive operations will follow the procedures outlined in the ESS, EM 385-1-97, and HGL SOP 502.01.1, *Explosive Demolition Operations* (Appendix I). Standard electric or nonelectric demolition equipment may be used, including remote firing devices. The UXOSO has the overall responsibility to comply with the minimum requirements listed below and has the authority to upgrade as the situation dictates.

17A.19.4.4 Demolition operations will not begin at a work site until all non-essential personnel are outside the minimum separation distances established for the ordnance and net explosive weight being detonated. MEC that cannot be moved will be BIP. Engineering controls may be used to reduce the intentional detonation minimum separation distances. The goal of engineering controls during MEC disposal operations is to avoid and minimize the potential impacts on the environment. If implemented, these controls will be used IAW the ESS.

17A.19.4.5 The Project Biologist will inspect the beach that would be used for detonation for the presence of sea turtles, sea turtle nests, and signs of recent sea turtle activity. An area not recently used by sea turtles and at least 100 meters from any place of active sea turtle use would be selected as the detonation site to the maximum extent practicable. Daily beach surveys will be conducted by qualified personnel to determine whether sea turtles are using beaches within the MRS. Prior to detonation, the Project Biologist will check the beach and adjacent waters for the presence of protected and listed seabird species by scanning the area with 10 X 50 binoculars.

The Project Biologist will also survey the beaches for signs of bird nesting. If bird nests are found within the detonation site and/or blast impact area, no detonation will be conducted in that area. If any protected bird species are within 200 meters of the detonation site, MEC detonation will be delayed until after the bird(s) leave the area. In addition, if blast impacts will extend into nearshore waters, the Project Biologist will observe for sea turtles and marine mammals. If these species are observed the detonation shall be postponed until the animal(s) leave the impact zone or more than 30 minutes have elapsed since it was last sighted. Immediately before detonation, the Project Biologist will scan the overhead sky for the presence of any birds. If birds are in flight within 100 meters of the detonation site, the detonation will be delayed until no birds are within 100 meters of the detonation site.

17A.19.4.6 No in-water detonations are anticipated during this TCRA. The SOPs for Endangered Species Conservation, USACE, Jacksonville District, references in-water detonations. However, not all procedures in the SOPs are applicable to the TCRA.

17A.19.4.7 Disposal operations will be under the direct control of the demolition team leader: an experienced and trained UXO Technician III charged with the responsibility for all demolition activities within the area. The UXOSO will be responsible for training all personnel regarding the nature of the materials handled, the hazards involved, and the necessary precautions to be taken, and will also be present during all on-site disposal operations. The UXOSO will ensure that the appropriate authorities are notified prior to any on-site demolitions.

The following will be in place prior to disposal operations:

- Puerto Rico Individual Explosive License
- Puerto Rico Storage Permit

The following entities will be notified of intent to detonate prior to detonation:

- USCG, Mr. Efrain Lopez, Marine Information Specialist (787) 289-2097), efrain.lopez1@uscg.mil, USCG Sector San Juan and, CWO Anthony Cassisa, (787) 289-2073, anthony.j.cassisa@uscg.mil. Warning broadcast to mariners over VHF for a scheduled demolition shot (Notice to Mariners [NOTMAR]).

- FAA Coordination Facility (787) 253-8664, Mr. Felipe Fraticelli, for a Notice to Airmen on flight restriction above the demolition area. Additional points of contact include Mr. Hector Plaza, (787) 525-6070, and Mr. Hector Rivera, FAA Office (404) 520-4241.

- Municipal Police (787) 742-0106 for any activity on Flamenco Beach. The HGL SUXOS or UXOSO will coordinate directly with the police department to overcome any language difficulties on demolition operations.

- Puerto Rican State Police (787) 742-3501, for any activities on Culebra. The HGL SUXOS or UXOSO will coordinate directly with the police department to overcome any language difficulties on demolition operations.

17A.19.4.7 Completion of demolition operations will be evaluated by the SUXOS using the MPCs described on WS #12A.

17A.19.4.8 *Material Potentially Presenting an Explosive Hazard*
MPPEH will be processed and disposed of IAW Chapter I, Section 11 of EM 385-1-97. Additionally, site personnel will adhere to HGL SOP 504.01.1, *MPPEH Inspection and Management* (Appendix I), which establishes overall practices for HGL UXO-qualified personnel inspecting, processing, securing, safeguarding, and managing MPPEH during MEC activities. Certification and disposal of MPPEH and MDAS will be monitored by the UXOQCS using the MPCs described on WS #12A.

17A.19.4.9 Within, or adjacent to, each grid actively undergoing subsurface clearance, a UXO Technician III will establish a temporary collection point for MD. Smaller MD items will be placed in plastic buckets or suitable containers. During operations, surface clearance teams will inspect each surface anomaly for the presence of explosives. MD items that are free of explosives contamination and do not require venting will be placed in the grid collection points. Upon completion of operations in that grid, the material in the temporary collection points will be collected. The UXO Technician III will perform a second inspection of the material to ensure that it is free of explosives and other hazardous materials (HAZMATs). The SUXOS will certify the inspection of each item a third time as the MD is placed in secured containers. The OESS or UXOQCS will verify that all MD and items placed in secured containers are free of explosive hazards and HAZMATs.

17A.19.4.10 *Material Documented as Safe*

17A.19.4.11 MPPEH that is inspected, verified, and certified to be free of explosive hazards will be classified as MDAS. MDAS generated during the project will be stored in a secure area inside locked containers. Once the field investigation is complete, the sealed containers will be shipped to a DoD-approved facility for proper disposal. Certification and disposal of MDAS will be monitored by the UXOQCS using the MPCs described on WS #12A.

17A.19.4.12 *MPPEH Documentation*

17A.19.4.13 The SUXOS will certify and the USACE OESS or UXOQCS will verify that debris is free of explosive hazards. If the OESS is not available, the UXOQCS will sign as the verifier. DD Form 1348-1A will be used as the certification/verification documentation. All DD 1348-1A forms will clearly show the typed or printed names of the SUXOS and OESS/UXOQCS, as well as the organization, signature, and home and field office telephone numbers for the persons certifying and verifying that the debris is free of explosive hazards. The form will state the following if only MD is being processed:

This certifies and verifies that the munitions debris listed has been 100 percent properly inspected and, to the best of our knowledge and belief, is free of explosive hazards.

17A.19.4.14 If range related debris is processed with MD, the form will state the following:

This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, free of explosive hazards, engine fluids, illuminating dials, and other visible liquid hazardous, toxic, and radioactive waste (HTRW) materials.

17A.19.4.15 The container will be closed and clearly labeled on the outside with the following information: the first container will be labeled with a unique identification that will start with USACE / Installation Name / Contractor Name / 001 / Seal's Unique Identification, and subsequent containers will be labeled sequentially. The SUXOS will ensure that a DD Form 1348-1A is completed for each container prior to transfer. The form will contain the following information:

- Location of where material was obtained
- Basic material content (type of metal: for example, steel or mixed)
- Estimated weight
- Unique identification number of each container
- Seal identification number

17A.19.4.16 In addition to the DD Form 1348-1A, MDAS shipments will be transferred to the recycler under a chain-of-custody (CoC).

17A.19.4.17 All material will be accounted for in the daily and weekly reports. All MDAS will be disposed of at a recycler, where it will be processed through a smelter prior to resale or release IAW all governing regulations. If it is discovered during the material transfer and shipping process that a seal has been broken or the CoC of the material cannot be verified, the material in question will be subject to reinspection following the established MPPEH process. The MDAS subcontractor will provide two documents:

(1) CoC: Upon receiving the unopened labeled containers, each with its unique identified and unbroken seal ensuring a continued CoC, and after reviewing and concurring with all provided supporting documentation, the MDAS recycler will sign for having received and agreed with the provided documentation that the sealed containers contained no explosive hazards when received. This document will be signed on company letterhead and state that the contents of sealed containers will not be sold, traded, or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content.

(2) Certification of Destruction Letter: The MDAS recycler will send notification and supporting documentation verifying that the sealed containers have been smelted and are therefore only identifiable by their basic content. This documentation will be submitted as an appendix to the final Site-Specific Final Report (SSFR).

17A.20 DFW 19: Demobilization

17A.20.1 When the SUXOS and UXOQCS have documented that all intrusive investigation is complete the UXOQCS will conduct a MPPEH/Explosives Records Assessment to ensure that all MPPEH and donor explosives are accounted for. MDAS will be properly documented and shipped offsite for demilitarization via smelting. Following successful completion of the records assessment, tools, equipment, and safety gear will be shipped from the site and personnel will demobilize.

Figure 17.1
Geophysical Classification Decision Tree – Preliminary Tasks and Anomaly Detection Survey

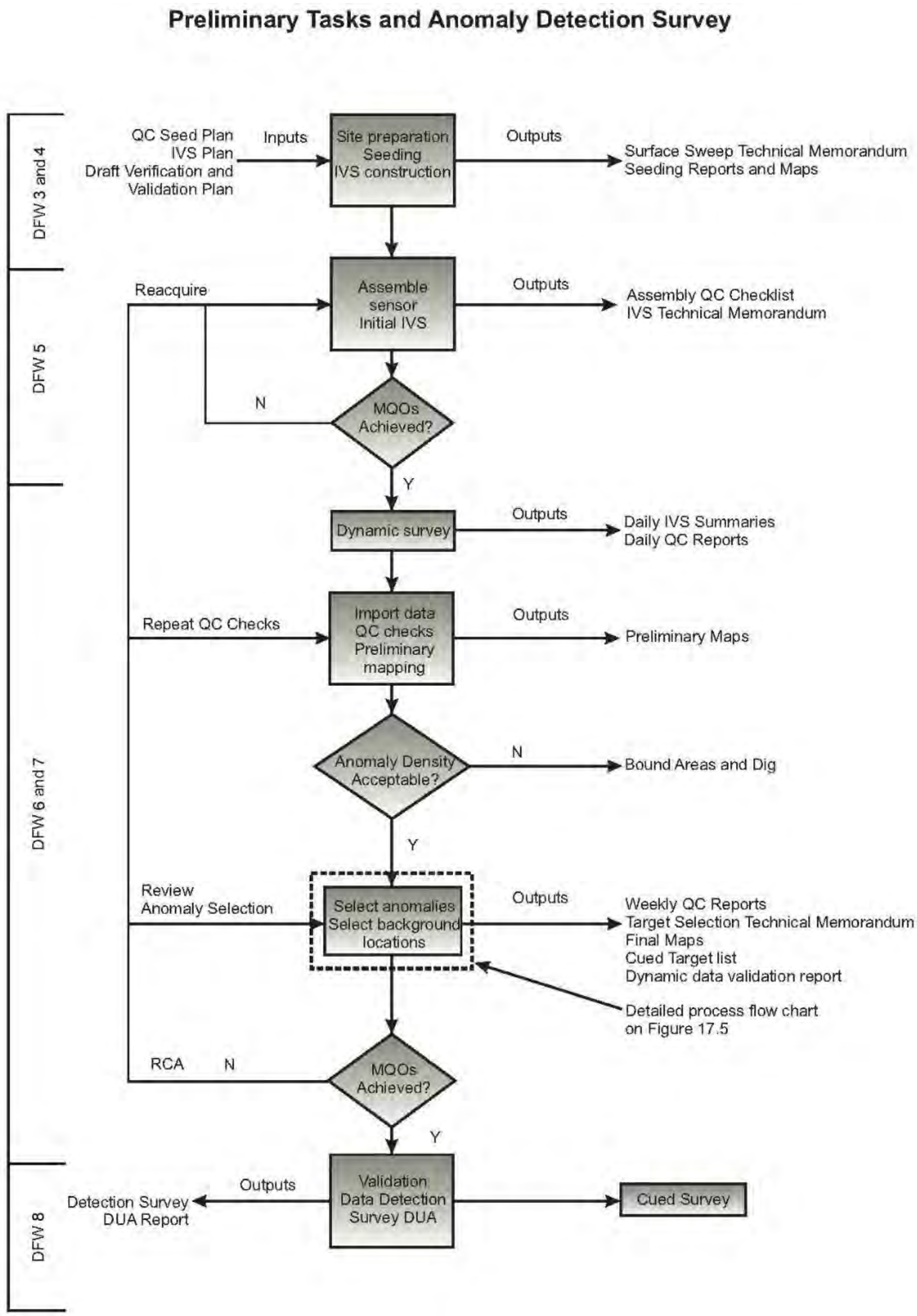


Figure 17.2
Geophysical Classification Decision Tree – Cued Survey

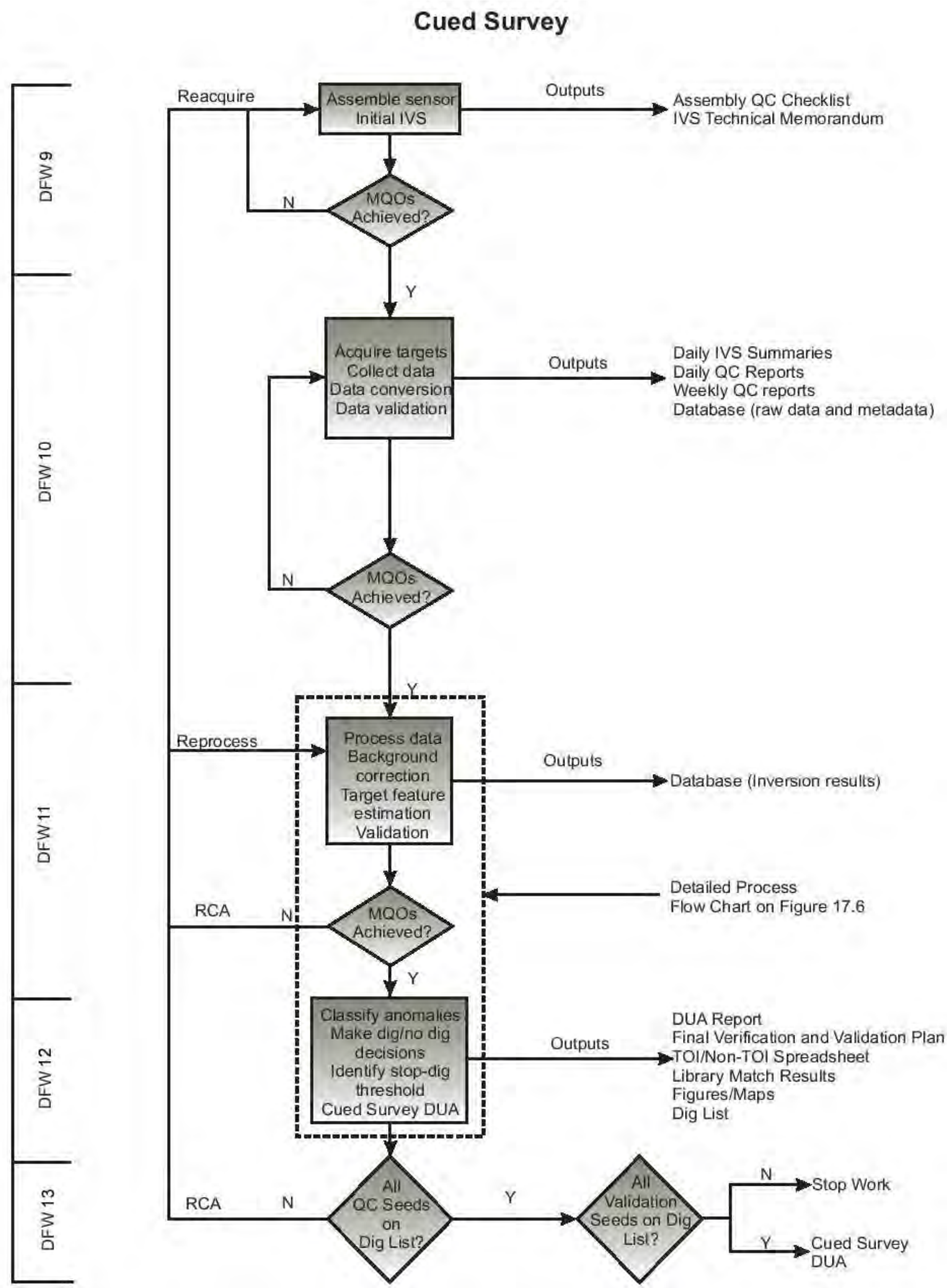
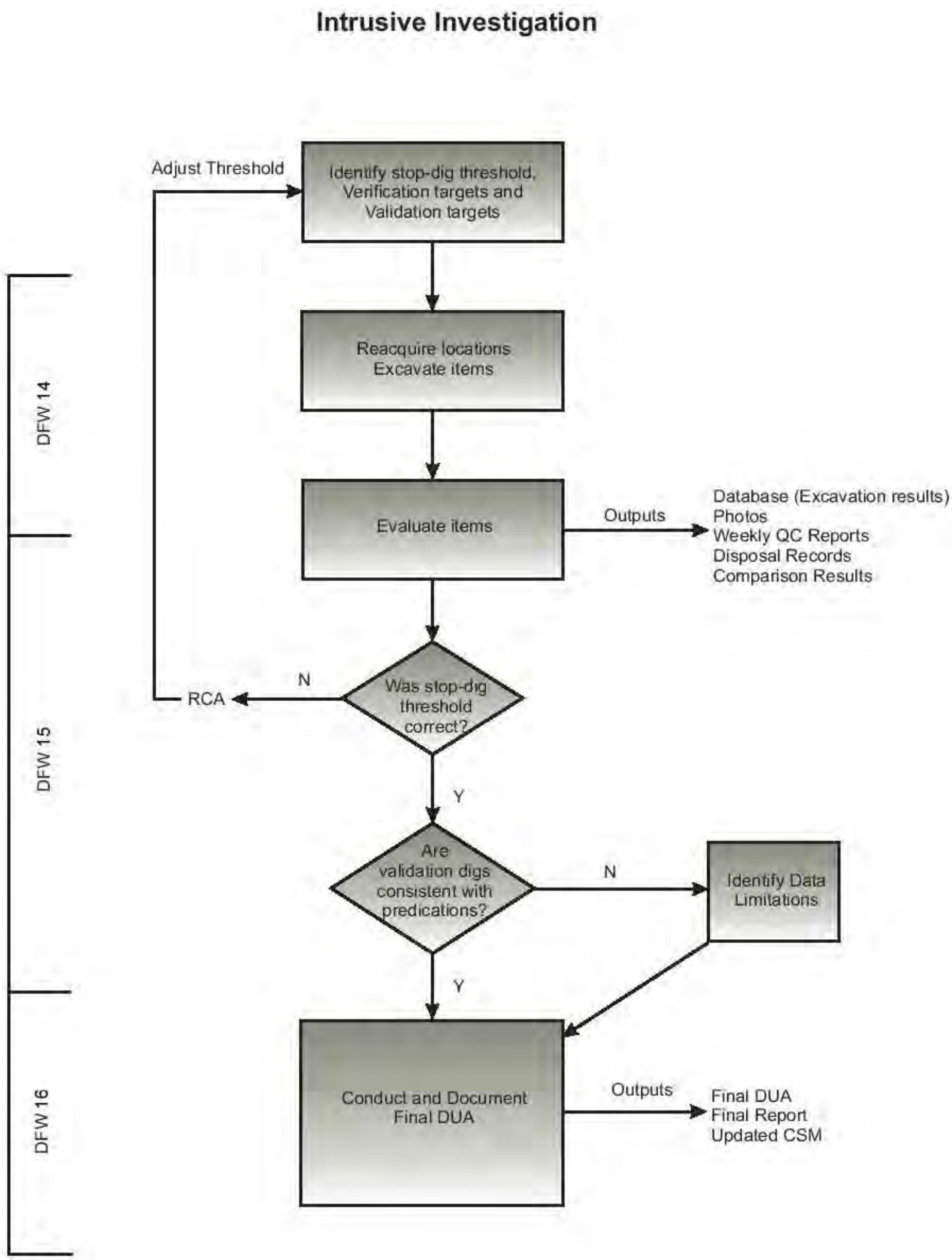


Figure 17.3
Geophysical Classification Decision Tree – Intrusive Investigation



WORKSHEET #17B
MC SAMPLING DESIGN AND RATIONALE

This worksheet describes the project design and the tasks that will be required to successfully complete MC sampling activities during this project and achieve the DQOs described on Worksheet #11B. MC sampling will be performed at MEC detonation locations conducted within the TCRA areas shown on Figure 10.3 (Appendix B).

DFW 20 (continued from WS #17A): MC Sampling

17B.1 Samples for MC analysis will be collected from 0-6 inches below ground surface at post-detonation locations. The objective of this task is to determine whether MEC detonation operations at the site have resulted in a release of MC that exceed the screening levels presented in Worksheet #15.

17B.2 Sample locations will be based on the location of the MEC detonation operations and will be determined in the field.

17B.3 Soil samples will be collected using the Cold Regions Research and Engineering Laboratory (CRREL) 7-point wheel composite method IAW SOP ENV-01.03, *Soil Sampling Procedures* (Appendix I). Soil samples will be analyzed for explosives listed in Worksheet #15.

17B.4 Sample collection procedures are addressed further on Worksheet #18 and in SOP ENV-01.03, *Soil Sampling Procedures* (Appendix I), and analytical procedures are summarized on Worksheets #19 & 30 and Worksheet #23. The GPS coordinates of samples collected will be recorded by the Contractor Sampling Lead. Sample handling and custody requirements are described on Worksheets #26 & 27.

17B.6 *Documentation*: Field logbooks, Daily QC Reports, Chain-of-Custody forms, Air Bills, Sample Log-in, Instrument print-out and raw data, Laboratory review checklists, PM Checklists, Data Validation Reports.

17B.7 *Decision point*: Have MPCs been achieved?

WORKSHEET #18
SAMPLING LOCATIONS AND METHODS

List all site locations that will be sampled and include sample/ID number, if available. (Provide a range of sampling locations or ID numbers if a site has a large number.) Specify matrix and, if applicable, depth at which samples will be taken. Only a short reference for the sampling location rationale is necessary for the table. The text of the QAPP should clearly identify the detailed rationale associated with each reference. Complete all required information, using additional worksheets if necessary.

The sampling and analysis program will be based on the result of the MEC data collection, which the project team will use to determine the location and final number of post-BIP soil samples.

Sample ID	Matrix	Depth	Type	Analyte/ Analytical Group	Sampling SOP	Comments
NWP-TCRA-CPST-S-MMDDYY-001	Soil	0-6" bgs	Hand trowel	Explosives	ENV-01.03	SOP para. *5.3.3 Seven-point Wheel Method for Soil*
NWP-TCRA- CPST -S-MMDDYY-00X[1]	Soil	0-6" bgs	Field Duplicate[2]	Explosives	ENV-01.03	SOP para. *5.3.3 Seven-point Wheel Method for Soil*
NWP-TCRA-CPST-S-MMDDYY-001MS/MSD	Soil	0-6" bgs	MS/MSD[2]	Explosives	ENV-01.03	SOP para. *5.3.3 Seven-point Wheel Method for Soil*
NWP-TCRA-CPST-S-MMDDYY-002	Soil	0-6" bgs	Hand trowel	Explosives	ENV-01.03	SOP para. *5.3.3 Seven-point Wheel Method for Soil*
NWP-TCRA-CPST-S-MMDDYY-003 thru 012[3]	Soil	0-6" bgs	Hand trowel	Explosives	ENV-01.03	SOP para. *5.3.3 Seven-point Wheel Method for Soil*

[1] Labeled so that analysts cannot distinguish duplicate samples
[2] Collect at rate of 1/10 samples (10%)
[3] Final ID to be based on number of detonation events.

bgs – Below ground surface
CPST – Post-detonation composite sample
MMDDYY – Month/Day/Year
MS/MSD – Matrix Spike/Matrix Spike Duplicate
S – Soil

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WORKSHEET #19 & 30
SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES

For each matrix and analytical group list the sample volume, container specifications, preservation requirements, and maximum holding time.

Laboratory: Eurofins Lancaster, 2425 New Holland Pike, Lancaster, PA 17605-2425, Amek Carter, amekcarter@eurofinsus.com, (717) 556-7252
Required accreditations/certifications: DoD ELAP
Sample Delivery Method: Air/FedEx

Analyte/Analyte Group	Matrix	Method/SOP[1]	Accreditation Expiration Date	Container(s) (number, size, & type per sample)[2]	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
Explosives	Soil	Preparation Method/SOP: SW8330B/P-1, P-2 Analysis Method/SOP: 8330B/L-1	11/30/16[3]	1 x 1 gallon Ziploc bag	Cool to < 6°C	14 days	40 days	21 days

1 Laboratory Standard Operating Procedures are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.
2 Sample size is a minimum, the containers listed will be filled to compensate for any required re-analysis or re-extractions. For samples requiring MS/Matrix Spike Duplicate, containers listed should be doubled.
3 Lancaster confirmed that it is currently in the process of renewing its certification and anticipates that there will be no discontinuity in certification coverage during support of this project.

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WORKSHEET #20
FIELD QUALITY CONTROL SUMMARY

This worksheet applies to MC Sampling (MEC-related QC is addressed in WS #22A) and summarizes the QC samples to be collected and analyzed for the project. It shows the relationship between the number of field samples and associated QC samples for each combination of analyte/analytical group and matrix. Note that if samples are collected over the estimated number shown, additional QC samples will be collected at the rate shown.

Matrix	Analytical Group	Estimated No. of Field Samples	Field Duplicates	Matrix Spike / Matrix Spike Duplicates	Estimated Number of Total Analyses
Soil	Explosives	12	10%	5%/5%	16

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WORKSHEET #21
FIELD STANDARD OPERATING PROCEDURES

The applicable field SOPs to be used during the TCRA at Culebra, Puerto Rico are listed in the below table. Copies of these field SOPs are provided in **Appendix I**. The SOPs presented in Appendix I include any project specific modifications.

Reference Number	Title, Revision Date, and/or Number	SOP Originating Organization	Related Equipment Types	Modified for Project? (Y/N)	Comments
AC-01	Assemble the 2X2 System and Verify Correct Operation, Revised 8/02/2016	Parsons	Advanced EMI sensor, RTK GPS, orientation sensor	Y	See Appendix I
AC-02	Advanced Classification Instrument Verification Strip (IVS), Revised 8/02/2016	Parsons	Advanced EMI sensor, RTK GPS, orientation sensor, inert munitions and/or ISOs, hand tools	Y	See Appendix I
AC-05	Collect Static Background Measurements, Revised 8/27/2015	Parsons	Advanced EMI sensor, RTK GPS, orientation sensor, sled, skid steer	N	See Appendix I
AC-06	Collect Cued Target Measurements, Revised 8/27/2015	Parsons	Advanced EMI sensor, RTK GPS, orientation sensor, sled, skid steer	N	See Appendix I
AC-07	Process Cued 2X2 Data, Revised 8/02/2016	Parsons	--	Y	See Appendix I
AC-08	Verify Recovered Objects are Compatible with Predictions, Revised 8/28/2015	Parsons	--	N	See Appendix I
AC-09	Validate Classification Process, Revised 8/28/2015	Parsons	--	N	See Appendix I
DGM-01	IVS Construction and Testing, Revised 8/27/2015	Parsons	Analog geophysical instrument(s), EM61-MK2 sensors, RTK GPS	N	See Appendix I
DGM-02	Seeding, Revised 8/28/2015	Parsons	Analog geophysical instrument(s), EM61-MK2 sensor, digital camera, RTK GPS	N	See Appendix I
DGM-03	EM61-MK2 Data Acquisition, Revised 8/28/2015	Parsons	EM61-MK2 sensors, tow vehicle, array structure, RTK GPS	N	See Appendix I
DGM-04	EM61-MK2 Data Processing, Revised 8/28/2015	Parsons	--	N	See Appendix I

WORKSHEET #21 (CONTINUED)
FIELD STANDARD OPERATING PROCEDURES

Reference Number	Title, Revision Date, and/or Number	SOP Originating Organization	Related Equipment Types	Modified for Project? (Y/N)	Comments
DGM-05	EM61-MK2 Reacquisition & Anomaly Resolution, Revised 8/28/2015	Parsons	EM61-MK2, RTK GPS	N	See Appendix I
ENV-01.03	Soil Sampling, Revised 10/07/15	Parsons	--	N	See Appendix I
CHEM-01	Chemistry Data Review and Management	Parsons	--	N	See Appendix I
501.01.1	Explosive Materials Accountability and Management	HGL	--	N	See Appendix I
502.01.1	Explosive Demolition Operations	HGL	Radios, demolition kit, first-aid equipment, fire extinguisher, sand bags, shovel	N	See Appendix I
503.01.1	Explosives Storage Inspection and Security	HGL	--	N	See Appendix I
504.01.1	MPPEH Inspection and Management	HGL	Analog geophysical instrument(s), first-aid equipment, fire extinguisher	N	See Appendix I
505.01.1	Analog MEC Clearance Operations	HGL	Analog geophysical instrument(s), first-aid equipment, fire extinguisher, shovel	N	See Appendix I
506.01.1	Digital MEC Clearance Operations	HGL	Analog and digital geophysical instrument(s), first-aid equipment, fire extinguisher, shovel, tape measure	N	See Appendix I
510.01.1	MEC Anomaly Avoidance Support	HGL	Analog geophysical instrument(s), first-aid equipment, fire extinguisher	N	See Appendix I
--	Supplemental Standard Operating Procedures for Endangered Species Conservation and their Critical Habitat, DERP-FUDS Property I02PR0068, Culebra, Puerto Rico	CESAJ	--	Y	See Appendix I

WORKSHEET #22A
FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION FOR MEC-RELATED DFWS

This worksheet describes the field equipment needed for the project and the associated calibration, maintenance, testing, and inspection procedures for that field equipment. This worksheet also documents the field equipment's frequency of activity, acceptance criteria, and corrective action requirements.

Table 22A.1
Dynamic Survey (Instrument: EM61-MK2 and Analog Sensor)

Measurement Quality Objective	DFW/ SOP Reference	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Instrument Functionality (Analog System)	DFW 3; DFW 4; DFW 6; DFW 17 / SOP 510.01.1; SOP 505.01.1	Daily	Operator/Daily QC Report/UXOQCS	Each operator demonstrates, in a test plot separate from the IVS, positive detection on a daily basis to the presence of 37mm projectile buried at a depth of 12 inches in best and worst case orientation and 5-inch HE projectiles buried at a depth of 40 inches (or equivalent ISOs).	Repair or replace instrument, then repeat test
Coverage, Detection, and Recovery (Analog)	DFW 6; DFW 17 / SOP 505.01.1	Evaluated for each 100 ft by 100 ft grid.	Field Team Leader/Daily QC Report; Grid Status Records /UXOQCS	QC seed items will be distributed such that each team will encounter between one and three detection seeds per team per day and coverage seeds such that each operator encounters between one and three total seeds per day	Root cause analysis (RCA)/CA CA assumption: grid fails; re-clear

Table 22A.1 (Continued)
Dynamic Survey (Instrument: EM61-MK2 and Analog Sensor)

Measurement Quality Objective	DFW/ SOP Reference	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Anomaly Resolution	DFW 17/ SOP 505.01.1	Evaluated for 100 ft by 100 ft grid.	Field Team Leader/Daily QC Report; Grid Status Records/UXOQCS	UXOQCS will conduct a 25 percent instrument-assisted resweeps of each grid in random patterns. Finding no MEC or MPPEH excluding small arms ammunition (.50 cal and smaller), and no MD or RRD equivalent to, or greater than 37mm in diameter or width on the surface of the MRS. Finding no subsurface MEC or MPPEH shallower than 8x the item's diameter.	RCA/CA CA assumption: excavation fails; re-clear
Geodetic Equipment Functionality	DFW 3 / SOP 505.01.1	Daily	Operator/Daily QC Report/UXOQCS	Measured position of control point within 10 cm of ground truth	CA assumption: redo affected work.
Initial dynamic positioning accuracy (IVS, EM61-MK2)	DFW 5 / SOP DGM-01.01	Once prior to start of dynamic data acquisition	Project Geophysicist/ IVS Technical Memorandum/ QC Geophysicist	Derived positions of IVS target(s) are within 25 cm of the ground truth locations	CA: Make necessary adjustments, and re-verify

Table 22A.1 (Continued)
Dynamic Survey (Instrument: EM61-MK2 and Analog Sensor)

Measurement Quality Objective	DFW/ SOP Reference	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Ongoing Instrument Function Test (EM61-MK2)	DFW 6 / SOP DGM-03.01	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ running QC summary / Project or QC Geophysicist	Response within 20% of initial response (comparison with the mean static spike minus mean static background)	CA: make necessary repairs and re-verify
Ongoing dynamic positioning precision (EM61-MK2)	DFW 6 / SOP DGM-03.01	Beginning and end of each day	Project Geophysicist/ running QC summary/ QC Geophysicist	Derived positions of IVS target(s) within 25 cm of the average locations	RCA/CA
Reacquisition and anomaly resolution precision (EM61-MK2)	DFW 6 / SOP DGM-03.01	Beginning and end of each day	Project Geophysicist/ running QC summary/ QC Geophysicist	Derived positions of IVS target(s) within 25 cm of the average locations	RCA/CA
In-line measurement spacing (EM61-MK2)	DFW 6/ SOP DGM-03.01	Verified for each data collection day using existing UX Detect tools based upon sensor center position	Project Geophysicist/ running QC summary/ QC Geophysicist	100% ≤ 0.25 m between successive measurements	RCA/CA CA assumption: data set fails, (recollect portions that fail)
Coverage (EM61-MK2)	DFW 6 / SOP DGM-03.01	Verified for each 100 ft by 100 ft grid using existing UX Detect tools based upon sensor center position	Project Geophysicist/ running QC summary and Dynamic Data Validation Report/ QC Geophysicist	100% at ≤0.7 m cross-track measurement spacing (excluding site specific access limitations, e.g., obstacles, unsafe terrain)	CA CA assumption: Gaps require fill-in lines to achieve required coverage unless no indication of subsurface metal in gap [(1)]

(1) Analyst will review data surrounding identified gaps to determine the possibility that subsurface metal is present in the gap. If the analyst and USACE Geophysicist agree that the data surrounding the gap indicates there is no potential for subsurface metal in the gap, it will not be recollected.

Table 22A.1 (Continued)
Dynamic Survey (Instrument: EM61-MK2 and Analog Sensor)

Measurement Quality Objective	DFW/ SOP Reference	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Dynamic detection performance (EM61-MK2)	DFW 6 / SOP AC-04, SOP DGM-04	Evaluated by 100 ft by 100 ft grid	QC Geophysicist; lead agency QA Geophysicist/ Dynamic Data Validation Report/ lead agency QA Geophysicist	All GSV seeds detected with at least 75% of minimum expected response at maximum horizontal offset Positional accuracy of GSV seed ≤ 0.35m + ½ line spacing for data collected with RTK GPS positioning, ≤ 0.50m + ½ line spacing for data collected with fiducial positioning.	RCA/CA
Valid position data (EM61-MK2)	DFW 6 / SOP DGM-03.01	Per measurement	Field Team Leader/ running QC summary/ Project Geophysicist	GPS status flag indicates fix and confirmation that fix should be indicative of DOP <4.0[2]	CA: Interpolate positions for minor (<3 m) GPS fluctuations along straight lines (path before and after gap indicates line was straight); longer out-of-spec data rejected

(2) GPS planning software will be used to confirm that expected DOP is less than 4.0 throughout the planned survey period each day; daily expected DOP graphs will be saved to the project file.

Table 22A.2
Cued Survey (Instrument: MM 2X2/TEMTADS; Classification Tool: UX-Analyze)

Measurement Quality Objective	DFW/ SOP Reference	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Verify correct assembly	DFW 9 / SOP AC-01	Once following assembly	Field Team Leader/ instrument assembly checklist/ Project Geophysicist	As specified in **SOP AC-01**, Assembly checklist	CA: Make necessary adjustments, and re-verify
Initial system functionality test	DFW 9 / SOP AC-01	Once following assembly	Field Team Leader/ instrument assembly checklist/ Project Geophysicist	Library match metric ≥ 0.95 for each of the five sets of inverted polarizabilities	CA: make necessary repairs or adjustments and re-verify
Initial IVS background measurement (five background measurements, one centered at the flag and one offset at least 35 cm in each cardinal direction)	DFW 9 / SOP AC-02	Once during initial system IVS test	Field Team Leader/ IVS Technical Memorandum/ Project Geophysicist	All decay amplitudes lower than project threshold (threshold dependent upon soil response)	CA: clear and resurvey or reject/replace BG location
Initial derived polarizabilities accuracy (IVS)	DFW 9 / SOP AC-02	Once during initial system IVS test	Project Geophysicist/ IVS Technical Memorandum/ QC Geophysicist	Library Match metric ≥0.9 for each set of inverted polarizabilities	RCA/CA
Derived target position accuracy (IVS)	DFW 9 / SOP AC-02	Once during initial system IVS test	Project Geophysicist/ IVS Technical Memorandum/ QC Geophysicist	All IVS item fit locations within 0.25 m of ground truth locations	RCA/CA
Ongoing IVS background measurements	DFW 10 / SOP AC-02	Beginning and end of each day as part of IVS testing	Project Geophysicist/ tracking summary/ QC Geophysicist	All decay amplitudes lower than project threshold	RCA/CA CA assumption: rejection of BG measurement (unless RCA indicates system failure)
Ongoing derived polarizabilities precision (IVS)	DFW 10 / SOP AC-02	Beginning and end of each day as part of IVS testing	Project Geophysicist/ tracking summary/ QC Geophysicist	Library Match to initial polarizabilities metric ≥ 0.95 for each set of three inverted polarizabilities	RCA/CA

Table 22A.2 (Continued)
Cued Survey (Instrument: MM 2X2/TEMTADS; Classification Tool: UX-Analyze)

Measurement Quality Objective	DFW/ SOP Reference	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Ongoing derived target position precision (IVS)	DFW 10 / SOP AC-02	Beginning and end of each day as part of IVS testing	Project Geophysicist/ tracking summary/ QC Geophysicist	All IVS items fit locations within 0.25 m of average of derived fit locations	RCA/CA
Initial measurement of production area background locations (five background measurements: one centered at the flag and one offset at least 35 cm in each cardinal direction)	DFW 10 / SOP AC-05	Once per background location	Field Team Leader/ background location report/Project Geophysicist	All decay amplitudes lower than project threshold	CA: reject BG location and find alternate or review project threshold if measured responses seem correct based on varying site conditions
Ongoing production area background measurements	DFW 10 / SOP AC-05	Once per background measurement Background data collected a minimum of every two hours during production	Field Team Leader/ failures noted in field log and tracking summary/ Project Geophysicist	All decay amplitudes lower than project threshold	CA: BG measurement rejected. Earlier/later BG point used if BG measurements are consistent throughout the day; re-collect affected data if varying BG results indicate loss of point is significant
Ongoing production area background measurements		Evaluated for each background measurement	Operator/ tracking summary/ Project Geophysicist	Background point collected within 0.4 m of initial collection location for that point	CA: BG measurement rejected; re-collect affected targets
Ongoing instrument function test		Beginning and end of each day as part of IVS testing	Field Team Leader/tracking summary/Project Geophysicist	Response (mean static spike minus mean static background) within 25% of predicted response for all monostatic Tx/Rx combinations	CA: make necessary repairs and re-verify

Table 22A.2 (Continued)
Cued Survey (Instrument: MM 2X2/TEMTADS; Classification Tool: UX-Analyze)

Measurement Quality Objective	DFW/ SOP Reference	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Transmit current levels		Evaluated for each sensor measurement	Field Team Leader/ tracking summary/ Project Geophysicist	Peak transmit current must be ≥ 5A for lithium ion batteries; ≥ 80% of initial currents measured for lead acid batteries when fully charged	CA: stop data acquisition activities until condition corrected
Orientation Data		Evaluated for each sensor measurement	Field Team Leader/tracking summary /Project Geophysicist	Ensure orientation data are valid: orientation data reviewed for out of range data.	CA: stop data acquisition activities until condition corrected or project team decides on acceptable work around.
Ongoing production area measurements	DFW 10 / SOP AC-06	Evaluated for each dynamic target	Operator/ tracking summary/ Project Geophysicist	Cued measurement collected within 0.4 m of all dynamic targets.	CA: Collect cued measurement directly over dynamic target
Confirm adequate spacing between units	DFW 10 / SOP AC-05	Evaluated at start of each day (or grid)	Field Team Leader/ Field Logbook/ Project Geophysicist	Minimum separation of 25 m	CA: Recollect all coincident measurements
Confirm response is not saturated	DFW 10 / SOP AC-07	Evaluated for each cued measurement	Data analyst/ tracking summary/ Project Geophysicist	Monitor for response clipping (identifiable as consecutive measurements of similar response [flat-line] for individual Tx/Rx pair data, typically above 800 mV/A)	CA: Cued measurements exhibiting saturation will be classified as either TOI, if the data indicates such despite saturation, or “inconclusive” if the data indicates non-TOI.
Confirm inversion model supports classification (1 of 3)	DFW 10 / SOP AC-07	Evaluated for all models derived from a measurement (i.e. single item and multi-item models)	Project Geophysicist/ Measurement QC summary/ QC Geophysicist	Derived model response must fit the observed data with a fit coherence ≥ 0.8	CA: Target classified as inconclusive or recollected unless analyst can justify poor coherence (dynamic target looks like noise, pick on edge of anomaly, etc.)

Table 22A.2 (Continued)
Cued Survey (Instrument: MM 2X2/TEMTADS; Classification Tool: UX-Analyze)

Measurement Quality Objective	DFW/ SOP Reference	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Confirm inversion model supports classification (2 of 3)	DFW 10 / SOP AC-07	Evaluated for each derived target	Project Geophysicist/ Measurement QC summary/ QC Geophysicist	Fit location estimate of item ≤ 0.4 m from center of sensor	CA: Re-shot at location specified by in-field inversion unless fit location is within 0.4 m of another cued target
Confirm inversion model supports classification (3 of 3)	DFW 10 / SOP AC-07	Evaluated once per 100 ft by 100 ft grid for all seeds	QC Geophysicist; lead agency QA Geophysicist/ Measurement Inversion model QC summary/USACE QA Geophysicist	100% of predicted seed positions ≤ 0.15 m from known position (x, y, z)	RCA/CA
Confirm reacquisition GPS precision	DFW 10 / SOP AC-07	Daily	UXO tech or field tech/ Project QC database/ Project Geophysicist	Benchmark positions repeatable to within 10 cm	RCA/CA
Classification Performance	DFW 12 / SOP AC-08	Evaluated once per 100 ft by 100 ft grid for all seeds	QC Geophysicist; USACE QA Geophysicist/ Ranked Dig List/ USACE QA Geophysicist	100% of QC and validation seed items placed on dig list	RCA/CA
Classification Performance	DFW 12 / SOP AC-08	Evaluated once per 100 ft by 100 ft grid for all seeds with predicted sizes based on three usable polarizabilities	QC Geophysicist; USACE QA Geophysicist/ Ranked Dig List/ USACE QA Geophysicist	100% of predicted sizes match seed item ground truth	RCA/CA

Table 22A.3
Intrusive Investigation

Measurement Quality Objective	DFW/ SOP Reference	Frequency	Responsible Person/ Report Method/ Verified by	Acceptance Criteria	Failure Response
Dynamic detection performance (analog surveys)	DFW 6 / SOP 505.01.1	Evaluated by 100 ft by 100 ft grid	UXO Team Leader/ running QC summary/ UXOQCS	All seed items recovered and returned to UXOQCS	RCA/CA
Anomaly Resolution (DGM, non-AC areas)	DFW 14 / SOP 506.01.1	Rate varies depending on lot size.	UXOQCS	90% confidence <1% unresolved anomalies. Accept on zero.	Lot fails. Redo lot.
Confirm derived features match ground truth (1 of 2)	DFW 15 / SOP AC-09	Evaluated for all targets classified as digs based on three usable polarizabilities	Project Geophysicist/Measurement Inversion Model QC Summary or Intrusive database/ QC Geophysicist	100% of fit locations ≤0.25 m from recovered item positions (x, y, z).	RCA/CA
Confirm derived features match ground truth (2 of 2)	DFW 15 / SOP AC-09	Evaluated for all targets classified as digs based on three usable polarizabilities	Project Geophysicist/Dig List and Intrusive database/ Project or QC Geophysicist	100% of predicted size estimates qualitatively match recovered object size(1)	RCA/CA
Verification of TOI/non-TOI threshold	DFW 15 / SOP AC-08	Evaluated once for project. By adding up to 200 digs beyond last TOI to the dig list. (See Appendix L).	Project Geophysicist/ Verification and Validation Report/ QC Geophysicist	100% of predicted non-TOI intrusively investigated are non-TOI	RCA/CA/Adjust threshold
Classification validation	DFW 15 / SOP AC-09	Evaluated once for project By adding up to 200 digs beyond classified as non-TOI to the dig list. (See Appendix L).	Project Geophysicist/ Verification and Validation Report/ QC Geophysicist	100% of predicted non-TOI qualitatively matches predictions (1)	Document in DUA

(1) It is acceptable for items with recovered or predicted size close to the small/medium or medium/large boundaries (e.g. a 37mm projectile, small ISO, large ISO, or 105mm projectile) to be placed in either size category.

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WORKSHEET #22B
FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION FOR MC SAMPLING

This worksheet describes the field equipment needed for MC sampling and the associated calibration, maintenance, testing, and inspection procedures for that field equipment. This worksheet also documents the field equipment's frequency of activity, acceptance criteria, and corrective action requirements. GPS equipment used for MC sampling will be calibrated, maintained, tested, and inspected IAW Table 22A.1, Measurement Quality Objective for Geodetic Equipment Functionality.

☒ Worksheet Not Applicable (State Reason): No additional MC sampling field equipment or instruments require calibration, maintenance, testing, or inspection.

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WORKSHEET #23
ANALYTICAL SOP REFERENCES TABLE

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
L-1	1-P-QM-WI -9029396: Nitroaromatics and Nitramines by Method 8330B in Water and Solids using HPLC with UV Detection, Revision 2; 10/13/2015	Definitive	HPLC/UV	Lancaster	No
P-1	1-P-QM-WI -9015173: Ultrasonic Extraction of Nitroaromatics and Nitramines by Method 8330/8330A/8330B in Solids, Revision 14; 06/23/2016	NA	Preparation method	Lancaster	No
P-2	1-P-QM-PRO-9030806: Sample Preparation of Solid Samples for Extraction and Analysis by SW-846 8330B, Revision 3; 09/08/2016	NA	Preparation method	Lancaster	No

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WORKSHEET #24
ANALYTICAL INSTRUMENT CALIBRATION TABLE

In all cases, the CA required in this worksheet will be the responsibility of the bench analysts and the laboratory Section Manager responsible for each method. Where an instrumental problem cannot be resolved by CA/routine maintenance, the affected instrument must be removed from service. Following necessary repairs, the instrument will be recalibrated and determined to be fully functional before being cleared for return to service.

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria[1]	Corrective Action (CA)	SOP Reference[2]
HPLC/UV	Minimum five-point initial calibration (ICAL) for target analytes for linear or six-point for quadratic; lowest concentration standard at or below the LOQ.	At instrument setup and after initial calibration verification (ICV) or CCV failure, prior to sample analysis.	%RSD of calibration factor for each analyte ≤method-specific maxima linear – $r^2 \geq 0.990$	1) Evaluate system 2) Recalibrate as necessary	L-1
	ICV (must be from a second source)	Immediately following initial calibration	Each target compound %D ≤method-specific maxima	1) Evaluate system 2) Recalibrate as necessary	L-1
	Retention time verification	Update at start of run or daily	All standards within retention time window	1) Correct problem 2) Re-analyze all samples analyzed since the last retention time check	L-1
	CCV	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	Each target compound %D ≤method-specific maxima	1) Evaluate system 2) Clean system 3) Reanalyze affected samples since the last in-control CCV	L-1

1 Method-specific criteria are provided in the method-specific Worksheet #12.
2 Analytical SOP References Table (Worksheet #23).

ICV =

WORKSHEET #25
ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[1]
HPLC/UV	Replace columns, detector flow cell windows and ball-valve cartridges as needed, clean/change filters, check eluent reservoirs	Sensitivity check	Instrument performance and sensitivity	Daily or as needed	CCV pass criteria	Recalibrate	Analyst	L-1

[1] Reference from the Analytical SOP References table (Worksheet #23).

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WORKSHEET #26 & 27
SAMPLE HANDLING, CUSTODY, AND DISPOSAL

This worksheet provides the procedures for handling, labeling, packaging, shipping, and disposal of soil samples collected for MC analysis, to include sample custody requirements. Personnel responsible for these activities are identified in Table 26/27.1.

26/27.1 SAMPLE HANDLING

26/27.1.1 Immediately after each sample has been collected, the following procedures will be used to initially prepare the sample containers for shipment to the laboratory:

1. Seal the container by wrapping tape around the lid or Zip-loc of the container. Use PVC tape on bottles containing samples for inorganic constituent analysis.
2. Place containers in bubble pack.
3. If using glass containers, place all glass containers in a Ziploc-type bag and seal.
4. Use a permanent marker to write the sample ID on the outside of the Zip-loc bag.
5. Line insulated shipping cooler with a large trash bag and place samples into the lined, insulated cooler, and then cool (to 4 ± 2 °C) using wet ice. **Samples will be placed on ice as soon as possible following collection.**
6. Place all samples in designated cooler. Make sure all samples in the cooler are listed on the COC form. See paragraph 26/27.6 below for additional information to be included on the COC form.

26/27.2 SAMPLE LABELING

26/27.2.1 Sample labels will include, at a minimum, project name, project number, sample ID, date/time collected, analysis group or method, preservative, and sampler's name. Labels will be taped to the jar or sample bag prior to sample collection to ensure that they do not separate.

26/27.3 SAMPLE PACKAGING

26/27.3.1 Once all of the samples for the day are collected, the following procedures will be used to complete the sample packaging procedures for shipment to the laboratory:

1. Seal completed COC form in a sealable plastic bag and tape to the inside of the cooler lid.
2. Pour out water from melted ice and replace with double bagged fresh ice.
3. If using bottles, place sample bottles in upright position in such a way they do not touch.
4. Close trash bag and seal with tape.
5. Fill empty spaces in cooler with ice or packaging material.

6. Tape shut cooler drain plug.
7. Securely seal shipping container/cooler with packing tape and custody seals (provided by laboratory).
8. Place "This side up" labels on all four sides of the cooler and "Fragile" labels on two sides of the cooler.
9. Attach a copy of the laboratory's USDA soil permit (Appendix J) to one of the remaining sides of the outside of the cooler, along with the shipping labels required by USDA.
10. Ship container/ cooler to the laboratory via overnight express.

26/27.4 SAMPLE SHIPPING

26/27.4.1 Field samples collected from the project site will be sent to:

Eurofins Lancaster Laboratories, Inc.
Attn: Amek Carter
2425 New Holland Pike
Lancaster, PA 17605-2425
Ph: (717) 556-7252

26/27.5 SAMPLE CUSTODY PROCEDURES

26/27.5.1 Coolers will be shipped to the laboratory via overnight shipping, with the air bill number indicated on the CoC (to relinquish custody).

26/27.5.2 All laboratory sample receipt, internal custody, and sample archiving procedures shall be completed IAW Lancaster SOPs: L-1, P-1, and P-2.

26/27.5.3 Upon receipt, the laboratory will document cooler temperatures IAW laboratory SOPs. Once the cooler has been examined and logged in, the laboratory will contact the HGL Project Chemist and discuss the status of the sample shipment.

26/27.5.4 Upon opening the cooler at the analytical laboratory, the receiving clerk will sign the CoC. Then the sample containers in the cooler will be unpacked and checked against the client's CoC. Any discrepancies noted with the samples will be noted on the CoC upon receipt. The clerk will deliver the CoC (and any other paperwork) to the Laboratory PM for entry into the Laboratory Information Management System (LIMS) and for client notification.

26/27.5.5 The laboratory will send sample login forms to the Parsons data validator to check that the sample IDs and parameters are correct. 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 CoC.

26/27.6 CHAIN-OF-CUSTODY DOCUMENTATION

26/27.6.1 CoC forms 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 CoC will also have the sampler's name and signature. The CoC will link the 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.

126/27.7 SAMPLE DISPOSAL

26/27.7.1 The field samples and all extracts will be stored at the laboratory for 30 days after a final report has been submitted to HGL. The laboratory hazardous waste manager will be responsible for the final sample disposal upon notice from the Contractor Project Chemist.

26/27.8 NON-CONFORMANCE

26/27.8.1 The Laboratory Project Manager will contact the Contractor Project Chemist to resolve any issues encountered during sample receipt and login. The Contractor Project Chemist will coordinate with the Contractor Sampling Lead and other personnel as necessary to resolve the issues.

Table 26/27.1
Responsibilities for Sample Handling, Custody, and Disposal

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference
Sample labeling	Contractor Sampling Team Lead/designee	Para. 26/27.2; WS #18; ENV-01.03
Chain-of-custody form completion	Contractor Sampling Team Lead/designee Lancaster Receiving Supervisor	Para. 26/27.5; Para. 26/27.6
Packaging	Contractor Sampling Team Lead/designee	Para. 26/27.3
Shipping Coordination	Contractor Project Chemist	
Sample Receipt, inspection, log-in	Lancaster Receiving Supervisor	Para. 26/27.4, L-1
Sample custody and storage	Lancaster PM	Para. 26/27.5, L-1
Sample disposal	Lancaster PM	Para. 26/27.7, L-1

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WORKSHEET #28
ANALYTICAL QUALITY CONTROL AND CA

The following tables provide general guidance for the evaluation of QC analyses and the implementation of CAs for out-of-control situations. The method-specific acceptance criteria are presented in the applicable table in Worksheet #12 and Worksheet #15.

WORKSHEET #28.1
METHOD QC TABLE – EXPLOSIVES BY SW-846 METHOD 8330B

QC Element	Frequency	Project-specific Performance Criteria[1]	CA	Person(s) Responsible for CA	DQI
MB	Every analytical batch (maximum of 20 samples)	Target analytes not detected >½ LOQ or >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater)	1) Rerun 2) Evaluate batch 3) Reextract or qualify results as necessary	Section Manager/ Laboratory Analyst	Accuracy/Bias and Representativeness
LCS (and LCSD, if performed)	Every analytical batch (maximum of 20 samples)	Analyte-specific %R and RPD acceptance criteria	1) Rerun 2) Evaluate batch 3) Reextract or qualify results as necessary	Section Manager/ Laboratory Analyst	Accuracy/Bias (and Precision)
MS/MSD	As indicated on CoC forms, and as required for batch control	Analyte-specific %R and RPD acceptance criteria (NA to air methods or if parent sample concentration ≥4x the spike level)	1) Evaluate MS/MSD to assess matrix interference 2) Evaluate batch and qualify results as necessary	Section Manager/ Laboratory Analyst	Accuracy/Bias and Precision
Surrogate Recovery	Every sample	Surrogate-specific %R acceptance criteria	1) Rerun 2) Reextract or qualify results as necessary	Section Manager/ Laboratory Analyst	Accuracy/Bias
Retention time window position	Once per initial calibration and at the beginning of the analytical shift	All peaks associated with positive results must elute within the established retention time window	1) Correct problem 2) Recalibrate instrument 3) Reanalyze results as necessary	Section Manager/ Laboratory Analyst	Analyte Identification
Confirmation column	All positive results must be confirmed	Result not confirmed using second column or detector	1) Analyst must evaluate data to determine if unconfirmed result is a detection 2) Section manager must review analyst's determination	Section Manager/ Laboratory Analyst	Analyte Identification
		Results between primary and second column RPD ≤40%; not required for TPH methods	1) Analyst must select result to report IAW method requirements and laboratory SOP 2) Section manager must review analyst's determination	Section Manager/ Laboratory Analyst	Accuracy/Bias

[1] Method-specific acceptance criteria are presented in the corresponding tables of Worksheets #12 and 15.

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WORKSHEET #29
PROJECT DOCUMENTS AND RECORDS

The following is a list of site records that should be used and maintained for each site investigation and for the project as a whole, as well as the personnel responsible for generating and verifying the records. All records should be maintained in the HGL, Parsons, laboratory, and other subcontractor project files for a minimum of five years.

29.1 PROJECT DOCUMENTS AND RECORDS FOR MEC-RELATED TASKS

29.1.1 All final document files, including reports, figures, and tables, will be submitted in electronic format (both Microsoft Office 2007 or later and portable document format (.pdf)). Any document files, logs, including reports, figures, and tables will be made available to the in-site USACE OESS upon request from the OESS.

29.1.1 Geographic Information System (GIS) Electronic File Management

29.1.1.1 A project-specific GIS will be used to store and manage all relevant geospatial-related data and information. HGL will manage and maintain project data and update the CSM in GIS IAW data item description (DID) WERS-007.01, EM 200-1-2, EM 1110-1-1200, EM 200-1-15 and applicable Interim Guidance Documents. The final GIS deliverable will include all documentation, reports, meeting minutes, databases, etc., created developed or modified under this TO in original and PDF format. GeoSpatial data activities will include the following:

- Maintain and update property GIS data for all landowners within the project boundaries. Property owner privacy will be preserved. Property owner names shall not be disseminated in any documents.
- Perform a pre- and post-project response action geospatial data analysis using a GIS.
- Consolidate all available existing data that is applicable to the project into the GeoDatabase. Analyze the data and relay pertinent information to the PDT. If an existing GIS database is available, it will be provided by the Government. The analyses may detail the fieldwork strategies, areas of concern, survey requirements, environmental concerns, milestones and/or other factors that affect product delivery and future action planning.
- Incorporate layers that overlay on maps of the site that identify physical features, and MPPEH/MD found during the investigation. Examples include: streets, anomalies, MEC positively identified, identifiable MD, sampling location, cultural resources, and environmental, biological, and socio-economic variables.
- Perform civil surveys IAW EM 200-1-15 and DID WERS-007.01.

29.1.2 DGM Electronic File Management

29.1.2.1 DGM data files will be delivered IAW the requirements in DID WERS-004.01 Attachment C. It is expected that all advanced EMI sensor and EM61-MK2 data transfer will be accomplished via ftp site. If the large size of the advanced EMI sensor data files makes the process cumbersome, the data will be transferred on an external hard drive.

29.1.2.2 EM61-MK2 detection data will be split or consolidated into survey units for storage and target selection, although initial QC checks for all data, with the exception of coverage, will be performed by date. Coverage QC will be performed for entire survey units. Raw cued data will be named by target ID, processed cued data will be organized, stored, and QC checked by date. Daily QC files (i.e. IVS, static, and function checks) and advanced EMI sensor background files will be stored in separate databases and folders from the production data, although they will also be named and organized by date in their respective folders.

29.1.2.3 Parsons and HGL geophysicists will use the latest version of UX-Analyze for processing and interpreting advanced EMI sensor and EM61-MK2 data. TOI libraries used for classification will be developed using the library provided with UX-Analyze, data collected during previous projects, and data collected as part of ESTCP's ongoing library expansion project (MR-201424). The TOI libraries will be included in advanced EMI sensor data deliverables to document what library was used for classification.

Table 29.1
Project Documents and Records for MEC-Related Tasks

Document/Record	Purpose	Primary Generator (1)	Completion/ Update Frequency	Format/Storage Location/Archival	Delivery/Availability
UXOSO Logbook	Record all important events	HGL UXOSO	Daily	Hard Copy/Onsite during fieldwork, then Project File/HGL Huntsville Office	Available to USACE on request
Surface Clearance Memorandum	Records completion of surface clearance for geophysical activities	HGL UXOQCS	Once	.DOCX or .PDF/Project File/HGL Huntsville Office	Available to USACE on request
QC Seed Plan	Describes intended seed types and locations for QC seeds to be placed	HGL QC Geophysicist	Once, prior to seeding	.DOCX/Onsite during seeding and in secure folder on HGL network (limited to QC personnel)/HGL-Denver Office	Via e-mail
QC Seed Firewall Plan	Describes methods used to limit QC seed information to Parsons QC personnel	HGL QC Geophysicist	Once, prior to seeding	.DOCX/Project HGL-Denver Office	Via e-mail and with Final QAPP (Appendix O)

Table 29.1 (Continued)
Project Documents and Records for MEC-Related Tasks

Document/Record	Purpose	Primary Generator [1]	Completion/ Update Frequency	Format/Storage Location/Archival	Delivery/Availability
Daily Status Reports	Report notable events to project team	HGL SUXOS	Daily	.DOCX or .PDF/Project File/HGL Huntsville Office	Via e-mail, and included with Site Specific Final Reports
Daily Biologist Survey Reports	Report notable Environmental Survey and Beach Monitoring events to project team	Project Biologist	Daily	.DOCX or .PDF/Project File/HGL Huntsville Office	Via e-mail, and included with Site Specific Final Reports
Daily QC Report	Report QC events to project team	HGL UXOQCS	Daily, when QC events occur	.DOCX or .PDF/Onsite during fieldwork, then Project File/ HGL Huntsville Office	Via e-mail, and included with Site Specific Final Reports
Weekly Geophysical QC Report	Report of DGM QC results	Parsons Project Geophysicist/ HGL QC Geophysicist	Weekly	.DOCX/Project File/ HGL Huntsville Office	Via e-mail
Team Leader Logbook(s)	Record important team-specific events	HGH Team - Team Leader(s)	Daily	Hard Copy/Onsite during fieldwork, then Project File/ HGL Huntsville Office	Available on request
Field Change Request Form	Record non-critical (i.e., minor) deviations from the QAPP (*"non-critical" deviations are defined as those that will not impact project objectives*)	HGL SUXOS	As needed	.DOCX or .PDF/Project File/ HGL Huntsville Office	Via e-mail, and included with SSFR

Table 29.1 (Continued)
Project Documents and Records for MEC-Related Tasks

Document/Record	Purpose	Primary Generator (1)	Completion/ Update Frequency	Format/Storage Location/Archival	Delivery/Availability
Root Cause Analysis	Document MPC failures and causes, as well as corrective actions taken, actions taken to prevent recurrence, and actions taken to monitor effectiveness of corrective action	HGL UXOQCS / QC Geophysicist	If MPC failures are noted	.DOCX or .PDF/Project File/ HGL Huntsville Office	Via e-mail, and included with DUA and SSFR
Photograph Log	Documents all photographs taken and video recorded to document work and/or site conditions, and to record MEC items recovered	HGL SUXOS	As needed	.JPG/Onsite during fieldwork, then Project File/ HGL Huntsville Office	Available on request
Production Area QC Seeding Report	Documents seed types, depths, locations, and orientations	HGL Seed Team Lead	Once, following completion of seeding	.DOCX and .XLSX or .ACCDB/ QC seed information stored in secure folder on HGL's network (limited to QC personnel)/HGL Denver Office	Via email
Grid Sheets	Documents the progress of the surface clearance	HGL SUXOS	Once following completion of surface clearance	Hard Copy or .PDF/Project File/Geophysical Database/HGL Huntsville Office	Upon request
IVS Technical Memorandum	Documents the results of the initial IVS tests	HGL Team - Project Geophysicist	Once, following initial IVS test (EM61-MK2 and advanced EMI sensor)	.DOCX/Project File/HGL Huntsville Office	Via e-mail
SOP Checklists	Document completion of SOPs	As noted on SOP Checklists	As required by SOP	.DOCX or .PDF/Onsite during fieldwork, then Project File/ HGL Huntsville Office	Via e-mail with associated data

Table 29.1 (Continued)
Project Documents and Records for MEC-Related Tasks

Document/Record	Purpose	Primary Generator [(1)]	Completion/ Update Frequency	Format/Storage Location/Archival	Delivery/Availability
Seed Tracking Log	Document seed placement and record recovery	HGL UXOQCS and QC Geophysicist	As seeds are detected/recovered	.Geosoft database or .XLSX /QC Geophysicist's PC/HGL Huntsville Office	Via e-mail/Available on request
DUAs	Document the results of the detection and cued classification surveys and intrusive investigation with regard to DQOs	Parsons Project Geophysicist	Once after acceptance of cued target list for each grid once after acceptance of final ranked dig list for each grid, and once after intrusive investigation	.DOCX/Project File/HGL Huntsville Office	Via e-mail, included with SSFR
Target Selection Technical Memorandum	Describe the process to be used to select targets in the advanced EMI sensor and EM61-MK2 detection data	Parsons Project Geophysicist	Once, 5 days after the start of detection data collection	.DOCX/Project File/HGL Huntsville Office	Via e-mail, included with SSFR
Final Ranked Dig List	List locations and characteristics of DGM anomalies selected for intrusive investigation; list locations, characteristics, and classification decisions for cued survey targets and order by likelihood of being TOI	Parsons Project Geophysicist	After cued data analysis and classification; before intrusive investigation of DGM anomalies	.GDB and .ACCDB/Onsite during fieldwork, and Project File/Geophysical Database/HGL Huntsville Office	Via ftp site during project; included with SSFR
Reacquisition Results	Record location and pre-excavation response of reacquired DGM anomalies	Parsons Reacquisition Team Leader(s)	During reacquisition of DGM anomalies	.ACCDB/Onsite during fieldwork, and Project File/Geophysical Database/HGL Huntsville Office	Via ftp site during project; included with SSFR

Table 29.1 (Continued)
Project Documents and Records for MEC-Related Tasks

Document/Record	Purpose	Primary Generator [1]	Completion/ Update Frequency	Format/Storage Location/Archival	Delivery/Availability
Intrusive Investigation Results	Record results of intrusive investigation, including DGM anomaly source description, characteristics, and coordinates	HGL Intrusive Team Leader(s)	During intrusive investigation of DGM anomalies	Hard Copy/Onsite during fieldwork, and Project File/Geophysical Database/HGL Huntsville Office	PDF and data included with SSFR
Analog Clearance Grid Sheets	Document the completion of analog removal (surface or subsurface) and record the results of the removal.	HGL Intrusive Team Leader(s)	At least daily during analog removal activities	Hard Copy/Onsite during fieldwork/Geophysical Database/ HGL Huntsville Office	PDF and data included with SSFR
Analog QC data	Documents QC metrics for analog surveys	HGL QC Geophysicist	At least weekly during DGM collection	.ACCDB, .gdb, or .pdf/Project File/Geophysical Database/HGL Denver Office	Via ftp site during project; included with SSFR; available on request
Anomaly Resolution Results	Record results of anomaly resolution QC checks	HGL Intrusive Team Leader(s)	During anomaly resolution QC checks	Hard Copy/Onsite during fieldwork, and Project File/ Geophysical Database/HGL Huntsville Office	PDF and data included with SSFR
DGM Data Deliverable	Document the results of geophysical surveys	Parsons Project Geophysicist	Weekly during DGM data collection	.TEM, MaglogNT, or .CSV (raw data); .GDB, .XYZ, and .MAP (processed data)/Geophysical Database/Project File/HGL Huntsville Office	Via ftp site or external hard drive during project; included with SSFR
DGM QC Deliverable	Documents QC metrics for geophysical surveys	HGL QC Geophysicist	At least weekly during DGM collection	.ACCDB, .gdb, or .pdf/Project File/Geophysical Database/HGL Denver Office	Via ftp site during project; included with SSFR; available on request

Table 29.1 (Continued)
Project Documents and Records for MEC-Related Tasks

Document/Record	Purpose	Primary Generator [(1)]	Completion/ Update Frequency	Format/Storage Location/Archival	Delivery/Availability
Supporting Classification Images	Summarize modeling and library match information for each cued target	Parsons Project Geophysicist	Weekly during DGM data collection	Project File Geophysical Database/HGL Huntsville Office	Via ftp site or external hard drive during project; included with SSFR
DD Form 1348-1A	Certify MPPEH as MDAS; maintain CoC for MDAS	HGL SUXOS	As required for batches of MPPEH	Hardcopy or .PDF/Onsite during fieldwork, and Project File/Parsons-Denver Office	Included with SSFR
Explosives Disposition	To document the material destroyed	HGL SUXOS	Each demolition operation	Hardcopy/Onsite during fieldwork, and Project File/HGL Huntsville Office	Included with SSFR
MDAS disposal documentation	To certify that MDAS has been disposed of IAW project requirements	Disposal Contractor	After each shipment of MDAS off site	.PDF/Project File/Geophysical Database/HGL Huntsville Office	Included with SSFR
Magazine Data Card	To record additions to or withdrawals from the inventory of donor explosives	HGL SUXOS	Each time donor explosives are placed into or removed from magazine	Hardcopy/Onsite during fieldwork, and Project File/HGL Huntsville Office	Included with SSFR
SSFR	To document the completion of the removal action and describe the process	HGL Project Manager	Once after completion of field work and final DUA Report	.PDF/Project File/HGL Huntsville Office	Hardcopy and electronic files

[1] The primary generator may designate another qualified individual to prepare the document or record; however, the primary generator is responsible for assuring the quality and accuracy of that document/record, and providing the preparer's signature when appropriate.

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29.2 PROJECT DOCUMENTS AND RECORDS FOR MC-RELATED TASKS

The following is a list of the kinds of site records that will be used and maintained for MC-related tasks, as well as the personnel responsible for generating and verifying each record. All records will be maintained in the Parsons, HGL, laboratory, and other subcontractor (such as construction, design, or data validation firms) project files for a minimum of 5 years. Electronic files will be maintained on a limited-access password-protected SharePoint site; hardcopy files will be maintained in the project file system at the applicable office location. Hardcopy documents generated or used on site will be maintained at the site office for the duration of site activities before transfer to the office filing location.

Record	Generation	Verification
Sample Collection Documents and Records		
Field notes (bound logbook)	Field staff	FTL
Sample documentation forms	Field staff	FTL
Tailgate safety meeting forms	UXOSO	Corporate H&S Officer
Daily QC reports	UXOQCS/FTL	PM
CoC records	Field staff	FTL
Air bills	Field staff	FTL
Custody seals	Field staff	FTL
CA forms	PM	Program QA Manager
Photographs	Field staff	PM
Geographic Information System data	Field staff	Database Manager
On-site Analysis Documents and Records		
Equipment calibration logs	Field Staff	UXOQCS/FTL
Equipment maintenance, testing, and inspection logs	Field Staff	UXOQCS/FTL
Equipment calibration logs	Field Staff	UXOQCS/FTL
Field sampling data sheets	Field Staff	UXOQCS/FTL
Field-generated data	Field Staff	UXOQCS/FTL
Waste disposal records	SUXOS/FTL	PM
Off-site Analysis Documents and Records (performed by laboratory personnel unless otherwise indicated)		
Sample receipt, custody, and tracking records	Sample Receipt Staff	Laboratory PM
Standard traceability logs	Analytical Staff	Section Manager/QA Manager
Equipment calibration logs	Analytical Staff	Section Manager/QA Manager
Sample preparation logs	Analytical Staff	Section Manager/QA Manager
Analytical run logs	Analytical Staff	Section Manager/QA Manager
Equipment maintenance, testing, and inspection logs	Analytical Staff	Section Manager/QA Manager
Analytical discrepancy forms	Analytical Staff	Section Manager/QA Manager

WORKSHEET #29 (CONTINUED)
PROJECT DOCUMENTS AND RECORDS

Record	Generation	Verification
Reported analytical results	Analytical Staff	Section Manager/QA Manager
Reported results for standards, QC checks, and QC samples	Analytical Staff	Section Manager/QA Manager
Data package completeness checklists	Analytical Staff/Section Manager	Laboratory PM/QA Manager
Sample disposal records	Assigned Laboratory Staff	Laboratory Operations Manager/QA Manager
Extraction and cleanup records	Analytical Staff	Section Manager/QA Manager
Raw data (stored electronically)	Analytical Staff	Laboratory Database Manager/QA Manager
Electronic database deliverables (EDDs)	Laboratory Database Manager	Database Manager (HGL)
Telephone logs, emails, faxes, and correspondence	Laboratory PM	Laboratory Operations Manager
Data Assessment Documents and Records		
Data validation reports	Data Validator	Data Validation PM/Project Chemist
Automated data review reports	Data Validator	Data Validation PM/Project Chemist
Database QC spreadsheets	Project Staff	Database Manager
DUAs	Project Chemist	PM
Quality Assurance Documents and Records		
Readiness reviews	PM	UXOQCS/ Program QA Manager
Management reviews (minor nonconformance)	PM	Program QA Manager
Management reviews (major nonconformance)	Program Manager	Program QA Manager
Field sampling audits	Audit Lead	Program QA Manager
Deliverables		
Project planning documents, including QAPP, Work Plan, Project Management Plan, Site Safety and Health Plan, Community Relations Plan, QA Surveillance Plan	PM	Program QA Manager
Project deliverables	PM	Program QA Manager
Telephone logs, emails, faxes, and correspondence	All project staff	PM
Permits	SUXOS/FTL	PM
Site maps	Graphics Staff	PM
Design documents	Design Staff	PM
EDDs	Project Database Staff	Database Manager

WORKSHEETS #31A, #32A, AND #33A
ASSESSMENTS AND CORRECTIVE ACTION FOR MEC-RELATED TASKS

Assessments:

This table provides information on the required periodic assessments for MEC-related tasks that will be performed during the course of the project to ensure the planned project activities are implemented IAW this UFP-QAPP. The type, frequency, and responsible parties of planned assessment activities to be performed for the project are summarized in the table below.

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Actions	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions
Fieldwork Readiness Review	Once before mobilization	Internal	HGL	HGL Program Manager	HGL Project Manager	HGL Project Manager	HGL Program Manager
Health and Safety Assessment	Once during field activities	Internal	HGL	HGL Project Health and Safety (H&S) Manager, or designee	HGL UXOSO	HGL UXOSO	HGL Project H&S Manager and SUXOS
Site Preparation Assessment	Following completion of brush cutting, if required, and grid placement	Internal	HGL	Parsons Project Geophysicist (grid locations) and Site Geophysicist (adequacy of brush clearing)	HGL SUXOS	HGL SUXOS	Parsons Site Geophysicist
Surface Clearance Assessment	Following completion of surface clearance	Internal	HGL	HGL SUXOS	HGL SUXOS	HGL SUXOS	HGL SUXOS
Seeding Assessment	Following completion of seeding	Both	HGL / USACE	HGL QC Geophysicist and USACE Geophysicist	HGL Seed Team Lead	HGL Seed Team Lead	HGL QC Geophysicist and USACE Geophysicist
DGM Data Deliverable Assessment	Weekly	Internal	HGL	HGL QC Geophysicist	Parsons Project Geophysicist	Parsons Project Geophysicist	HGL QC Geophysicist
Classification Assessment	Once prior to submittal of ranked dig list	Internal	HGL	HGLQC Geophysicist	Parsons Project Geophysicist	Parsons Project Geophysicist	HGL QC Geophysicist

WORKSHEETS #31A, #32A, AND #33A (CONTINUED)
ASSESSMENTS AND CORRECTIVE ACTION FOR MEC-RELATED TASKS

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Actions	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions
Analog Removal Assessment	Per grid	Internal	HGL	HGL QC Geophysicist	HGL SUXOS	HGL SUXOS	HGL QC Geophysicist
Anomaly Resolution Assessment	Per grid	Internal	HGL	HGL UXOQCS	Parsons SUXOS	HGL SUXOS	Parsons UXOQCS
Intrusive Results Assessment	Weekly	Internal	HGL	Parsons QC or Project Geophysicist	Parsons SUXOS	HGL SUXOS	Parsons QC or Project Geophysicist
MPPEH/ Explosives Records Assessment	Once prior to demobiliza tion	Internal	HGL	HGL UXOQCS	HGL SUXOS	HGL SUXOS	HGL UXOQCS
Review Geospatial Data	For each GIS data submittal	External (see QA Surveillance Plan [QASP])	USACE	Applicable USACE PDT Members	HGL GIS Manager	HGL GIS Manager	HGL PM
Field Activities	See QASP	External (see QASP)	USACE	Applicable USACE PDT Members	HGL PM and relevant personnel	SUXOS and other relevant personnel	HGL UXOQCS and QC Geophysicist
Geophysical Surveys	See QASP	External (see QASP)	USACE	USACE Project Geophysicist	HGL PM and Parsons Project Geophysicist	Parsons Project Geophysicist	HGL QC Geophysicist
Review SSFR	For each submittal	External (see QASP)	USACE	Applicable USACE PDT Members	HGL PM	HGL PM and relevant personnel	HGL PM

WORKSHEETS #31A, #32A, AND #33A (CONTINUED)
ASSESSMENTS AND CORRECTIVE ACTION FOR MEC-RELATED TASKS

Corrective Action:

Based on the findings of project assessments above, corrective action may be required. A "corrective action" is defined as an action taken by a project to eliminate the cause(s) of nonconformity in order to prevent recurrence. For assessment findings that require corrective action, deficiencies will be documented and communicated to the appropriate project personnel. Corrective action will then be implemented and a follow-up assessment will be performed to verify the results of the corrective action. Procedures for handling UFP-QAPP deviations during each type of assessment are summarized in the table below.

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Time Frame of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Time Frame for Response
Fieldwork Readiness Review	Internal e-mail	HGL Project Manager	3-5 business days	Internal e-mail	HGL Program Manager	3–5 business days
Preparatory, initial, and follow-up inspections	Internal e-mail	HGL Project Manager HGL SUXOS	1-3 business days	Follow-up inspection	HGL Project Manager HGL SUXOS	24 hours after notification
Health and Safety Assessment	Written assessment report	HGL SUXOS, HGL PM, UXOSO	3-5 business days	Letter or memo	HGL Project H&S Manager	24 hours after notification
QAPP Compliance and MEC Operations Assessment	Written assessment report	HGL PM, HGL SUXOS, HGL SUXOS, and HGL UXOQCS	3-5 business days	Letter or memo	HGL MEC Operations Manager and HGL QC Manager	3–5 business days
Site Preparation Assessment	Internal e-mail	HGL SUXOS	1-3 business days	Internal e-mail	Parsons Site Geophysicist and Project Geophysicist	24 hours after notification
Surface Clearance Assessment	Internal e-mail	HGL SUXOS	24 hours	Internal e-mail	HGL SUXOS	24 hours after notification
Seeding Assessment	E-mail	HGL Seed Team Lead	24 hours	E-mail and/or RCA	HGL QC Geophysicist and USACE Geophysicist	24 hours after notification
DGM Data Deliverable Assessment	Internal e-mail, SOP checklist(s) noting deficiency	Parsons Site Geophysicist and Project Geophysicist	1-5 business days	Internal e-mail and/or RCA	HGL QC Geophysicist	24 hours after notification

WORKSHEETS #31A, #32A, AND #33A (CONTINUED)
ASSESSMENTS AND CORRECTIVE ACTION FOR MEC-RELATED TASKS

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Time Frame of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Time Frame for Response
Classification Assessment	Internal e-mail	Parsons Project Geophysicist	1-2 business days	Internal e-mail and/or RCA	HGL QC Geophysicist	1-2 business days
Analog Removal Assessment	Internal e-mail	HGL SUXOS	1-2 business days	Internal e-mail and/or RCA	HGL QC Geophysicist	1-2 business days
Anomaly Resolution Assessment	Internal e-mail	HGL SUXOS	24 hours	Internal e-mail and/or RCA	HGL UXOQCS	24 hours
Intrusive Results Assessment	Internal e-mail	HGL SUXOS	1-5 business days	Internal e-mail and/or RCA	HGL QC or Parsons Project Geophysicist	1-2 business days
MPPEH/Explosive Records Assessment	Internal e-mail	HGL SUXOS	24 hours	Internal e-mail	HGL UXOQCS	24 hours
Review Geospatial Data	Electronic Submittal QA Form, Geospatial QA Form	HGL PM and HGL GIS Manager	14 calendar days	E-mail or appropriate QA Form with responses	Lead Organization and Design Center PMs	10 business days
Field Activities	Corrective Action Requests, Geophysical QA Forms, QAR, HNC-948, Memorandum for Record	HGL PM and SUXOS (*and other technical personnel if appropriate*)	1-5 business days (immediately if serious deficiency)	E-mail or appropriate QA Form with responses	Lead Organization and Design Center PMs	1-2 business days
Geophysical Surveys	Corrective Action Requests, Geophysical QA Forms	HGL PM and Parsons Project Geophysicist	1-5 business days (immediately if serious deficiency)	E-mail or appropriate QA Form with responses	Lead Organization and Design Center PMs, and USACE Project Geophysicist	1-2 business days
Review SSFR	CEHNC Form 7, KO Transmittal Memo	HGL PM	14 calendar days	CEHNC Form 7 with completed responses	Lead Organization and Design Center PMs	10 business days

WORKSHEETS #31B, #32B, AND #33B
ASSESSMENTS AND CORRECTIVE ACTION FOR MC SAMPLING

Assessments:

Assessment Type	Responsible Personnel and Organization	Number and Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Review of QAPP, SOPs, and Site Safety and Health Plan with Field Staff	HGL SUXOS/FTL	Prior to sampling startup and with all new field staff prior to assignment	October 2016	Completed acknowledgement signature pages	48 hours following assessment
Work performed IAW programmatic and site-specific QAPP.	HGL UXOQCS/FTL	Ongoing during all phases of field work	November 2016-March 2017	Daily progress reports	24 hours following conclusion of business day
Logbook and Field Forms Review	HGL UXOQCS/FTL	Daily	November 2016-March 2017	NA; corrections will be made directly to reviewed documents	24 hours following assessment
Laboratory Assessment for Appropriate Certifications, Capacity, and QAPP Review with Staff	HGL Project Chemist	Prior to sampling mobilization, as new laboratories are contracted	December 2016	Receipt of copies of certifications. Email traffic concerning lab capacity prior to sampling startup. QAPP sign-off sheet received from laboratory.	48 hours following assessment
General Site Safety Meeting	HGL UXOSO	Daily	November 2016-March 2017	Verbal debriefing and daily sign-off log; a Supervisor Injury Employee Report, if a safety incident occurs.	Weekly; any safety incidents will be reported to the PM and Corporate H&S Officer immediately
Tailgate Safety Meeting	HGL UXOSO	Daily	November 2016-March 2017	Team-oriented briefing for the day’s specific operation and peculiar safety issues for that operation.	Weekly; any safety incidents will be reported to the PM and Corporate H&S Officer immediately
Field Sampling and CoC Form Review Against QAPP Requirements	HGL Sample Coordinator	Daily	November 2016-March 2017	Corrections will be made directly to reviewed documents; communication may be in the form of email	24 hours following assessment

WORKSHEETS #31B, #32B, AND #33B (CONTINUED)
ASSESSMENTS AND CORRECTIVE ACTION FOR MC SAMPLING

Assessments (Continued):

Assessment Type	Responsible Personnel and Organization	Number and Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Data Validation	HGL Project Chemist	Per Sample Delivery Group	March 2017	Communication may be in the form of email traffic clarification of the analytical report or CAs due to deficiencies identified in the validation process.	24 hours following assessment
Laboratory Report Deliverables and Analytical Results Against QAPP Requirements	HGL Project Chemist	As discrepancies are identified in the validation process	March 2017	Memorandum or email to PM and Project Chemist	72 hours following assessment

Assessment Response and CA:

Assessment Type	Individual(s) Notified of Findings	Assessment Response Documentation	Time Frame for Response	Responsibility for Implementing CA	Responsibility for Monitoring CA
Review of QAPP, SOPs, and Site Safety and Health Plan with Field Staff	HGL SUXOS/UXOSO/FTL	Completed acknowledgement signature pages	48 hours following assessment	HGL FTL	HGL FTL
Work performed IAW programmatic and site-specific QAPP	HGL SUXOS/PM	Interim CA documented pending final approval	By close of same business day	HGL FTL	HGL PM and QA Officer
Logbook and Field Form Review	HGL SUXOS/FTL	Corrections will be made directly to reviewed documents	NA	HGL FTL	HGL SUXPOS/FTL
Laboratory Assessment for Appropriate Certifications, Capacity, and QAPP Review with Staff	HGL Project Chemist	Response to email or memorandum	48 hours after notification	Laboratory PM	HGL Project Chemist
Tailgate Safety Meeting	HGL UXOSO	Included as part of the process of the Supervisor Injury Employee Report	24 hours after notification	HGL PM	HGL Corporate H&S Manager
Field Sampling and CoC Form Review Against QAPP Requirements	HGL Sample Coordinator	Response to email	48 hours after notification	HGL FTL	HGL FTL

WORKSHEETS #31B, #32B, AND #33BW (CONTINUED)
ASSESSMENTS AND CORRECTIVE ACTION FOR MC SAMPLING

Assessment Response and CA (Continued):

Assessment Type	Individual(s) Notified of Findings	Assessment Response Documentation	Time Frame for Response	Responsibility for Implementing CA	Responsibility for Monitoring CA
Data Validation	HGL Project Chemist	If required, laboratory reports will be amended and corrections noted in the analytical narrative and contained with the validation report.	1 business week	Data Validation PM	HGL Project Chemist
Laboratory Report Deliverables and Analytical Results Against QAPP Requirements	HGL Project Chemist	If required laboratory reports will be amended and corrections noted in the analytical narrative.	72 hours after notification	Laboratory PM	Laboratory QA Officer HGL Project Chemist

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WORKSHEET #34
DATA VERIFICATION AND VALIDATION INPUTS

This worksheet lists the inputs that will be used during data verification and validation. Inputs include planning documents, field records, and laboratory records. Data verification is a check that all specified activities involved in collecting and analyzing samples have been completed and documented and that the necessary records (objective evidence) are available to proceed to data validation. Data validation is the evaluation of conformance to stated requirements, including those in the contract, methods, SOPs, and the QAPP.

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
4	Field SOPs	X	
5	Laboratory SOPs	X	
Field Records			
6	Field logbooks	X	X
7	Equipment calibration records	X	X
8	CoC forms (SOP 504.01.1)	X	X
9	Sampling diagrams/surveys	X	X
10	**Intrusive MEC Field Records**		
10a	Dig Sheets	X	X
10b	Team Leader Grid Sheet	X	
10c	Grid Drawing Sheet	X	
10e	DD Form 1348-1A	X	X
10f	Demolition Summary Sheet	X	X
10g	MDAS disposal documentation	X	X
10h	Explosives Usage Record	X	X
10i	Magazine Data Card	X	X
10j	Demolition Shot Record	X	X
10k	Intrusive Results	X	X
11	**Geophysics Field Records**		
11a	Weekly Geophysical QC Report	X	X
11b	Production Area QC Seeding Report or QC Seed Tracking Log (SOP DGM-02)	X	X
11c	Field logbooks	X	X
11d	Sensor Function Test Results (Detection Survey)	X	X
11e	IVS Construction Records	X	X
11f	Instrument Assembly Checklist (Cued Survey) (SOP AC-01)	X	X
11g	Sensor Function Test Results (Cued Survey)	X	X
11h	Preparatory Background Data Checklist (SOP AC-05)	X	X
11i	Initial Background Data Checklist (SOP AC-05)	X	X
11j	Recovered Object Verification Checklist (SOP AC-08)	X	X
11k	Classification Process Validation Checklist (SOP AC-09)	X	X
12	Relevant correspondence	X	X
13	Change orders/deviations	X	X
14	Field audit reports	X	X
15	Field CA reports	X	X

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Geophysics Electronic Data			
16	Raw data files	**X**	**X**
17	Converted data files	**X**	**X**
18	Data Processing Log (Detection Survey)	**X**	
19	Target List	**X**	**X**
20	Final Data Archive (for each delivered area subset)	**X**	**X**
21	Cued Measurement Data (Target Measurement Data, Background Measurement Data, and Target Features Database)	**X**	**X**
22	Classification Images (pdf/png files)	**X**	
Analytical Data Package			
23	Cover sheet (laboratory identifying information)	**X**	**X**
24	Case narrative	**X**	**X**
25	Internal laboratory CoC	**X**	**X**
26	Sample receipt records	**X**	**X**
27	Sample chronology (e.g., dates and times of receipt, preparation, and analysis)	**X**	**X**
28	Communication records	**X**	**X**
29	Project-specific PT sample results	**X**	**X**
30	LOD/LOQ establishment and verification	**X**	**X**
31	Standards Traceability	**X**	**X**
32	Instrument calibration records	**X**	**X**
33	Definition of laboratory qualifiers	**X**	**X**
34	Results reporting forms	**X**	**X**
35	QC sample results	**X**	**X**
36	CA reports	**X**	**X**
37	Raw data	**X**	**X**
38	Electronic data deliverable	**X**	**X**

WORKSHEET #35A
DATA VERIFICATION PROCEDURES FOR MEC-RELATED TASKS

"Verification" is a completeness check that is performed before the data review process is conducted to determine whether the required information is available for validation. It involves a review of all data inputs to ensure that they are present. This step of the data review process answers whether or not the required data inputs are present. "Validation" is performed to identify and qualify data that do not meet the MPCs specified on WS #12A. Data requiring validation are summarized on WS #34A. The information in these tables shows what data inputs are required for data validation as well as the processes used to conduct the validation.

Activity and Records Reviewed	Requirements/ Specifications	Process Description/Frequency	Responsible Person	Documentation
General MEC Field Documentation	QAPP	Verification only; confirm documentation is complete for each day of field activities and any required signatures are present.	UXOQCS	UXOQCS Daily QC Report
			SUXOS	Daily Status Reports
			SUXOS	Team Leader Logbook(s)
			SUXOS	Field Change Request Form
			UXOQCS/Parsons Project Geophysicist	Root Cause Analysis
			UXOQCS	Photographic Log
		Verification; confirm documentation is complete for each day of field activities and any required signatures are present. Validation; Ensure the results of all relevant MPCs are attained and correctly documented in the deliverable.	UXOQCS	Daily QC Report
			UXOQCS	Surface Clearance Seeding QC Tracking Log
			UXOQCS	Analog Removal Seeding QC Tracking Log
General Geophysics Documentation	QAPP	Verification only; confirm documentation is complete for each day of field activities and any required signatures are present.	Parsons Project Geophysicist	Field logbooks
		Verification; confirm Weekly Geophysical QC Reports on file cover entire duration of field effort. Validation; ensure the results of all relevant MQOs are attained and correctly documented in the deliverable.	Parsons Project Geophysicist (verification) / HGL QC Geophysicist (validation)	Weekly Geophysical QC Report Final Data Archive (for each delivered survey unit)
Detection Survey – IVS	QAPP; SOP DGM-01; SOP AC-02	Verification; confirm documentation is complete, including dates and applicable signatures. Validation; Initial IVS surveys have been conducted according to SOPs DGM-01 and AC-02. All specifications have been achieved, or exceptions noted. If appropriate, corrective actions have been completed.	HGL QC Geophysicist	IVS Technical Memorandum
Detection Survey - Seeding	QAPP; SOP DGM-02	Verification; confirm documentation is complete, including dates and applicable signatures. Validation; Seeding has been conducted according to SOP. DGM-02 and the QC Seed Plan. All specifications have been achieved, or exceptions noted. If appropriate, corrective actions have been completed.	HGL QC Geophysicist	Production Area QC Seeding Report or QC Seed Tracking Log
			Seed Team Lead	Production Area Seeding QC Checklist

WORKSHEET #35A (CONTINUED)
DATA VERIFICATION PROCEDURES FOR MEC-RELATED TASKS

Activity and Records Reviewed	Requirements/ Specifications	Process Description/Frequency	Responsible Person	Documentation
Detection Data Collection	QAPP; SOP DGM-03	Verification only; confirm documentation is complete for all processing steps.	Parsons Project Geophysicist	Weekly Geophysical QC Report
		Verification; confirm documentation is complete, including dates and applicable signatures. Validation; MQOs have been achieved, with any exceptions noted. If appropriate, corrective actions have been completed.	Parsons Project Geophysicist	DGM Data
Detection Data Processing	QAPP; SOP DGM-04	Verification; confirm documentation is complete, including dates and applicable signatures. Validation; Sensor Function Test Results meet project MQOs and processing has completed according to SOP DGM-04 and SOP AC-04, as appropriate. MQOs have been achieved, with any exceptions noted. If appropriate, corrective actions have been completed.	Parsons Project Geophysicist	Sensor Function Test Results (Detection Survey)
Cued Survey - IVS	QAPP; SOP AC-01; SOP AC-02	Verification; confirm documentation is complete, including dates and applicable signatures. Validation; Initial IVS Survey has been conducted according to SOP AC-02. All specifications have been achieved, or exceptions noted. If appropriate, corrective actions have been completed.	Parsons Project Geophysicist	Instrument Assembly Checklist (Cued Survey)
Cued Data Collection	QAPP; SOP AC-05; SOP AC-06	Verification; confirm documentation is complete, including dates and applicable signatures. Validation; Instrument Assembly and data collection have completed according to SOPs AC-05 and AC-06, as appropriate. Sensor Function Test Results meet project MQOs with any exceptions noted. If appropriate, corrective actions have been completed.	Parsons Project Geophysicist	Weekly Geophysical QC Report Cued Measurement Data (Target Measurement Data, Background Measurement Data, and Target Features Database)
Cued Data Processing	QAPP; SOP AC-07	Verification; confirm documentation is complete, including dates and applicable signatures. Validation; cued data processing has been completed according to SOP AC-07. MQOs have been achieved, with any exceptions noted. If appropriate, corrective actions have been completed.	Parsons Project Geophysicist	Processed Cued Databases

WORKSHEET #35A (CONTINUED)
DATA VERIFICATION PROCEDURES FOR MEC-RELATED TASKS

Activity and Records Reviewed	Requirements/ Specifications	Process Description/Frequency	Responsible Person	Documentation
Classification	QAPP; SOP AC-07	Verification only; confirm documentation is complete for each cued anomaly. Verification; confirm documentation is complete, including dates and applicable signatures.	Parsons Project Geophysicist	Classification Images (pdf/png files)
		Validation; classification has been completed according to SOP AC-07. MQOs have been achieved, with any exceptions noted. If appropriate, corrective actions have been completed.	HGL QC Geophysicist	QC Seed Tracking Log
Intrusive	QAPP; SOP 505.01.1 and 506.01.1	Verification; Confirm that Intrusive Results are on file listing items recovered from all investigated anomalies Validation; Ensure dig sheet data are complete and adequately describe the reacquisition results and dig results, including the correct item type, MEC type, nomenclature, description, quantity, and post dig response, for all listed items; ensure that items “left in place” are clearly noted and described; ensure that anomalies not investigated are clearly noted and explained.	UXOQCS/Parsons Project Geophysicist	Intrusive Results
Surface Clearance	QAPP; SOP 505.01.1	Verification; Verify that all magnetometer/metal detector test data and surface clearance grid status sheets are on file spanning the duration of the project Validation; Ensure the results of all relevant MPCs are attained and correctly documented in the deliverable.	UXOQCS	Daily Instrument Test Report Surface Clearance Grid Status Log
Analog Removal	QAPP; SOP 505.01.1	Verification; Verify that all magnetometer/metal detector test data, analog removal records, and analog grid status sheet are on file spanning the duration of the project. Validation; Ensure the results of all relevant MPCs are attained and correctly documented in the deliverable.	UXOQCS	Daily Instrument Test Report Analog Grid Status Log Analog Removal Records
Explosives Storage and Transport	SOP 501.01.1	Verification; Confirm that DD Form 1348-1As are on file spanning the duration of the project. Validation; Ensure all MDAS handled and transported off site is accounted for and that the COC for those transfers is correctly documented.	SUXOS and UXOQCS	DD Form 1348-1A

WORKSHEET #35A (CONTINUED)
DATA VERIFICATION PROCEDURES FOR MEC-RELATED TASKS

Activity and Records Reviewed	Requirements/ Specifications	Process Description/Frequency	Responsible Person	Documentation
		Verification; Verify that Explosives Usage Records are on file for all demolition operations conducted during the project. Validation; Ensure the record of each demolition event agrees with the related Magazine Data Card entries.	SUXOS	Explosives Usage Record
		Verification; Verify that the inventory records are on file for all magazines spanning the duration of the project. Validation; Ensure the record of each demolition event agrees with the related Explosive Usage Records; ensure that there is no remaining inventory of donor explosives.	SUXOS	Magazine Data Card
Demolition Operations	SOP 502.01.1	Verification; Verify that Demolition Summary Sheet is on file for demolition operations conducted during the project Validation; Ensure all MEC destroyed by demolition and all demolition events are listed	SUXOS	Demolition Summary Sheet
		Verification; Verify that the shot records are on file for all demolition operations conducted over the duration of the project. Validation; Ensure the record of each demolition event agrees with the related dig sheet or Magazine Data Card entries.	SUXOS	Demolition Shot Record
MPPEH Handling	QAPP; SOP 504.01.1	Verification; Verify that MDAS Disposal Documentation have been received and are on file for all MDAS shipped off site during the project. Validation; Ensure disposal documents account for all shipments of MDAS transported off site and they certify the disposal of the material IAW project requirements.	SUXOS	MDAS disposal documentation

WORKSHEET #35B
DATA VERIFICATION PROCEDURES FOR MC SAMPLING

Verification Input	Description	Responsible for Verification
CoC (shipping)	CoC forms will be reviewed upon completion and verified against the packed sample coolers and site sampling requirements. This QC check will be verified by initialing the CoC form next to the shipper's signature. A copy of the CoC form will be retained in the project file and the original and one copy will be taped inside the cooler in a waterproof bag.	HGL FTL
Log review	Log reviews will be performed on a daily basis. This review will be performed to verify that all field monitoring equipment was maintained, calibrated, and operated properly. In addition, the review denotes all required information has been correctly documented in the field logbooks and sample documentation sheets.	HGL FTL
CoC (receipt)	CoC forms will be reviewed and compared to cooler contents. Any discrepancies (sample bottles, sample IDs, requested methods) will be communicated to the Laboratory PM for resolution with the HGL PM.	Laboratory Sample Receipt Manager Laboratory PM
Analytical data package	Laboratory data packages are required to include all data elements that will constitute a Stage 4 (formerly Level IV) deliverable. All data used to prepare analytical data packages will be reviewed at multiple levels throughout the laboratory. The requirements for this review process are described in the laboratory's quality manual. No data packages will be delivered to HGL without the necessary approval.	Laboratory QA Officer
Analytical data package	Analytical data packages will be reviewed to ensure that the appropriate analytical samples have been collected, appropriate site IDs have been used, and the correct analytical methods have been applied.	HGL Sample Coordinator
Analytical data package[1]	Analytical reports will be reviewed to establish that all required forms, case narratives, samples, CoC forms, logbooks, and raw data have been included.	Parsons Data Validator
EDD (export)	All EDDs will be verified against the requirements of a SEDD Stage 2A EDD (compliant with the latest EDD version [Version 5.2]) prior to transmittal to HGL.	Laboratory Database Manager
EDD (import)	Any EDD nonconformance from the laboratory will be reviewed and addressed before the data is processed further. This check is performed on the EDD to ensure that it is in the correct format and that it contains the correct standard values. All data qualifiers must meet EPA's Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. Any errors or warnings will be addressed before processing the data further.	HGL Database Manager
Project database	All data qualifiers applied to the project database by manual entry will receive a 100% QC check for accuracy and completeness. Prior to final approval, each EDD output will receive a 10% QC check of electronically reported results against the hardcopy laboratory reports. The eQAPP, EDDs and location data, will be uploaded to FUDSCHEM. All uploaded files will be verified for accuracy.	HGL Database Manager

[1] This verification step is performed as part of the data validation process described in Worksheet #36 and Attachment A.

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WORKSHEET #36A
DATA VALIDATION PROCEDURES FOR MEC

The Verification and Validation Plan (August 2016) for MEC is included in Appendix L. The Verification and Validation Plan (August 2016) describes how each of the decision-making thresholds for detection and classification will be tested and identifies how anomalies will be selected for the threshold verification and validation digs. It addresses the contractor's QC seeding plan, the threshold verification digs, and validation digs. (The placement of Government validation seeds is addressed in the Government's QASP.) The number, type, and placement of QC seeds depend on project-specific DQOs. The final number and distribution of threshold verification digs and validation digs depends on the DQOs, as well as actual performance in the field against established MPCs. For that reason, the validation approach evolves as the project is implemented. The Verification and Validation Plan is finalized following cued data processing.

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WORKSHEET #36B
DATA VALIDATION PROCEDURES FOR MC SAMPLING

Validation Stage	Matrix	Analytical SOP[1]	Validation Criteria	Data Validator
Data Review Step IIa				
Data Verification (Stage 1)	Soil	L-1	Package Completeness Narrative: Additional items noted for resolution or clarification	Parsons Data Validator
Data Validation – Stage 4	Soil	L-1	Holding Times: Worksheet #19 DQIs: Method-specific criteria presented in Worksheets #12, #15, #24, and #28 Evaluation and Qualification criteria are presented in Appendix Q, Table Q.1	Parsons Data Validator
Data Review Step IIb				
Senior Review	Soil	L-1	See Worksheet #37	HGL Project Chemist
Overall Assessment	Soil	L-1	See Worksheet #37	HGL PM

[1] Refer to Worksheet #23.

WORKSHEET #36B (CONTINUED)
DATA VALIDATION PROCEDURES FOR MC SAMPLING

An overview of the data validation process is presented in the following table. This process is described in full in Attachment A.

Validation Stage	Validation Input	Description	Person Responsible for Validation
Data Review Step IIa			
Data Verification	Laboratory data reports (see Worksheet #35)	The data validator will verify data package completeness, review case narratives, evaluate sample delivery and condition, and evaluate preparation and analysis holding times (Worksheet #19 and #30).	Parsons Data Validator
Data Validation	Laboratory data reports	The data validator will perform an evaluation of sample- and batch-related QC results (see Appendix Q, Table Q.1) for screening or screening and definitive QC elements, as required for each method on a site-specific basis.	Parsons Data Validator
Data Review Step IIb			
Senior Review	Data validation reports	Senior review of reports to approve of all validation results and final qualifiers; overall evaluation of analytical performance against QAPP requirements.	HGL Project Chemist
Overall Assessment	Project documentation (Worksheet #31, #32, and #33)	Complete project dataset and documentation: Determine whether the sampling plan was executed as specified (that is, the number, location, and type of field samples were collected and analyzed as specified in the Work Plan); evaluate whether sampling procedures were followed with respect to equipment and proper sampling support (for example, techniques, equipment, decontamination, volume, temperature, and preservatives).	HGL PM

WORKSHEET #37A
DATA USABILITY ASSESSMENT FOR MEC

The DUA is an evaluation based on the results of data verification and validation in the context of the overall project decisions or objectives. The assessment determines whether the project execution and resulting data meet the project DQOs (see WS #11A) and MPCs (see WS #12A) for MEC-related tasks. All types of data (e.g., surface clearance, DGM, intrusive, etc.) will be considered with the ultimate goal of assessing whether the final, qualified results support the decisions to be made with the data. The following sections summarize the processes to determine whether the collected data are of the right type, quality, and quantity to support the environmental decision-making for the project, and describes how data quality issues will be addressed and how limitations of the use of the data will be handled.

37A.1 SUMMARY OF USABILITY ASSESSMENT PROCESSES

37A.1.1 Data gaps may be present if (1) data are not collected, (2) data are not evaluated with regard to the necessary parameters, or (3) data are determined to be unusable. The need for further investigation or corrective action will be determined on a case-by-case basis, depending on whether data can be recovered, extrapolated from other data, and/or whether the missing data are needed based on the results of other recorded data. Once completed the data usability report will be included as an appendix to the SSFR.

37A.1.2 The following individuals will participate in the DUA:

(1) USACE PM
(2) HGL PM
(3) Project quality assurance manager
(4) Project geophysicist
(5) QC geophysicist
(6) Field geophysicist (lead)
(7) SUXOS
(8) UXOQCS
(9) Other technical personnel as necessary

37A.1.3 The following documents will be reviewed as part of the DUA:

(1) Quality Assurance Project Plan
(2) Contract specifications
(3) Quality Assurance Surveillance Plan
(4) Daily QC Reports
(5) Weekly QC Reports
(6) IVS Technical Memorandum
(7) Final Validation Plan
(8) Site-specific library
(9) Target list
(10) Classification Technical Memorandum
(11) Validation Dig Report
(12) Analog removal grid records

37A.1.4 The DUA will follow a four-step process:

(1) Review the project objectives and sampling design:
   a. Are the DQOs (WS #11A) and MPCs (WS #12A) still applicable?
   b. Are the underlying assumptions in the DQOs and MPCs still valid?
   c. If the DQOs or MPCs have been changed, have the changes been documented?
   d. Is the sampling design consistent with project objectives?

(2) Review the data verification and validation outputs and evaluate conformance to MPCs documented on WS #12A:
   a. Have the data been verified and validated as described on WS #35A and #36A?
   b. Evaluate conformance to MPCs documented on WS #12A. Are there impacts from non-conformance on data usability?

(3) Document data usability, update the CSM, and draw conclusions:
   a. Have the DQOs been achieved?
   b. Can the data be used as intended, considering implication of deviations and corrective actions?
   c. Are there limitations on data use?
   d. What new information can we add to the CSM?
   e. Update the CSM and document usability conclusions in the data usability summary report.

(4) Document lessons learned and make recommendations:
   a. Could the DQOs, MPCs, or sampling design have been improved for similar future studies?
   b. Summarize lessons learned and make recommendations for changes.

37A.1.5 During data validation (WS #35A and #36A), non-conformances will be documented, and data will be qualified accordingly. All data are usable as qualified by the relevant HGL personnel, with the exception of rejected data. The data are considered usable if the relevant MPCs are achieved and both the verification and validation steps are considered to have yielded acceptable data. During verification and validation steps, data may be qualified by the person validating the data. Qualifiers are typically intended to indicate minor QC deficiencies, which will not affect the usability of the data. All qualifiers will be documented in the Data Usability Report and SSFR. When major QC deficiencies are encountered, data will be rejected and, in most cases, will not be considered usable for making project decisions. Where applicable, project data will be checked to ensure that values and any relevant qualifiers are appropriately transferred to the project electronic database. Deviations from the UFP-QAPP will be reviewed to assess whether corrective action is warranted and to assess impacts on achievement of DQOs.

37A.2 USABILITY ASSESSMENT DOCUMENTATION

37A.2.1 The results of dynamic DUAs will be reported in a Dynamic Data Usability Report. The results of cued DUAs will be documented in Cued Data Usability Reports. All results will be reported for an overall quality assessment in the MEC Data Usability Report (see Table 37A.1), which will be completed after intrusive investigation of the survey area(s). Each Data Usability Report will document the Usability Assessment based on the four-step process described above. The assessment will include whether each MEC-related data element has been verified and validated according to WS #35A and WS #36A, whether the DQOs (WS #11A) and MPCs (WS #12A) have been attained, and whether the data can be used as intended.

Table 37A.1
MEC Data Usability Report

STEP 1: REVIEW PROJECT OBJECTIVES AND SAMPLING DESIGN			
Evaluation	**Yes/No**	**Reference (1)**	**Comments (2)**
Are the DQOs and MPCs still applicable?			
Are the underlying assumptions in the DQOs and MPCs still valid?			
If DQOs or MPCs have been changed, are the changes documented?			
Is the sampling design consistent with project objectives?			
STEP 2: REVIEW THE DATA VERIFICATION AND VALIDATION OUTPUTS AND EVALUATE CONFORMANCE TO MPCs (Data Inputs listed on Worksheet #34A)			
Evaluation	**Yes/No**	**Reference (1)**	**Comments (2)**
Have the data been verified?			
Have the data been validated?			
STEP 3: DOCUMENT DATA USABILITY, UPDATE THE CSM, AND DRAW CONCLUSIONS			
Evaluation	**Yes/No**	**Reference (1)**	**Comments (2)**
Have the DQOs been achieved?			
Can the data be used as intended?			
Are there limitations on data use?			
Has the CSM been updated with any new information?			
STEP 4: DOCUMENT LESSONS LEARNED AND MAKE RECOMMENDATIONS			
Evaluation	**Yes/No**	**Reference (1)**	**Comments (2)**
Could the DQOs, MPCs, or sampling design have been improved for similar future studies?			
Have lessons learned and recommendations been documented?			

(1) The reference field lists the primary location in the SSFR or DUA where related data are presented, along with any sections of the report where the validation of that data is discussed.

(2) The comments field presents a brief explanation of any issues. Note that any such issues may be further explained in other parts of the DUA.

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WORKSHEET #37B
DATA USABILITY ASSESSMENT FOR MC

This worksheet documents procedures that will be used to perform the DUA for MC-related tasks. The DUA is performed at the conclusion of data collection activities, using the outputs from data verification and data validation. It is the data interpretation phase, which involves a qualitative and quantitative evaluation of environmental data to determine if the project data are of the right type, quality, and quantity to support the decisions that need to be made. It involves a retrospective evaluation of the systematic planning process, and, like the systematic planning process, involves participation by key members of the project team. The DUA evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence.

37B.1 SUMMARY OF USABILITY ASSESSMENT PROCESSES

37B.1.1 HGL will determine if quality control data is within specifications (MPC) through the data assessment and data validation process. HGL will use all data not rejected during validation to determine the nature of contamination. The data assessment team will perform the operations summarized in Worksheet #35B and Worksheet #36B to evaluate sampling team and laboratory compliance with the requirements with this QAPP and other project planning documents. HGL will work with USACE and project regulators if there is a concern about the statistical validity of the sample results or to determine if sample locations with rejected data need to be re-sampled.

37B.1.2 The following individuals will participate in the DUA:

(1) USACE PM
(2) USACE TM
(3) USACE Chemist
(4) HGL PM
(5) Project QA Manager
(6) Project Chemist
(7) Risk Assessor
(8) Other technical personnel as necessary

37B.1.3 Data Validation:

Data validation will be the first step of the usability assessment. See WS #28B for DQIs associated with the analytical measurements to be used on the project. All data qualifiers will be evaluated and any possible impact to the overall data quality will be discussed in the DUA Report. Any data gap due to the field and/or lab error will be pointed out in the report.

37B.1.4 The DQIs for MC described in Worksheet #12B will be assessed, including any QC results that indicate trends or biases in the data set. Individual sample results that include non-detections with LODs elevated above the PALs due to dilution will be evaluated as potential data gaps. Deviations from planned performance will be documented and evaluated to determine whether corrective action is advisable. Potential corrective actions will range from resampling and/or reanalysis of data, to qualification or exclusion of the data for use in the data interpretation. In the event that corrective action is not possible, the limitations, if any, of the data with regard to achieving the DQOs will be noted.

37B.1.5 In conjunction with the review of performance against the DQI requirements, the investigators will need to make decisions for the use of qualified values, which are a consequence of the formalized evaluation/validation process. Data qualifiers will be applied to individual data results. Data usability decisions will be made based on the assessment of the usability of each of these results for the intended purpose. Evaluation will describe the uncertainty (such as bias and imprecision) of the qualified results. Multiple discrepancies in DQIs may require technical judgment to determine the overall effect on the usability of the associated data. Decisions about usability of qualified data for use in risk assessment will be based on the EPA guidance, which allows for the use of estimated values. Finally, data users may choose to determine final data usability qualifiers as a result of this overall examination and decision process.

37B.1.6 The data validation protocols described in Table Q.1 include instructions for rejecting (R-qualifying) results associated with severe non-conformances. Following data validation, a critical component of the data usability process is the evaluation of all results qualified R during the data qualification process. The HGL Project Chemist and Project Manager, in consultation with the USAESCH Project Chemist, will evaluate the impact of the identified QC discrepancies on the affected results and make a final determination as to whether each result is usable with respect to the DQOs even if severe technical discrepancies are associated with those results. In such cases where the affected result is determined to be usable, the R qualifier will be removed and replaced with an appropriate qualifier as determined by the data usability team. The final decision to accept or reject such results will be documented in the appropriate data quality evaluation documents.

37B.2 USABILITY ASSESSMENT DOCUMENTATION

37B.2.1 A Data Validation Report will be created for each sample delivery group SDG to provide documentation whether data generated were in control throughout sample analysis. Each data validation report will include a discussion of all QC parameters evaluated, the acceptance criteria used to evaluate each QC parameter, a list of all QC exceedances as well as the extent of the exceedance, the samples associated with each exceedance, and the qualifiers applied. Any lab trending in the QC samples, such as high biased lab control sample for a particular analyte will be discussed. Data summary tables will be generated in order for the data reviewer to review the results in an organized manner.

37B.2.2 An overall data usability report will describe the data usability evaluations and will include sufficient information to support the data usability conclusion. The report will also include the rationale for the data used and will present any data limitations. Discussion of the accuracy, precision, representativeness, completeness, and comparability of the data set and deviations from planned procedures and analysis and the impact on the project objectives will also be discussed in the report.

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APPENDIX A

PERFORMANCE OF WORK STATEMENT

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Performance Work Statement
Time Critical Removal Action (TCRA)
Specific Areas within the Northwest Peninsula
Culebra Island, Puerto Rico
I02PR0068
23 February 2016
Revision: 1
Revision Date: 22 March 2016

Revision 1 (dated 22 March 2016) Summary (changes are in bold italics):
-Section 2.1: Replaced the Typo of Fort Pierce with Culebra.
-Section 3.3, Task 3, TCRA Field Activities: The performance standards have been revised to state that "to the maximum extent practicable the contractor should conduct the field investigation by utilizing Advanced Geophysical Classification".
- Section 3.3, Task 3, TCRA Field Activities: The performance standards now clarify that required advanced classification personnel may be employed by the prime contractor or subcontractor.

1.0 Objective: The objective of this task order is to remove Munitions and Explosives of Concern (MEC), Material Potentially Presenting an Explosive Hazard (MPPEH) and Explosive Hazards from the areas within the Northwest Peninsula of Culebra Island as specified in Section 317 of Public Law 113-291, per the TCRA Approval Memorandum dated 23 February 2016. These areas include portions of Carlos Rosario Beach, Flamenco Beach, Tamarindo Beach, the Flamenco Campground, and the Carlos Rosario Trail.

2.0 BACKGROUND

2.1 Work under this Performance Work Statement (PWS) falls within the within the DERP-FUDS Military Munitions Response Program (MMRP) for ***Culebra*** ~~***Former Fort Pierce***~~, a Formerly Used Defense Site (FUDS). The Contractor shall perform all work in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP), 40 CFR Part 300. All activities involving work in areas potentially containing explosive hazards shall be conducted in full compliance with United States Army Corps of Engineers (USACE), Department of the Army (DA), and Department of Defense (DOD) regulations, guidance, standards and manuals.

2.2 Available Site Specific information will be provided with the request for proposal for contractor review and use via either a designated Internet site or delivery of recorded data on CD/DVD. This information may include but is not limited to general site history, previous investigations, munitions response sites, and other documentation.

3.0 General Requirements:

3.0.1 Contractor Methods: This is a performance based task order. The performance objectives and standards included herein are the basis of the task order requirements. The technical approach and level of effort expended to achieve task order objectives and standards are solely up to the contractor to select and adjust as necessary through the life of the task order. Government recognizes the contractor's right to change the technical approach and level of effort from that proposed with the understanding that the contractor shall still meet all project objectives and gain government Quality Assurance acceptance in order to receive payment.

3.0.2 Quality monitoring and measurement: The contractor will be evaluated periodically during performance of this task order to ensure compliance with the proposed and accepted performance goals, regulations, guidance and DIDs, and to document that acceptance criteria (AC), delivery schedule, and the overall completion date are being met. This evaluation will be performed according to a Quality Assurance Surveillance Plan (QASP). A programmatic QASP will be provided by the government as a starting point for the contractor prepared Draft QASP per Task 1. The government will finalize the contractor's Draft QASP. This final QASP will be supplied to the contractor and used by the government to evaluate the contractor's performance. Failure to adequately complete any service or submittal to at least a satisfactory level of quality or timeliness may result in a repeat of the work, or a poor performance evaluation, or both.

3.0.3 Performance Requirements: Performance requirements are addressed in each task and summarized in the Performance Requirements Summary (PRS) provided in Attachment A. Performance metrics are provided in Attachment

B. If discrepancies or ambiguity exists between the documents, the order of precedence is 1) the Task; 2) Performance Requirements Summary; 3) Performance Metrics.

3.0.4 Task Pricing: A pricing schedule is provided separately.

3.1 Task 1, Project Management Plan (PMP), Munitions and Explosives of Concern Quality Assurance Project Plan (MEC-QAPP) and QASP: This is a Firm Fixed Price task.

Objective: Prepare, submit, and gain acceptance of a PMP, MEC-QAPP, and QASP that are detailed and comprehensive plans covering all aspects of project execution as required in Task 3. The PMP is a living document and shall be updated as necessary.

Performance Standard: Prepare the PMP in accordance with Army Regulation (AR) 5-1; AR 11-2; USACE PMBP Manual, PROC2000, PMP-PgMP Development, REF8005G; PMP-PgMP Content and Data Item Description (DID) WERS-018. Prepare the MEC-QAPP in accordance with Section 1.0 of DID WERS-001.01 and other applicable DIDs for sub plans, EM 200-1-15, EM 385-1-1, EM 385-1-97 (including Errata Sheets and Changes), Intergovernmental Data Quality Task Force UFP-QAPP Manual, and other interim guidance, DIDs, or State regulatory guidance, as appropriate. The Draft QASP shall meet the requirements described in guidance. The QASP shall include systematic methods used to monitor performance and to identify the required documentation and the resources to be employed to include monitoring Quality Control requirements in guidance, DIDs and the Contractor's Quality Control Plan.

AC: Acceptance of MEC-QAPP and all sub-plans with a Draft for Government agency review, Draft Final for back check and review by the EM-CX prior to release to the Regulators, Draft Final to the regulators, Final for Back check by all, Approved Final. One additional revision is acceptable to incorporate EM-CX, as required. Draft QASP reflects requirements of the QAPP with one revision required. Acceptance of the PMP with one revision.

Measurement / Monitoring: Review of PMP, MEC-QAPP, and QASP to verify that the minimum acceptable content has been provided and meets applicable guidance.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at Contractor's expense.

Specific Task Requirements: The intention of Section 2.3 of WERS-018 is to discuss remedy reviews (e.g. root cause analysis, corrective action plans) to address QC/QA failures. In addition to Basic Contract Section C and DID project status reporting requirements, the contractor shall include a project kick-off meeting and in-progress review (IPR) meetings. IPR meetings shall include but are not limited to, regular feedback to the Government on the progress of its work through teleconferences, electronic mails, and face to face meetings as required by the government. The MEC-QAPP shall include methods that will be utilized to ensure that data generated are of an acceptable quality for its intended use. The Contractor shall include a discussion as to how the project shall be managed and implemented. The Contractor shall determine if a streamlined QAPP is appropriate for this task order.

3.1.1 Task 1a, Optional Explosive Safety Submission Amendment: This is a Firm Fixed Price task. If this optional task is not awarded, an up to date Explosive Safety Submission will be provided by the government for inclusion in the UFP-QAPP.

Objective: Prepare, submit and gain acceptance of an amendment to the current Explosives Safety Submission.

Performance Standard: Prepare required submission in accordance with DoD 6055.09-M, EM 385-1-97, Errata Sheet #3, and DID WERS-003.01 as a stand-alone document for inclusion after acceptance into the QAPP.

AC: Acceptance of submission with two revisions. One additional revision is acceptable to incorporate EM-CX, USATCES and DDESB comments.

Measurement / Monitoring: Review by Government using guidance cited to determine acceptability.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: Once the amended ESS has been reviewed and accepted by the Design Center, the document will be reviewed by the CEHNC-EM-CX, USATCES, and DDESB. All comments shall be incorporated. Allow eight (8) weeks in the schedule for DDESB approval after submission of final document to the CEHNC-EM-CX.

3.2 Task 2, GeoSpatial Data: This is a Firm Fixed Price task.
Objective: Utilize GIS in the maintenance and management of all project and geospatial data.

Performance Standard: Manage and maintain project data, and update the CSM in GIS IAW DID WERS-007.01, EM 200-1-2, EM 1110-1-1200, EM 200-1-15 and applicable Interim Guidance Documents.

AC: Acceptance of GeoSpatial Data submissions meets quality and formatting requirements.

Measurement / Monitoring: Review by Government using guidance cited to determine acceptability.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: The GeoSpatial Data shall include:
- Maintain and update property GIS data for all landowners within the project boundaries. Property owner privacy will be preserved. Property owner names shall not be disseminated in any documents.
- Track and assist the District in obtaining property Right -of -Entry as needed.
- A pre and post-project response action geospatial data analysis will be performed using a GIS.
- All available existing data that is applicable to the project will be consolidated into the GeoDatabase and analyzed to relay pertinent information to the PDT. If an existing GIS database is available, it will be provided by the government.
- The analyses may detail the fieldwork strategies, areas of concern, survey requirements, environmental concerns, milestones and/or other factors that affect product delivery and future action planning.
- Entities that may be affected by response actions include but are not limited to: landowners, homeowners, rental tenants, schools, utilities, roads, businesses, recreational areas, air traffic, water bodies and/or industries.
- The GeoDatabase shall be a living repository that is refined throughout the life of the project.
- Incorporate layers that overlay on maps of the site that identify physical features, and Material Potentially Presenting Explosive Hazard (MPPEH)/Munitions Debris (MD) found during the investigation. Examples include: streets, anomalies, Munitions and Explosives of Concern (MEC) positively identified, identifiable MD, sampling location, cultural resources, environmental, biological, and socio-economic variables.
- Archeological site location(s) will not be released to the public without written permission from USACE.
- Perform civil surveys IAW EM 200-1-15 and DID WERS-007.01.
- Final GIS deliverable shall include all documentation, reports, meeting minutes databases, etc. created developed or modified under this task order in original and PDF format. This deliverable shall meet QA acceptance prior to payment of final invoice.

3.3 Task 3, TCRA Field Activities: This is a Firm Fixed Price task.
Objective: Conduct a TCRA within the specified areas in accordance with the accepted MEC-QAPP, ESS, and all applicable standards such that the objective of this PWS is met. The contractor shall also conduct all field work so as to sufficiently reduce the imminent hazard of contamination to potential receptors. Field Work shall begin within 6 months of approval of the TCRA Memo and IAW FUDS policy.

3.3.1 Task 3a, Beach Monitoring: This is a Firm Fixed Price task.
Objective: The Contractor shall provide a qualified Project Biologist for daily beach monitoring prior to intrusive ordnance activities as described in the Standard Operation Procedure for Endangered Species Conservation, USACE, Jacksonville District. Project Biologist qualifications shall reflect 2-4 years' experience in related work, working independently under general supervision (equivalent to industry Biologist II).

Performance Standard:
- The contractor shall perform all necessary field work to identify and remove all UXO items from the specified areas, and to subsequently dispose of all confirmed MEC in accordance with the MEC-QAPP and ESS.
-Field work, data quantity and quality, and analysis of data shall be performed in accordance with applicable laws, regulations, and guidance documents and the results will be provided in the appropriate deliverable format.
-Field activities shall be performed in accordance with the accepted MEC-QAPP.

- The Government finding no MEC or MPPEH excluding small arms ammunition (.50 cal and smaller), and no MD or RRD equivalent to, or greater than 37mm in diameter or width on the surface of the munitions response site.
- The Government finding no subsurface MEC or MPPEH shallower than 8x the item's diameter.
-The Government finding no signal equivalent to, or greater than anomaly selection criteria as documented in the Instrument Verification Strip (IVS) Letter Report without an acceptable explanation.
- Anomalies in the subsurface shall be resolved, regardless of if water is encountered.
- Quality Control (QC) deliverables and Quality Assurance (QA) inspections/review demonstrate that the work was performed IAW the UFP-QAPP, ESS, applicable laws, regulations, and guidance documents.
- All operations at the project site shall be managed, supervised, and performed by fully Unexploded Ordnance (UXO)-qualified personnel meeting the requirements of the DDESB Technical Paper 18.
-Site restorations and backfilling shall be in accordance with the work plan and all applicable laws, regulations, and guidance documents.
-MEC encountered during the removal action will be detonated onsite or otherwise properly disposed of under a TCRA ESS.
- Proper processing and disposition of UXO, DMM, and MD encountered in accordance with approved plan(s).
- All MPPEH encountered will be inspected, characterized according to its explosive safety status as Material Documented as Safe (MDAS) or Material Documented as Explosive Hazard (MDEH). It shall be managed, certified, and recycled according to procedures in DoDM 6055.9 Vol 7, DoDI 4140.62, and EM 385-1-97.
- QC deliverables and QA inspections/review demonstrate that the work was performed in accordance with the MEC-QAPP, ESS, applicable laws, regulations, and guidance documents;
- All materials for circulation to the public shall be approved by USAESCH and CESAJ before distribution.
- All geophysics shall be IAW EM 200-1-15 and DID WERS-004.01.
-To the maximum extent practicable the contractor should conduct the field investigation ***by utilizing Advanced Geophysical Classification.*** ~~***gathering sensor data that is digitally recorded and geo-referenced (geo-referencing need be no more accurate than is needed for the use of the data)***~~. Exceptions may include situations where other methods provided data and/or significant cost value in which case the contractor shall provide detailed justification in their proposal describing why the other methods provide a better value. In any case a geo-referenced permanent record of the investigation shall be delivered as part of the report (GIS of traverse and items located, digital geophysical data, etc).

If Advanced Classification (AC) is proposed the following Performance Standards apply:
- Work shall be in compliance with "The Geophysical Classification for Munitions Response Quality Assurance Project Plan (GCMR-QAPP) template produced by the Intergovernmental Data Quality Task Force (IDQTF), current version".
- The contractor shall identify personnel with experience in AC (minimum Experience described below); explain how AC will be implemented to include equipment, planning documents, site preparation, seeding programs, survey, cue and classification; provide justification for use of AC versus conventional geophysics; and assumptions as to use of Government Furnished Property and requirements thereof.

~~***Key***~~ ***AC*** Personnel Experience: Requirements are in addition to Base Contract requirements. ***Personnel identified as having AC experience may be employed by the prime contractor or the subcontractor.***
1) Project Manager. At least one (1) advanced classification project to include management at the field operational level
2) Senior Geophysicist.
   a) Experience with the theoretical and practical aspects of detecting and selecting a wide range of targets of interest (TOI) and non-targets of interest (non-TOI).
   b) Experienced in the selection and utilization of various types of geophysical instruments and ancillary components to include high-precision global positioning systems, inertial motion sensors and the software used to control and integrate the geophysical system as a whole.
   c) Shall have, at a minimum, documented experience performing advanced classification using only advanced EMI instrument survey data , to include documented experience processing and analyzing advanced EMI instrument data, and developing and performing or overseeing quality control procedures for advanced EMI data acquisition, analysis and classification processes.
3) Field Geophysicist. The field geophysicist(s) shall be responsible for proper operation of advanced geophysical EMI systems and performing quality control during advanced EMI system surveys. Field Geophysicist(s) shall have, at a minimum, the following qualifications:
   a) Documented or independently verifiable experience operating an advanced geophysical EMI system to include the geophysical instruments, high-precision global positioning systems, inertial motion sensors and the software used to control and integrate the geophysical system as a whole.

AC: Conduct the RA in accordance with the accepted/approved MEC-QAPP, and ESS.

- Geophysical QC data submitted meets requirement described in DID WERS-004.01 and EM 200-1-15.
- No more than 3-4 CARs/948s for non-critical violations and/or 1 CAR/948 for critical violation. No unresolved corrective action requests.
- All final data and QC tests/documentation submitted. Government QA acceptance of QC tests/documentation gained.
- No Class “A” Safety accidents, contractor at fault; No Class “B”, contractor at Fault, no more than 1 non-explosive Class “C” accident; and <2 non-explosive related Class “D” accidents, IAW AR 385-40.
- Major safety violations, no more than 1 non-explosive related safety violation.
- Minor safety violations, no more than 2 safety violations.
- Zero letters of formal grievances or letters of concern.

Measurement / Monitoring: Periodic inspection/review of field work. Verify compliance with accepted MEC-QAPP and applicable laws, regulations, and guidance documents. Quality control tests/documentation submitted per the QASP for government review. QC deliverables and QA inspections/review demonstrate that the field activities are performed such that sufficient quality data is produced and the data can be used for its intended purpose.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor’s expense.

Specific Task Requirements:
- This is a time critical removal action and must comply with all time limits, laws, regulations, and guidance related to TCRA field work. The contractor will obtain any necessary permits or Rights of Entry.
- Restore all areas to their original condition; all access/excavation/detonation holes shall be backfilled.
- Maintain a detailed accounting of all UXO, DMM, MD and range-related debris encountered per DID WERS-004.01. This accounting shall include as a minimum: amounts of UXO, DMM and MD; nomenclature; location and depth of UXO/DMM; location of MD; and final disposition. The accounting system shall also account for all demolition materials utilized on site. Digital photographs of UXO and DMM and examples of MD found during the investigation are to be taken.
- All UXO, DMM and MC encountered during this munitions response shall be processed in accordance with the approved work and safety plans.

3.4 Task 4, TCRA Site Specific Final (SSF) Report: This task is a Firm Fixed Price task.
Objective: Prepare, submit and gain acceptance of a TCRA SSF report.

Performance Standard: The SSF report shall document the results of the TCRA and be in accordance with EP 1110-1-18 and DID WERS-013.01.

AC: Acceptance of SSF report with two revisions. One additional revision is acceptable to incorporate EM-CX.

Measurement / Monitoring: Review of SSF report against guidance to verify that the minimum acceptable content has been provided.

Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor’s expense.

Specific Task Requirements: None

3.5 Task 5, Administrative Record: This task is a Firm Fixed Price task.
Objective: Update and maintain the Administrative Record for the TCRA areas throughout the period of performance of this Task Order.

Performance Standard**:** Prepare in accordance with the guidance in EP 200-3-1, Chapter 4 (Establishing and Maintaining Administrative Records) and Standard Operating Procedure for Formerly Used Defense Sites (FUDS) Records Management, Revision 5, dated January 2008 (or most recent version).

AC: Administrative record will be evaluated against guidance for compliance with requirements, accuracy and completeness of the record, with up to one uncorrected deficiencies remaining during the period of performance.

Measurement / Monitoring: The government will visit, at least once, the administrative record's location and check for completeness and compliance with referenced EP; electronic submissions will be evaluated randomly upon receipt as data is entered into the record.

Task specific Incentives/Disincentives: Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Specific Task Requirements: Within 60 days of the start of on-site removal activity, the Contractor shall establish or update as required the Administrative Record and publish a public notice in a major local newspaper of general circulation to announce the availability of the Administrative Record file. All materials for circulation to the public shall be approved by USAESCH and CESAJ before distribution. Provide copies of all final documents posted to the Administrative Record on CD/DVD to USAESCH and CESAJ, 2 copies each. These files shall be suitable for placement on the FRMD web site. This task requires close coordination with the Jacksonville District (CESAJ) and USAESCH to secure all required documents to support the Administrative Record.

4.0 Submittals.

Even though draft and draft final submittals are requested, the term "draft" shall not reflect upon the quality of the submittal being provided by the Contractor. Submittals shall include all supporting materials including supporting data whether electronic or hardcopy. Submittals not meeting the requirements of referenced guidance or Data Item Descriptions or missing supporting data may be rejected and revised by the contractor at the contractor's own expense.

4.1 The Contractor shall deliver the specified number of copies shown in Table 4.2 of each report listed in Table 4-1 to the following addressees (addresses to be verified by Contractor):

US Army Engineering & Support Center, Huntsville
Attn: CEHNC-CT-E (Janice Jamar)
PO Box 1600
Huntsville, AL 35807-4301
4820 University Square
Huntsville, AL 35816-1822

US Army Engineering & Support Center, Huntsville
Attn: CEHNC-OE-DC (Roland Belew) (COR)
PO Box 1600
Huntsville, AL 35807-4301
4820 University Square
Huntsville, AL 35816-1822

US Army Corps of Engineers, Jacksonville District
Attn: CESAJ-PM-M
Wilberto Cubero, Project Manager
904-232-1804
701 San Marco Blvd
Jacksonville, Florida

US Army Engineering & Support Center, Huntsville
Attn: CEHNC-CX-MM
PO Box 1600
Huntsville, AL 35807-4301
4820 University Square
Huntsville, AL 35816-1822

Contractor to obtain and/or verify addresses.

4.2 Submittals and Due Dates.

The Contractor shall submit 1 copy of the entire submittal on a CD with each hard copy of a submittal (Reports, Plans, etc) in accordance with DID WERS-007.01, latest version. Hardcopies shall be printed on both sides of the paper whenever possible. **All deliverables, except for Final versions, shall be electronic submittals.**

Table 4-1 List of Submittals

Submittal	Due Date (Calendar Days)
Meeting minutes for Kickoff phone conference	7 days after Kickoff phone conference
Proposed Schedule	7 days after Kickoff conference call
Explosives Safety Submission Addendum	Separate DDESB approval before intentional physical contact with MEC on site
Draft PMP, electronic copy only	14 days after Kickoff conference call
Final PMP, electronic copy only	7 days after acceptance of comment responses
Draft MEC-QAPP	21 days after Kickoff conference call
Draft Final MEC-QAPP w/ GIS on DVD	14 days after acceptance of comment responses
Final MEC-QAPP	14 days after acceptance of comment responses
Draft QASP, electronic copy only	With Draft Final UFP-QAPP
Quality Control Documents	**As required by Regulation, guidance, DIDs, QCP, QASP, or agreed to in project schedule.**
Draft TCRA SSF Report	21 day after completion of field work
Draft Final TCRA SSF Report	14 days after receipt of comments
Final TCRA SSF Report	14 days after on board Review
Final GIS Files on CD	End of Project
Final Administrative Record	End of Project

4.3 Submittal Quantities
Provide the number of submittals shown in Table 4-2 to the addressees given in Section 4.2. No draft documents shall be released to the regulatory community until reviewed by the government.

Table 4-2 Submittal Guidance

	Draft Documents	Draft Final/Final Documents
KO/COR	1 each	1 each
USAESCH	2	2
CESAJ	2	4

4.4 Review Period: The contractor shall include at least a minimum 14 calendar day review period for USAESCH, 21 calendar day review period for the EM-CX and 30 calendar day review period for the regulators.

4.5 Period of Performance: Field activities must be initiated within six (6) months from approval of the Action Memorandum. The Completion Date for this Task Order is 31 January 2018.

5.0 Milestone Payments for firm fixed price tasks: Milestones will be considered met or completed when the required QC documentation has been submitted, QA completed and the submittal and/or product is accepted. Any payment vouchers submitted that do not coincide with the final accepted milestones or do not have the appropriate QC documentation will be rejected. All payments will be made utilizing an agreed upon Payment Milestone Schedule. The Contractor shall provide suggested milestones for payment. Milestones for payment shall be shown on the project schedule.

5.1 The following is a list of potential milestones for payment:
- Final Submittals: upon government acceptance, for example: Final MEC-QAPP
- Field Work: completion of TCRA removal actions
- Meetings: after completion of meetings with government acceptance of meeting minutes, for example: Kick-off meeting minutes.

6.0 REFERENCES:

6.1 Refer to "Base Contract."

6.2 Data Items Descriptions provided upon request.

7.0 GENERAL CONDITIONS: See the Base Contract Section C, Section 10 General Conditions and the following:

7.1 This is a performance based task order.

7.2 Government acceptance of the proposed technical approach and/or price does not relieve the Contractor from full responsibility for the viability, productivity, and efficiency of the approach used to meet the performance requirements of the PWS at the price proposed. The task order is for the provision of services that ultimately meet the performance requirements of this task. If the contractor must adjust its technical approach or perform more field work than anticipated in order to achieve the proposed performance goal then the contractor will do so with no change in task order price.

7.3 If the Government at its sole discretion chooses to modify the performance standard the parties to this task order will assess the impact on the estimated amount of field work required to achieve the new performance standards and will negotiate a price adjustment.

7.4 The Contractor attests that it applied due diligence in the research and development of its proposal has priced reasonable estimates of the site conditions and the associated risks into the price. The Contractor accepts full and sole responsibility for identifying and considering all factors that may affect the cost to execute the work. The act of signing this task order signifies that the Contractor has been given ample opportunity to assess the conditions under which the work will be performed and the Contractor either fully understands those conditions or has factored the risk into the price.

7.5 The Government provided the Contractor with historical documents and documents from previous site activities. The Contractor attests it interpreted the data utilizing an experienced understanding of how the data of this type is collected, analyzed, interpreted, and presented.

7.6 Proposals shall account for any reasonably foreseeable delays due to weather or oceanic events.

8.0 ARMY CONTRACTOR MANPOWER REPORTING

8.1 Implementation.

8.1.1 The Office of the Assistant Secretary of the Army (Manpower & Reserve Affairs) operates and maintains a secure Army data collection site where the contractor will report contractor manpower information (including subcontractor manpower information) required for performance of this contract. The contractor shall submit all the information required in the format specified at the following web address: **https://cmra.army.mil/default.aspx**

8.1.2 The Contractors shall fill in the required information on the website, fields are shown below:

- Contract Number
- Delivery Order Number (if applicable)
- Task Order Number (if applicable)
- Requiring Activity Unit Identification Code (UIC)
- Command
- Contractor Contact Information
- Federal Service Code (FSC)
- Direct Labor Hours
- Direct Labor Dollars
- Location Information (where contractor and subcontractors (if applicable) performed the services

8.1.3 Reporting period will be the period of performance not to exceed 12 months ending September 30 of each government fiscal year and must be reported by 15 October of each calendar year.

8.1.4 If your particular contract crosses fiscal years, 2 entries must be made to capture the data for the contract period; for example if the contract start date is 1 January 2007 and ends 31 December 2007, the data for the period from 1 January 2007 through 30 September 2007 shall be entered not later than 15 October 2007 and the period 1 October 2007 through 31 December 2007 shall be entered not later than 15 January 2008.

Attachment A

Performance Requirements Summary:

A.1 The Contractor shall meet the following performance requirements. Performance requirements are addressed in each task and summarized in the following Performance Requirements Summary. If discrepancies or ambiguity exists between the documents, the order of precedence is 1) the Task; 2) Performance Requirements Summary; 3) Performance Metrics

Table A-1 Performance Requirements Summary

Task	Objective	Performance Standard	Minimum Acceptable Criteria	Measurement / Monitoring	Incentive/ Disincentive
1	Prepare, submit, and gain acceptance of a PMP, MEC-QAPP, and QASP that are detailed and comprehensive plans covering all aspects of project execution as required in Task 3.	See Task.	Acceptance of MEC-QAPP and all sub-plans with a Draft for Government agency review, Draft Final for back check and review by the EM-CX prior to release to the Regulators, Draft Final to the regulators, Final for Back check by all, Approved Final. One additional revision is acceptable to incorporate EM-CX, as required. Draft QASP reflects requirements of the QAPP with one revision required. Acceptance of the PMP with one revision.	Review of PMP, MEC-QAPP, and QASP to verify that the minimum acceptable content has been provided and meets applicable guidance.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
1a	Prepare, submit and gain acceptance of an amendment to the current Explosives Safety Submission.	Prepare required submission in accordance with DoD 6055.09-M, EM 385-1-97, Errata Sheet #3, and DID WERS-003.01 as a stand-alone document for inclusion after acceptance into the QAPP.	Acceptance of submission with two revisions. One additional revision is acceptable to incorporate EM-CX, USATCES and DDESB comments.	Review by Government using guidance cited to determine acceptability.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
2	Utilize GIS in the maintenance and management all project and geospatial data.	Manage and maintain project data, and update the CSM in GIS IAW DID WERS-007.01, EM 200-1-2, EM 1110-1-1200, EM 200-1-15 and applicable Interim Guidance Documents.	Acceptance of GeoSpatial Data submissions meets quality and formatting requirements.	Review by Government using guidance cited to determine acceptability.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
3	Conduct a TCRA within the specified areas in accordance with the accepted MEC-QAPP, ESS, and all applicable	See Task	Conduct the RA in accordance with the accepted/approved MEC-QAPP, and ESS. - Geophysical QC data submitted meets requirement described in DID WERS-004.01 and EM 200-1-15. - No more than 3-4 CARs/948s for non-	Periodic inspection/review of field work. Verify compliance with accepted MEC-QAPP and applicable laws,	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

	standards such that the objective of this PWS is met. The contractor shall also conduct all field work so as to sufficiently reduce the imminent hazard of contamination to potential receptors. Field Work shall begin within 6 months of approval of the TCRA Memo and IAW FUDS policy.		critical violations and/or 1 CAR/948 for critical violation. No unresolved corrective action requests. - All final data and QC tests/documentation submitted. Government QA acceptance of QC tests/documentation gained. - No Class "A" Safety accidents, contractor at fault; No Class "B", contractor at Fault, no more than 1 non-explosive Class "C" accident; and <2 non-explosive related Class "D" accidents, IAW AR 385-40. - Major safety violations, no more than 1 non-explosive related safety violation. - Minor safety violations, no more than 2 safety violations. - Zero letters of formal grievances or letters of concern.	regulations, and guidance documents. Quality control tests/documentation submitted per the QASP for government review. QC deliverables and QA inspections/review demonstrate that the field activities are performed such that sufficient quality data is produced and the data can be used for its intended purpose.	
4	Prepare, submit and gain acceptance of a TCRA SSF report.	The SSF report shall document the results of the TCRA and be in accordance with EP 1110-1-18 and DID WERS-013.01.	Acceptance of SSF report with two revisions. One additional revision is acceptable to incorporate EM-CX.	Review of SSF report against guidance to verify that the minimum acceptable content has been provided.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.
5	Update and maintain the Administrative Record for the TCRA areas throughout the period of performance of this Task Order.	Prepare in accordance with the guidance in EP 200-3-1, Chapter 4 (Establishing and Maintaining Administrative Records) and Standard Operating Procedure for Formerly Used Defense Sites (FUDS) Records Management, Revision 5, dated January 2008 (or most recent version).	Administrative record will be evaluated against guidance for compliance with requirements, accuracy and completeness of the record, with up to one uncorrected deficiencies remaining during the period of performance.	The government will visit, at least once, the administrative record's location and check for completeness and compliance with referenced EP; electronic submissions will be evaluated randomly upon receipt as data is entered into the record.	Satisfactory or greater CPARS rating/poor CPARS rating and/or re-performance of work at contractor's expense.

Attachment B
PERFORMANCE METRICS

B.1 Performance Metrics for Performance Assessment Record (PAR)

	Exceptional	Very Good	Satisfactory	Marginal	Unsatisfactory
PAR Category: Quality of Product or Service					
Performance indicator: Document reviews					
Draft Plans, Reports, and documents [Plans, documents and reports are considered draft until accepted as final by the Government]	All contract-milestone documents accepted as submitted	No substantive comments (i.e. limited to grammar, spelling, terminology) to any of the documents, but a few exceptions were noted and corrected	Contractor met Acceptance Criteria	One or more documents required revisions to be resubmitted for approval prior to proceeding. Two back-checks were required on one or more documents before original comments were resolved satisfactorily.	One or more documents did not comply with contract requirements, or one or more documents required more than two back-checks before original comments were resolved satisfactorily, or more than one document was rejected.
Performance indicator: Project Execution					
Process Compliance	Zero Corrective Action Requests (CAR) or 948s	1-2 CARs/948s for non-critical violations to WP requirements	Contractor met Acceptance Criteria	5-6 CARs/948s for non-critical violations and/or {2} CARs/948 for critical violations	>6 CARS for non-critical violations and/or >2 CARs/948s for critical violations, or any unresolved CARs
Project Execution	Zero letters of formal grievances or concerns AND one or more unsolicited letters of commendation		Contractor met Acceptance Criteria	One letter of formal grievance or concern that was resolved through negotiation	More than one letter of formal grievance or concern that were resolved through negotiation
Task Completion			Contractor met Acceptance Criteria		Final data and QC documentation submitted but not accepted
PAR Category: Schedule					
Performance indicator: Timely completion of tasks					
Final Plans and Reports, project milestones, T.O. invoices	All document submittals and task order milestones and invoices complete and accepted by	Project closed out/final invoice accepted ahead of schedule	Project closed out/final invoice accepted on T.O. date	Project closed out/final invoice accepted within 30 calendar days after T.O. date.	Project closed out/final invoice accepted more than 30 calendar days after T.O. date.

	Exceptional	Very Good	Satisfactory	Marginal	Unsatisfactory
	T.O date, project closed out/final invoice approved ahead of schedule				
Project status reports accurate			Yes		No
Performance indicator: Impacts to schedule					
Impacts caused by Contractor or other causes identified, in writing to HNC CO/ PM, in a timely manner to apply acceptable corrective actions.			Yes		No
PAR Category: Cost Control (Not Applicable for Firm Fixed Price)					
Performance indicator: No unauthorized cost overruns					
Unauthorized cost overruns			No		Yes
Total Project Costs	Total contract invoices less than 98% of T.O. authorized amount	Total contract invoices greater than 98% but less than 99.99%of T.O. authorized amount	Total contract invoices between 99.99% and 100% of T.O. authorized amount	Total contract invoices greater than 100% but less than 105% of T.O. authorized amount	Total contract invoices greater than or equal to 105% of T.O. authorized amount
Performance indicator: Monthly cost report					
Monthly cost reports accurate			Yes		No
Performance indicator: Impacts to cost					
Impacts caused by Contractor or other causes identified, in writing to HNC CO/PM, in a timely manner to apply acceptable corrective actions.			Yes		No
PAR Category: Business Relations					
Performance indicator: Met contractual obligations					
Corrective Actions taken were timely and effective (Refer to CARs issued to Contractor)			Yes		No
Performance indicator: Professional and Ethical Conduct					
Meetings and correspondences with Public, project delivery	Zero letters of formal grievances or concern AND		Contractor met Acceptance Criteria	One letter of formal grievance or concern that was resolved	More than one letter of formal grievance or concern that

	Exceptional	Very Good	Satisfactory	Marginal	Unsatisfactory
team and other stakeholders	one or more unsolicited letters of commendation			through negotiation	were resolved through negotiation OR removal of one or more project personnel as a results of a letter of formal grievance or concern.
Performance indicator: Customer has overall satisfaction with work performed					
Customer survey results for rating period	4.0-5.0	3.0-3.9	2.0-2.9	1.0-1.9	<1.0
Performance indicator: Personnel responsive and cooperative					
Key personnel responsive, and cooperative	Always		Most Times		Almost Never
PAR Category: Management of Key Personnel and Resources					
Performance indicator: Personnel knowledgeable and effective in their areas of responsibility					
Personnel assigned to tasks	All personnel proposed by Contractor were assigned to project; some personnel were substituted by higher qualified individuals.		All personnel proposed by Contractor were assigned to project; some personnel were substituted by equally qualified individuals.	All personnel proposed by Contractor were assigned to project; some personnel were substituted by equally qualified individuals, Letter of formal grievance or concern received for personnel conduct from HNC.	All personnel proposed by Contractor were assigned to project, some personnel were substituted by lesser qualified individuals or HNC requested, in writing, removal of assigned personnel for poor performance.
Performance indicator: Personnel able to manage resources efficiently					
Instances when resource management had negative impact on project execution	0	1-2	3-4	5-6	>6
PAR Category: Safety					
Performance indicator: Accidents and Violations					
*No Class A Accidents, Contractor at fault *Major safety violations	0 No class A accidents IAW AR 385-10 0 accidents/injuries No safety	No class A accidents IAW AR 385-10 0 accidents/injuries No safety	Contractor met Acceptance Criteria	<2 non-explosive related Class C accidents, or 1 non-explosive Class B accident, IAW AR 385-10 2 non-explosive safety violations.	1 Any Class A accident IAW AR-385-10 or Any explosive related accident. >1 any violation of procedures for

	Exceptional	Very Good	Satisfactory	Marginal	Unsatisfactory
	violations	violations			handling, storage, transportation, or use of explosives IAW the WP, and all Federal, State and local laws/ordinances
*Minor safety violations	No safety violations	1 safety violation		3 safety violations	>3 safety violations

Classes of Accidents:

- **Class A:** Fatality or permanent total disability (Government Civilian, Military Personnel, and/or Contractor), or >$2,000,000 property damage.

- **Class B:** Permanent partial disability or impatient hospitalization of 3 or more persons (Government Civilian, Military Personnel, and/or Contractor), $500,000< $2,000,000 property damage.

- **Class C:** Lost Workday (Contractor) or Lost Time (Government Civilians), $50,000< $500,000 property damage.

- **Class D:** $2000 < $50,000 property damage.

* From Section C of Solicitation Number W912DY-04-R-0003, Amendment 0001 (may be included but are not limited to these).

The following guidelines are provided for issuing ratings that are subjective in nature; these ratings will be supported by the weight of evidence documented during the government's surveillance efforts:

Exceptional: Performance *meets* contractual requirements and *exceeds many* to the Government's benefit. The contractual performance of the element or sub-element being assessed was accomplished with *few minor problems* for which corrective actions taken by the Contractor were *highly effective*.

Very Good: Performance *meets* contractual requirements and *exceeds some* to the Government's benefit. The contractual performance of the element or sub-element being assessed was accomplished with *some minor problems* for which corrective actions taken by the Contractor were *effective*.

Satisfactory: Performance *meets* contractual requirements. The contractual performance of the element or sub-element contains *some minor problems* for which corrective actions taken by the Contractor *appear or were satisfactory*.

Marginal: Performance *does not meet all* contractual requirements. The contractual performance of the element or sub-element being assessed reflects a *serious problem* for which the Contractor has *not yet identified corrective actions*. The Contractor's proposed actions appear only *marginally effective or were not fully implemented*.

Unsatisfactory: Performance *does not meet most* contractual requirements and *recovery is not likely* in a timely manner. The contractual performance of the element or sub-element contains *serious problems* for which the Contractor's corrective actions *appear or were ineffective*

APPENDIX B

SITE FIGURES

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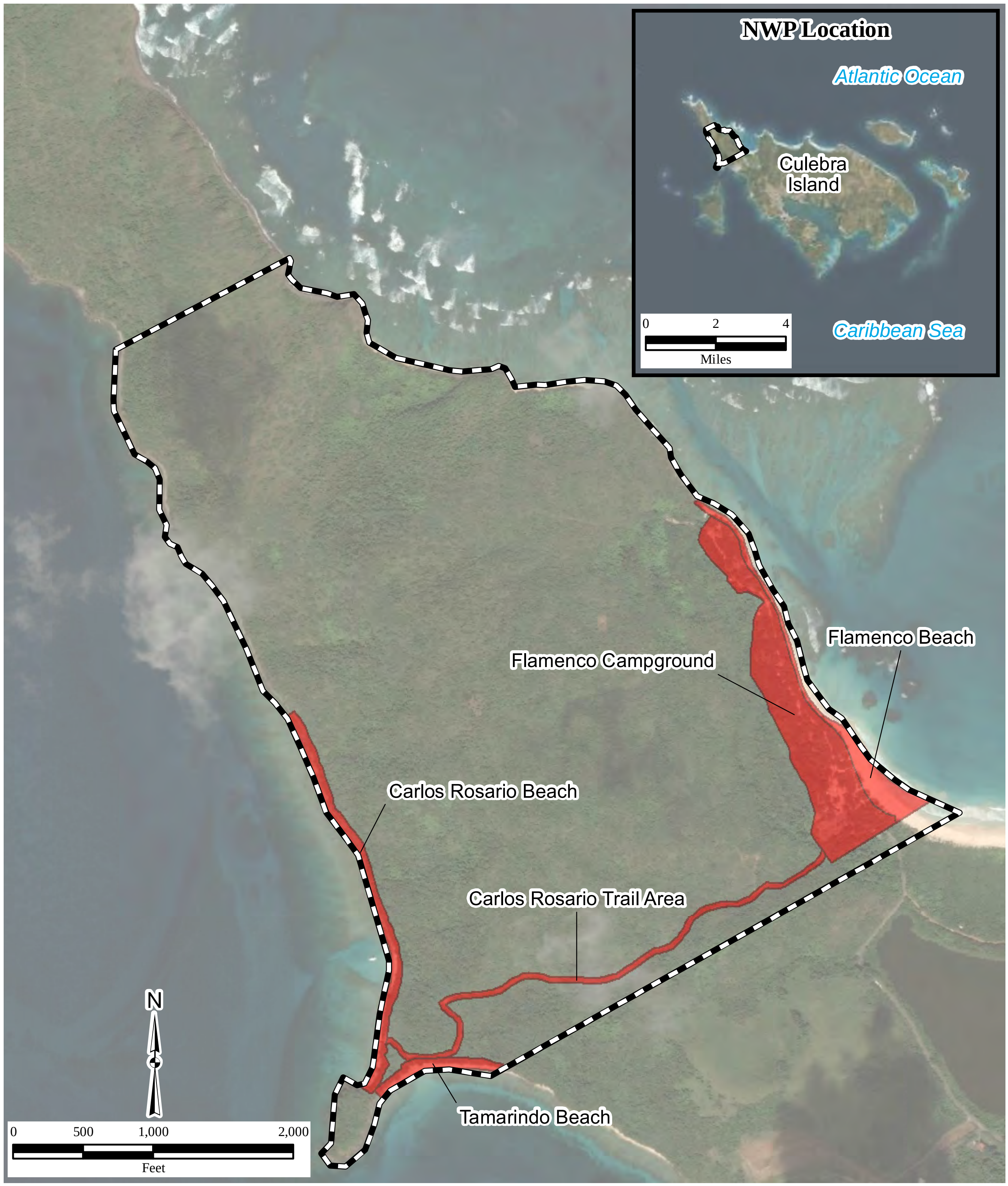


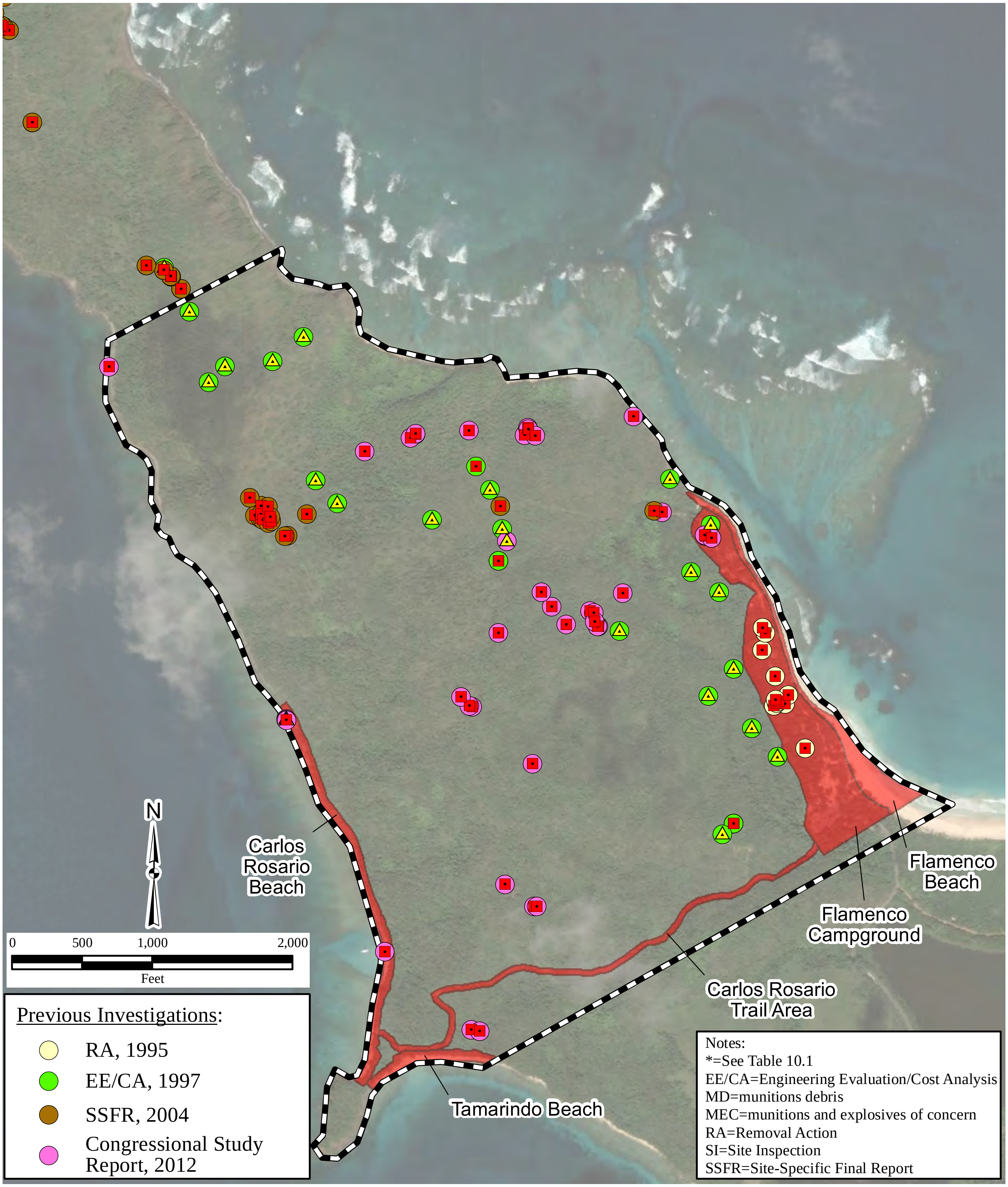
\\gst-srv-01\HGLGIS\Culebra_MSIW\QAPP\(10-01)SiteLocation.mxd
11/7/2016 CNL
Source: HGL, Parsons, USACE
ArcGIS Online Imagery

Legend

Clearance Area and Project Boundaries or Limits (31.83 acres)

Southern Portion of Northwest Peninsula

Figure 10.1
Site Location
Northwest Peninsula (NWP)
Culebra, Puerto Rico



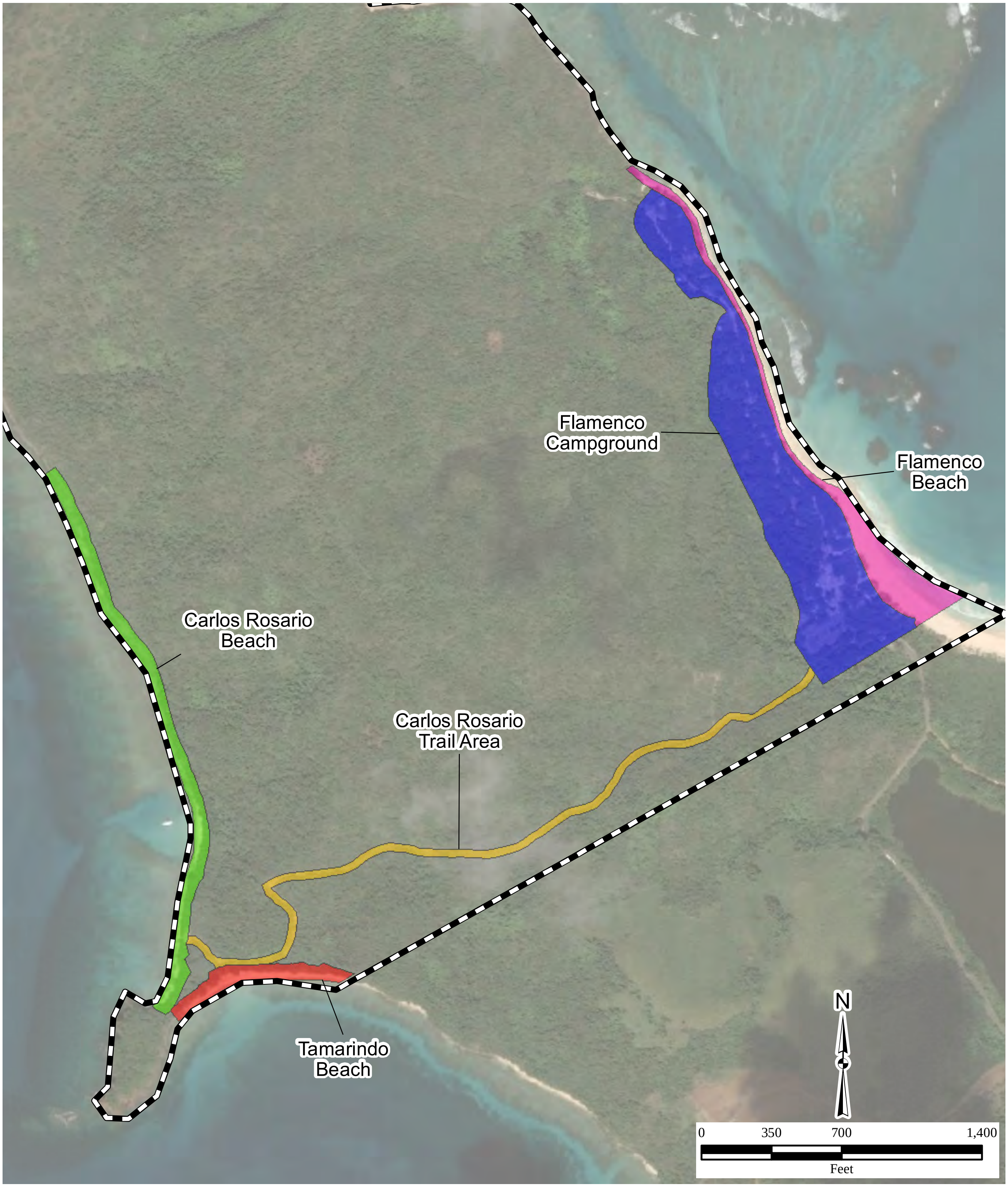
\\gst-srv-01\HGLGIS\Culebra_MSIW\QAPP\(10-02)MEC_Items.mxd
11/8/2016 CNL
Source: HGL, Parsons, USACE ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

Legend

- MEC Item*
- MD Item*
- Clearance Area (31.83 acres)
- Southern Portion of Northwest Peninsula

Figure 10.2
MEC Items Found During Previous Investigations



\\gst-srv-01\HGLGIS\Culebra_MSIW\QAPP\(10-03)ClearanceAreas.mxd
11/7/2016 CNL
Source: HGL, Parsons, USACE
ArcGIS Online Imagery

Legend

- Flamenco Beach
- Carlos Rosario Beach
- Carlos Rosario Trail Area
- Flamenco Campground
- Tamarindo Beach
- Southern Portion of Northwest Peninsula

HGL HydroGeoLogic, Inc

Figure 10.3
Clearance Areas

Legend

- SOUTHERN PORTION OF NORTHWEST PENINSULA BOUNDARY
- 500 YARD BUFFER ZONE (1946)
- TOWER
- TANK TARGET
- RADAR TARGET
- PILL BOX TARGET
- ANTI-AIRCRAFT TARGET
- OTHER TARGET
- TARGET LINE TOWERS (1953)
- TARGET LOCATIONS (1950)
- NAVAL GUN IMPACT AREAS
- NAVAL GUNFIRE RANGE 1969

Figure 10.4
Navy Sub-Range Areas

N

0 750 1,500 Feet

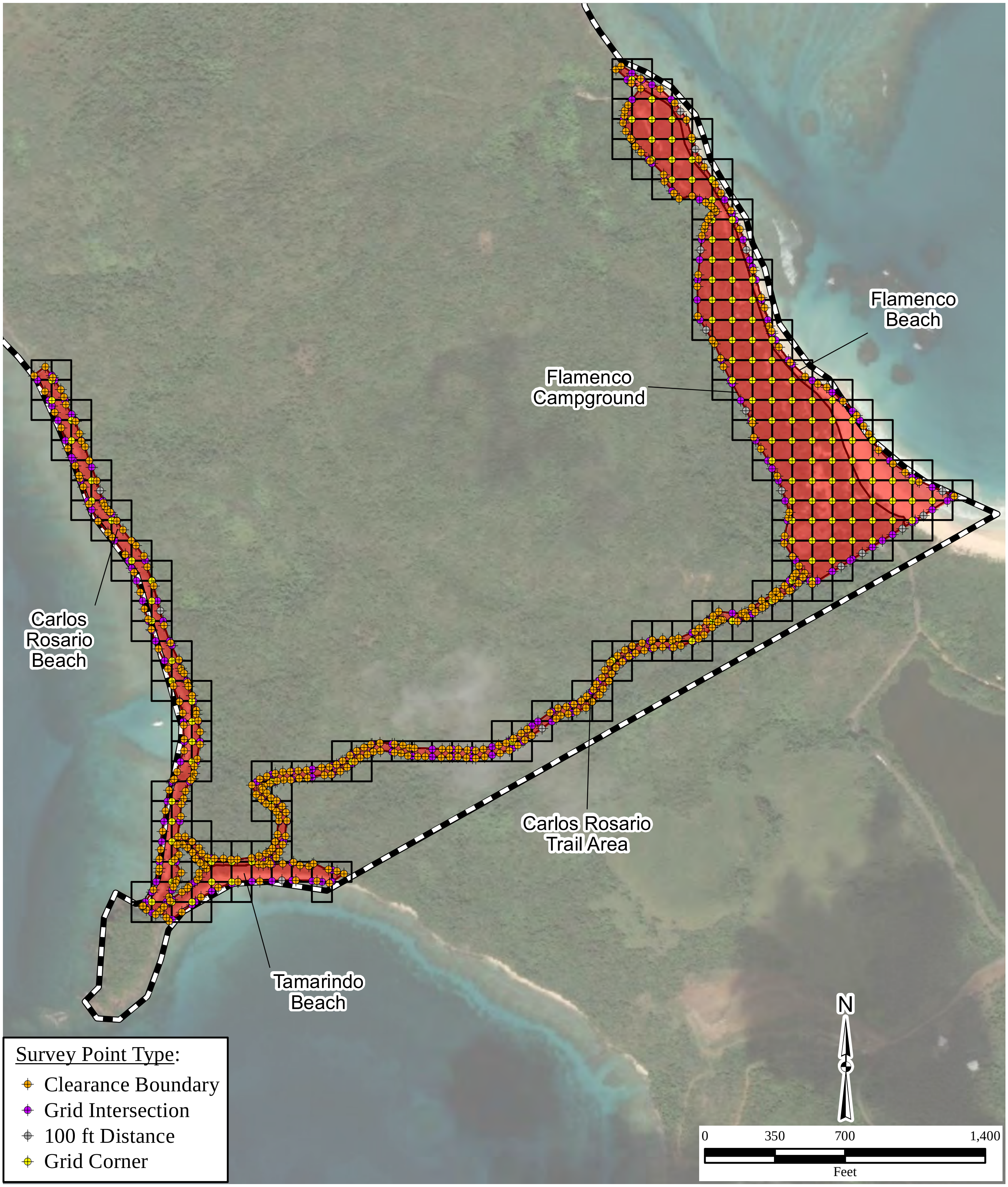
U. S. ARMY CORPS OF ENGINEERS
JACKSONVILLE DISTRICT

CULEBRA
FUDS PROPERTY # I02PR0068
CULEBRA ISLAND, PUERTO RICO

NWP SOUTHERN PORTION TARGET LOCATIONS

PROJ. DATE: Oct 2016 | PLATE NO.

Path: H:\CULEBRA_ALL\2016_APA\SPECIAL2.mxd



\\gst-srv-01\HGLGIS\Culebra_MSIW\QAPP\(14-01)SurveyClearanceGridDesign.mxd
11/7/2016 CNL
Source: HGL, Parsons, USACE
ArcGIS Online Imagery

HGL HydroGeoLogic, Inc

Legend

100 ft x 100 ft Grid

Clearance Area (31.83 acres)

Southern Portion of Northwest Peninsula

Figure 14.1
Survey and Clearance Grid Design

APPENDIX C

POINTS OF CONTACT

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POINTS OF CONTACT

POC	POSITION	ORGANIZATION	ADDRESS/ EMAIL	TELEPHONE
US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE (CEHNC)				
Rebecca Terry	COR/Project Manager	USAESCH	4820 University Square Huntsville, AL 35816-1822 Rebecca.K.Terry@usace.army.mil	256-895-1788
Kelly Longberg	Technical Manager	CEHNC-EDC-E	4820 University Square Huntsville, AL 35816-1822 Kelly.D.Longberg@usace.army.mil	256-895-1408
Kelly Enriquez	Project Geophysicist	CEHNC-EDC-G	4820 University Square Huntsville, AL 35816-1822 Kelly.D.Enriquez@usace.army.mil	256-895-1373
Michael D'Auben	Chemist	USAESCH	4820 University Square Huntsville, AL 35816-1822 Michael.J.D'Auben@usace.army.mil	256-895-1460
USACE, JACKSONVILLE DISTRICT (CESAJ)				
John Keiser	Program Manager	CESAJ-PM-M	701 San Marco Blvd Jacksonville, FL 32207 John.E.Keiser@usace.army.mil	904-232-1758
Wilberto Cubero	Project Manager	CESAJ-PM-M	701 San Marco Blvd Jacksonville, FL 32207 Wilberto.Cubero-Deltoro@usace.army.mil	904-232-1426
Amanda Parker	Public Affairs	CESAJ-CC-O	701 San Marco Blvd Jacksonville, FL 32207 Amanda.D.Parker@usace.army.mil	904-232-1576
Paul DeMarco	Biologist		701 San Marco Blvd Jacksonville, FL 3220 Paul.M.DeMarco@usace.army.mil	904-232-1897

Department of Public Safety, Stakeholders				
Mr. Mayor Ivan Solis	Mayor	Culebra	PO Box 7 Culebra, PR 00775-0189	787-742-3577 787-742-0487 787-742-0616 Fax
Ms. Coral Parrilla	Executive Director	Autoridad de Conservacion y Desarrollo de Culebra	P.O. Box 217, Culebra, PR 00775	787-742-3880
Marelisa Rivera	Deputy Field Supervisor, CESTO	US FWS - CESTO	Road 301, Km5.1, Boqueron, PR 00622 marelisa.rivera@fws.gov	787-851-7297 X 206
Ana M. Roman	Deputy Project Leader Culebra Refuge Manager	US FWS	Road 301, Km5.1, Boqueron, PR 00622 Ana.roman@fws.gov	787-396-7711
Richard Henry	National Technical Liaison ERT	US FWS	2890 Woodbridge Ave. Edison, NJ 08837 Richard_Henry@fws.gov	732-906-6987 973-204-5825 (cell)
Dr. Craig Lilyestrom	Director Marine Services Division	PR DNER	1375 Ponce de Leon Avenue San Juan, PR 00926 craig.lilyestrom@drna.pr.gov	787-772-2022
Dr. Lisamarie Carrubba, Ph.D.	NMFS PRD	NMFS	Road 301, Km 5.1 P.O. Box 1310 Boqueron, PR 00622 Lisamarie.Carrubba@noaa.gov	787-851-3700 787-455-0007 (cell)
Jose Rivera	NOAA Fisheries	NOAA Fisheries	c/o U.S. Army Corps of Engineers Antilles Office Annex Building Fundacion Angel Ramos 2nd Floor, Suite 202 Franklin Delano Roosevelt Ave. # 383 jose.a.rivera@noaa.gov	787-405-3605
Diane Wehner	Regional Resource Coordinator	NOAA	85 Central Ave. New Providence, NJ 07974 diane.wehner@noaa.gov	240-338-3411
Juan J. Baba Peebles	Project Manager	PREQB	P.O. Box 11488 San Juan, PR 00910	787-767-8181
Gloria M. Toro Agrait	Environmental Permitting Officer II	PREQB	P.O. Box 11488 San Juan, PR 00910 GloriaToro@jca.pr.gov	787-767-8181 x. 3586 or 787-833-4680
Julio Vazquez	EPA Region 2 – RPM	USEPA	290 Broadway – 18th Floor New York, NY 10007-1866	212-637-4323

Fire Department				
Culebra Fire Department Calle Escudero 317 Culebra, PR 00775			787-742-3530	
Police				
Puerto Rico State Police Department			787-742-3501	
Culebra Municipal Police			787-742-0106	
FAA				
Mr. Felipe Fraticelli	FAA Coordination Facility	FAA	www.nes.notams.faa.gov	787-253-8663 787-253-8664 FAA Coordination (NOTAM)
Mr. Hector Plaza	Alternate POC	FAA	www.nes.notams.faa.gov	787-525-6070
Mr. Hector Rivera	Alternate POC	FAA	www.nes.notams.faa.gov	404-520-4241
USCG				
RSC San Juan (Sub-Center of RCC Miami)		Commander, Sector San Juan, San Juan, PR	Southeast portion of the Caribbean Sea	787-289-2042/2041 VHF Channel 16
Mr. Efrain Lopez	Marine Information Specialist	USCG	San Juan, Puerto Rico efrain.lopez1@uscg.mil 24 hours notification requirement for Broadcast Notice to Mariners (BNM)	787-289-2097
CWO Anthony Cassisa	USCG Sector San Juan AtoN & WWM Officer	USCG	anthony.j.cassisa@uscg.mi This is for a Broadcast to Mariners of the scheduled demolition shot	787-289-2073
Medical				
Culebra Hospital and Local Ambulance			787-742-3511/0001	
Divers Alert Network (DAN) telephone number			919-684-9111	
DAN Medical Information Line			919-684-2948	
Puerto Rico Medical Center Centro Medico San Juan, PR Puerto Rico Medical Center PO Box 2129			787-777-3535/3827 (phone) ext.: 6476/6475/6068 787-777-3702 (fax) hiperbarica@asempr.org Director: Juan Angel Nazario, M.D 24hr Phone: 787 390-3243 Chamber #: 787 777-3535 x6475 or 6481 Office #: 787 777.3700	

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APPENDIX D

ACCIDENT PREVENTION PLAN

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APPENDIX D
ACCIDENT PREVENTION PLAN

TIME CRITICAL REMOVAL ACTION (TCRA)
SPECIFIC AREAS WITHIN THE NORTHWEST PENINSULA
CULEBRA ISLAND, PUERTO RICO

Contract No. W912DY-10-D-0023
Task Order No. 0022

Prepared for:

U.S. Army Engineering and Support Center, Huntsville

Prepared by:

HydroGeoLogic, Inc.
11107 Sunset Hills Road, Suite 400
Reston, VA 20190

November 2016

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EMERGENCY CONTACT INFORMATION

In case of emergency or unplanned situation, contact the appropriate responder from the list below.

- In emergency situations, contact the site Point of Contact (POC) who will then contact the appropriate response teams.
- If a serious, life threatening emergency arises, contact emergency personnel before contacting the site POC.

This list precedes this Accident Prevention Plan for quick reference.

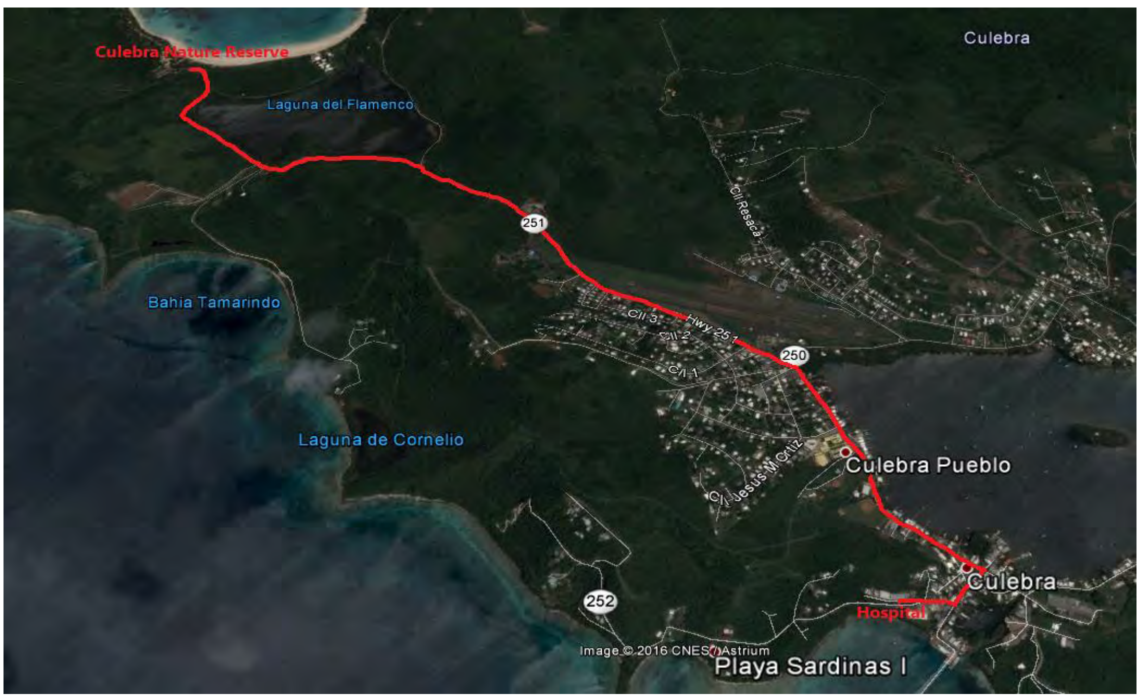
EMERGENCY TELEPHONE NUMBERS AND PROJECT CONTACTS

Emergency Medical Care		
Hospital: Culebra Medical Clinic	911 (787) 742-3511	
National Poison Control Center	(800) 222-1222	
National Response Center Environmental Emergencies	(800) 424-8802	
Federal OSHA Emergency Hotline	(800) 321-6742	
Culebra Emergency Numbers		
AERO Med Medical Evacuation Flight		(787) 756-3480
Emergency Management Office – Culebra		(787) 742-3849
Fire Fire Department – Culebra Island	Emergency Nonemergency	911 (787) 742-3530
Police Police Department – Culebra Island	Emergency Nonemergency	911 (787) 742-3501
USACE		
USAESCH COR	Rebecca Terry	(256) 895-1788
CESAJ PM	Wilberto Cubero	(904) 232-1426
HydroGeoLogic, Inc. (HGL)		
Health and Safety Emergency Number		(800) 341-3647
Project Manager	Derek Anderson	(703) 596-5715
Corporate Quality Management Representative	Neil Feist	(256) 970-2103
Senior UXO Supervisor (SUXOS)	TBD	TBD
UXO Safety Officer (UXOSO)	TBD	TBD
Corporate Health and Safety Director	Steve Davis CIH, CSP	(865) 659-0499
Project CIH	Edie Scala-Hampson CIH, CHMM	(847) 409-6384
HGL Corporate Occupational Physician *WorkCare 24-hour hotline nurse	Dr. Peter Greaney, MD	(714) 978-7488, ext. 114 *(888) 449-7787
Parsons		
Project Manager	Patti Berry	(678) 969-2410
Parsons Corporate Health and Safety Manager (CHSM)	Ed Grunwald	(770) 969-2394
Parsons WorkCare Incident Intervention	N/A	(888) 449-7787 or (714) 978-7488 ext. 228

Directions to Culebra Medical Clinic

- From the southeastern entrance to the Culebra Nature Reserve take HWY 251 south approximately 1.84 miles.
- HWY 251 will end at an intersection with HWY 250/C. Escuedero Road. Keep right on HWY 250 and continue south for another 0.56 miles.
- Turn right onto C. Pedro Marquez Road and continue for approximately 0.9 miles.
- Turn right onto C. William Font Street.
- The Culebra Medical Center is located 0.9 miles ahead on the right (16 minutes)

The Culebra Medical Clinic building is located near the island ferry landing at the end of C. William Font Street, which extends up the hill past the collection of local government buildings. The medical building is identified by a Red Cross symbol and is marked by a “Recetas” (prescriptions) sign.



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LIST OF ATTACHMENTS

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LIST OF ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AHA	activity hazard analysis
ANSI	American National Standards Institute
APP	Accident Prevention Plan
CDHS	Corporate Director of Health and Safety
CFR	Code of Federal Regulations
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
COR	Contracting Officer's Representative
CPR	cardiopulmonary resuscitation
CSP	Certified Safety Professional
CWM	chemical warfare materiel
DA	Department of the Army
dBA	A-weighted decibels
DDESB	Department of Defense Explosives Safety Board
DEET	N,N-Diethyl-m-toluamide
DID	Data Item Description
DoD	U.S. Department of Defense
ECT	equivalent chill temperature
EM	Engineer Manual
EMS	emergency medical services
EOD	explosive ordnance disposal
ESS	Explosives Safety Submission
GFCI	ground fault circuit interrupter
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCP	Hazard Communication Program
HGL	HydroGeoLogic, Inc.
HSP	Health and Safety Program
HTRW	hazardous, toxic, and radioactive waste
IAW	in accordance with
IDW	investigation derived waste
MD	munitions debris
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

MRS	munitions response site
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
PFD	personal flotation device
PM	Project Manager
POC	point of contact
PPE	personal protective equipment
RAC	risk assessment code
SDS	Safety Data Sheet
SHM	Safety and Health Manager
SOP	standard operating procedure
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
TBD	to be determined
TCRA	Time Critical Removal Action
TLV	threshold limit value
TSM	tailgate safety meeting
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USDAFS	U.S. Department of Agriculture Forest Service
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
WBGT	wet bulb globe thermometer
WP	Work Plan

ACCIDENT PREVENTION PLAN ACKNOWLEDGMENT

I have read, understand, and agree to abide by the provisions as detailed in this Accident Prevention Plan prepared by HydroGeoLogic, Inc. Failure to comply with these provisions may lead to disciplinary action that may include dismissal from the work site, termination of employment or, for subcontractors, termination of the work contract.

Printed Name	Company	Signature	Date

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1.0 SIGNATURE SHEET

Scott Schroepfer
Digitally signed by Scott Schroepfer
DN: cn=Scott Schroepfer, o=HydroGeoLogic, Inc., ou=Munitions Response Team, email=sschroepfer@hgl.com, c=US
Date: 2016.08.01 18:14:35 -05'00'

Prepared by: ______________________________ ______________

Scott Schroepfer — Date
HGL
HGL UXO Safety Representative

Approved by: Janardan J Patel
Digitally signed by Janardan J Patel
DN: cn=Janardan J Patel, o=HGL, ou=ECD, email=jpatel@hgl.com, c=US
Date: 2016.08.01 18:59:48 -04'00'
08/01/2016

Janardan Patel — Date
HGL
HGL Senior Vice President, Engineering and Construction Division

Review/ Concurrence by: Edith Scala-Hampson
Digitally signed by Edith Scala-Hampson
Date: 2016.08.01 18:33:25 -05'00'

Edie Scala-Hampson, CHMM, CIH — Date
HGL
Project Certified Industrial Hygienist (CIH)
(847) 409-6384

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2.0 BACKGROUND INFORMATION

This Accident Prevention Plan (APP) and accompanying Site Safety and Health Plan (SSHP) (Attachment D1) describe the safety program that will be implemented during the Time Critical Removal Action (TCRA) project at Specific Areas within the Northwest Peninsula on Culebra Island. (Report figures are located in Appendix B of the Work Plan [WP].) This APP was prepared in accordance with (IAW) U.S. Army Corps of Engineers (USACE) Engineer Manual (EM) 385-1-1, Safety and Health Requirements Manual, Appendix A, Minimum Basic Outline for APPs, and Data Item Description (DID) WERS-005.01.The purpose of this APP is to establish the site-specific safety and health procedures, practices, and equipment to be used to protect field personnel from potential hazards associated with project site activities that may be suspect of containing munitions and explosives of concern (MEC). The APP assigns responsibilities, establishes standard operating procedures (SOPs), and provides contingency plans for situations that may arise during field activities. The project involves the following:

- Detection and investigation of anomalies
- Disposal of MEC and material potentially presenting an explosive hazard (MPPEH), to include munitions debris (MD), from areas of the project footprint

All activities involving work in areas potentially containing unexploded ordnance (UXO) hazards will be conducted in full compliance with USACE, Department of the Army (DA), and U.S. Department of Defense (DoD) safety standards, and with state and local safety requirements regarding personnel, equipment, and procedures.

2.1 CONTRACTOR

HGL (Corporate Office)
11107 Sunset Hills Road
Suite 400
Reston, Virginia 20190
(703) 478-5186

2.2 CONTRACT NUMBER

W912DY-10-D-0023, Task Order No. 0022

2.3 PROJECT NAME

Time Critical Removal Action at Specific Areas within the Northwest Peninsula, Culebra Island, Puerto Rico.

2.4 PROJECT DESCRIPTION

The objective of this project is to provide all Military Munitions Response Program (MMRP) services necessary to remove MEC and MPPEH, including MD, from the proposed Specific Areas within the Northwest Peninsula on Culebra Island, Puerto Rico.

2.5 CONTRACTOR ACCIDENT EXPERIENCE

HGL has received multiple National Safety Council Perfect Record and "Occupational Excellence" Awards for our most recent safety performance.

HGL qualified for the awards by demonstrating our ability to implement actions discussed in our health and safety policy statement, such as including safety in task planning, staffing our projects with knowledgeable and skilled personnel, selecting good subcontractors, and by managing our work to ensure that it is conducted safely. HGL achieved a rate of lost time injuries and illnesses that was less than one-half of the average for similar companies, as reported by the Bureau of Labor Statistics. Companywide, HGL had only one recordable injury in 2015. This excellent safety performance was achieved through the diligent efforts of our management teams to identify and control hazards and through the prudent execution of our work by everyone.

We take great pride in the Perfect Record awards because they reflect HGL's successful teamwork in preventing serious work-related injuries and illnesses and our goal of continuous improvement. We also take pride in these awards because they distinguish us from our competitors.

HGL has successfully implemented a safety management system including management involvement, hazard recognition, hazard control, and employee input. The safety management system has been used to develop and implement our safety and health program and manage risks by defining responsibilities, practices, procedures, processes, resources and setting objectives. Occupational Safety and Health Administration (OSHA) 300 and 300 A forms are included as Figure 2.1.

2.6 PHASES OF WORK AND HAZARDOUS ACTIVITIES

Activity hazard analysis (AHA) forms for each planned activity are presented in Attachment D2 of this APP. A detailed description of field activities rationale and procedures are presented in the WP.

- Mobilization/demobilization
- General site hazards
- MEC avoidance – survey escort
- Munitions response site (MRS) clearing and grubbing (as required)
- MEC subsurface clearance
- MEC movement within the project area
- MEC disposal
- MPPEH processing
- Water Vehicle Operations
- Vehicle operations

Figure 2.1 OSHA 300 and 300A

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 2015

U.S. Department of La

Occupational Safety and Health Adm

Form approved OMB no.

You must record information about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an injury and illness incident report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name HydroGeologic, Inc.

City Reston State VA

Identify the person		Describe the case				Classify the case									
						CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or ch… illness:			
						Death	Days away from work	Remained at work				(M)			
(A) Case No.	(B) Employee's Name	(C) Job Title (e.g., Welder)	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)			Job transfer or restriction	Other record-able cases	Away From Work (days)	On job transfer or restriction (days)	Injury	Skin Disorder	Respiratory Condition	Poisoning
						(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)
1		UXO Tech	4/14/2015	KSAAP	Torn meniscus, left knee		x			69		x			
2															
3															
					Page totals	0	1	0	0	69	0	1	0	0	0

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Injury (1) Skin Disorder (2) Respiratory Condition (3) Poisoning (4)

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instruction, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Ave, NW, Washington, DC 20210. Do not send the completed forms to this office.

Page 1 of 1

Figure 2.1 OSHA 300 and 300A (continued)

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Year 2015

U.S. Department of Labor
Occupational Safety and Health Administration
Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the log. If you had no cases write "0."

Employees former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR 1904.35, in OSHA's Recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
0	1	0	0
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
69	0
(K)	(L)

Injury and Illness Types

Total number of...
(M)

(1) Injury	1	(4) Poisoning	0
(2) Skin Disorder	0	(5) Hearing Loss	0
(3) Respiratory Condition	0	(6) All Other Illnesses	0

Post this Summary page from February 1 to April 30 of the year following the year covered by the form

Public reporting burden for this collection of information is estimated to average 58 minutes per response, including time to review the instruction, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Ave, NW, Washington, DC 20210. Do not send the completed forms to this office.

Establishment information

Your establishment name HydroGeologic, Inc.

Street 11107 Sunset Hills Road, Suite 400

City Reston State Virginia Zip 20190

Industry description (e.g., Manufacture of motor truck trailers)
Remediation Services

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)

OR North American Industrial Classification (NAICS), if known (e.g., 336212)
5 6 2 9

Employment information

Annual average number of employees 330

Total hours worked by all employees last year 660,000

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Scott Schulein — Company executive; COO — Title

703-478-5186 — Phone; 1/11/2016 — Date

3.0 STATEMENT OF SAFETY AND HEALTH POLICY

HGL's Commitment to Employee Health and Safety

HydroGeoLogic, Inc. (HGL) is committed to providing safe and healthful working conditions for every employee. Our objective is to have the safest employees, both at work and at home, in our industry. HGL promotes sound safety practices based on the identification and control of Occupational Health & Safety (OH&S) risks where our employees work. We do this by effective project and task planning; by staffing our projects with knowledgeable and skilled professionals; by carefully selecting our subcontractors and business partners; by executing projects according to approved plans; and by monitoring performance.

As an organization, HGL is dedicated to:

- Protecting the safety and health of our employees through anticipation, recognition and control of hazards in the workplace.
- Complying with applicable health, safety regulatory and client requirements everywhere we operate.
- Ensuring our commitment to employee health and safety is an integral aspect of our culture and our services.
- Measuring and periodically reviewing our progress and striving for continuous improvement and to exceed expectations.

Specifically, it is HGL's belief that acceptance and adherence to the following principles will achieve safety excellence in day-to-day operations:

- All levels of management are responsible for providing resources and leadership required to provide a safe work environment.
- Working safely is a condition of employment.
- Safety and the prevention of injuries is everyone's responsibility.
- Training and supporting employees to perform their work safely is essential.

By integrating employee health and safety considerations into all aspects of HGL's business, we protect our employees and our clients while achieving sustainable growth and productivity.

Peter S Huyakorn

Peter S. Huyakorn, Ph.D

President

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4.0 RESPONSIBILITIES AND LINES OF AUTHORITY

HGL, as the prime contractor, will manage health and safety activities on this project IAW its corporate health and safety procedures and project-specific documents.

HGL's Health and Safety Program (HSP) is detailed in the Corporate Health and Safety Manual, available in print or electronically, and implemented/overseen by HGL's Corporate Director of Health and Safety (CDHS), Steve Davis, Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP). HGL managers and employees are expected to conduct business in compliance with governmental environmental and safety regulations, client programs, and company policies and procedures. The "rules of construction" for subcontractors apply, as specified in 29 Code of Federal Regulations (CFR) 1926.16.

4.1 IDENTIFICATION AND ACCOUNTABILITY OF PERSONNEL RESPONSIBLE FOR SAFETY

Key project personnel include the following:

- HGL Project Manager (PM): Derek Anderson
- HGL Senior UXO Supervisor (SUXOS): to be determined (TBD)
- HGL Unexploded Ordnance Safety Officer (UXOSO): TBD
- Safety and Health Manager (SHM)/CDHS: Stephen Davis, CSP, CIH
- Project CIH: Edie Scala-Hampson, CIH, Certified Hazardous Materials Manager (CHMM)

HGL's Occupational Medicine Physician is Peter Greaney, MD, President of WorkCare, Inc.

Applicable certifications for key field project personnel responsible for safety are included in Attachment D3 of the APP.

HGL policies and procedures regarding noncompliance with safety requirements follow Human Resources Policy No. 45, *Performance Improvement Plan Policy*, which involves a three-step process of identification, performance improvement, and employment action. Employees who violate a company policy, whose actions pose a threat to co-workers, whose actions constitute harassment, or who violate the law may have their employment terminated without following the HGL Performance Improvement Policy.

4.2 LINES OF AUTHORITY

The lines of authority and communication for this task order are presented on Figure 4.1. The PM has the overall responsibility for this project and will execute the contract in a manner consistent with this APP/SSHP and other contract-specific requirements. The PM will coordinate with the SUXOS, UXOSO, and SHM/CDHS to complete the work in a manner consistent with this APP/SSHP.

The SUXOS directs site activities IAW the approved WP, the APP/SSHP, and all federal, state, and local laws and regulations. The SUXOS is responsible for maintaining contact with the PM and the HGL SHM/CDHS for matters regarding project health and safety. The SUXOS reports to the PM.

The UXOSO will monitor and confirm that operations are conducted IAW this APP/SSHP, USACE requirements, and OSHA regulations. The UXOSO communicates with the PM on technical matters during execution of project activities, but reports directly to the SHM/CDHS or Project CIH on functional issues regarding safety.

4.2.1 All Personnel

Each person is responsible for completing tasks in a safe manner, and for reporting any unsafe acts or conditions to the UXOSO. All persons on site are responsible for continuous adherence to the APP/SSHP provisions during the performance of project work. All employees/personnel have the authority and responsibility to stop work on the site if an imminent hazard is observed. Even when a hazard is not imminent, employees/personnel should intercede if unsafe behavior or conditions are observed.

All HGL and subcontractor personnel are required to read and acknowledge their understanding of this APP by signing the APP acknowledgment form of this document and by cooperating with project management to ensure a safe work site.

4.2.2 Program and Project Manager

The HGL MMRP Program Manager is the single point of contact (POC) with the USACE Contracting Officer's Representative (COR). The HGL PMs are the primary POCs with the USACE Technical Manager. The PMs have overall responsibility for the health and safety of personnel on the project, including:

1) Ensuring the project team adherence to company policy and this APP/SSHP;
2) Confirming the proper review and distribution of health and safety documents;
3) Communicating with the UXOSO/CDHS for any variances or modifications in a timely manner;
4) Verifying that HGL personnel assigned to the project:
    a. Are current participants in the medical surveillance program,
    b. Have a current (within the last calendar year) respiratory fit test (if applicable), and
    c. Have completed required safety and health training.
5) Determining that subcontractors have submitted required health and safety documents to the Site Safety and Health Officer (SSHO); and
    - Maintaining and reporting records of exposure hours and work-related accidents, injuries, and illnesses of HGL and subcontractors.

4.2.3 Unexploded Ordnance Safety Officer

The UXOSO will be present at all times when MEC field activities are being performed. For tasks with no exposure to mechanical or explosive hazards (for example, field walk-overs and surface soil sampling) a collateral duty safety officer may be assigned. The UXOSO will provide day-to-day safety and industrial hygiene support, provide site safety orientations, oversee air monitoring and training, confirm appropriate personal protective equipment (PPE) selection, conduct tailgate safety meetings (TSMs), conduct daily site safety inspections, confirm work zone delineations, verify training and medical clearances of on-site personnel, and report activities to the HGL PMs and SHM/CDHS. Specific tasks assigned to the UXOSO include:

- Verifying that the APP/SSHP and AHAs are followed by HGL and subcontractors;
- Verifying the training and medical clearances of HGL on-site personnel;
- Verifying that the specified PPE is available and used;
- Participating in accident/incident and near-miss investigations;
- Reviewing pertinent safety and health documentation from the field for compliance with this APP/SSHP;
- Updating and reviewing AHAs, as indicated;
- Developing a schedule for safety observations and inspection checklists;
- Establishing appropriate site control zones and control the entry and exit points;
- Conducting or presenting initial site training;
- Conducting and documenting regular update training (TSMs);
- Conducting site safety inspections (Section 7.a);
- Monitoring the field team for signs of thermal stress, fatigue, and exposure symptoms;
- Monitoring site weather conditions (heat, cold, inclement weather) and implementing hazard controls as needed;
- Knowing emergency procedures, evacuation routes, shelters and telephone numbers;
- Reporting all near-miss, injury, illness, and vehicle accidents or incidents to the PM and SHM/CDHS within 24 hours, and confirming that an Accident Investigation Form is completed;
- Holding a safety stand-down meeting to conduct training at any time a deviation or degradation of safety warrants a review;
- Seeking guidance from the SHM/CDHS when unanticipated conditions develop; and
- Stopping work if any operation threatens worker or public safety or health.

The UXOSO is the main contact in any on-site emergency situation. The UXOSO is responsible for facilitating and coordinating the field implementation of the APP/SSHP and has the responsibility and authority to halt or modify hazardous activities or working conditions. The UXOSO has the authority to request (IAW the chain of command) removal from the site any person who refuses to comply with the APP/SSHP or whose behavior endangers his or her own safety, or the safety of others. Should the UXOSO become aware that a subcontractor's employee is not following the APP/SSHP, the UXOSO will notify the most senior member of the relevant subcontractor's field team and require that the subcontractor begin immediate corrective actions.

4.2.4 Certified Industrial Hygienist/Corporate Health and Safety Director

The SHM/CDHS and/or Project CIH will advise the PM and UXOSO on safety and health issues that may have an impact on project operations, and provide technical assistance to the project team, based upon a review of the APP/SSHP and contributing documents. The SHM/CDHS or Project CIH is also responsible for reviewing and approving the APP/SSHP; suggesting modifications to the APP/SSHP; and reviewing and approving all changes and updates suggested by the field team. In addition, the SHM/CDHS and/or Project CIH is responsible for the following:

- Providing general safety and health program administration.
- Conducting field safety and health audits for APP/SSHP conformance.
- Establishing air monitoring parameters based on expected contaminants.
- Establishing employee exposure monitoring notification programs.
- Establishing random and for cause drug and alcohol testing, as warranted.
- Providing technical assistance to the PM and the SUXOS/UXOSO.
- Investigating significant incidents, illnesses, and near-misses.
- Providing support for evaluation of subcontractor actions as they pertain to protecting the safety and health of workers and the public.

4.2.5 Occupational Medicine Physician

The occupational physician's responsibilities include the following:

- Performing medical surveillance as directed by 29 CFR 1910.120.
- Determining if medical clearance per 29 CFR 1910.120 is needed on an annual or biennial basis.
- Providing medical review officer services for drug and alcohol test results review.
- Providing clinical consultation to injured employees before they go to an emergency room and consulting with treating physicians as necessary.
- Maintaining contact with injured employees to determine if there are issues or barriers to rapid healing, rehabilitation and return to full duty status.

- Providing technical support as needed for determination of project-specific medical monitoring.

4.2.6 Subcontractor Management and Personnel

The management organization of each subcontractor is responsible for the compliance of its personnel with applicable laws and regulations, applicable provisions of HGL's APP, and site-specific SSHPs, as well as with its own safety and health programs and AHAs. Subcontractors are directly responsible for the safety and health of their personnel. HGL will communicate significant site hazards and recommended controls to the subcontractors; review and comment on health and safety-related document submissions; and verify that subcontractor staff are qualified to safely complete their tasks. HGL will monitor activities to confirm that subcontractors are performing their operations IAW the provisions of HGL's APP/SSHP, relevant HGL AHAs, and the subcontractors' AHAs and contract documents.

The APP/SSHP requirements that apply to HGL personnel (for example, training, substance abuse screening, and incident reporting) also apply to subcontractors and their field personnel.

Additional subcontractor safety responsibilities are detailed in Section 5.0.

4.2.7 On-Site Personnel and Visitors

A Site Entry Log for visitors will be maintained on site (Appendix F of WP). All persons entering the site during site operations must first sign in and be given a site hazard briefing. Visitors will not be allowed within the regulated work areas without authorization from the Site Supervisor or SUXOS and the knowledge of the UXOSO. Visitors requesting authorization to enter a designated regulated area must meet the requirements for medical exams, training, and PPE as required by this APP/SSHP.

4.2.8 SUXOS

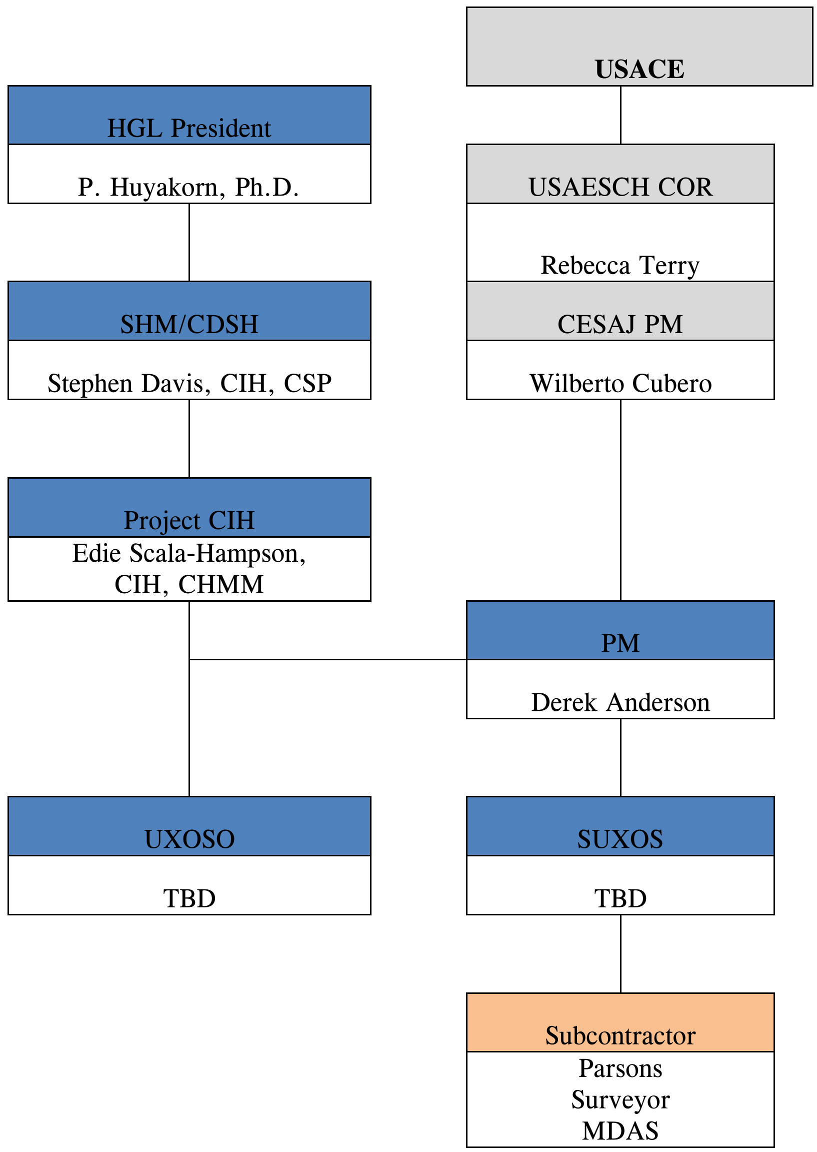
The SUXOS is ultimately responsible for all MEC operations during project activities. The SUXOS acts as the field team UXO supervisor and is directly responsible for all MEC activities. The SUXOS is responsible for the following:

- Ensuring compliance with applicable DoD, DoD Explosives Safety Board (DDESB), USACE, federal, state, and local laws and regulations.
- Planning, coordinating, and supervising all on-site munitions response and operational range clearance activities.
- Supervising MEC teams.
- Assisting in development of project planning documents.
- Reviewing all field reports (for example, daily reports, audits) and approving MEC team reports.

- Evaluating, with the UXOSO, the risk of movement of MEC within an MRS or operational range and providing approval for movement when the risk of movement is determined to be acceptable.
- Coordinating with the UXOSO in establishing planned ingress, egress, and routine vehicle footpath routes within the project area to avoid MEC hazards.

The SUXOS has the responsibility and authority to halt or modify any working condition and to remove from the site any person who refuses to comply with the APP/SSHP or whose behavior endangers his or her own safety or the safety of others. Should the SUXOS become aware that a subcontractor is not following the APP/SSHP, the SUXOS will notify the subcontractor and require that the subcontractor begin immediate corrective actions.

Figure 4.1 Lines of Authority



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5.0 SUBCONTRACTORS

Subcontractors report to the HGL PM and the SUXOS. Subcontractors conducting fieldwork on HGL projects will establish an effective safety program applicable to their work and employees. Subcontractors will review and accept the HGL APP/SSHP and prepare their own safety AHAs for presentation to HGL PM at least 10 days before site mobilization. All AHAs must be reviewed/accepted by the government, the subcontractor must meet the requirements of this APP/SSHP and provide safety equipment and safeguards suitable for the tasks and hazards involved. Subcontractors must provide to their personnel the appropriate safety and health hazards and controls information for their project tasks.

The identified subcontractor personnel responsible for safety are listed in Table 5.1. The subcontractors' field supervisors and competent persons are responsible for performing daily safety inspections of their operations (29 CFR 1926.20[b][2]). A copy of this inspection report will be submitted to the UXOSO each day.

Table 5.1
Subcontractor List

Expertise	Subcontractor Name	Field Superintendent*
Geophysics	Parsons	TBD
MPPEH Disposition	TBD	N/A
Surveyor	TBD	N/A

*Amend the title of the subcontractor's lead employee as needed.

All subcontractors and suppliers will receive training on MEC recognition and UXO safety precautions before beginning activities at the site. All subcontractors will be given a daily safety briefing and will be escorted at all times by a UXO technician while on site. Each subcontractor must do the following:

- Provide documentation for each on-site worker of successful completion of applicable training.
- Provide documentation of medical approval on an as-needed basis before the worker arrives on site.
- Provide all PPE required by their employees (subject to the provisions of 29 CFR 1910.132[h]).
- Provide awareness-level training to affected employees and other subcontractor workers regarding any material, equipment, or operation that may pose a hazard.
- Conduct any required industrial hygiene monitoring for their workers.
- Participate in the daily TSMs and in routine site inspection activities.
- Report immediately all unsafe conditions, faulty equipment, incidents, and close calls to the UXOSO so that lessons learned can be discussed at TSMs—all deficiencies have to be tracked on the Safety and Health Deficiency Tracking Log through resolution.

- Document that all equipment brought to the site is new or in like new condition, is inspected before use and routinely during use, and is maintained in safe working order.

6.0 TRAINING

6.1 PROJECT-SPECIFIC TRAINING

The UXOSO will give site-specific training to all personnel prior to their initial site entry. The training will include:

- Project scope to include organization and responsibilities, site orientation, facilities, access, egress, evacuation routes, and other general information; and
- All elements of the SSHP, including general safety, safe work practices, physical hazards, PPE, on-site and off-site emergencies, evacuation routes, emergency agencies/numbers, emergency equipment, medical emergencies, drug and alcohol awareness, bloodborne pathogens, and other pertinent safety information.

6.2 DAILY SAFETY AND TAILGATE MEETINGS

Before beginning fieldwork, field personnel assigned to this project will participate in an initial meeting with the PMs, SUXOS, and UXOSO to review and discuss the APP/SSHP and sign the APP acknowledgment form located at the beginning of this document. All new personnel assigned to the project after the initial safety meeting will review the APP, receive site-specific health and safety training, and sign the APP acknowledgement page.

The following subjects will be discussed during the initial safety indoctrination:

- Lines of authority, organization, and responsibilities
- Communication methods and cell phone access locations
- Site facilities, locations of utilities, access/egress, and work zones
- Site contaminants
- Phases and sequence of work, equipment, and chemicals required
- Potential physical and chemical hazards, hazard controls, and safe work practices
- Potential weather-related hazards, controls, and monitoring
- Lifting and material handling (if applicable)
- Required PPE
- Decontamination procedures
- Evacuation routes, emergency response plan, places of safe refuge, route to hospital
- Emergency notifications
- Emergency contact information
- On-site persons certified in first aid and cardiopulmonary resuscitation (CPR)
- Spill kits, first aid kits, fire extinguishers
- MEC awareness (if applicable)
- Fire prevention
- AHAs

The UXOSO will conduct a safety briefing for all HGL and subcontractor site personnel at least weekly and more often as appropriate based on site activities and changing tasks or conditions. These briefings will be used as an opportunity to address site-specific safety issues, refresh workers on specific procedures, address new hazards and controls, and discuss any lessons learned. An example of the Safety Meeting Training Log is included in Appendix F of the WP.

Topics to be discussed at the TSM include the following:

- Day's activities
- Potential health and safety issues
- Changes in activities and operations
- Changes in conditions
- Weather conditions and heat/cold stress or other precautions
- Methods of risk reduction
- Required PPE for each task
- New MEC hazards or ordnance identification
- Recent significant incidents
- Biological hazards
- Changes to the SSHP
- Completion of Pre-Task Safety and Health Analyses worksheet, as needed
- Other applicable information that will increase safety awareness on the project

Employee feedback regarding health and safety will also be solicited. Documentation of each meeting will be retained.

6.3 PROJECT SAFETY INDOCTRINATION

The UXOSO will conduct a detailed safety indoctrination presentation on all site risks and the workplace HSP before work commences on the project site and at other times when new site workers arrive. Topics will include the following:

- Requirements and responsibilities for maintaining safe and healthful work environment
- General safety and health policy and procedures
- Employee and supervisor responsibilities for reporting all accidents
- Emergency response plans and procedures for obtaining medical treatment
- Procedures for reporting and correcting unsafe conditions or practices
- Specific job hazards and the means to mitigate the risks
- Names of and contact information for those responsible for safety program administration
- Site hazards, hazard recognition, and symptoms of excessive exposure to site hazards
- Proper use of required PPE

- Safe use of engineering controls and equipment on the project site
- Temporary site facilities
- Equipment storage
- Planned parking areas
- Explosive storage (when required)
- Public traffic routes
- Access and egress to the work site and rally points (USACE EM 385-1-1, Section 04.A.01)

In addition, the UXOSO will provide detailed safety training in the following areas to workers exposed to the hazards described:

- **Chemical hazard communication**. If chemicals are brought onto the job site, employees potentially exposed to their hazards will receive appropriate safety training. This training will include the details of the chemical hazard communication program (HCP) described in the accompanying SSHP.
- **Fire prevention and response**. The UXOSO will conduct training sessions on measures to prevent fires and procedures for suppressing fires. Employees will receive training in the use of fire extinguishers to fight incipient fires.
- **Control of hazardous energy (lockout/tagout)**. If site work involves the potential for injury from the release of stored energy, then employees will be trained in appropriate lockout/tagout procedures.

The UXOSO will confer with the CDHS to determine an appropriate schedule for retraining employees in site-specific safety topics. Annual or more frequent refresher sessions will be required. Daily safety briefings will be conducted by the UXOSO for site personnel prior to the start of each day's activities. Such sessions will be used to discuss anticipated risks and safe practices to mitigate hazards. The UXOSO also will conduct appropriate safety briefings for visitors and vendor representatives who will be on the site for short periods. The topics covered will be determined by the nature of the potential hazards to which they will be exposed.

6.4 MANDATORY TRAINING

UXO personnel working at this site have completed U.S. Military explosive ordnance disposal (EOD) or another DoD-certified UXO training program that details procedures for evaluation and disposal of MEC. In addition to the training listed above, workers will have successfully completed the following:

- A 40–hour Hazardous Waste Operations and Emergency Response (HAZWOPER) course and have 3 days of documented supervised field experience
- An 8–hour HAZWOPER refresher training course on an annual basis

- An 8-hour HAZWOPER supervisor course (for example, SUXOS, UXOSO, UXO Quality Control Specialist (UXOQCS), and UXO Technician III)
- An OSHA 30-hour construction safety course (for UXOSO)
- A first aid/CPR/automated external defibrillation course every 2 years (minimum two personnel on site)

The UXOSO and SUXOS will review site-specific emergency action procedures as a part of the site safety orientation training and periodically as a component of site indoctrination and TSMs. All site personnel will be trained in the emergency response procedures. This training will include the following:

- Identification of the emergency coordinator(s) and contacts
- Procedures for emergency communications and notifications
- Procedures for contacting emergency services
- Locations of functioning communication devices for personnel not equipped with cellular telephones and for personnel working in areas with limited or no cellular telephone reception
- Locations of communication service marshaling areas
- Locations of emergency telephone contact lists
- Locations of emergency medical facilities
- Site emergency evacuation procedures
- Locations of emergency evacuation rally points and safe refuge areas
- Identification of trained first aid and CPR providers

7.0 SAFETY AND HEALTH INSPECTIONS

7.1 PERSONNEL RESPONSIBLE FOR SITE SAFETY INSPECTIONS

Job site safety and health inspections (reviews and audits) can be conducted by UXOSO, quality control QC officers, PM and the SHM/CDHS, Project CIH, or SHM/CDHS designee. The following reviews will be performed:

- The UXOSO will inspect the job site daily or more often if warranted by ongoing activities. Findings will be documented on the Daily Project Safety Inspection Report (Appendix F of WP) and the results posted on the project bulletin board.
- The PM or SHM/CDHS may conduct unannounced job site safety audits.

All safety deficiencies identified during the inspection processes will be tracked until closed on the Safety and Occupational Health Deficiency Tracking Log, which will be retained in the field or facility office. The log will include:

- Date deficiency is identified,
- Description of deficiency,
- Name of person responsible for correcting deficiency,
- Projected resolution date, and
- Date resolved.

7.2 INSPECTOR TRAINING QUALIFICATIONS

The UXOSO assigned to the project will meet the qualifications of DDESB Technical Paper 18.

7.3 FREQUENCY OF INSPECTIONS

Site safety inspections will be conducted daily and recorded on a Project Safety Inspection Report (see Appendix F of WP).

Portable Fire Extinguishers

The UXOSO is responsible for performing monthly inspections of and obtaining annual service for portable fire extinguishers that are not mounted on vehicles or equipment. The inspections will be documented on the inspection tag on each extinguisher. Vehicle and equipment operators are responsible for the daily inspection of fire extinguishers on vehicles or equipment.

First Aid Kits

First aid kits will be inspected monthly by the UXOSO or his/her designee. A seal may be placed on first aid kits to allow for less frequent inspections. If the seal is not broken, then an inspection is not required for up to 3 months.

Eyewash

An emergency eyewash unit capable of delivering at least 0.4 gallon of water per minute for 15 minutes or more shall be located immediately adjacent to employees who handle hazardous or corrosive materials, such as treatment plant operational chemicals. The emergency eyewash units will be inspected monthly by the UXOSO. The inspection will be documented on the inspection tag on each eyewash station

7.4 DEFICIENCY TRACKING SYSTEM

All unsafe conditions, faulty equipment, incidents, and close calls will immediately be reported to the UXOSO so that lessons learned can be discussed at TSMs. All deficiencies will be tracked on the Safety and Health Deficiency Tracking Log through resolution.

7.5 COMPETENT PERSONS OR QUALIFIED PERSONS REQUIREMENTS

A competent person, as defined by 29 CFR 1926.651(k)(1), is required to supervise activities requiring excavation and trenching, fall protection, scaffolding, permit-required confined space entry, and lockout/tagout.

EM 385-1-1 has additional requirements for competent persons for cranes and rigging; training; rescuing; equipment operation; hazardous, toxic, and radioactive waste (HTRW) (lead, asbestos control, radiation); site safety and occupational health; hazardous energy; health hazard evaluation and control of chemical, physical and biological agents; and PPE selection use and maintenance.

The following activities planned for this project require a competent person in the position of SSHO/UXOSO.

Subcontractors will provide licensing/qualifications of equipment operators and provide letters on company letterhead stating the competency on the equipment for which they are qualifying and the name of the qualified person.

No work will be performed unless the SSHO/UXOSO or the designated alternate competent person is present on the job site.

7.6 EXTERNAL INSPECTIONS

USACE or regulatory agencies may, at any time, perform inspections or audits of field health and safety practices. The HGL PM and SHM/CDHS will immediately be notified when a regulatory agency inspector requests access to a work site for the purpose of a compliance inspection.

The COR will immediately be notified by the HGL PM of any regulatory agency inspection. The inspection should not be delayed due to nonavailability of the COR or his/her designee. If a citation is issued to HGL or its subcontractors, a copy of the citation will be submitted to the USACE COR along with a corrective action plan.

8.0 SAFETY AND HEALTH EXPECTATIONS AND COMPLIANCE

8.1 HEALTH AND SAFETY PROGRAM GOALS

The goal of HGL's corporate HSP is to provide the education and tools required to deliver a safe and compliant work environment for its employees, project personnel, subcontractors, and the general public as the nature of the work allows. The HSP includes written policies and procedures; new employee orientation; project-specific training, refresher training and customized classes; a project-specific medical monitoring program, worker exposure monitoring; an incident reporting system that includes reporting and evaluating near misses; review and approval of subcontractors' health and safety performance prior to hiring; and annual management-level health and safety performance goals and objectives. HGL considers worker safety a priority and has established a goal of zero incidents throughout the company.

HGL's safety program goals, safety performance objectives, and accident experience objectives are as follows:

- The written safety program as reflected in the APP, SSHP, and AHAs will conform to the standards and expectations of HGL, meet client needs and expectations, and comply with applicable regulations and consensus standards required by USACE EM 385-1-1.
- Permanent and temporary staff assigned to work at HGL sites will have read, understood, been given the opportunity to question, and signed off on these safety program documents. HGL and subcontractor staff will be briefed by the appropriate safety and health official before starting new or nonroutine tasks on the field conditions to be faced, the tasks to be performed, the hazards expected, and the control methods that will be used to eliminate or control those hazards to an acceptable level of risk.
- No employee or subcontractor will be allowed to work on a task unless they have been trained and/or certified IAW regulatory requirements and approved for safety-related responsibilities by the SSHO.
- Safety equipment will be inspected within the frequency prescribed by the manufacturer, this APP, regulatory and consensus standards, and EM 385-1-1, and these inspections will be documented.
- The goal is for this project to proceed without accidents and injuries. This goal can be achieved if work is planned, the employees are properly equipped and trained, and management provides proper leadership and support.

8.2 INCENTIVE PROGRAM

HGL tracks incidents and significant near misses to the organization and office or location. Offices and locations with excellent safety performance are recognized by presentation of National Safety Council Award Certificates. HGL also awards items such as HGL branded sweatshirts and jackets to crews, on a case-by-case basis, to encourage personnel in the development of a positive safety culture.

8.3 NONCOMPLIANCE WITH SAFETY REQUIREMENTS

HGL policies and procedures regarding noncompliance with safety requirements follow its Human Resources Policy No. 45, *Performance Improvement Plan Policy*, which involves a three-step process of identification, performance improvement, and employment action. Intentional or egregious acts that pose a threat to co-workers or violate legal requirements, may trigger immediate termination without following the HGL performance improvement policy.

8.4 MANAGEMENT ACCOUNTABILITY

Written health and safety goals are developed annually for members of the senior, office, and project management team. The goals are designed to advance development of the HSP at HGL, involve all levels of employees, proactively address health and safety issues, and reinforce accountability for staff health and safety with the management team. Management personnel are held accountable for completion of these goals, and compensation is tied to the success of an individual in meeting the goals.

HGL holds managers and supervisors accountable for safety through implementation of its Health and Safety Procedure No. 1, *Health and Safety Management System*, and HGL Corporate Policy No. 7, *Employee Performance Appraisals*. Managers and supervisors with safety-related responsibilities are listed in Health and Safety Procedure No. 1, and the following is a partial list of those expectations:

- Be a role model for safety
- Actively participate in safety and health activities at all levels
- Promptly address any unsafe conditions or unsafe acts
- Report all accidents, incidents, and near misses
- Implement disciplinary procedures as warranted for those violating safety rules

9.0 ACCIDENT REPORTING

9.1 EXPOSURE DATA (MAN-HOURS WORKED)

The HGL PM is responsible for reporting and maintaining records of all exposure and accident experiences incidental to the work, which includes those of subcontractors, and reporting this information to USACE. At a minimum, these records will include exposure work hours and equivalents as prescribed by 29 CFR 1904. This exposure data will be provided to USACE using the USACE Prime Contractor Monthly Record of Work-Related Injuries/Illnesses and Exposure Form.

9.2 ACCIDENT INVESTIGATIONS, REPORTS, AND LOGS

Project personnel are required to report near misses, injuries, illnesses, and incidents to the UXOSO and SUXOS immediately. The UXOSO will summon/arrange appropriate medical care if required. If an employee is injured or ill, WorkCare should be contacted as soon as practical, **(888) 449-7787**, after emergency care (if needed) has been initiated. The HGL emergency number, (**800) 341-3647**, should be used for after-hours reporting.

Except for rescue and emergency measures, the accident scene will not be disturbed until it has been released by the UXOSO and the investigation is complete. This means that the accident scene will be left as it was immediately after the accident occurred. Except for injured personnel, nothing at the scene will be moved, straightened up, thrown away, or cleaned. Photographs of the incident site will be taken, and any independent witness statements will be recorded as soon as safely possible. Witnesses are to be isolated and questioned separately if possible.

On-site management personnel will investigate near misses, injuries, illnesses, and incidents and accidents to identify unsafe acts or conditions that occurred or existed at the time of the accident. Corrective actions will be determined and implemented to prevent a recurrence of the incident, and responsibility for implementation of corrective actions will be assigned. The final report and required forms will be submitted to the HGL PM for signature and forwarded to the USACE COR. ENG Form 3394 will be completed and submitted to the COR within five working days of the completion of the investigation into the incident.

If an accident results in an employee being sent to a doctor, a medical assessment/work capacity form will be completed by the attending physician on the date of treatment and will state one of the following conditions:

- Employee may return to full duty work
- Employee may return to limited duty (with type of limitations)
- Employee is unable to return to work

A copy of the completed medical assessment/work capacity report must accompany the completed accident reports.

At the discretion of the COR, HGL will provide a face-to-face briefing of all lost workday accidents to the USACE within five days of the accepted ENG Form 3394. HGL Team management, the UXOSO, and others deemed necessary will be present at the briefing.

9.3 IMMEDIATE NOTIFICATION REQUIREMENTS

The SUXOS will notify the HGL PM, SHM/CDHS, and others as required by HGL's incident reporting policy. The UXOSO will complete and submit an HGL Incident Report form within 24-hours as directed by HGL's HSP incident reporting policy. The HGL PM will report incidents to the COR and USACE PM as soon as the facts are known, but no longer than 24 hours after the incident. The appropriate forms to be completed include the following:

- Automobile Accident Report
- HGL Incident Report
- ENG Form 3394 – USACE Accident Investigation Report (submitted within 5 days)

Subcontractors and other non-HGL employees will report all close calls, equipment property damage, injuries, or illnesses to the UXOSO. The subcontractor's safety personnel will investigate and analyze the incident so that the situation can be corrected. A copy of the subcontractor's investigation report will be made available to the HGL PM. The PM will then forward the report to the SHM/CDHS.

Immediate notification to USACE through the HGL PM is required for any of the following:

- A fatal injury.
- An arc flash incident.
- One or more individuals become ill or have a medical condition that is suspected to be related to a site condition, or a hazardous or toxic agent on the site.
    - Note: As of January 1, 2015, OSHA must be contacted for all work-related fatalities, all work-related in-patient hospitalizations of one or more employees, and all work-related amputations and eye losses. Employers must report work-related fatalities within 8 hours of finding out about them. For any in-patient hospitalization, amputation, or eye losses, employers must report the incident within 24 hours of learning about it. The CDHS is responsible for contacting OSHA.
- The hospitalization of one or more people resulting from a single occurrence.
- Property damage of $500,000 or more.

The HGL PM will notify USACE immediately when the following injury classifications have been made:

- A permanent total disability, or
- A permanent partial disability.

10.0 MEDICAL SUPPORT

The respective occupational medical care providers will be available to provide patient-specific information in case medical treatment is needed. For injuries or illnesses requiring emergency medical services (EMS), personnel at the scene will notify emergency response services via the 911 system or equivalent system. Emergency response personnel will determine the best course of treatment and the medical treatment facility where this will occur. Personnel may be transported to the nearest medical treatment facility as determined by EMS personnel.

For HGL non-emergencies, the WorkCare 24-hour support hotline should be contacted at (888) 449-7787.

Qualified first aid and CPR providers may treat minor injuries on site. Two field team members must be trained to render both CPR and first aid. Each HGL first aid/CPR-certified employee is part of a Bloodborne Pathogens Exposure Control Program.

A first aid kit (meeting American National Standards Institute [ANSI] Z308.1 content guidelines), including necessary protection against bloodborne pathogens, will be available in project vehicles or on site. An adequate supply of fresh potable water for emergency eyewash purposes or portable emergency eyewash will be available.

If additional treatment beyond first aid is required, the injured personnel will be transported to the identified emergency medical care facility. If the injury is not serious or if the ambulance response time is excess, the injured party may be transported by the SUXOS to the nearest emergency room using a field vehicle. The emergency information sheet and the map and directions indicating the fastest route to the hospital emergency room will be retained in each field vehicle. In all cases the SUXOS or delegated responsible person will accompany injured workers to the hospital or medical care facility.

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11.0 PERSONAL PROTECTIVE EQUIPMENT

11.1 LEVELS OF PROTECTION

The terminology of the U.S. Environmental Protection Agency for PPE used on this project is Levels D, C, B, and A. Project personnel will use Level D protective clothing for project activities. If monitoring results or site conditions indicate the need, an upgrade to Modified Level D or Level C will be made.

The phases of work, their associated tasks, and the level of protection for each task have been assigned IAW Table 11.1.

Table 11.1
RA/CS Activity/Level of Protection

Phase/Task	Activity	Initial Level of PPE
1	Mobilization and Site Preparation	D
2	Surveying	D
3	MEC, MPPEH, and MD Subsurface Clearance	D
4	Demolition of MEC Hazards	D
5	Inspection and Handling of MPPEH	D
6	Demobilization	D

Note: As site activities progress, levels of PPE are subject to change or modification. Upgrading of PPE can occur when action levels are exceeded or whenever the need arises to protect the safety and health of site personnel. Levels of PPE will not be downgraded without prior approval from the CDHS. During fieldwork activities where personnel will be working in thick vegetation, long sleeve coveralls and/or chaps should be considered. Hard hats are required only if potential overhead hazards are present.

Level D PPE at a minimum consists of the following:

- Standard work uniform or coveralls
- Nonmetallic reinforced toe, high-topped leather work boots
- Safety glasses
- Leather gloves when handling debris, tools, or other equipment
- Hard hat when overhead hazards exist
- Hearing protection for staff who will be exposed to high noise level activities (noise in excess of 85 A-weighted decibels [dBA]) (A good rule of thumb is to wear hearing protection when normal conversation cannot be heard at arm’s length. Hearing protection will have a minimum noise reduction rating of 25 dBA.)
- High-visibility vest (minimum ANSI Class 2) when working around vehicle traffic or equipment
- Type III life jackets will be worn while operating or riding on a water vessel. Type III life jackets will be worn while conducting operations near the shore line (working near water deeper than 4 feet [EM 385-1-1 05.J]). Type III life jackets will also be worn during water emergency procedures. (Type I life jackets may be used if desired in place

of Type III. Type V inflatable life jackets may be used on water vessels if deemed appropriate by the captain; however, if used they will be worn at all times while the vessel is underway.)

- Long-sleeve coveralls and/or chaps when working in areas where contact with snakes, spiders, ticks, poison ivy, and/or poison oak is a potential risk

11.2 RESPIRATORY PROTECTION

Respiratory protective equipment and real-time monitoring are not required for this project. If implemented, the level of respiratory protection selected will be based on real-time air monitoring of the work environment.

11.3 PERSONAL PROTECTIVE EQUIPMENT FOR VISITORS

An adequate supply of hard hats, safety glasses, and other basic PPE will be maintained on site for use by government personnel and other visitors. This does not apply to other government contractors, which must supply all of their own PPE. Visitors are not to be supplied with chemical protective clothing without the prior approval of the CDHS and documentation of proper training. Respirators will not be issued to non-HGL personnel.

12.0 PLANS, PROGRAMS AND PROCEDURES

The following sections discuss plans that have been identified as applicable to this project and notes plans that are not applicable.

12.1 LAYOUT PLANS

Layout plans are not applicable for this project as temporary structures will not be constructed.

12.2 EMERGENCY RESPONSE PLANS

Pre-planning measures to avoid personal injury or exposure include employee training, fire and explosion prevention and protection, chemical spill and discharge prevention and protection, and safe work practices. In the event that an emergency situation occurs, site personnel will assess the situation, decide if they have the equipment, supplies, PPE and tools to respond to, contain, or clean up the incident. If any aspect of an emergency response effort is missing, the SSHO will announce a site evacuation (emergency action) to the rally points detailed in the emergency action plan. Emergency response plans include the following:

- Emergency response team organization
- Communication means and protocols
- An evaluation of likely emergencies
- Staff training and capabilities
- Emergency response equipment
- A determination of likely emergencies that can be handled using internal resources and a list of likely emergencies needing outside emergency assistance
- Steps to summon and coordinate outside emergency responders
- Cleanup actions necessary after the immediate emergency has been contained
- Provisions for a critical review of actual emergency response activities against the activities specified for that type of emergency in the emergency response plan
- Changes to the written plan and briefing site personnel on the changes

Emergency action plans limit site employee activities to the following:

- Emergency recognition
- Emergency notification inside the site and with outside emergency responders
- Communication means and protocols
- An evaluation of likely emergencies
- Staff training and capabilities
- Steps to coordinate with outside emergency responders on site

- Evacuation routes and rally points
- Cleanup actions necessary after the immediate emergency has been contained
- Provisions for a critical review of actual emergency actions against the actions specified for that type of emergency in the emergency action plan
- Changes to the written plan and briefing site personnel on the changes

12.2.1 Procedures and Tests

Upon mobilization to the project site, the SUXOS and UXOSO will verify that personnel have an effective means of communications (cellular telephone or two-way radio) from every work area on the site. Before project fieldwork commences, the provisions for emergency response will be confirmed. Emergency communication equipment will be tested, and the routes to local medical facilities will be confirmed to be accessible and practical. A designated site emergency assembly point will be established and its location communicated to the field team during the initial site safety orientation.

In the event that an emergency arises, the appropriate immediate response must be taken by the first person to recognize the situation. The field crew will contact emergency response services by calling 911 (or the location-specific emergency communication system), and then immediately notify the UXOSO of the incident. The authority to order personnel to evacuate the area rests with the SUXOS, UXOSO, or a qualified USACE representative.

In the event that site evacuation is required, a continuous, uninterrupted horn will be sounded for approximately 10 seconds. Air horns in the work area or a vehicle horn will be used. Continuous communication will be maintained between the site and the main office. Personnel will evacuate to a designated safe, upwind location, and the crew leader will perform a head count. Once the head count has been performed, the UXOSO will be provided a status report of the event. Emergency alert systems will be tested periodically.

During any on-site emergency, work activities in the affected area will cease until the emergency is brought under control.

The UXOSO or designated on-site personnel will be responsible for checking weather conditions at a minimum of twice daily. When there are warnings or indications of impending severe weather (heavy rains, thunderstorms, damaging winds, tornados, hurricanes, floods, lightning, etc.), weather conditions will be monitored using a weather station that is part of the National Oceanic and Atmospheric Administration weather radio all hazards network or similar notification system. Appropriate precautions will be taken to protect personnel and property from the effects of severe weather. A safe place of refuge will be discussed during the TSMs.

Thunder and lightning storms, hail, high winds, tornados, and hurricanes may occur. Fog and lighting may pose potential problems in the work area as well. If lightning is observed, all load handling equipment, drill rigs, work on elevated platforms or scaffolding, roofing activities, tree trimming activities, or work in open areas will stop. A determination will be made as to the proximity of the storm to the operation being performed.

Explosive and MEC operations must cease if lightning approaches within 5 miles of the project location. Once lightning is seen, the number of seconds until thunder is heard will be counted. The number of seconds will be divided by 5 to determine the distance to where the lightning occurred. If lightning is 10 miles away or less, work should stop until 30 minutes after the last audible thunder or visible flash of lightning. An alternative approach is to use the "30-30 Rule" when visibility is good and there is nothing to obstruct the view of the thunderstorm. When lightning is seen, the time until thunder is heard is counted. If that time is 30 seconds or less, then the thunderstorm is within 6 miles and is dangerous. Activities with exposure will cease at that time and will not resume until at least 30 minutes after the last lightning strike.

Work will cease if fog limits visibility during situations where accurate vision is required (that is, driving, work around power lines, measuring, equipment spotting, and precise equipment operations).

The weather will be monitored routinely. It may be necessary to halt certain hazardous operations or stop work altogether to allow the situation to pass. The UXOSO must decide what operations, if any, are safe to perform based on existing and anticipated conditions. In the case that immediate shelter is required, all personnel will go to the designated meeting location and wait until hazardous conditions pass.

12.2.2 Spill Plans

Personnel will maintain the following equipment and materials on site for use during spill response activities:

- Spill control materials
- Shovels and assorted hand tools

Potential spill events include those of vehicle and equipment fuels, oils, and other fluids that may occur during fueling operations or because of equipment leaks. Materials that may cause contamination will be present in radiators, fuel tanks, hydraulic reservoirs, fuel cans, and oil cans. To prevent leaks, the following measures will be taken:

- Vehicles and equipment will be inspected daily and immediately taken out of service in the event of leaks.
- Cans containing fuels or oils will be labeled and stored appropriately.
- Nonemergency maintenance of heavy equipment or vehicles will not be performed on site. In the event that on-site equipment maintenance is required, precautions such as buckets and plastic sheeting will be used to so that contaminants are not released to the environment.

Waste stockpiles and other potential spills are not anticipated on this project.

If a hazardous material spill is observed at the site, the cause of the spill will be addressed (if possible) as soon as it is safe to do so. After addressing the cause, spill control materials will be applied to the spill if appropriate. The UXOSO will then be notified, and he/she will make an assessment of the magnitude and potential impact of the spill, including if the material represents a reportable quantity. If fuel or oil spills onto the ground, the following measures will be taken: The appropriate emergency response agencies will immediately be notified. A spill of over one gallon is required to be reported to the USAESCH on-site representative. If human health or the environment is threatened, the National Response Center and the state will be notified as soon as possible. The PM will notify the COR.

If a spill occurs during fueling operations, the vehicle tank will be capped and fuel dispensing device moved away from the equipment. Spill control materials will be applied to the spill (usually kitty litter), and the solidified spill will be dug up and transferred to 55-gallon metal open-top drums. The drums will be labeled with the location, date, time, and contents.

For other spills that can safely be handled by on-site personnel, the spilled material will be cleaned up when it is safe to do so as follows:

- The spill area will be approached from upwind.
- The spilled material will be identified based on the source of the material (fuel tank, labeled container, etc.). The Safety Data Sheets (SDSs) will be reviewed by the SUXOS and/or UXOSO. The potential hazards will be evaluated to determine the proper personal protection levels, methods, and equipment necessary for response.
- The spill area will be evacuated, isolated, and secured, if necessary.
- Work zones will be set up.
- Spill containment will initially be made without entering the immediate hazard area. Priority will be given to prevent the spilled material from entering any streams, ditches, or sewers.
- Entry to the spill area for cleanup will be made by personnel with the PPE, training, methods, and equipment necessary to perform the work. Spill cleanup and collection typically involves shoveling or excavating the affected soil into drums or larger containers.
- The spilled material will be stored for disposal. Disposal options will depend on the amount and type of material.

12.2.3 Firefighting Plan

In the event of a fire or explosion, the UXOSO will notify the nearest fire department and EMS, contact the HGL PM, and escort the response personnel to the location of the fire or explosion. The UXOSO will determine the extent of the fire; use available on-site fire extinguishers (Type 2A:10BC) on incipient stage fires only, and provide emergency first aid as needed. Site personnel will not fight fires containing explosives. The responding fire department personnel will be informed of the nature of the fire and if explosives are present.

12.2.4 Posting of Emergency Telephone Numbers

To facilitate the quick retrieval of information in the event of an emergency, a summary that includes emergency contact information and a map showing the route from the project site to the hospital has been placed at the front of this APP. A copy of this emergency information will be kept in all field vehicles and posted on bulletin boards in on-site offices (as applicable).

12.2.5 Wild Land Fire Prevention Plan

Any wild land fires will be responded to as indicated in Section 12.2.3 above. More than one vehicle escape route has been plotted from the site in case the primary route is blocked by fire or smoke. An overland route also has been plotted in case all roadways are blocked. Additional fire prevention measures may be needed (for example, removing brush or wetting areas down) during some activities.

12.2.6 Man Overboard/Abandon Ship

All personnel on water vessels or working near the shore line will be required to wear a Type III personal flotation device (PFD). The buddy system will be in effect for all operations the site. Employees will watch out for each other. In the event that somebody falls overboard, co-workers will immediately alert the boat Captain, who will immediately turn the boat around and go back to retrieve the missing individual. In the event there is no Captain (single operator water vessel or shore line incident), the immediate supervisor and UXOSO will be notified to direct rescue operations. The rehearsed man overboard procedures will be activated and all personnel will participate in the recovery per the Captain's or supervisor's directions.

Visitors to the site will also be required to wear a Type III PFD during transportation by water vessel. Visitors will receive a safety briefing by the UXOSO. Should a visitor fall overboard, the same rescue procedures will apply.

12.3 HAZARD COMMUNICATION PROGRAM

This HCP was developed to meet the requirements of the OSHA Hazard Communication Standard, Title 29 CFR 1910.1200 and 1201, including the 2012 amendments based on the Globally Harmonized System. OSHA requires that employers make information available to employees about hazardous chemicals that they may be exposed to in the workplace. This information includes toxicology, physical and chemical hazards, means of detection, and protection against exposure.

For hazardous chemicals brought to the site, HGL makes this information available to staff members through a written HCP, lists of chemicals in use, current copies of SDSs, container labeling, and staff training.

As a part of the HCP, the project UXOSO is responsible for the following:

- Bringing current SDSs for each hazardous chemical introduced to the site
- Developing and maintaining a comprehensive list of hazardous chemicals introduced to the job site, and making it accessible to all staff on the site

- Reviewing the SDSs, which accompany incoming shipments, and maintaining the SDSs in project files on site
- Contacting the source of the hazardous chemicals if the SDSs are not complete or if an SDS is not supplied with an initial shipment
- Labeling temporary and permanent hazardous chemical containers
- At multi-employer sites, informing the other employers of the location of the written HCP and copies of SDSs for the site

Communicating with other employers (for example, owner, contractors, and subcontractors) to obtain information about the location of their written HCPs, labeling programs, and SDSs, and, if applicable, information on the hazardous chemicals they may produce or introduce to the job site that employees may be potentially exposed to.

12.4 RESPIRATORY PROTECTION PLAN

HGL will utilize the following administrative and engineering controls to minimize the need for respiratory protection on site:

- Air monitoring for exposure will be performed in work areas to determine whether levels of gases, vapors, and dusts are within published exposure limits (as required).
- Personnel will be positioned upwind to avoid working in dusts and released vapors when possible.
- Water will be utilized to control dust (as required).
- Natural and mechanical ventilation will be used to reduce or eliminate exposures to dusts, gases, and vapors (as required).

HGL does not anticipate the use of respirators for the project.

12.5 HEALTH HAZARD CONTROL PROGRAM

Jobsite operations, materials, and equipment involving potential exposure to hazardous or toxic agents or environments will be evaluated by the CDHS or the Project CIH and a Hazard Control Program formulated. The Hazard Control Program for this site consists of the following:

- Exposure monitoring/air sampling program
- AHAs
- Hazard/risk analysis
- PPE
- Standard safety procedures, work practices, and engineering controls

12.6 LEAD ABATEMENT PLAN

Not applicable. Lead hazards are not anticipated for this project.

12.7 ASBESTOS ABATEMENT PLAN

Not applicable. Asbestos hazards are not anticipated for this project.

12.8 ABRASIVE BLASTING PLAN

Not applicable. Abrasive blasting is not within the scope of this project.

12.9 CONFINED SPACE ENTRY

Not applicable. Confined space entry hazards are not anticipated for this project.

12.10 HAZARDOUS ENERGY CONTROL PLAN (LOCKOUT/TAGOUT/TRYOUT)

Not applicable. Hazardous energy locations are not anticipated for this project.

12.11 CRITICAL LIFT PROCEDURES

Not applicable. Critical lifts are not anticipated for this project.

12.12 CONTINGENCY PLAN FOR SEVERE WEATHER

Routinely monitoring weather conditions and reports may help reduce the impact of severe weather and natural disasters. Weather conditions will be a part of the daily briefing. It may be necessary to halt certain hazardous operations or stop work altogether to allow the situation to pass. The UXOSO must decide what operations, if any, are safe to perform based on existing and anticipated conditions. A lightning detector will be present on the site and will be monitored by the UXOSO when threatening storms are forecast. The best protection against most severe weather episodes and natural disasters is to avoid them. This means seeking shelter before a storm arrives.

12.13 ACCESS AND HAUL ROAD PLAN

Not applicable. Access and haul roads are not within the scope of this project.

12.14 DEMOLITION PLAN

Not applicable. Demolitions are not within the scope of this project.

12.15 EMERGENCY RESCUE PLAN

An emergency rescue plan is not required for this project. Local emergency rescue capabilities will be used through the 911 system.

12.16 UNDERGROUND CONSTRUCTION FIRE PREVENTION AND PROTECTION PLAN

Not applicable. Underground construction activities are not within the scope of this project.

12.17 COMPRESSED AIR PLAN

Not applicable. Compressed air activities are not within the scope of this project.

12.18 FORMWORK AND SHORING ERECTION AND REMOVAL PLAN

Not applicable. Form and shoring activities are not within the scope of this project.

12.19 JACKING AND LIFT PLAN

Not applicable. Jacking and slab activities are not within the scope of this project.

12.20 BLASTING PLAN

The transportation, handling, storage, and use of demolition explosives, blasting agents, and blasting equipment are addressed in Appendix M, the Explosives Safety Submission (ESS), and HGL SOPs. Applicable state and federal regulations and explosive blasting procedures required in Section 29 of EM 385-1-1 apply.

12.21 DIVING PLAN

Not applicable. Diving activities are not within the scope of this project.

12.22 DRUG AND ALCOHOL ABUSE PREVENTION PLAN

HGL implements a Substance Abuse Deterrence Program in support of its corporate drug-free workplace policy and will enforce the requirements of a drug-free workplace. The program is designed to maintain a safe workforce and prohibits the following:

- Engaging in any drug activity that is prohibited by federal, state, or local law. This includes, but is not limited to, the possession, use, manufacture, distribution, or sale of illegal drugs at any time or at any place.
- Working under the influence of alcohol or illegal drugs.

The deterrence program includes post-offer/pre-employment drug testing, random testing for safety-sensitive employee groups, testing for cause, and testing after an accident when it appears that the employee is under the influence.

The deterrence program includes post-offer/pre-employment drug testing, testing for cause, random testing and post-accident testing when it appears that substance intoxication caused or contributed to the accident.

12.23 FALL PROTECTION PLAN

Not applicable. No activities requiring fall protection are anticipated for this project.

12.24 STEEL ERECTION PLAN

Not applicable. Steel erection activities are not within the scope of this project.

12.25 NIGHT OPERATIONS LIGHTING PLAN

Not applicable. Night operations are not within the scope of this project. Intrusive activities will be performed during daylight hours only.

12.26 SITE SANITATION PLAN

HGL will maintain hygienic sanitation provisions during the duration of this project. General requirements for a temporary, mobile field crew include the following:

- Drinking water – Bottled drinking water will be maintained on site for use by all personnel.
- Washing and toilet facilities – At a minimum, toilet facilities will be available on the site. If there will be no facilities at the job site itself, directions to facilities will be reviewed with all personnel (closest gas station, restaurant, or similar locations). Hand washing supplies such as soap, towels, or anti-microbial gels will be available.
- Waste Disposal – Investigation derived waste (IDW) generated during the field activities will be classified, handled, and disposed of IAW the waste management procedures outlined in the WP following applicable federal, state, and local regulations.

Disposable materials (not classified as hazardous) such as latex gloves, used PPE, aluminum foil, and paper towels will be placed and sealed in plastic garbage bags for disposal with sanitary waste from the site.

12.27 FIRE PREVENTION PLAN

Items associated with emergency actions, including fire prevention, are discussed in Section 12.41.

12.28 FATIGUE MANAGEMENT PLAN

Excessive Work Hours

The following workday duration limitations for hours worked on the project will be in effect:

- Personnel working on site, including those who are operating hoisting equipment or mobile construction equipment, may work up to 12 hours at the site, which does not include travel time to/from their home/motel or uncompensated lunch breaks. This workday duration is subject to reduction by the other requirements and factors described in the bullets below. The 12-hour limit is primarily due to motor vehicle driving restrictions.

- Personnel, while on duty, will not operate motor vehicles after being in a duty status (regardless of their role or function) for more than 12 hours during any 24-hour period without at least 8 consecutive hours of rest. Personnel may work an additional 2 hours at the motel or their home (for a total 14-hour day), though they are still subject to reduction by the other requirements and factors described below. A minimum of 8 consecutive hours will be provided for rest in each 24-hour period.
- No employee may drive continuously for more than 10 hours in any single on-duty period (continuous period of more than 10 hours in any 24-hour period without at least 8 consecutive hours of rest).

For each project effort, the UXOSO is responsible for adjusting the workday duration within these limits. The following factors will be considered by the UXOSO for adjusting the workday duration:

- Time of year (for example, reduce workday duration because there is less daylight in winter).
- Temperature/weather (for example, reduce workday duration when the temperature is very cold, very hot, or very windy).
- Type of work (for example, reduce workday duration for personnel involved in physically demanding phases of work).
- Individual personnel limitations (for example, reduce workday duration for personnel with minor head colds, suffering from temporary effects of allergies, or showing signs of heat stress).

12.29 BLOODBORN PATHOGEN PLAN

Qualified first aid and CPR providers may treat minor injuries on site. Two field team members (HGL or subcontractor) must be trained to render both CPR and first aid. If first aid response is necessary, all biological materials will be assumed to be infectious, and universal precautions will be taken. First aid- and CPR-trained staff will wear PPE (nitrile gloves, eye protection, masks) depending on the exposure anticipated and will wash their hands immediately after removal of gloves. Each HGL first aid/CPR-certified employee is part of the HGL Bloodborne Pathogens Program, which includes a Post-Exposure Control Plan for staff exposed to bloodborne pathogens. The Post-Exposure Control Plan includes instructions to seek medical attention within 2 hours of exposure and has provisions for a confidential medical examination and follow-up with WorkCare for the Hepatitis B vaccine series.

A first aid kit, including necessary protection against bloodborne pathogens, will be available in project vehicles. An adequate supply of fresh potable water for emergency eyewash purposes or a portable emergency eyewash will be available.

12.30 HEARING CONSERVATION PROGRAM

Noise will be generated from the use of equipment and tools. Hearing loss resulting from occupational exposure to noise can be prevented through the use of hearing protection. As part of the criteria for the HGL Hearing Conservation Program, audiometric testing of personnel will be conducted biannually, and American Conference of Governmental Industrial Hygienists ([ACGIH], 2016) threshold limit values (TLVs) will be used as the minimum for instituting hearing protection. Personnel will wear hearing protection when working with or around operating equipment or power tools that generate noise at 85 dBA or above—levels that require a person to raise his/her voice to carry on a conversation at a distance of 3 feet. Warning signs will be posted in areas where noise greater than 85 dBA necessitates the use of hearing protection. The use of headphones for entertainment purposes is prohibited.

12.31 PROCESS SAFETY MANAGEMENT PLAN FOR HIGHLY HAZARDOUS CHEMICALS

A Process Safety Management Program is not applicable IAW 29 CFR 1910.119 and the Safety and Health Requirements Manual (USACE, 2014) under the current work scope, as no highly hazardous chemicals will be used.

12.32 RADIATION SAFETY PROGRAM

Not applicable. This type of work will not be performed under the current work scope.

12.33 HEAT/COLD STRESS MANAGEMENT

Heat Stress

In hot environments, the following guidelines will be followed to prevent heat-related injury.

a. Drinking water will be made available to employees, and employees will be encouraged to frequently drink small amounts (for example, 1 cup every 15 to 20 minutes). The water will be kept reasonably cool.

b. Toolbox training will include training on the symptoms of heat-related problems, contributing factors to heat-related injuries, and prevention measures.

c. When possible, work will be scheduled for cooler periods during the day.

d. A buddy system will be established to encourage fluid intake and watch for symptoms of heat-related injury.

e. The UXOSO will monitor those individuals who have had a previous heat-related illness, are known to be on medication, or exhibit signs of possibly having consumed large amounts of alcohol in the previous 24 hours for signs or indicating symptoms of heat-related illness.

f. Breaks in shaded or air conditioned areas will be taken at intervals to prevent harmful heat stress.

g. Individuals who are not acclimatized will be allowed additional breaks. The period and number should be determined by the UXOSO and provided to the supervisor and employee for implementation.

h. Additional measures will be taken, as needed, to minimize heat stress. These measures may include measures such as pop-up tents over the work area and personal cooling products such as water-retentive bandanas and neck wraps.

i. Sunscreen with at least a sun protection factor of 30.

Heat Stress Monitoring

The UXOSO will monitor heat stress and will adjust heat stress controls to control the hazard to personnel. This monitoring will include visual monitoring of work and worksite conditions as well as feedback from work crews. The UXOSO may also use local reports of heat index, applications such as OSHA's Heat Safety Tool, or a wet bulb globe thermometer (WBGT) and the heat stress TLV.

The risk of heat-related illness among healthy workers who are acclimatized to hot work is low if the WBGT value does not exceed the ACGIH "screening criteria" shown below in Table 12.1 (ACGIH).

Table 12.1
ACGIH Screening Criteria and Action Limit for Heat Stress Exposure
(WBGT Values in Degrees Celsius [°C]/Fahrenheit [°F])

Work/Recovery Cycle	TLV®				Action Limit			
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
75 - 100% work	31/87.8	28/82.4	-	-	28/82.4	25/77	-	-
50 - 75% work	31/87.8	29/82.2	27.5/81.5	-	28.5/83.3	26/78.8	24/75.2	-
25 - 50% work	32/89.6	30/86	29/84.2	28/82.4	29.5/85.1	27/80.6	25.5/77.9	24.5/76.1
0 - 25% work	32.5/90.5	31.5/88.7	30.5/86.9	30/86	30/86	29/79	28/82.4	27/80.6

Values from the current edition of the ACGIH publication Threshold Limit Values (TLV®) and Biological Exposure Indices.

If impermeable clothing is worn in hot environments, additional controls such as cooling vests will be implemented. Physiological monitoring will also be conducted if impermeable clothing is being worn.

The following heart rate guidance should be used:

- Count the radial (wrist) pulse during a 30-second period as early as possible in the rest period.
- If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.
- If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by an additional one-third and keep the rest period the same.

Additional physiological monitoring, such as continual pulse or core temperature, may be implemented, as needed.

Cold Stress

The potential for cold stress is determined primarily by two variables: the temperature of the air and the speed of the wind. The cooling effects of moving air on exposed flesh can be expressed as an equivalent chill temperature (ECT), which combines temperature and air speed. At a given temperature, calm air is less dangerous.

Table 12.2 shows values of ECT for various temperature and speed combinations. The conditions represented by Zones B and C are extremely dangerous to exposed skin. Continuous exposure of exposed skin should not be permitted if the ECT is 25°F or less. Work under conditions represented by Zone A is much less dangerous to exposed skin. However, workers can suffer frostbite injury in the less severe environment if they develop a false sense of security and fail to take precautions.

At low ECT values, precautions against hypothermia are necessary, even if workers are dressed in well-insulated clothing. The danger of hypothermia is especially severe if immersion in water is possible during the work.

Table 12.2
Equivalent Chill Temperature (°F)
at Various Air Temperatures and Wind Speeds

Estimated Wind Speed (mph) ↓	**Actual Temperature Reading (°F)**											
	50	**40**	**30**	**20**	**10**	**Zero**	**-10**	**-20**	**-30**	**-40**	**-50**	**-60**
Calm	*50*	*40*	*30*	*20*	*10*	*0*	*-10*	*-20*	*-30*	*-40*	*-50*	*-60*
5	*48*	*37*	*27*	*16*	*6*	*-5*	*-15*	*-26*	*-36*	*-47*	*-57*	*-68*
10	*40*	*28*	*16*	*-9*	*-24*	*-24*	*-33*	*-46*	*-58*	*-70*	*-83*	*-95*
15	*36*	*22*	*9*	*-5*	*-18*	*-32*	*-45*	*-58*	*-72*	*-85*	*-99*	*-112*
20	*32*	*18*	*4*	*-10*	*-25*	*-39*	*-53*	*-67*	*-82*	*-96*	*-110*	*-121*
25		***Zone A***		*-15*	*-29*	*-44*	*-59*	*-74*	*-88*	*-104*	*-118*	*-133*
30		***Little Danger***		*-18*	*-33*	**Zone**	*-63*	*-79*		**Zone C**		
35		*(in <1 hour, if skin is dry)*		*-20*	*-35*	**B**	*-67*			**Great Danger** (Flesh may		
40	*26*	*10*	*-6*	*-21*	*-37*	*-53*	*-69*	*-85*		freeze within 30 seconds.)		

The UXOSO will make an assessment of the potential for cold stress before fieldwork begins, primarily through local weather reports but also by using thermometers or wind speed measuring equipment on site as needed.

Work rules related to the prevention of cold-related injury will be required if conditions of the type represented in Zones A, B, or C in the ECT table are anticipated. Under such conditions, the UXOSO will measure temperature and wind speed when work commences each day and at routine intervals (at least every 4 hours) thereafter, unless he/she believes that some other means of hazard assessment is adequate. The CDHS must approve any alternative means of hazard assessment. When work is conducted under conditions represented in Zones A, B, or C, the UXOSO will implement the work rules described below to manage the potential hazard.

- Employees will receive training on the dangers and symptoms of cold-related injury and the work rules adopted to prevent it.
- Site workers will be warned that older individuals and people with circulatory problems might be at increased risk for cold-related injury, and that added precautions might be necessary to protect them.
- Each employee will be under protective observation by someone else during work (that is, use of the "buddy system" will be required).
- Employees who experience pain in the extremities or are shivering will be removed from exposure to the cold work environment.
- Work must be halted if frostbite cannot be prevented. Continuous skin exposure will not be permitted when the ECT is -25°F or less (Zones B and C on the ECT table).
- Tasks should be scheduled to avoid long periods during which workers must sit or stand still.
- Work expectations for new employees should be adjusted downward for the first few days, to permit acclimatization to the cold conditions.
- Dehydration, which decreases blood flow to the extremities, should be avoided. Employees will be encouraged to replenish water lost to perspiration and respiration. The UXOSO will provide soups and warm sweet drinks as appropriate.
- The UXOSO will develop procedures that reduce the likelihood of immersion in water or soaking of the clothing by other means during project work. Such precautions should apply to any work with liquids like gasoline, alcohols, solvents, or cleaning fluids.
- The UXOSO will plan for any likely scenarios that would lead to wet clothing (through immersion in water, soaking by mist, etc.), and provide for quick changing into dry clothing and treatment for hypothermia.
- Emergency plans will give special attention to the prevention of cold-related injury (hypothermia and freezing of damaged tissues).

If continuous work must be performed at an ECT below 19.4°F, then the UXOSO or PM will provide a heated shelter (truck, car, tent, cabin, or similar space) for warming after exposure to the cold environment. Employees should be encouraged to use the shelter at frequent intervals and upon (1) onset of pain or heavy shivering, (2) occurrence of minor frostbite, or (3) onset of feelings of excessive fatigue, drowsiness, irritability, or euphoria. For these conditions, the UXOSO will monitor weather and environmental conditions and implement a mandatory work/warming regimen according to Table 12.3.

Table 12.3
Work/Warming Schedule for a 4-Hour Shift

Air Temp. (°F)	Air Speed (mph)				
	Calm	**5**	**10**	**15**	**20**
-15 to -19	Normal Breaks (1)	Normal Breaks (1)	75 min. max. work period with 2 breaks	55 min. max. work period with 3 breaks	40 min. max. work period with 4 breaks
-20 to -24	Normal Breaks (1)	75 min. max. work period with 2 breaks	55 min. max. work period with 3 breaks	40 min. max. work period with 4 breaks	30 min. max. work period with 5 breaks
-25 to -29	75 min. max. work period with 2 breaks	55 min. max. work period with 3 breaks	40 min. max. work period with 4 breaks	30 min. max. work period with 5 breaks	
-30 to -34	55 min. max. work period with 3 breaks	40 min. max. work period with 4 breaks	30 min. max. work period with 5 breaks		
-35 to -39	40 min. max. work period with 4 breaks	30 min. max. work period with 5 breaks	**Nonemergency work should cease.** NOTE: The above work/warming regimens are applicable to workers in dry **not** wet clothing.		
-40 to -44	30 min. max. work period with 5 breaks				
-45 and below					

Break period is a 10-minute warmup time in a warm location.
Source: ACGIH TLVs and BEIs, Cincinnati, OH, 2015
Adapted from the Occupational Health and Safety Division, Saskatchewan Department of Labor

The rules implemented by the UXOSO will require that employees wear adequately insulating dry clothing if conditions of the type represented in Zones A, B, or C in the ECT table are anticipated. Workers should wear cold-protective clothing appropriate for the environmental conditions and the level of physical activity. The following considerations should guide the selection and use of protective clothing:

- Layered clothing will be used to preserve body heat. An easily removable outer windbreak garment should be worn in windy conditions.
- Inner garments and underwear will be made of fabrics that dry quickly and wick moisture away from the body.
- Outer garments will be made with provisions for easy ventilation to prevent inner layers to be wetted by sweat.
- An employee will not enter or remain in a cold work environment if his or her clothing is wet as a consequence of sweating. If clothing is wet, then the employee must change into dry clothing before returning to the cold environment.
- Gloves and/or mittens will be used as necessary to protect the hands, and employees will be warned not to touch very cold objects and surfaces with bare skin.
- Workers will routinely change socks and removable felt insoles to reduce moisture around the feet.

- Eye protection suitable to the type of hazard will be used. Special precautions against ultraviolet light and glare might be necessary in snow-covered terrain.
- Hardhat liners will be used. If work must be done on slippery surfaces, then shoe attachments that enhance traction shall be used.

12.34 INDOOR AIR QUALITY MANAGEMENT

Not applicable. This type of work will not be performed under the current work scope.

12.35 MOLD REMEDIATION PLAN

Not applicable. This type of work will not be performed under the current work scope.

12.36 CHROMIUM (VI) EXPOSURE EVALUATION

Not applicable. This type of work will not be performed under the current work scope.

12.37 CRYSTALLINE SILICA ASSESSMENT

Not applicable. This type of work will not be performed under the current work scope.

12.38 LIGHTING EVALUATION

A review of the lighting requirements for the project-specific tasks or operations will be evaluated as part of the AHA.

12.39 LIGHT PLAN FOR NIGHT OPERATIONS

A Night Operations Lighting Plan is not applicable, as all work will be scheduled during daylight hours.

12.40 TRAFFIC CONTROL PLAN

A Traffic Control Plan will not be required for this project.

12.41 FIRE PREVENTION PLAN

This section details fire prevention and protection procedures/resources to be used at the project site. This information is to be included in the site health and safety indoctrination.

Workplace Fire Hazards

The main fire hazards at the project site consist of brush and range fires, electrical fires, and those associated with flammable and combustible liquids, waste materials, combustible wastes, fueling operations, storage of fuels and other flammable liquids at the project site, and welding and cutting activities.

Potential Ignition Sources

The significant ignition sources at the project site include smoking materials (matches and lighters), welding/cutting equipment, vehicle/equipment exhaust, and catalytic converters.

Fire-Control Systems, Equipment, and Procedures

Depending on the nature and extent of a fire, the following fire-control systems and equipment will be evaluated or provided for at the project site:

- Contact information for the fire department (listed at the beginning of this APP) will be available.
- Fire extinguishers will be maintained in all vehicles and in specific areas of concern (for example, near electrical work or areas of hot work). Where flammable or combustible materials in quantities greater than 5 gallons are present and where hot work will be performed, 10-pound extinguishers rated 4A:60B:C will be present in the immediate area. At least one dry chemical fire extinguisher having a minimum UL rating of 1A5BC will be available in all vehicles and trailers.
- A hot work permit will be required before a flame- or spark-producing activity can commence.
- Flammable wastes will be stored or disposed of in metal containers, clearly marked as containing flammable materials.
- Storage of combustible materials will be kept to a minimum.
- Flammable and oxidizing materials will be stored in marked (no smoking, matches, or open flame) areas with fire extinguishers available.
- Smoking will be permitted only in designated areas. Personnel will never discard cigarette butts into the environment while working at the site.
- Open flames will be prohibited.
- Vehicles and equipment will not be left idling or parked in areas where catalytic converters may ignite vegetation.
- Project personnel will be permitted to extinguish small fires in their incipient stages only provided that the personnel have been trained and feel comfortable doing so.

Fire-Control Equipment Maintenance Responsibilities

The UXOSO will be responsible for performing the monthly inspections of portable fire extinguishers and obtaining annual service for all HGL provided fire extinguishers used at the project site. Subcontractors will be responsible for performing the monthly inspections and obtaining annual service for all fire extinguishers that they provide for use at the project site. Vehicle and equipment operators will be responsible for the daily inspection of fire extinguishers on vehicles/equipment.

In the event of a fire, staff should only attempt to extinguish a fire if it is containable. All additional occupants will immediately evacuate the area following the posted emergency evacuation routes and go to the designated rally point. A head count will be taken by the senior person present to account for all personnel.

12.42 WILD LAND FIRE MANAGEMENT PLAN

Wild land fires will be responded to as indicated in the Fire Prevention Plan discussed in Section 12.41 above.

12.43 ARC FLASH HAZARD ANALYSIS

Not applicable. This type of work will not be performed under the current work scope.

12.44 ASSURED EQUIPMENT GROUNDING CONTROL PROGRAM

All portable electrical equipment and extension cords will be protected with a ground fault circuit interrupter (GFCI). Only hard or extra hard outdoor usage extension cords with a rating (in watts or amps) at least equal to the sum of the connected loads will be used. Extension cords, power tools, and lighting equipment will be inspected before each use, protected from damage, and kept out of standing water.

All electrical installations will be made as required by National Fire Protection Association (NFPA) 70: National Electrical Code (NFPA, 2012) or the local code, whichever is more protective. Only qualified electricians may work on electrical circuits. Qualified personnel will receive training on the use of the special precautionary techniques, PPE, arc flash, insulating and shielding materials, and insulated tools and test equipment.

12.45 NAVAL ARCHITECTURAL ANALYSIS

Not applicable. This type of work will not be performed under the current work scope.

12.46 FLOAT PLAN

If used, boat operators will meet EM 385 -1-1 (19.F.05). If used, boat operators will be U.S. Coast Guard Licensed Captains which meet EM 385-1-1 (19.F.05) requirements. Personal water vessel (jet ski) operators for security or logistical purposes are not required to be Coast Guard Certified but will demonstrate safe operating skills at all times. All personnel participating in water operations as well as personnel performing support operations from the shore will be required to wear a PFD.

12.47 FALL PROTECTION

Not applicable. This type of work will not be performed under the current work scope.

12.48 SAFE ACCESS PROGRAM/LADDERS, STAIRS AND RAILINGS

Not applicable. This type of work will not be performed under the current work scope.

12.49 EXCAVATION/TRENCHING PLAN

An Excavation/Trenching Plan is required for excavations and trenches that will exceed depths greater than 5 feet below ground surface (bgs). Any changes to the plan that become necessary will be submitted to the Project CIH for acceptance. Once accepted by the CIH, the plan will be added to the APP as an amendment.

12.49.1 Conditions

Excavation operations on the site will be conducted to characterize the extent of contamination inside the excavations that have been identified by geophysical mapping and then subsequently to excavate and remediate those areas that exceed threshold requirements established by the Government. Due to the variations in depth all excavations will be covered under both this Excavation/Trenching Plan and the AHA for Excavation/Trenching. The AHA covering this plan will be included in the SSHP.

12.49.2 Competent Person

Daily inspections of the excavation shall be performed by a competent person. The daily inspections will be documented on the Excavation Inspection Form (Appendix F in QAPP). The designated excavation competent person may vary throughout the project; however, the excavation competent person shall possess the following credentials, at a minimum:

- Successfully completed the OSHA 30 Hour Construction Safety Course
- Successfully completed Excavation Competent Person Training
- Designation by their employer as being given Competent Person responsibilities on the project.
- Requirements of Section 25, EM 385-1-1 and 29 CFR 1926 Subpart P
- The name of the competent person must be identified for each daily excavation. Documentation of these credentials for the excavation competent person must be attached to the AHA for the day that excavation is performed.

12.49.3 Diagram

The general locations (TCRA footprint) of the trenches and excavations that may be conducted are shown in the QAPP Appendix B, Figure 10.3.

12.49.4 Projected Excavation Depths

The projected depths of the trenches and excavations will vary throughout the site.

12.49.5 Projected Soil Types and Methods of Testing

The site is located on Culebra Island, Commonwealth of Puerto Rico, approximately 17 miles east of the main island of Puerto Rico. The soil cover is homogeneous with only one soil association, the Descalabrado-Guayama. This association is described as composed of shallow, well drained, strongly sloping to very steeply sloping soils derived from the underlying volcanic rocks. Permeability is moderate and ranges from 0.6 to 2.0 inches per hour (USGS, 1996). Loamy organic-rich soils are found in areas of dense vegetation and grasses, while sandy soils are found on tidal flats or areas near the beach. Many of the beaches on Culebra, including Flamenco Beach and Carlos Rosario Beach have clean white to tan sand, while other beaches are rocky with a mix of cobbles and pieces of dead coral reef.

12.49.5.1 Visual Soil Testing Method

Visual testing will be performed to estimate the range of particle sizes (fine or coarse grained), observe the excavated soil to evaluate whether it is cohesive or breaks apart easily, observe the sides and adjacent surface area of the opened excavation to identify if fissures are present, evaluate if the soil has been previously disturbed, see if water conditions (groundwater) are present, and determine if any vibrations from construction activities, nearby roads, etc. are impacting the excavation.

12.49.5.2 Manual Soil Testing Method

The following manual testing methods may be used:

1. Thumb Penetration Test. The thumb penetration procedure involves an attempt to press the thumb firmly into the soil in question. If the thumb makes an indentation in the soil only with great difficulty, the soil is probably Type A. If the thumb penetrates no further than the length of the thumb nail, it is probably Type B soil, and if the thumb penetrates the full length of the thumb, it is Type C soil. The thumb test is subjective and is therefore the least accurate of the manual testing methods.
2. Plasticity or Wet Thread Test. This test is conducted by molding a moist sample of the soil into a ball and attempting to roll it into a thin thread approximately 1/8 inch (3 mm) in diameter (thick) by 2 inches (50 mm) in length. The soil sample is held by one end. If the sample does not break or tear, the soil is considered cohesive.

12.49.5.3 Soil Classification

- Type A
    - Clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam.
    - No soil is Type A if it is fissured, is subject to vibration of any type, has previously been disturbed, is part of a sloped, layered system where the layers dip into the on a slope of 4 horizontal to 1 vertical (4H:1V) or greater, or has seeping water.excavation on a slope of 4 horizontal to 1 vertical (4H:1V) or greater, or has seeping water.
- Type B
    - Cohesive soil which include angular gravel; silt; silt loam; previously disturbed soils unless otherwise classified as Type C; soils that meet the unconfined compressive strength or cementation requirements of Type A soils but are fissured

or subject to vibration; dry unstable rock; and layered systems sloping into the trench at a slope less than 4H:1V (only if the material would be classified as a Type B soil.

- Type C
  - Cohesive soils which include granular soils such as gravel, sand and loamy sand, submerged soil, soil from which water is freely seeping, and submerged rock that is not stable. Also included in this classification is material in a sloped, layered system where the layers dip into the excavation or have a slope of four horizontal to one vertical (4H:1V) or greater.

12.49.5.4 Inspections

Inspections shall be made by a competent person and should be documented. The following guide specifies the frequency and conditions requiring inspections:

- Daily and before the start of each shift;
- As dictated by the work being done in the trench;
- After every rainstorm;
- When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom, or other similar conditions occur;
- When there is a change in the size, location, or placement of the spoil pile; and
- When there is any indication of change or movement in adjacent structures.

12.49.6 Planned Methods for Shoring, Sloping, and/or Bracing

Excavations less than 5 feet in depth and which a competent person examines and determines there is no potential for cave-in will not require protective systems; however, a fixed means of egress will be required. Sloping and benching will be performed on excavations >5 feet in depth if personnel entry is required. Sloping and benching will conform to the systems in EM 385-1-1 and OSHA 29 CFR 1926, Subpart P, Appendix B.

The primary approach for sloping excavations less than 20 ft in depth will be having a maximum slope of 34 degrees measured from the horizontal (1-1/2 horizontal to 1 vertical). If alternate sloping or benching approaches are required, they will be conducted IAW Section 25.C of EM 385-1-1.

Table 12.4 shows the allowable slopes and angles for all soil types. Unless designed by a Registered Professional Engineer, excavations less than 20 ft in depth will have a maximum slope of 34 degrees measured from the horizontal.

Table 12.4
Sloping

Soil type	height/Depth ratio	Slope angle
Stable Rock	Vertical	90°
Type A	¾:1	53°
Type B	1:1	45°
Type C	1½:1	34°
Type A (short-term)	½:1	63°

12.49.7 Confined Space Entry, Safe Access and egress, and Atmospheric Monitoring

Atmospheric monitoring will be performed on excavations greater than 4 feet in depth if there is a potential for a hazardous atmosphere. If the potential for hazardous atmosphere exists, personnel that are required to enter the trench will use a 4-gas multiple gas indicator (oxygen level/LEL/CO/VOC) meter to test the atmospheric conditions. Testing will follow these guidelines:

- Testing should be conducted before employees enter the trench and should be done throughout the entry process to ensure that the trench remains safe.
- The frequency of testing should be increased if equipment is operating in the trench.
- A daily log will be kept of the atmospheric conditions during excavation operations.

Employees will not be allowed to work in hazardous atmospheres. Such conditions include:

- Less than 19.5% or more than 23.5% oxygen;
- A combustible gas concentration greater than 10% of the lower flammable limit; and
- VOC concentration will be measured in the breathing zone of the entrants. Action level for Level D operations will be from 0 to 5 ppm (Parts Per Million).
- Carbon monoxide measurements will be taken with the 4 gas monitor if equipment will be operating in the trench during an entry. Employees will exit the trench if concentrations of carbon monoxide reach the TLV of 25 ppm.

Safe Egress from the trenches will follow these guidelines:

- Trenches 4 ft or more in depth should be provided with a fixed means of egress.
- Spacing between ladders or other means of egress must be such that a worker will not have to travel more than 25 ft laterally to the nearest means of egress.
- Ladders must be secured and extend a minimum of 36 in (0.9 m) above the landing

12.49.8 Location of Utility Shut-offs

There are not any active utilities in the planned excavation areas. If excavations are planned in areas with active utilities, the utilities will be marked and permits obtained as necessary.

12.49.9 Protection of Utilities, Facilities, and Features

Above ground and overhead utilities will be sufficiently avoided to prevent impact from the excavation activities. Excavation operations will not be located near energized power lines.

12.49.10 Management of Excavated Soil, Asphalt, and Concrete

All excavated materials will be placed no closer than 2 feet from the edge of the excavations IAW EM 385-1-1. Following completion of the intrusive investigation, the spoils will be replaced back into the excavations.

12.49.11 Traffic Control

When performing excavation activities across roads, the roads will be monitored but not closed. Road closed signs will be placed at the nearest intersections, 1,100 feet before the excavation area. All personnel will request entry into the excavation area by radio or phone. The equipment operator will stop digging to allow nonessential personnel travel through the exclusion zone.

12.49.12 Excavation Permits

Excavation permits are not anticipated for this operation. If required, coordination will be made with local authorities to ensure proper permits are in place.

12.49.13 Excavation Permits

Excavation permits are not anticipated for this operation. If required, coordination will be made with local authorities to ensure proper permits are in place.

12.49.14 Certification of Unexploded Ordnance

Excavation will be performed in areas known or suspected to contain explosives, unexploded munitions, or military ordnance. Work will be performed IAW the WP and DDESB approved ESS.

12.49.15 Perimeter Protection

Perimeter protection shall be provided for unattended excavations as specified in EM 385-1-1, Section 25.B. The excavation competent person shall evaluate daily the exposure of the excavation to employees, the public, vehicles, and equipment. This evaluation shall be used in determining the class of perimeter protection.

12.49.16 Accumulated Water

Surface water will be diverted from excavations using swales or berms as necessary. If water is encountered while excavating buried objects that impacts the safety of the operation, water pumps or water diversion may be used to dewater excavations. If water is controlled or prevented from accumulating by the use of water removal equipment, the process shall be monitored by a competent person to verify proper operation.

12.50 PRECAST CONCRETE PLAN

Not applicable. Precast concrete will not be used under the current work scope.

12.51 LIFT SLAB PLANS

Not applicable. Lift slab work will not be performed under the current work scope.

12.52 MASONRY BRACING PLAN

Not applicable. This type of work will not be performed under the current work scope.

12.53 STEEL ERECTION PLAN

Not applicable. Steel erection work will not be performed under the current work scope.

12.54 EXPLOSIVES SAFETY SITE PLAN

HGL will conduct explosive operations IAW the ESS.

12.55 UNDERWATER DIVE OPERATIONS PLAN

Not applicable. Diving work will not be performed under the current work scope.

12.56 TREE FELLING/MAINTENANCE PROGRAM

Not applicable. This type of work will not be performed under the current work scope.

12.57 AIRCRAFT/AIRFIELD CONSTRUCTION SAFETY AND PHASING PLAN

Not applicable. This type of work will not be performed under the current work scope.

12.58 SITE SAFETY AND HEALTH PLAN

The SSHP is included as Attachment D1 of this APP.

12.59 CUMULATIVE TRAUMA DISORDER PREVENTION

Injuries may occur from hand digging with shovels, clearing and grubbing tools, and hand augers. Workers will be instructed to avoid over-reaching, lifting, and twisting while moving equipment, and to ensure that footing is solid before lifting commences. The following actions will be taken to minimize ergonomic risks:

- Use a hand truck or other mechanical aids to move heavy objects.
- Push, do not pull, whenever possible.
- If you find that you must twist or stretch to reach a load to be handled, readjust the load before moving it or reposition yourself before lifting it.

- Consider the size, shape, and weight of the object to be lifted. No individual employee is permitted to lift any object that weighs over 50 pounds. Multiple employees or the use of mechanical lifting devices is required for objects over the 50-pound limit.
- Consider that the safe lifting zone is between the knees and shoulders. If the object is below knee level, bend the knees and lift with the legs. If the load is above the shoulders, use a sturdy step ladder.
- Inspect the anticipated path to the destination for the presence of slip, trip, and fall hazards, and clear obstacles before commencing to move the load/object. Place feet far enough apart for good balance and stability (typically shoulder width).
- Get as close to the load as possible. Bend legs at the knees.
- Keep the back as straight as possible and abdominal muscles tightened.
- Avoid twisting motions when performing manual lifts.
- Straighten legs from their bent position to lift the object.
- Take small turning steps without twisting the knees or the back if it is necessary to turn with the load.
- Never carry a load that cannot be seen over or around.

Vibration Hazards

Both hand-held and stationary tools that transmit vibration through a work piece can cause vibration “white fingers” or hand-arm vibration syndrome. The use of these types of tools is not anticipated on this project; however, if they should be required, proper control measures will be utilized to minimize hand-arm vibration. The control measures may include the following:

- Using anti-vibration tools and/or gloves
- Keeping hands and body warm
- Minimizing the vibration coupling between the hand and the tool
- Participating in the medical surveillance program
- Adhering to the ACGIH TLV for hand-arm vibration

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13.0 CONTRACTOR INFORMATION

The health and safety requirements of EM 385-1-1 will be met through the application of HGL's HSP policies and the implementation of the project APP/SSHP and AHAs.

13.1 EXCAVATIONS

Excavation activities will be limited to anomaly investigation with hand tools to identify subsurface targets. Excavations will only be conducted by qualified UXO personnel.

13.2 MEDICAL AND FIRST AID REQUIREMENTS

Before fieldwork begins, arrangements will be made for medical facilities and personnel to provide prompt attention to medical emergencies and occupational safety and health matters. The directions and maps for the nearest medical facilities will be posted in the site trailers and in each site vehicle.

At a minimum, at least two on-site employees will be qualified to administer first aid and CPR. The UXOSO vehicle will be designated as the primary emergency support vehicle. All site vehicles will carry first aid kits.

13.3 CHEMICAL EXPOSURE PREVENTION

The only anticipated chemical hazards expected during site activities are fuels and oils brought on site for equipment use and maintenance. All site personnel will follow the procedures and precautions outlined in the appropriate SDS for the appropriate use and storage of these materials. The SDS binder will be kept in the UXOSO site vehicle and will be available to all employees on request. Chemical warfare materiel (CWM) is not expected to be found on this site. Should CWM be found on the site, HGL will secure the site, withdraw to an upwind safe position, and contact USACE.

13.4 SANITATION

HGL will establish and maintain basic sanitation provisions for employees as detailed in Section 12.26.

13.5 PPE

See Section 11.0 of this APP.

13.6 FIRE PREVENTION

The APP/SSHP will serve as the written fire prevention plan and will be provided and posted at the project site. The APP/SSHP includes emergency contact information, a list of major workplace fire hazards, potential ignition sources, types of fire suppression equipment available to control a fire, and responsibilities and good housekeeping procedures and considerations. Fire prevention training and awareness will be provided during the site-specific briefing and during daily TSMs.

13.7 MACHINERY AND MECHANIZED EQUIPMENT

Before any machinery or mechanized equipment is placed into use, it will be inspected and tested to verify that it is in safe operating condition. Records of tests and inspections will be maintained at the site. The following safety procedures will be adhered to on sites using heavy machinery and equipment:

- HGL will designate a competent person to be responsible for the daily inspection of all machinery and equipment and during use to ensure that it is in safe operating condition. Tests will be made at the beginning of each day during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition.
- Preventive maintenance procedures recommended by the manufacturer will be followed. Any machinery or equipment found to be unsafe will immediately be removed from service and its use prohibited until unsafe conditions have been corrected. A tag indicating that the equipment may not be operated will be placed in a conspicuous location on the equipment. The tag will remain until it is demonstrated to the individual tagging the equipment that it is safe to operate. Where possible, lockout procedures will be used.
- Only licensed or trained personnel will operate machinery and mechanized equipment. Equipment deficiencies observed at any time that affect safe operation will be corrected before continuing operation. Seats and seat belts will be installed and used by operators and passengers of heavy equipment. The only exception to this requirement will be for heavy equipment designed for stand-up operation. Entering or exiting any equipment while it is in motion is prohibited. Machinery or equipment requiring an operator will not be permitted to run unattended. Machinery or equipment will not be operated in a manner that will endanger individuals or property, and safe operating speeds or loads will not be exceeded.
- Equipment operated on the public roads will be equipped with turn signals visible from the front and rear. Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shut-off, which will prevent spillage if connections are broken, may be used to fuel diesel-powered equipment left running.
- All towing devices used on any combination of equipment will be structurally adequate for the weight drawn and securely mounted. Persons will not be permitted to go between a towed and towing piece of equipment except to connect the equipment. All equipment with windshields will be equipped with powered wipers. Vehicles that operate under conditions that cause fogging or frosting of windshields will be equipped with operable defogging or defrosting devices.

- Whenever the equipment is parked, the parking brake will be set. Equipment parked on inclines will have the wheels chocked or track mechanism blocked and the parking brake set.
- Personnel will not work or pass underneath the loads handled by lifting or digging equipment.
- Each piece of heavy equipment on site will be equipped with at least one dry chemical or carbon dioxide fire extinguisher.
- A warning device or signal person will be provided where there is danger to nearby workers from moving equipment such as swinging loads, buckets, or booms. Where manual (hand) signals are used, only one person will be designated to give signals to the operator. The signal person will be located to see the load and be clearly visible to the operator. Employees will be required to stay clear of any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials.
- Loose, ill-fitting clothing can become caught in heavy equipment; therefore, proper fitting clothing will be worn during field activities that involve heavy equipment. Long hair that extends below the hard hat will be tied in a manner to prevent contact with moving equipment parts. PPE, IAW the APP/SSHP, will be required of all persons working with or near heavy equipment operations. Employees exposed to public vehicular traffic will be provided with, and will wear, warning vests or other suitable garments marked with or made of reflective or high-visible material.

13.8 PUBLIC SAFETY REQUIREMENTS

The sites associated with this TCRA are located along the western, eastern, and southern perimeter of the Culebra Nature Reserve on Culebra Island, Puerto Rico; any public safety notifications required prior to fieldwork will coordinated through USACE. The HGL team will coordinate with the local beach authority during intrusive activities. It is anticipated that the issuance of camp permits will cease during the TCRA fieldwork and support from the beach authority will be provided to clear campers from the area. Site access will be limited and exclusion zones will be maintained. Hazardous work activities will cease if necessary to ensure public safety.

13.9 BIOLOGICAL HAZARD EXPOSURE PREVENTION

Personnel will be made aware of the various biological hazards that may be encountered while working at the sites, including ticks, poisonous insects (for example, fire ants, chiggers, and disease-bearing mosquitoes), poison ivy, and snakes, during the initial site safety orientation. Appropriate preventative measures will be employed to minimize potential exposure to biological hazards, including designating a field member to watch for biological hazards. Table 13.1 shows the biological hazards for the site.

Table 13.1
Biological Hazards

Mosquitoes
 
Fire Ants

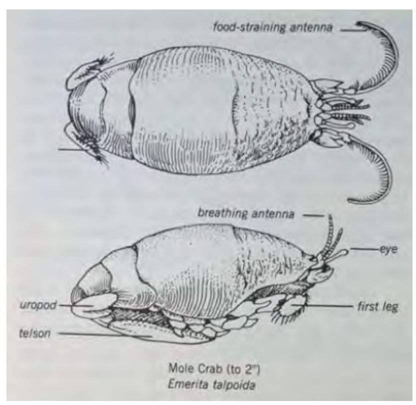
Sand Fleas

Scorpions


Table 13.1 (continued)
Biological Hazards

Spiders

Brown Recluse

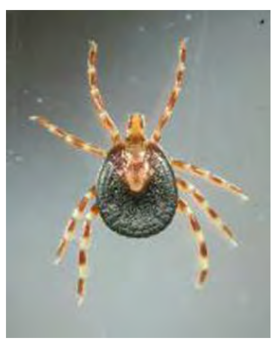
Brown Tarantula

Stinging Insects

Africanized Honey Bee

Wasp

Ticks



Tropical Bont Tick

Table 13.1 (continued)
Biological Hazards

Snakes

Puerto Rican Racer

Boa Constrictor

Mongooses

Poisonous Plants, Shrubs and Trees

- The following plants are considered poisonous and may cause severe itching and rash:
  - Palo Bronco
  - Stinging Nettle
  - Ortiga Brava
  - Tabaiba
  - Carrasco
  - Cabbage Angelin
  - Dumane, Frangipani
  - Guinea Grass
  - Cow Itch
  - Elephant Ear
  - Giant Philodendron

Cow Itch

The UXOSO will be responsible for instructing personnel in avoiding or minimizing exposure to biological hazards. The keys to avoiding biological hazards are awareness of one's surroundings and general knowledge of the habits of various species that may present a threat. In general, the vertebrates will escape to avoid human contact when encountered. Reptiles will often seek out warm sunny locations in morning hours and during cold weather. A reconnaissance of the site work area should be conducted every morning to identify the presence of potential threat species of plants, insects, and animals. Clearings of vegetation and soil excavation near burrows are activities that potentially disturb reptiles or hornets nests in proximity to personnel. Extra care and caution should be exercised in any work area that disturbs vegetation or soil, or when entering any vegetated area where one cannot directly see the ground surface at all times.

The work sites may contain ticks, venomous spiders, (brown recluse), sand fleas, and venomous insects, such as wasps and hornets. Venomous insects and spiders are generally reclusive, and the greatest potential for exposure arises when personnel are opening containers, structures, buildings, and well casings; handling idle equipment; or moving construction material stockpiles. Caution should be taken when opening the casing around monitoring wells.

Mosquitoes

Mosquitoes are bothersome and may carry diseases, such as the West Nile and Zika Viruses. They are attracted by heat, sweat, body odor, and carbon dioxide. Site personnel should wear protective clothing and insect repellent containing N,N-Diethyl-m-toluamide (DEET). Insect repellent should be reapplied at least every 4 hours. The following suggestions should provide some protection from mosquitoes (OSHA, 2016):

- Review the hazards associated with the West Nile Virus and Zika Virus through exposure to mosquito bites periodically during the TSMs. Zika virus prevention is an important issue because contracting this virus during pregnancy appears to pose a significant risk of neurological birth defects including microcephaly. Infection appears to be much less dangerous for healthy adults. Get regular updates on transmission and controls from: Centers for Disease Control - www.cdc.gov/zika/ www.cdc.gov/zika/
- Review the power point training and Zika handout at the links below. https://hydrogeologic.sharepoint.com/sites/hglcentral/lib/Documents/Health%20and%20Safety/Health%20and%20Safety%20Training/Zika%20slides%20from%20OSHA%20DTSEM_Zika_Virus_Update_-_June_2016.pdf

  https://hydrogeologic.sharepoint.com/sites/hglcentral/lib/Documents/Zika%20Virus%20handout.docx?d=w885ef93f791143438822236555975169
- Document the briefing and the topics covered. Standard tailgate forms can be used as long as the form documents the topics covered. Have all sign to ensure training on Zika virus has been conducted.
- If you are using sunscreen, apply sunscreen first and then insect repellent.

- Take extra precautions like Thermocell units and head nets (as long as they do not interfere with visual acuity).
- Increase protective measures when working at dawn, dusk, and in the early evening.
- Reduce the area of exposed skin when working outdoors. Long-sleeved shirts with sleeves rolled down are recommended; however, it should be understood that mosquitoes may bite through thin clothing. To avoid mosquitoes, personnel should evaluate the actual Level D clothing worn; for example, heavy long sleeved work shirts and heavy dungarees/jeans may mitigate mosquito bites. The use of a disposable coverall, such as Tyvek®, may further reduce the risk of mosquito bites.
- Use an insect repellent containing approximately 30 percent DEET. Use the repellent according to the manufacturer's directions provided on the container. Frequent reapplication or saturation is not necessary for repellent containing DEET to be effective. Avoid prolonged and excessive use of DEET. Caution: some individuals may be sensitive to DEET – always read and follow label directions. After returning from outdoor field activities, wash treated skin with soap and water.
- Use commercially prepared "clothing and gear" insect repellants containing 0.5 percent permethrin when additional protection against mosquitoes is necessary. These repellants, such as Repel Permanone™, are available in the sporting goods departments at major retailers. Clothing and gear insect repellants are not for use on skin. Use the repellent according to the manufacturer's recommendations provided on the container.
- Avoid using fragrances.
- Prevent accumulation of water, which can provide breeding grounds for mosquitoes.

The Zika virus is primarily transmitted through mosquitoes, but may also be spread via bloodborne (contact) transmissions and sexual transmission (partner to partner). The current outbreak affects countries throughout Central and South America and Pacific Islands including Puerto Rico and the U.S. Virgin Islands. Only 1 in 5 infected individuals develop signs and symptoms which include fever, rash, joint and muscle pain, headaches and red or pink eyes. Symptoms begin to occur between 2 and 7 days after exposure, are usually mild, and can last up to a week. Although the Zika virus is mild and may go undetected in most infected individuals it is important to take precautionary measures to avoid spreading the virus through bloodborne or sexual transmission. Zika poses the greatest risk if the infection is acquired immediately before or during pregnancy. People who are pregnant or may participate in getting pregnant in the near future should consider not accepting the assignment.

- Travelers returning to the U.S. should take precautions to prevent mosquito bites for 3 weeks to avoid spreading the virus to uninfected mosquitos.
- Male to partner is the most common sexual transmission pathway; however, female to male, though rare, is possible. Men who have traveled to an area with Zika but don't have symptoms should use condoms for 8 weeks to protect their partners. Men who have Zika symptoms or are diagnosed with Zika should use condoms for 6 months.

- If the man's partner is pregnant, the couple should either use condoms or practice abstinence during the pregnancy. Women who have traveled to an area with Zika but don't have symptoms should wait 8 weeks after travel before trying to get pregnant.

Sand Fleas

Sand fleas are a type of mite found in sand throughout the island. Sand fleas are nearly invisible and can cover your feet and legs in a short time. Bites are painful and cause severe itching, red pimple-like bumps (papules or hives).

The following are suggestions that should provide some protection from sand fleas:

- Stay out of areas where sand fleas are likely to be present including areas with thick vegetation, beaches, and residential areas. Sand fleas are especially common after rain, early in the morning, or late evening.
- Wear loose-fitting clothing (if possible) when working outdoors. Vehicles should be vacuumed frequently to reduce the number of sand fleas that may have been deposited.
- Spray an insect repellent containing approximately 30 percent DEET around pant legs and socks. Insect repellant containing DEET will be available to personnel while working on site. Use the repellent according to the manufacturer's directions provided on the container. After returning from outdoor field activities, wash treated skin with soap and water.
- Take a bath immediately after possible exposure to sand fleas, thoroughly scrubbing the body with hot soapy water. This will kill or dislodge many of the sand fleas. The clothes that were worn when the bite(s) occurred should be placed in a plastic bag for temporary storage until they can be laundered.
- Apply rubbing alcohol when bites begin to itch, followed by one of the nonprescription local anesthetics. A baking soda paste, calamine lotion, or product such as "After-Bite" also will help reduce discomfort. Avoid scratching bites since this only increases irritation and may lead to a secondary infection of the bite.

Fire Ants

Nests should not be allowed to form near structures and areas where personnel will continue to have a need for access. If bitten, personnel should wash the bite area with soap and water; apply cool compress to the area; elevate the area on a pillow, and apply a paste of baking soda and water for itching.

Stinging Insects

Workers should keep alert for bee and wasp activity, and avoid wearing bright clothing and scented toiletries when working outside. Be wary of areas around structures where bees and wasps may live. If bee or wasp activity is noted, the area should be avoided if possible. The use of insect repellants containing DEET is not effective in preventing stings. Anyone can have an allergic reaction to a bee sting, even if they were stung before with no reaction. Allergic reactions to bee stings may include swelling around the lips and eyes, rapid development of a rash, difficulty breathing, or signs of shock (pale skin, rapid pulse, and fainting). If any of these symptoms occur, call 911 immediately. Individuals who have had a previous reaction should notify the UXOSO before fieldwork begins and carry a "bee-sting kit," EpiPen®, or Ana-Kit. All personnel will immediately report stings to the UXOSO.

Nests should not be allowed to form near structures and areas where personnel will continue to have a need for access. If stung, personnel should wash the bite area with soap and water, apply a cool compress to the area, elevate the area on a pillow, and make a paste of baking soda and water for itching.

Africanized Honey Bees ("killer bees") are more aggressive and dangerous than other types of bees. If attacked by bees, workers should cover their faces, run away from the hive, and seek shelter in an enclosed area. If stung, the stinger should be removed and first aid sought if necessary.

Centipedes

Centipedes are commonly found throughout Puerto Rico and are larger (up to 15 inches in length) than those seen on the mainland United States. Centipedes are venomous though rarely fatal; however, if bitten observe the individual for signs of allergic reaction for a minimum of 30 minutes. If a team member is bitten by a centipede, immediately report the incident to the UXOSO to provide first aid treatment.

Scorpions

The scorpion species found in Puerto Rico, including Culebra Island, are not poisonous; however, contact with scorpions should be avoided as stings are painful. The following are suggestions to avoid scorpions and procedures in case a scorpion sting occurs:

- Scorpions can be found in dark places such as under vegetation, rocks, containers, and in dark corners. Be cautious when performing vegetative clearance, moving organic material such as tree branches or rocks from the ground, and when moving contains in the field office.
- Scorpion sting symptoms include local pain, burning, tingling, numbness, and swelling. If an individual is stung by a scorpion, immediately clean the wound with soap, water and apply a cold compress, and call the poison control center.

Spiders

Brown recluse spiders and brown tarantulas are venomous and may also be present in and around structures, vegetation, or burrowed in the ground. Spider bites from this species can cause swelling and intense pain, and in some instances have caused death (U.S. Department of Agriculture Forest Service [USDAFS], 2016a). Additional species of spiders found in Puerto Rico include banana spiders, cave spiders, and orb weavers. If bitten, personnel should wash the area with soap and water, apply a cool compress to the area, elevate the area on a pillow, and call the nearest poison control center, which will monitor the personnel's condition and advise if medical attention is needed.

Ticks

Nearly all work sites on this project may contain ticks. Working in tall grass, especially in or at the edge of wooded areas, increases the potential for ticks to bite workers. Ticks can be particularly numerous in the spring and fall. Ticks are vectors of many different diseases, including Lyme disease. Ticks attach to the skin and feed on blood, creating an opportunity for disease transmission.

The primary symptoms of tick-borne diseases are high fever, head and joint aches, nausea, and vomiting. Additionally, persons develop rashes or experience occasional coughs, chest pain, and severe pneumonia. Lyme disease usually presents a distinctive bull's eye rash at the site of the bite in addition to flu-like symptoms and swollen lymph nodes.

If ticks are prevalent, treat clothing with a permethrin-based product like Permanone as directed by the manufacturer. Use an insect repellent containing approximately 30 percent DEET on any bare skin. Insect repellant will be available to personnel. Caution: some individuals may be sensitive to DEET – always read and follow label directions. Pant legs should be closed with tape or elastic bands, or by tucking them into socks. Shirts should be tucked into pants.
Periodically during the workday, employees should inspect themselves for the presence of ticks. If a tick is discovered, the following procedure should be used to remove it:

- Do not try to detach a tick with bare fingers; bacteria from a crushed tick may penetrate even unbroken skin. Fine-tipped tweezers should be used.
- Grip the tick as close to the skin as possible and gently pull it straight away from you until it releases its hold.
- Do not twist the tick as you pull and do not squeeze its body; this may inject bacteria into your skin.
- Wash your hands and the bite area thoroughly with soap and water, and then apply an antiseptic to the bite area.

Snakes

Puerto Rico is home to four species of snakes none of which are poisonous; however, contact with any snake should be avoided. If bitten by a snake, a person should pay attention to the characteristics of the snake, including color and pattern. The bitten person should be transported immediately to a medical facility, and the snake should be described to the attending physician. If immediate transportation to a medical facility is not possible, the victim should be placed at rest, and the extremity of the bite should be splinted.

To minimize contact with snakes, individuals walking on site should avoid tall grass and vegetation and avoid placing hands in concealed areas. The following precautions should be followed:

- Be aware of your surroundings at all times. Learn to check around with a sweeping glance to scan for camouflaged snakes in woodlands, weeds, trails, bushes, and other cover habitat.
- Avoid specific snake habitats such brush piles, rock piles, crevices, debris mounds, logjams, root systems, abandoned buildings, and watery areas. If movement of materials (such as rocks or brush) is necessary, use a remote means to initially relocate the material. Before entering an area, look and listen carefully.
- Never climb or step over obstacles anywhere without first carefully checking for snakes.
- Watch where you sit, where you place your hands and feet, and where you step at all times; use caution when exiting a vehicle parked off road.
- Wear snake gaiters or chaps when walking in suspected snake country.
- Never try to capture or kill ANY snakes.
- Never handle “dead” snakes; they may not be completely dead.
- If an individual is bitten by a snake immediate inform the UXOSO and seek medical attention.

Mongooses

The Small Indian Mongoose was introduced to Puerto Rico in an attempt to control Black Rat infestations; however, the lack of natural predators has led to a large population of mongooses throughout the islands. Mongooses seek shelter in hollow logs and trees, holes in the ground, or crevices in rocks. These rodents can be found throughout forests, along roads and trails, and occasionally in well populated areas. Mongooses can be infected with rabies and should not be approached for any reason (USDAFS, 2002).

Allergenic Plants

Poison Ivy and Poison Oak, though common in the continental U.S., are not found in Puerto Rico. Several other species of poisonous plants can be found throughout the islands. The best preventative measure for poisonous plants is recognition and avoidance.

All of the plants listed in Table 13.1 cause mild to severe skin irritation and skin rash (USDAFS, 2016b). Nearly everyone is allergic or capable of becoming allergic. Additionally, when operating a chainsaw to clear brush in the winter or early spring, sawdust may contain enough oleoresin to cause a severe rash. Symptoms usually occur 24 to 48 hours after exposure, resulting in rashes that itch and blister. Should exposure to these plants occur, wash/rinse the affected area within one-half hour after contact, using Technu™, rubbing alcohol, Neutrogena™ acne wash/skin cleanser, or similar product. Do not scrub. Do not use soap with lotions or emollients, as this will cause spreading of the allergenic plant oils. Seek medical attention as necessary. The use of disposable gloves and Tyvek® coveralls or barrier creams (applied in advance of exposure), and care in laundering clothing (segregating clothing) worn on site can help prevent skin contact with these plants.

The best defense in dealing with these plants is preventing the direct physical contact that can lead to allergic reaction. This can be accomplished through the use of a skin barrier. Effective barriers include clothing, which should be handled carefully when laundering, and barrier cream.

The irritants can also be transported in smoke if these plants are burned and can be released into the air when these plants are ground up such as in mowing or mulching. These exposures may affect the respiratory tract as well as the skin.

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14.0 SITE-SPECIFIC HAZARDS AND CONTROLS

Detailed project-specific hazards and controls for each major definable feature of work/activity will be addressed in task-specific AHAs. The AHAs define the job steps to be performed for each activity; the specific anticipated hazards associated with each job step; and the equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk. The AHAs will include site-specific training requirements, inspection schedules, and the names of competent and qualified personnel. The AHAs are to be considered living documents and are intended to be created in the field and updated by the workers as needed. A risk assessment code (RAC) associated with each activity will be determined. RACs are defined by probability and severity of occurrence.

AHAs will be revised, as necessary, when unforeseen circumstances arise or work-site conditions change. Any revisions will be immediately communicated to the affected site workers. If the need to complete an unplanned task becomes necessary at any point throughout the day, the AHA will be revised.

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15.0 REFERENCES

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National Fire Protection Association (NFPA), 2012. NFPA 70E, *Standard for Electrical Safety in the Workplace,* at URL http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=70E&cookie%5Ftest=1.

Occupational health and Safety Administration (OSHA), 2016. *OSHA Worker Safety and Health Activities and the Ongoing Zika Virus Outbreak*, June.

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U.S. Department of Agriculture Forest Service (USDAFS), 2002. *Wildlife Facts – Small Indian Mongoose*, at URL http://www.fs.usda.gov/detail/elyunque/learning/nature-science/?cid=fsbdev3_042886 (Accessed 19 July 2016).

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U.S. Department of Agriculture Forest Service (USDAFS), 2016b. *Poisonous Plants, Shrubs and Trees on the El Yunque National Forest*, at URL http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gDfxMDT8MwRydLA1cj72DTUE8TAwjQL8h2VAQAMtzFUw!!/?navtype=BROWSEBYSUBJECT&cid=fsbdev3_042885&navid=150130000000000&pnavid=150000000000000&ss=110819&position=Not%20Yet%20Determined.Html&ttype=detailfull&pname=El%20Yunque%20National%20Forest-%20Nature (Accessed 19 July 2016).

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ATTACHMENT D1
SITE SAFETY AND HEALTH PLAN

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EMERGENCY CONTACT INFORMATION

In case of emergency or unplanned situation, contact the appropriate responder from the list below.

- In emergency situations, contact the site Point of Contact (POC) who will then contact the appropriate response teams.
- If a serious, life threatening emergency arises, contact emergency personnel before contacting the site POC.

This summary precedes this Accident Prevention Plan for quick reference.

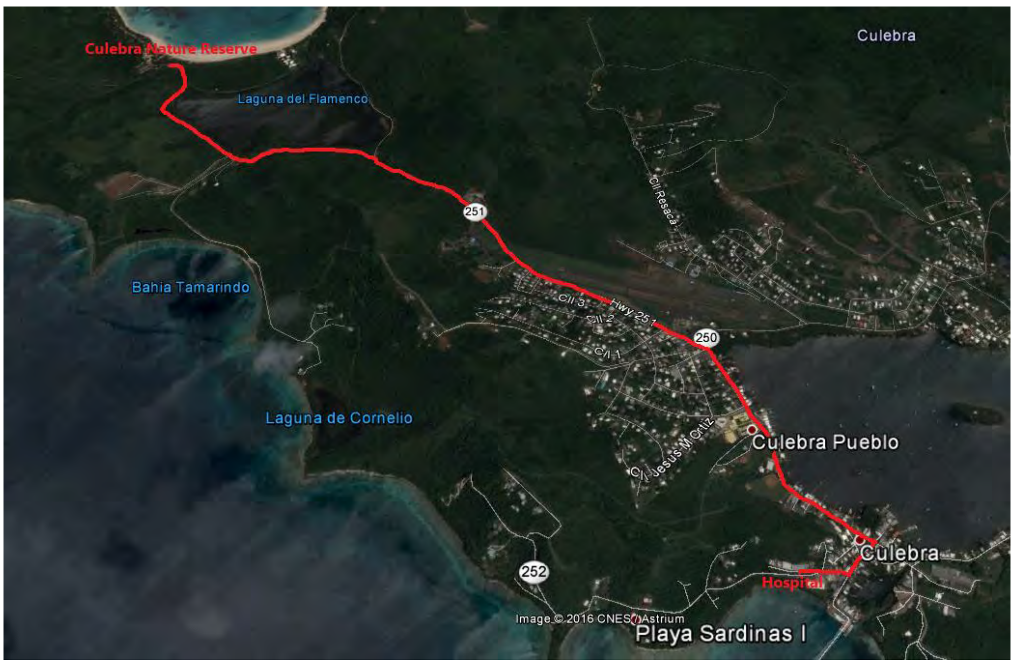
EMERGENCY TELEPHONE NUMBERS AND PROJECT CONTACTS

Emergency Medical Care		
Hospital: Culebra Medical Clinic	911 (787) 742-3511	
National Poison Control Center	(800) 222-1222	
National Response Center Environmental Emergencies	(800) 424-8802	
Federal OSHA Emergency Hotline	(800) 321-6742	
Culebra Emergency Numbers		
AERO Med Medical Evacuation Flight		(787) 756-3480
Emergency Management Office – Culebra		(787) 742-3849
Fire Fire Department – Culebra Island	Emergency Nonemergency	911 (787) 742-3530
Police Police Department – Culebra Island	Emergency Nonemergency	911 (787) 742-3501
USACE		
USAESCH COR	Rebecca Terry	(256) 895-1788
CESAJ PM	Wilberto Cubero	(904) 232-1426
HydroGeoLogic, Inc. (HGL)		
Health and Safety Emergency Number		(800) 341-3647
Project Manager	Derek Anderson	(703) 596-5715
Corporate Quality Management Representative	Neil Feist	(256) 970-2103
Senior UXO Supervisor (SUXOS)	TBD	TBD
UXO Safety Officer (UXOSO)	TBD	TBD
Corporate Health and Safety Director	Steve Davis CIH, CSP	(865) 659-0499
HGL Corporate Occupational Physician *WorkCare 24-hour hotline nurse	Dr. Peter Greaney, MD	(714) 978-7488, ext. 114 *(888) 449-7787
Parsons		
Project Manager	Patti Berry	(678) 969-2410
Parsons Corporate Health and Safety Manager (CHSM)	Ed Grunwald	(770) 969-2394
Parsons WorkCare Incident Intervention	N/A	(888) 449-7787 or (714) 978-7488 ext. 228

Directions to Culebra Medical Clinic

- From the southeastern entrance to the Culebra Nature Reserve take HWY 251 south approximately 1.84 miles.
- HWY 251 will end at an intersection with HWY 250/C. Escuedero Road. Keep right on HWY 250 and continue south for another 0.56 miles.
- Turn right onto C. Pedro Marquez Road and continue for approximately 0.9 miles.
- Turn right onto C. William Font Street.
- The Culebra Medical Center is located 0.9 miles ahead on the right.

The Culebra Medical Clinic building is located near the island ferry landing, at the end of C. William Font Street which extends up the hill, past the collection of local government buildings. The medical building is identified by a Red Cross symbol, and is marked by a “Recetas” (prescriptions) sign.



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LIST OF TABLES

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LIST OF ACRONYMS AND ABBREVIATIONS

AHA	activity hazard analysis
APP	Accident Prevention Plan
ATF	Bureau of Alcohol, Tobacco, Firearms and Explosives
CDHS	Corporate Director of Health and Safety
CFR	Code of Federal Regulations
CIH	certified industrial hygienist
CPR	cardiopulmonary resuscitation
CSP	certified safety professional
dBA	A-weighted decibels
DOE	U.S. Department of Energy
EHS	environmental health and safety
EM	Engineer Manual
EOD	explosive ordnance disposal
EP	Engineer Pamphlet
EPA	U.S. Environmental Protection Agency
ESS	Explosives Safety Submission
EZ	exclusion zone
HAZWOPER	Hazardous Waste Operations and Emergency Response
HE	high explosive
HGL	HydroGeoLogic, Inc.
IT	International Technology Corporation
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
MPPEH	material potentially presenting an explosive hazard
OESS	Ordnance and Explosives Safety Specialist
OJT	on the job training
OSHA	Occupational Safety and Health Administration
PM	project manager
PPE	personal protective equipment
PWP	plasticized white phosphorus
QA	quality assurance

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

RP	red phosphorus
SAIC	Science Applications International Corporation
SDS	safety data sheet
SSHP	site safety and health plan
SUXOS	senior unexploded ordnance supervisor
TCRA	time critical removal action
TRIR	Total Recordable Incident Rate
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
UXO	unexploded ordnance
UXOSO	Unexploded Ordnance Safety Officer
WP	white phosphorus

1.0 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

The specific areas to be addressed under the time critical removal action (TCRA) make up approximately 31.89 acres within the Culebra Nature Reserve on the northwest Peninsula located on the Puerto Rican island of Culebra.

This Munitions and Explosives of Concern (MEC) TCRA project will be performed along portions of Flamenco Beach and campgrounds, Carlos Rosario trails and beach, and Tamarindo beach.

The Culebra property, consisting of Culebra Island and surrounding cayos, was acquired via land transfers, purchases, donations, and leases. The area was used for coaling and communications stations, aerial bombing, maneuvers, naval gun and artillery firing, and amphibious training by the U.S. Marine Corps and the U.S. Navy during various periods between 1903 and 1975. Naval rounds were fired onto the northwest peninsula, including 5-inch projectiles and 3-inch, 6-inch, and 8-inch gun ammunition. Additionally, 5-inch high explosive (HE) naval projectile, 2.75-inch rockets, 40 millimeter (mm) projectiles, 75mm projectiles, 81mm mortars, 100-pound general purpose bombs, a 500-pound general purpose bomb, 16-inch projectiles, and BDU-33 practice bombs have all been found. Some of these findings were encountered and reported by residents of Culebra or visitors.

The presence of large, HE munitions in, or near, heavily used public beaches (e.g., Flamenco, Carlos Rosario, and Tamarindo beaches) and nearby businesses pose a significant imminent risk to public health, safety, and the environment.

The Northwest Peninsula TCRA project will include:

- MEC, material potentially presenting an explosive hazard (MPPEH), and munitions debris (MD) identification, removal, inspection and handling, and disposal;
- MEC identification, anomaly avoidance and MEC/MPPEH/MD removal, inspection, handling and disposal conducted by HydroGeoLogic, Inc. (HGL) unexploded ordnance (UXO) technicians;
- Geophysical Survey (analog geophysical) of the Flamenco Campground vegetated area, Carlos Rosario Trail and vegetated area, and Tamarindo vegetated area.

The site location map is provided in Appendix B of the Work Plan.

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2.0 HAZARD ANALYSIS AND RISK ASSESSMENT

HGL has analyzed the Performance Work Statement and historical information to determine work risk hazards associated with fieldwork tasks to be performed within the northwest peninsula TCRA project areas. The hazards likely to be encountered during fieldwork include classic safety, explosive ordnance, physical safety, and biological hazards. Chemical and ionizing radiation hazards are not likely to be encountered while performing the fieldwork. The tasks and hazard/risk analyses detailed in this section shall be modified and approved throughout the project as needed to address changing work conditions.

The following task hazard analysis includes both Hazardous Waste Operations and Emergency Response (HAZWOPER) and non-HAZWOPER related tasks, which may or may not occur during the initial phase of the project, but may occur during the MEC removal action or during the continuation of fieldwork. Table 2.1 presents the task hazard analysis for all planned work activities. The Activity Hazard Analysis (AHA) sheets developed specifically for the hazardous tasks associated with this project site are provided in Attachment 2 of this Site Safety and Health Plan (SSHP). Each AHA sheet provides job specific steps, associated hazards, and actions necessary to eliminate or minimize the potential hazards.

Table 2.1
Task Hazard Analysis

Potential Hazards	Geophysical Investigation Surveying	MEC Intrusive Operations	MEC Excavation	MPPEH Processing	Off-Road Vehicle Operations
Flying Debris/Objects	X	X	X	X	X
Noise > 85dBA		X	X	X	
Electrical	X	X	X		X
Buried Utilities, Drums, Tanks	X	X	X		
Slip, Trip, Fall	X	X	X	X	X
Back Injury	X	X	X	X	X
Trenches/Excavations			X		
Visible Lightning	X	X	X	X	X
Vehicle Traffic	X	X	X		X
Fires			X		X
Heavy Equipment		X			
Explosive Ordnance	X	X	X	X	
Biological	X	X	X	X	X
Heat/Cold Stress	X	X	X	X	X

Table 2.2 lists the equipment to be used and the related inspection and training requirements for the project.

Table 2.2
Project Equipment and Training Requirements

Equipment to be Used	Inspection/Test Requirements	Training Requirements
Vehicles	Daily – preventive maintenance and operational checks	Valid driver's license and/or operator training.
Ordnance detection locators	Prior to operation	40-hour HAZWOPER (*Code of Federal Regulations [CFR] 1910.120*). 8-hour HAZWOPER Refresher (*CFR 1910.120*). 24-hour supervised field experience. Graduate of a military explosive ordnance disposal (EOD) school or a formal training course.
Demolition/explosive materials		Must have all the above certifications and a valid *Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) Employee Possessor Questionnaire (ATF E-Form 5400.28)* on file.
Explosive vehicle	Explosive Vehicle Inspection	On public transportation routes, if required for the type of explosives being transported, the driver must have all the above certifications and a valid commercial driver's license with a hazardous material endorsement.
Blocking, bracing, and cushioning materials	Prior to operation	UXO Technician III certified or above.
Fire extinguishers	Monthly	Site specific.
First-aid kits	Weekly – inventory and inspection	Cardiopulmonary resuscitation (CPR) and first aid certified.
Manual hand tools	Prior to operation	On the job training (OJT).
Mechanized equipment	Prior to operation	Operator's certificate.
Heavy equipment	Prior to operation	Operator's certificate.
Geophysical instrumentation	Prior to operation	OJT.
Global Positioning System instrumentation	Prior to operation	OJT.
Personal protective equipment (PPE)	Prior to use	Site specific.
Communications equipment	Prior to operation	Site specific.
Battery charging station	Prior to operation – visual Monthly – entire system	Site specific.
Eye wash station	Weekly – visual Monthly – operational 90-day – solution replacement	Site specific.
Weather monitoring equipment	Prior to operation	UXO Technician III certified or above.

The principal anticipated hazard to site workers is UXO. This hazard will be managed through procedures stated in detail in the work plan. There is no evidence that chemical or radiological hazards are present at the site. However, if evidence of these hazards is discovered, the UXO safety officer (UXOSO) will notify the project manager (PM) and the corporate director of health and safety (CDHS) as soon as possible. In addition, appropriate addenda to this plan will be prepared.

In the unlikely event that a chemical weapon (or chemical weapons materiel) is encountered during operations, work will halt immediately, and personnel will withdraw upwind from the area. The U.S. Army Corps of Engineers (USACE) safety specialist will be notified. Site personnel will stand by and wait for instructions from the USACE contracting officer.

Biological hazards anticipated for this project site include bees, wasps, hornets, spiders, ticks, ants, mosquitoes, snakes, poisonous plants, and blood borne pathogens.

2.1 CLASSIC SAFETY

The following distinct phases of project work or distinct potentially hazardous operations have been identified:

- Mobilization
- Site preparation
- General site work
- Location surveys and mapping
- Vegetation removal
- Anomaly avoidance
- Instrument-assisted surface clearance of MEC and MPPEH
- MEC disposal
- Material documented as safe disposal
- Environmental sampling
- Demobilization

Hazards and potential for injury associated with these activities include the following:

- Lifting hazards, such as back strain, pulled muscles and tendons, pinched or crushed fingers and toes, and lacerations from sharp surfaces on objects lifted
- Hazards associated with the operation of hand and power tools (for example, chain saws), including lacerations and flying objects
- Slip, trip, and fall hazards associated with ground cover, exposed tree/brush stumps, uneven terrain, rocks, and vegetation growth
- Inclement weather events, such as heavy rain, and lightning
- Sharp objects, including nails, broken glass, cultural debris, and exposed tree/brush stumps
- Noise from heavy equipment
- Vehicle accidents
- Conditions that could cause heat-related illness

– NOTE –

If site conditions or activities occur that are not discussed in this document or in the Accident Prevention Plan (APP), then the UXOSO will notify the CDHS immediately and new procedures will be developed.

2.2 EXPLOSIVE ORDNANCE

2.2.1 MPPEH Hazards

During the project, MPPEH will be encountered by the field UXO teams. Every precaution will be taken to ensure all MEC surface and surface clearance operations are conducted in the safest possible manner.

2.2.2 MEC Hazard Safety

When MEC is encountered during any phase of work, the senior UXO supervisor (SUXOS) and the UXOSO will be immediately notified. In general, the following MEC safety precautions and protocols will be followed:

- Positively identify all MEC.
- Always remain alert at all times for MEC, UXO, and related scrap or MPPEH hazards.
- The cardinal principle to be observed involving ordnance, explosives, ammunition, severe fire hazards, or toxic materials is to limit the exposure to a minimum number of personnel, for the minimum amount of time, to a minimum amount of hazardous material consistent with a safe and efficient operation.
- Always assume MEC hazards contain a live charge until determined otherwise.
- Death or injury can occur from MEC/UXO and explosive related accidents.
- The age or condition of a MEC hazard does not decrease the effectiveness. MEC that has been exposed to the elements for an extended period of time can become more sensitive to shock, movement, and friction because the stabilizing agent in the explosives may be degraded.
- Consider MEC that has been exposed to fire as extremely hazardous. Chemical and physical changes to the contents may have occurred that render it more sensitive than it was in its original state.
- DO NOT approach leaking white phosphorus (WP) munitions unless absolutely necessary as burning WP may detonate.
- DO NOT dismantle, strip, or handle any MEC unnecessarily.
- Submerge smoking (leaking) munitions containing phosphorus, plasticized white phosphorus (PWP), red phosphorus (RP), or WP in water or cover with mud, wet sand, or earth as quickly and gently as possible if necessary to handle or transport.

- PWP/RP/WP will ignite and burn on contact with air. Handle crusted-over PWP/RP/WP with special care—breaking the crust can cause the round to begin burning again.
- DO NOT touch crusted WP. WP munitions are prone to leaks, causing smoke in hot weather.
- Additional protective clothing should be worn while removing residue or attempting to move a smoking PWP/RP/WP round into a water bath.
- DO NOT touch, move or jar any ordnance items regardless of the markings or apparent condition. Under no circumstances will any MEC be handled during avoidance activities or moved in an attempt to make a positive identification.
- DO NOT touch, pick up, kick or move anything that is unfamiliar or unknown.
- DO NOT roll the item over or scrape the item to identify markings.
- DO NOT approach or enter a munitions site if an electrical storm is occurring or approaching. If a storm approaches during site operations, leave the site immediately and seek shelter.
- DO NOT transmit radios or cellular phones in the vicinity of suspect MEC hazards.
- DO NOT walk across an area where the ground surface cannot be seen and that has not been cleared of MEC hazards by the UXO technician.
- DO NOT rely on color codes for positive identification of ordnance items or their contents.
- DO NOT drive vehicles into a suspected MEC area—use clearly marked lanes.
- DO NOT carry matches, cigarettes, lighters or other flame-producing devices into a MEC site.
- DO NOT be misled by markings on the MEC item stating “practice bomb,” “dummy,” or “inert.” Practice ordnance can have explosive charges that are used to mark and/or spot the point of impact, or the item could be marked incorrectly.
- Clearly mark the location of any ordnance item found for future location and avoidance.
- Follow the procedures of the work plan and SSHP. Upon locating any MEC hazards, immediately notify the SUXOS and UXOSO.
- Post the following warning on site:

— WARNING —

Removing or taking any munitions, explosive, UXO, or munitions-related debris from the site by any employee is strictly prohibited.

Additional MEC safety precautions will be provided during daily safety meetings and are addressed in Engineer Pamphlet (EP) 385-1-97, *Explosives Safety and Health Requirements Manual*.

2.2.3 Explosive Demolition Operations

Explosive demolition operations will only be conducted by UXO-qualified personnel who meet the requirements of the U.S. Department of Defense Explosives Safety Board Technical Paper 18 and HGL standard operating procedures. Explosives Safety Submission (ESS) approved engineering controls will be used to mitigate explosive hazards associated with demolition operations, as required.

Explosives demolition and procedures are addressed in the work plan. Each task has been analyzed to assess the potential safety hazards that may be encountered by site personnel and prescribes the proper engineering and/or administrative controls and/or PPE. These controls will ensure that the risks to health and safety are reduced or eliminated during project performance.

2.3 MATERIAL HANDLING AND LIFTING PROCEDURES

Site personnel will exercise care in lifting and handling heavy or bulky items. No site worker will attempt to lift any item in excess of 50 pounds without assistance or use of a mechanical device. Materials being lifted either mechanically or manually will not be moved or suspended over personnel unless precautions have been made to protect the personnel from falling objects. Whenever heavy or bulky material is to be moved manually, the size, shape, and weight of the object and the distance and path of movement must be considered to prevent joint and back injuries. Adhere to the following hierarchy in selecting a means for material handling:

1. Movement of the material by mechanical device (lift truck, crane, and similar)
2. Movement by manual means using mechanical aid (dolly or cart)
3. Movement manually in a planned manner with an adequate number of personnel

The UXOSO will train employees in proper lifting techniques and require that they lift objects properly. The following procedures shall be followed:

1. Ensure the hands and object are free of oil, grease, or water that might prevent a firm grip. A firm grip on the object is essential.
2. Keep hands, and especially the fingers, away from any points where pinching or crushing could occur, particularly when setting the object down.
3. Inspect the item for metal slivers, jagged edges, burrs, rough or slippery surfaces and pinch points, and, if necessary, use gloves to protect the hands.
4. Place the feet far enough apart for good balance and stability.
5. Ensure that solid footing is available before lifting the object.
6. When lifting, remain as close to the load as possible, bending legs at the knees, keeping the back as straight as possible, and lifting the object with the legs while straightening from a bended position.
7. Never carry a load that cannot be seen over or around while carrying it.

8. When setting an object down, keep the stance and position identical to that for lifting, with the back straight and the legs bent at the knees while the object is lowered.
9. When two or more people are required to carry an object, distribute the load uniformly. Each person, should face the direction in which the object is being carried as much as possible.

2.3.1 Chemical

Chemical hazards are not likely to be encountered while performing the fieldwork, except for hazardous substances brought on site for the execution of site activities. These chemical substances will be discussed in APP Section 12.3 Hazard Communication Program, and with associated safety data sheet (SDS) for the chemical substances used at the project site.

2.4 PHYSICAL

The following physical hazards may be encountered during this project:

- Cuts and scrapes from visible or buried debris
- Stress endured from excessive heat or cold

Physical hazards are addressed in more detail in the AHAs and the hazard control plan.

2.5 IONIZING RADIATION

Ionizing radiation hazards are not likely to be encountered while performing the fieldwork.

2.6 BIOLOGICAL HAZARDS

Biological hazards are discussed in detail in Section 13.8 of the APP.

2.7 ACTION LEVELS

Action levels and methods to mitigate the hazards noted above vary depending on the hazard. Controls, preventative measures, and treatments are discussed with listed hazardous conditions. Additional action levels and required actions are presented below:

- Implementation of engineering controls and safe work practices shall be discussed prior to starting work or a new task.
- Upgrades/downgrades in levels of PPE shall be considered if hazards exist or if hazards are mitigated.
- Work stoppage or emergency evacuation of on-site personnel will be carried out if a hazardous condition warrants such action.
- Public exposures to hazards created by site activities will be prevented or minimized.

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3.0 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

This information is found in Section 4.0 of the APP. As field personnel are identified ahead of the field mobilization date, Appendix H of the work plan will be updated to include the personnel qualifications certification letter. Mr. Stephen Davis, as personnel assigned specific safety and health responsibilities, has a resume included here.

NAME:	**STEPHEN L. DAVIS CIH, CSP**	**HYDROGEOLOGIC, INC.**
TITLE:	**Director, Environmental Health and Safety**	**Reston, VA**

EDUCATION AND TRAINING:

M.S., Public Health, Industrial Hygiene specialization - University of South Carolina, 1983
Bachelor of Science in Zoology - Valdosta State University, 1975

PROFESSIONAL CERTIFICATIONS:
Certified Industrial Hygienist (CIH) (#4213), by the American Board of Industrial Hygiene, 1989
Certified Safety Professional (CSP) (#10044), by the Board of Certified Safety Professionals, 1991

EXPERIENCE SUMMARY:

Mr. Davis is a seasoned Environmental Health and Safety (EHS) professional with a broad range of successful experience in both program and project management. He is focused on developing cost-effective and "common sense" solutions to EHS challenges within resource-constrained systems. Mr. Davis is highly effective at creating successful safety cultures in order to achieve regulatory compliance and excellent injury statistics. He has achieved effective Workers' Compensation case management and excellent safety statistics while maintaining compliance with client safety requirements and third party review systems. Mr. Davis also has experience in medical surveillance program management.

EMPLOYMENT HISTORY:

HydroGeoLogic, Inc., Director, Environmental Health and Safety, Reston VA, February 2014–Present.
Program Manager for EHS, Workers' Compensation, and Medical Surveillance programs. Responsible for execution and continuous improvement of systems to ensure the safety of HGL personnel, pursue our zero incident goal, meet or exceed Occupational Safety and Health Administration (OSHA) regulatory requirements, exceed client EHS requirements, effectively manage workers compensation claims, and achieve best-in-class safety statistics.

Science Applications International Corporation (SAIC), Environmental, Health and Safety and Quality Assurance Manager, Oak Ridge, TN, 2010–2012.
Program Manager for EHS and Quality Assurance (QA) for the Federal Infrastructure organization within SAIC. Responsible for execution of systems to meet or exceed OSHA regulatory requirements, exceed client EHS and QA requirements, assess and minimize risks, effectively manage Workers' Compensation claims, and achieve best-in-class safety statistics.

- Created business-unit level system for project and program risk review to identify and control risks such as serious health and safety risks, third party lawsuits, regulatory citations and fines, and environmental damage. System documented potential risks and agreed-upon risk controls and facilitated subsequent verification of execution and effectiveness.
- Managed QA program for 5,000-employee organization conducting multiple disparate types of activities subject to requirements of multiple government and commercial clients using either NQA-1 or ISO 9001. The 5,000-employee Business Unit achieved Total Recordable Incident Rate (TRIR) of 0.27 in 2011, which is less than 1/3 the average rate reported by the Bureau of Labor Statistics for engineering firms. Average TRIR for last 4 years was 0.37. The 5,000-employee Business Unit received the National Safety Council Industry Leader award and was one of only 81 of the 54,000 National Safety Council members to receive this award.

SAIC, Vice President, Environmental, Health and Safety, Oak Ridge, TN, 1993–2009.
Program Manager for EHS for the Energy, Environment and Infrastructure Business Unit within SAIC. Responsible for execution of systems to meet or exceed OSHA regulatory requirements, exceed client EHS requirements, assess and minimize risks, effectively manage Workers' Compensation claims, and achieve best-in-class safety statistics.

- Created and implemented EHS program compliant with American National Standards Institute Z-10 "American National Standard for Occupational Health and Safety Management Systems" for the 5,000 employee Business Unit. This program exceeded all regulatory requirements and established a system for establishing and tracking world-class safety practices and performance. Led and directed activities of seven EHS Managers of sub-tier organizations and dozens of site health and safety officers. The Business Unit received the National Safety Council "Perfect Record" award for working 2,780,000 hours without a lost time injury or illness in 2009. The Business Unit received the National Safety Council "Occupational Excellence" award each year for ten consecutive years by maintaining a lost time incident rate of less than half the average rate for other businesses in its North American Industry Classification System code.
- Established EHS systems and documentation to achieve approval from multiple third-party review programs such as ISNetworld and PICS, and clients such as the U.S. Department of Energy (DOE), the USACE, and multiple major oil and gas clients.
- Managed EHS portions of successful acquisition of $20M in commercial oil and gas business. EHS systems and performance represented 20% to 40% of evaluation criteria for these bids.

- Provided EHS leadership for over $200M in work at 100s of sites. This work included Architect and Engineer, Military Munitions Response Program, Long Term Response Action and Hazardous Toxic and Radioactive Waste contracts for the USACE Louisville District, Savannah District, St. Louis District, Omaha District, Northwestern Division, Buffalo District, Mobile District, and Nashville District. It also included similar work for the Air Force Center for Energy and the Environment (3P, 4P, 4PAE), the U.S. Navy, the National Aeronautics and Space Administration, the National Guard Bureau, the Tennessee Department of Transportation, U.S. Forest Service, Washington Department of Ecology, DOE prime contractors, and multiple commercial clients including oil and gas companies.
  - Coordinated with clients regarding safety expectations, provided guidance to multiple regional and onsite health and safety officers, wrote or reviewed hundreds of health and safety plans and activity hazard analyses, conducted formal readiness reviews to verify preparations, conducted audits, conducted incident investigations, conducted EHS performance reviews and compiled performance statistics.
  - Met challenges associated with these programs including MEC, residual explosives contamination, hazardous wastes, petroleum residues, ionizing radiation and radioactive contamination, operation and maintenance of onsite treatment systems, remedial construction, excavation, SCUBA diving, vessel operation, heavy equipment operation, elevated work and high voltage electrical systems.
- Established processes for Workers' Compensation reporting and case management that facilitated significant reduction in OSHA recordable injury and illness rates.
- Established successful Behavior Based Safety Program in compliance with multiple client requirements. This program allowed the organization to successfully satisfy rigorous requirements of several major oil and gas clients and federal agencies.
- Created and implemented process to review and qualify subcontractors based on prior health and safety performance in order to ensure exceptional safety performance. This program served two important functions; 1) Exclude unsafe subcontractors and 2) Notify all subcontractors that only first-class EHS programs and execution were acceptable.

International Technology Corporation (IT), Regional Manager Health and Safety Consulting and Training, Knoxville, TN, 1983–1993.
Managed a consulting program delivering health and safety program audits, health and safety training, field project health and safety oversight, job hazard analyses, and occupational exposure monitoring for multiple clients including the DOE, USACE, U.S. Navy, and the California Department of Health Services.

- Successfully managed project to deliver health and safety support to the USACE at the Bruin Lagoon Superfund Site. The acid sludge disposal site was being remediated by excavating the sludge, mixing it with lime and soil and burying the mix on site.
  - Services consisted of health and safety oversight of the remedial contractor, general health and safety technical advice, on-site monitoring with four real-time instruments mounted on all-terrain vehicle, and installation and maintenance of a real-time perimeter data logging system to collect and store results from multiple hydrogen sulfide and

hydrogen chloride sensors. The perimeter monitoring system measured real-time concentrations, recorded instantaneous and average concentrations and provided immediate notification (alarmed) of unacceptable excursions.

  - Following project completion, the general results of the air-monitoring program were published and presented, with USACE and U.S. Environmental Protection Agency (EPA) input and approval, at the EPA Design and Construction Conference.

- Successfully managed second phase of job hazard analyses project for Ft. Bliss Army Post, Texas. Managed and participated in a project to perform hundreds of job hazard analyses at the Ft. Bliss Army Post for AIRHAS.
  - Interviewed dozens of army personnel, observed maintenance and storage operations, inventoried chemical supplies, assessed the nature and severity of potential exposures, and identified issues and hazards that needed immediate attention. Reduced the data to Army codes and entered the accumulated data into the Army's Health Hazard Information Module database. Provided industrial hygiene support for remedial investigation at the DOE Feed Materials Production Center, Fernald, Ohio.
  - The primary objective of this activity was to attain compliance with the requirements of 29 CFR 1910.120, the HAZWOPER standard. Conducted detailed on-site hazard assessments, prepared over 20 task-specific health and safety plans including a line-by-line analysis of compliance with the OSHA lead standard, coordinated activities and hazard controls with DOE representatives, and conducted real-time air monitoring to assess employee exposures and verify compliance with exposure limits.
- Managed and participated in the development and delivery of over 20 sessions of the 3-day "Hazard Appraisal and Recognition planning," course for the California Department of Health Services. This course was the basic health and safety training for the state hazardous waste compliance officers and was developed to meet the specific needs of the sponsor and included training in preparing program-specific hazard assessment forms, using program-specific monitoring instruments, and complying with program-specific policies. The courses were presented on site at multiple locations around the state.
- Managed and participated in 25 presentations of "The Navy Hazardous Substance Incident Response Management Course." This five-day course was presented in Kaneohe Bay HI, Pearl Harbor HI, Norfolk VA, Virginia Beach VA, Charleston SC, Washington, D.C., Guam, Oakland CA, Philadelphia PA, Pensacola FL, San Diego CA, Port Hueneme CA, and Seattle WA. Successful presentation required maintenance, shipment, and set-up of over two thousand pounds of gear including self-contained breathing apparatus, totally encapsulating chemical protective suits, air purifying respirators, and real time air monitoring instruments. Each course culminated in students leading responses to simulated hazardous materials incidents.

U.S. CITIZEN: Yes

PUBLICATIONS AND TECHNICAL PRESENTATIONS:

Publications:

Davis, S.L., and B. Khona, 1991, "Airborne Exposure Control at an Acid Sludge Remedial Site," published in the proceedings of EPA conference, Design and Construction Issues at Hazardous Waste Sites.

Davis, Stephen L., 1985, "Permeation Testing of Protective Gloves Exposed to Selected High Hazard Pesticides," report prepared under EPA contract number 68 03 3069, IT Corporation, Edison, New Jersey.

Davis, S.L., C.E. Feigley, and G.A. Dwiggins, 1984, "A Comparison of Two Methods Used to Measure Permeation of Glove Materials by a Complex Organic Mixture," American Society for Testing and Materials Special Technical Publication, First International American Society for Testing and Materials Symposium on the Performance of Protective Clothing.

Technical Presentations:

Davis, Stephen, L., 1991, "Airborne Exposure Control at an Acid Sludge Remedial Site," EPA Conference, Design and Construction Issues at Hazardous Waste Sites.

Davis, Stephen, L., 1985, "Industrial Hygiene Assessment for Initial Entry into Hazardous Waste Sites," Joint Conference of Occupational Health, Orlando, Florida.

Davis, Stephen, L., 1983, "Permeation of Glove Materials by Liquefied Coal," Carolina's Section, American Industrial Hygiene Association, Asheville, North Carolina.

Davis, Stephen, L., 1983, "A Comparison of Two Methods Used to Measure Permeation of Glove Materials by a Complex Organic Mixture," Carolina's Section, American Industrial Hygiene Association, Asheville, North Carolina.

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4.0 TRAINING

Personnel who participate in field activities associated with this project are subject to the site-specific training requirements presented in Section 6.0 of the APP. This information is presented only in the APP to eliminate redundancy.

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5.0 PERSONAL PROTECTIVE EQUIPMENT

PPE is addressed in Section 11.0 of the APP.

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6.0 MEDICAL SURVEILLANCE

Workers exposed to site hazards, including all employees of HGL, will participate in a program of medical surveillance of the type specified in 29 CFR 1926.65, the OSHA standard on "Workplace Health and Safety in Hazardous Waste Operations and Emergency Response." Such workers must present a physician's statement that they are medically qualified for (1) work in hazardous waste operations, and (2) the use of respirators. The UXOSO will evaluate all physicians' letters and refer any questions to the CDHS. Annual or biennial medical certification is required—a physician's statement must be no older than 2 years.

The UXOSO will note any restrictions stated on a physician's statement and make arrangements to avoid any prohibited activity or condition. In addition, the UXOSO will monitor all employees to detect early signs of exhaustion, heat stress, or other conditions that might suggest a lack of fitness for a particular task.

Medical treatment received related to a workplace injury or illness will be managed in accordance with the OSHA standard referenced above. The UXOSO will notify the CDHS immediately if such an event occurs.

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7.0 EXPOSURE MONITORING AND AIR SAMPLING

No routine exposure monitoring or air sampling is anticipated. The UXOSO and the CDHS will confer often to assess the need for such testing and will implement a monitoring or sampling program if this is warranted by site activities or conditions.

The UXOSO will monitor employees' noise exposure whenever noisy operations are in progress and require the use of hearing protection whenever the sound level measured in a work area is 85 A-weighted decibels (dBA) or greater. A good rule of thumb is to wear hearing protection when normal conversation cannot be heard at arm's length. Hearing protection will have a minimum noise reduction rating of 25 dBA.

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8.0 HEAT STRESS AND COLD STRESS

The potential for heat stress is high because due to the tropical climate in which the project site is located. Care must be taken to control work schedules and hydration and to observe and respond to symptoms. Heat and cold stress management is addressed in Section 12.33 of the APP.

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9.0 SAFETY PROCEDURES, CONTROLS, AND PRACTICES

This section outlines the general hazards and safe work practices that all site personnel will follow to eliminate or reduce the risk of exposure to anticipated site hazards. These controls are presented as a guide for site personnel and do not cover all compliance issues. The SUXOS and UXOSO will ensure full compliance with applicable regulatory requirements.

9.1 SITE RULES

General safe work practices for every job site include the following:

- **Using the Buddy System**. Employees shall not work alone—every employee is required to work near someone else who could offer assistance or summon help in the event of an accident or illness. At all times, an employee on a field site must be observable by at least one other person or sufficiently close to at least one other person to communicate by voice.
- **Reporting unsafe conditions**. Site personnel will immediately report to the UXOSO any unsafe acts or conditions, including violations of this document or the APP.
- **Reporting injuries and illnesses**. All injuries or illnesses, including apparently minor ones such as insect bites, will be reported to the UXOSO promptly.
- **Reporting pre-existing medical conditions**. Site personnel will inform the UXOSO of any known medical conditions that may cause illness in the workplace, aggravate a possible work-related illness, or increase the likelihood of accidents. This includes hypersensitive allergic reactions to stinging and biting insects or to contact with poisonous plants; diabetes; high blood pressure; skin or eye sensitivity to sunlight and ultraviolet radiation; chronic illness; and acute illnesses such as a cold, the flu, or stomach/intestinal disorders. Persons with known hypersensitive allergic reactions to stinging/biting insects or to toxic plants will carry appropriate emergency medical antidotes on their person at all times when on site.
- **Prohibiting horseplay**. Site personnel shall not engage in horseplay, running, or other irresponsible behavior or harm people, property, or the environment.
- **Avoiding skin contact with poisonous plants**. Personnel in vegetated or wooded areas shall wear long-sleeve shirts with the sleeves rolled down to reduce contact with poisonous plants.
- **Eating, drinking, and smoking restrictions**. Eating, drinking, and smoking shall be permitted only in areas designated by the UXOSO and at designated break times after employees have washed their hands. Eating, drinking, and smoking shall be forbidden in any exclusion zone (EZ) or nearby decontamination area.
- **Prohibiting ignition sources**. Ignition of flammable materials in any work area is prohibited, unless approved in writing by the UXOSO. Matches, lighters, or other sources of sparks shall not be allowed in any EZ or nearby decontamination area.

- **Limiting personnel exposed to potential risks**. The number of personnel in any work area will be the minimum number necessary to perform work tasks in a safe and efficient manner.
- **Reporting the location of site personnel**. Site personnel will check in with the UXOSO before leaving the site and upon returning to the site.
- **Escorting site visitors**. Site visitors are to be escorted by the UXOSO, or an appropriate designee, at all times.
- **Qualifying personnel for specific tasks**. Site personnel shall perform only those tasks for which they are qualified by training and, when applicable, appropriate certifications. Such certifications shall include those required by this document and the APP.
- **Limitation on admission to work areas**. No one may enter a site work area without the approval of the UXOSO. The UXOSO shall consider the qualifications of each entrant and the risks present in the areas into which entry is desired.
- **Housekeeping**. All work areas will be maintained in a clean, neat, and orderly fashion, free of loose debris and scrap. Any materials and equipment not being used will be stored or discarded properly. All work areas will be supplied with a trash receptacle that includes a lid. The contents of all trash receptacles either will be removed from the site daily or emptied daily into a larger trash storage container that will be tightly closed each night prior to departure of personnel from the sites.

9.2 HAZARD COMMUNICATION

HGL's Hazard Communication Program is discussed in Section 12.3 of the APP.

9.3 WORK PERMIT REQUIREMENTS

There are no work permit requirements associated with this project.

9.4 MATERIAL HANDLING PROCEDURES

There are no known material handling procedures associated with this project.

9.5 DRUM CONTAINER/TANK HANDLING

There are no planned drums or tank handling activities associated with this project.

9.6 COMPREHENSIVE ACTIVITY HAZARD ANALYSIS OF TREATMENT TECHNOLOGIES

There are no planned treatment technologies associated with this project.

9.7 MACHINE GUARDING

To protect site personnel from unguarded moving machinery and equipment surfaces, follow the requirements found in Subpart O of 29 CFR 1910, Section 16B of U.S. Army Engineering and

Support Center, Huntsville (USAESCH), Engineer Manual (EM) 385-1-1 and the general provisions listed below:

- All reciprocating, rotating, or moving parts of machinery or equipment will be guarded in accordance with manufacturers' specifications if they create a hazard through contact with personnel.
- No guard, safety appliance, or device will be removed from machinery or equipment or made ineffective except when making immediate repairs, lubrication, or adjustments, and then only after the power has been shut off.
- All guards or safety appliances removed for repair, lubrication, or adjustments will be replaced immediately upon completion of said activity and before the power is restored.

9.8 HAZARDOUS ENERGY CONTROL

All site personnel involved in the use of lockout/tagout for the control of hazardous energy will receive on-site training. All training will comply with Section 12 of EM 385-1-1. If tagout procedures are used on site, authorized personnel will be trained in the following limitations of tags:

- Tags are essentially warning devices affixed to energy-isolating devices and do not provide the physical restraint on those devices that is provided by a lock.
- When a tag is attached to an energy-isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.
- Tags must be legible and understandable by all authorized and affected personnel whose work operations are, or may be, in the area.
- Tags must be securely attached to energy-isolating devices so that they cannot be inadvertently or accidentally detached during use.

9.9 ILLUMINATION

Potentially hazardous operations will be performed only during the time period from 30 minutes after sunrise to 30 minutes before sunset.

9.10 LIGHTNING AND SEVERE STORMS

The UXOSO will remain aware of weather forecasts and plan for inclement weather during project work. If inclement weather appears imminent, the safety officer will direct site workers to halt work and to take refuge in vehicles or nearby buildings. A lightning detector will be present on the site and will be monitored by the UXOSO when threatening weather is noted or when storms are forecast. If the UXOSO deems that lightning is a potential threat, he will order employees to take shelter in an enclosed building or in a vehicle.

9.11 SANITATION AND DRINKING WATER

An adequate supply of potable (drinkable) water will be provided on site at all times and will be supplied in accordance with the following provisions:

- Containers will be clearly marked, capable of being tightly closed, equipped with a tap, maintained in a sanitary manner, and cleaned at least weekly.
- Where single-service cups are provided, separate sanitary containers will be available to store the unused cups and to dispose of the used cups.
- Water or other supplied beverages will not be dipped from the container by any means, and use of a common cup will not be allowed. Use of nonpotable water is not anticipated; however, if containers of such water are used, they will be conspicuously labeled "Caution: water unfit for drinking, washing, or cooking."

Toilet and washing facilities will be available at the project site. The UXOSO will require proper hygienic practices to remove contaminants that might be present on the hands, clothing, or PPE.

9.12 POWER AND HAND TOOL OPERATION

To control the hazards associated with use of hand and power tools, the requirements outlined in EM 385-1-1, Chapter 13, and the safe work practices listed below will be observed when using power tools:

- Power tools will be operated by personnel trained in the use of the tool, its operation, and safety precautions.
- Power tools will be inspected prior to use, and defective equipment will be removed from service until repaired.
- Power tools with guards for moving parts will have such guards in place before and during use, and loose fitting clothing or long hair will be secured away from moving parts.
- Hands, feet, etc., will be kept away from all moving parts.
- Maintenance and/or adjustments to equipment will not be conducted while the equipment is in operation or connected to a power source, and maintenance on gasoline-powered tools will be conducted only after the spark plug has been removed and secured.

Use of improper or defective hand tools can contribute significantly to the occurrence of accidents on site. Therefore, the requirements outlined in EM 385-1-1, Chapter 13, and the safe work practices listed below will be observed when using hand tools:

- Hand tools will be inspected for defects before each use.
- Defective hand tools will be removed from service and repaired or properly discarded.

- Tools will be selected and used in the manner for which they were designed.
- Workers will be certain of footing and grip before using any tool.
- Leather work gloves will be worn to increase gripping ability and to protect the hand if a cut, laceration, or puncture hazard exists during the use of the tool.
- Safety glasses or a face shield will be used if use of tools presents an eye/face hazard.
- When working on elevated surfaces, tools will be secured to ensure they cannot fall on someone below.
- Tools that have split handles, mushroom heads, worn jaws, or other defects will not be used.
- Makeshift tools or other improper tools will not be used.

9.13 CHEMICAL HAZARD COMMUNICATION

The UXOSO will control the entry of chemical products into the work environment and limit the number of such products to the minimum necessary for project execution. He will obtain a copy of the available SDS for all such chemical products (unless an exception applies) and maintain these on the site. In addition, the UXOSO will review the hazards inherent in the storage and anticipated use of the chemicals and provide training to workers exposed to these hazards. Such training will be provided upon initial assignment to the site and before use of the product. Supplemental training will be scheduled and presented whenever a new hazardous substance is introduced into the work area or whenever an employee changes job locations where different products are encountered.

The UXOSO will maintain the following documents and records on the site and will inform site workers of their place of storage: (1) The OSHA standard on chemical hazard communication (29 CFR 1910.1200), and (2) a list of chemical products on the site with associated SDSs.

Subcontractors will comply with the requirements presented above and will supply the UXOSO with copies of the SDS for any chemical products that they bring to the site.

9.14 SPILL CONTROL

A portable spill-response kit containing oil/solvent absorbent pillows/pads, PPE, and disposal supplies will be maintained in a readily accessible location where fuels, oils, solvents and other environmentally harmful materials are stored on site. The UXOSO will train workers in the proper use of such equipment.

9.15 CONTACT WITH CONTAMINATED SOIL OR WATER

Significant exposure to chemical contaminants in soil and water is unlikely. Limited potential for exposure to munitions constituents will exist when employees come into contact with soil or water. The UXOSO will inform site workers of the risks discussed below and implement the precautions described.

Inhalation of chemical vapors and contaminated dust could occur during excavation operations. Chemical vapors could be present above freshly exposed earth long after excavation tasks are complete. Personnel will attempt to remain upwind of excavation operations, fresh excavations, and piles of freshly exposed earth.

Ingestion of contaminants could occur through hand-to-mouth contact, which easily could be avoided. The UXOSO will require proper hygienic practices to prevent ingestion of contaminants that might be present on the hands, clothing, or PPE.

The UXOSO will halt work immediately and confer with the HGL CDHS if evidence of grossly contaminated soil or water is noted. Such evidence could include unusual odors, unusually discolored soil or water, or the unexpected presence of chemical containers.

9.16 WORK AROUND HEAVY EQUIPMENT

There is no work planned involving the use of heavy equipment.

9.17 WORK AROUND DEEP WATER

There is no work planned adjacent to deep water environments.

10.0 SITE CONTROL

10.1 WORK ZONE ACCESS CONTROL AND SECURITY

The UXOSO and SUXOS will control access to the site during operations and will enforce the restrictions found elsewhere in this document upon site visitors. If difficulties related to access control and site security arise, the UXOSO will confer with the USACE Ordnance and Explosives Safety Specialist (OESS) to identify corrective action.

10.2 WORK ZONES

The EZ around a potentially hazardous operation will be determined in each case by the UXOSO. When ordnance could be disturbed, the distances established in the ESS will define the EZ. In other cases, the EZ will be dictated by the distance necessary to avoid work hazards, such as the steep edge of an excavation or heavy downwind dust concentrations. If heavy equipment is used, then the "reach" of the bucket, plus a few extra feet, will determine the radius of the EZ.

The support zone will include the equipment storage area, access roads, and adjacent areas designated by the UXOSO. The UXOSO will implement procedures to prevent the transport of gross contamination from the EZ into the support zone on boots, clothing, tools, and heavy equipment. The need for rigorous decontamination procedures is not anticipated.

10.3 SITE COMMUNICATIONS

Effective on-site and off-site communication will be established prior to initiation of site activities. On-site communication will be used to coordinate site operations, to maintain site control, to convey safety information, and to alert site personnel to emergency situations. Off-site communication will be available to ensure effective coordination with off-site management personnel, the USACE, and emergency response services.

All site personnel will be familiar with the different methods of both on-site and off-site communication. The methods that will be used for on-site and off-site communication will include the following:

On-site communication will consist of:

- Handheld radios issued to the field team leader, supervisors and managers;
- Cellular telephones; and
- Air horns, bullhorns, sirens, or hand signals can also be used, as needed, for communication.

Site personnel will use cellular telephones or other supplied communication systems for off-site communication. The UXOSO will verify that the 911 service is available and will make appropriate alternative arrangements if it is not available.

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11.0 PERSONNEL HYGIENE AND DECONTAMINATION

Sanitary and washing facilities, personnel and Level D decontamination, and waste control plans are discussed below.

11.1 SANITARY FACILITIES

HGL will ensure toilet facilities are available, with at least one unit for each 15 workers, in accordance with EM 385-1-1, Section 2.

11.2 WASHING FACILITIES

HGL will provide hand-washing supplies convenient to the work area, including potable washing water and soap. All hand-washing facilities will be supplied with soap, paper towels, and trash receptacles. All washing facilities or areas will be kept clean and free of trash.

All field personnel will wash their hands and faces before eating and drinking and before leaving the site for the day.

11.3 PERSONNEL DECONTAMINATION

Effective decontamination is not simply removing contaminants, it begins with preventing contamination. PPE prevents the wearer from becoming contaminated and good work practices reduce contamination of protective clothing and equipment.

11.4 LEVEL D DECONTAMINATION

No Level D personnel decontamination is anticipated for this project.

11.5 WASTE CONTROL AND DISPOSAL

Solid trash, paper towels, and other items used in the work areas will be classified as solid waste and containerized and disposed of appropriately.

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12.0 EQUIPMENT DECONTAMINATION

Procedures for the decontamination of field equipment is presented in Section 3.0 of the work plan.

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13.0 EMERGENCY EQUIPMENT AND FIRST AID

The emergency equipment listed in Table 13.1 will be on site, stored in the location indicated and available for use during the operation specified. Emergency equipment assigned to an area or team will be maintained in proper working order by the team, as directed by the team leader. The UXOSO will conduct an inspection of all emergency equipment at least weekly to ensure completeness and proper working order.

Table 13.1
Emergency Equipment Requirements

Emergency Equipment	No. Per Location	Area Where Item(s) Will Be Stored	Operation Requiring Specified Equipment
Portable Eye Wash Kit*	2 each	Each vehicle	All operations
15-Minute Eye Wash*	1 each	Support Zone	All operations
First Aid Kit	1 each	Each vehicle	All operations
Fire Extinguisher	1 each	Support vehicles, and Support Zone	All operations
Cellular Telephone/ Site Communication	1 each	SUXOS/UXOSO and Support Zone	All operations

*For use if employees are exposed to corrosives, strong irritants, or toxic chemicals.

The size and number of first aid kits will be sufficient to accommodate the maximum number of people (including government personnel and visitors) on site at any given time.

When required, portable eyewash bottles will be available for immediate use while the injured person is transported to the area where the 15-minute eye flushing station will be available. After flushing, the eyes will be bandaged lightly, and the person will be transported to the appropriate medical facility for further evaluation and treatment, if needed.

Personnel administering first aid and/or CPR will comply with the following:

- Personnel will wear disposable latex gloves if there is any visible body fluid.
- The CPR Pocket Mask will be used when performing CPR and disposed of after use.
- Personnel will immediately change clothing that becomes contaminated with body fluids as a result of performing first aid, or as soon as feasible.
- Personnel will wash their hands immediately after performing first aid procedures.

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14.0 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

The Emergency Response Plan addresses the following emergency response and contingency procedures: pre-emergency contingency planning, contacting off-site agencies, documentation, personnel, medical facility routes, and SDS. Each is summarized below in this section.

14.1 PRE-EMERGENCY CONTINGENCY PLAN

A pre-emergency contingency plan is a written document that establishes policies and procedures and outlines authority for responding to site emergencies. The contingency plan will be part of the SSHP, will anticipate the potential emergencies at the site, and will integrate actions by the local agencies, fire department, and medical facilities.

The contingency plan assigns the role of authority to the UXOSO and SUXOS. These two individuals are responsible for directing emergency response operations, notifying on-site and off-site personnel, requesting aid from outside sources, and documenting the event.

14.2 CONTACTING OFF-SITE AGENCIES

The pre-emergency contingency plan will include arrangements with the local medical provider, police, and fire department for support in the event of an emergency. A list of telephone numbers and directions to these agencies will be in each vehicle. All personnel will be informed of this list and the communication system at the morning tailgate safety meeting.

A map is included in the front of the document showing the location of the closest medical provider in relationship to the site.

14.3 DOCUMENTATION

The UXOSO and CDHS will initiate an investigation and create documentation of any incidents. This step is important in all cases but is especially so when the incident has resulted in personal injury, on-site property damage, or damage to the surrounding environment. Documentation may be used to help avert recurrences, as evidence in future legal action, for assessment of liability by insurance companies, and for review by government agencies.

Documentation may include a written transcript taken from tape recordings made during the emergency or a bound field book with notes. The document must be accurate and authentic. Documentation steps will include:

- An objective recording of all information,
- A chain of custody procedure, and
- Signed and dated document entries.

Documentation should be maintained with a minimum number of documents (forms or logbooks) to avoid confusion and conflicting accounts. Individuals may be required to give testimony at hearings or in court—a minimal number of documents will facilitate testimony.

If details change or revisions are needed, the person making the notation should mark a horizontal line through the old material and initial the change—nothing should be erased.

At a minimum, the following will be included:

- Chronological history of the incident
- Facts about the incident and when they became available
- Title and names of personnel involved, composition of team
- Actions—decisions made and by whom; orders given to whom, by whom, and when; actions taken—who did what, when, where, and how
- Types of samples and test results
- Possible exposure of site personnel
- History of all injuries or illnesses during or as a result of the emergency

14.4 PERSONNEL ROLES, AUTHORITY, AND COMMUNICATION PLAN

The UXOSO has full responsibility and commensurate authority for responding to any emergency that may occur at the MEC work site until HGL is relieved by the proper authorities. With multiple teams working on site, emergency alerts will be broadcast on mobile and/or hand portable field radios. The UXOSO will inform the SUXOS and PM of emergencies and response actions by telephone or fax as soon as practicable, followed by a written report providing full details. HGL will provide the UXOSO with a cellular telephone and radio communication for use in the field, along with telephone numbers and frequencies that may be used to communicate with emergency services providers and other authorities.

Emergency situations might arise as a result of fire, injury/accident, accidental initiation of explosives or ordnance, serious illness, or weather (such as lightning). All personnel are responsible to be observant of the work environment, to personally practice safe work habits, and to insist that other personnel work safely. However, it is the duty of the UXOSO to ensure that the potential for emergencies is minimized at the work site by closely observing personnel work habits and ensuring that the physical layout of the work site is established and maintained in such a way that there is minimal potential for incidents.

14.5 ROUTE MAPS TO THE CLOSEST MEDICAL FACILITY

Maps containing routes and written directions to the supporting medical facility are provided in the front of the APP and at the front of this document. This information will be given to all personnel at morning safety meetings, and a copy will be kept on site.

14.6 SAFETY DATA SHEETS

When available, an SDS can provide valuable information when handling a chemical substance. Since the establishment of the Hazard Communication Standard (29 CFR 1910.1200), chemical manufacturers and distributors are required to provide SDSs and warning labels on their products. Obtaining an SDS on a chemical substance may provide valuable information on the chemical and physical hazards the material presents.

The sections on an SDS and the information they can provide are as follows:

- Chemical identity and manufacture information
- Hazardous ingredients and exposure limits
- Physical and chemical characteristics
- Fire and explosion hazard data
- Reactivity and stability data
- Health hazard and medical treatment information
- Precautions and protection for safe handling and use
- Control measures to avoid overexposure

SDSs are intended to provide comprehensive hazard information; however, many published SDSs are incomplete and lack enough accurate information to assess a chemical hazard. Therefore, use SDSs as a guide and get more in-depth information from other sources. Names of applicable SDSs brought on site by HGL and its subcontractors will be filed in a binder, maintained on site at the HGL field office trailer, and made available for project personnel at all times.

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15.0 EMERGENCY RESPONSE PLAN

The UXOSO will evaluate the nature of the emergency and take proper precautions to secure the site to protect project personnel and public safety. Depending on the emergency, personnel will follow the specific safety requirements presented below.

15.1 OPERATIONS

The frequency and severity of emergency situations can be dramatically reduced through proper implementation of the APP. However, if an emergency does occur, quick, decisive action is required. Delays of just minutes can create or escalate life-threatening situations. In an emergency situation, site personnel involved in emergency response and rescue must be prepared to respond immediately. All required equipment must be on hand, in proper working order, and ready to use. To ensure rapid, effective response to a site emergency, the procedures and contingency plans outlined in this section must be implemented before and during any site activities involving exposure to safety and health hazards.

15.2 PRE-EMERGENCY PLANNING WITH LOCAL EMERGENCY RESPONDERS

Prior to conducting site operations, HGL site representatives will meet with the appropriate local authorities to inform them of the nature of the site activities to be performed under this SSHP, and the potential hazards that the conduct of these activities pose to site personnel, the environment, and the general public.

15.2.1 Identification of Local Emergency Services

During the meeting with local authorities and base personnel, HGL personnel will be informed as to the type of emergency services available through local authorities and will receive the contact telephone numbers for these services. In the event that evacuation of the general public is required, due to either normal site operations or an emergency event, the safety point of contact, USACE OESS, and HGL UXOSO are responsible for contacting the appropriate local officials who execute and coordinate an evacuation.

15.3 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION

Key personnel roles, lines of authority, and communications plan are detailed in Section 4 of the APP. Emergency response roles are discussed below.

15.3.1 Personnel On-Scene Incident Commander

If an emergency arises, the UXOSO assumes the responsibility of the site with the SUXOS as alternate if the UXOSO is unavailable or incapacitated. The UXOSO has responsibility for directing all on-site and off-site response personnel and, as soon as possible, advises the USACE OESS of the emergency situation.

15.3.2 On-Site Emergency Response Services

HGL personnel are trained to provide first aid treatment for minor injuries. At least two people on site will be trained in first aid and CPR. The UXOSO will determine whether any injury requires treatment in addition to first aid. If there is any doubt as to whether additional treatment is necessary, the UXOSO will call 911 for follow-on advanced care and transport to Culebra Medical Clinic.

15.3.3 Off-Site Emergency Response Services

Off-site emergency response services that may be needed in the event of a site emergency include medical and law enforcement personnel. All requests for emergency services are accessible via the 911 telephone system.

15.4 EMERGENCY RECOGNITION AND PREVENTION

During the development of this SSHP, great attention has been given to identifying potential safety and health hazards associated with conducting site activities. Once identified, these hazards were assessed to determine if they could result in an emergency situation. The potential emergencies that may result during site activities are as follow:

- Injury or illness
- Fire/explosion
- Inclement weather

If additional site or task hazard information becomes available during the project, the CDHS will assess this information to determine whether the contingency plans in this section need to be updated.

15.5 SAFE DISTANCES AND PLACES OF REFUGE

Safe distances and places of refuge will be addressed at the daily safety meetings depending on field activities. Work and EZs will vary from day to day. EZs will be established to protect the public during MEC intrusive activities and safe working distances will be established to protect site workers.

During an emergency situation, all work will stop and field crews will return to a predesignated rally point for further direction on the best place of refuge.

15.6 SITE SECURITY AND CONTROL

In an emergency, it is imperative that site control and security be maintained. The UXOSO will use the Personnel Site Entry/Exit Log to ensure all are present or accounted for at the prearranged emergency assembly points. Depending on site size and configuration, weather and wind conditions, and the nature of the emergency, the following will, as applicable, be used to maintain site security:

- Close, but do not lock, gates as evacuation occurs.
- Erect flagging or barrier tape to prevent accidental entry.
- Use vehicles to block access routes to the site, but ensure they can be moved rapidly if emergency vehicles must use the access route.

15.7 EVACUATION ROUTES AND PROCEDURES

Evacuation routes and procedures are discussed below.

15.7.1 Evacuation Route

The established evacuation route will be checked by the UXOSO and then traveled by all site personnel before the start of site activities to become familiar with the route. Emergency meeting points will vary from day to day depending on work location. The planned evacuation route will be discussed with the field crew at the daily tailgate safety briefing.

Emergency evacuation routes will be posted in the HGL field office at each room's exit point. All exit routes will be unobstructed and kept free of debris.

15.7.2 Medical Facilities

A map showing the location of the Culebra Medical Clinic will be kept readily available in each project vehicle. The emergency number is 911.

15.7.3 Directions to Hospital

A map to the Culebra Medical Clinic will be in each vehicle and posted in the field. Directions and maps also can be found in the front of this SSHP and the APP.

15.7.4 Medical Evacuation

Medical evacuation requirements will be determined by the emergency first responder. Personnel requiring additional treatment will be evacuated to the hospital. Any further treatment or evacuation will be arranged by the hospital site personnel who will receive specialized training that will be given by the UXOSO and conducted prior to initiating site activities involving safety and health hazards. Training will be documented using the site training log and will include the subjects listed below:

- Emergency chain-of-command
- Communication methods and signals
- Emergency equipment and PPE
- Removing injured personnel from the site
- Emergency contacts, telephone numbers, and hospital route

15.8 DECONTAMINATION

Leaking hazardous substances are not expected to be encountered. Field crews are to avoid drums or leaking substances and to report them when discovered.

15.9 EMERGENCY MEDICAL TREATMENT AND FIRST AID

If an emergency arises, field crews will have first aid kits and at least two staff qualified to administer first aid. The objective will be to stabilize the victim and call for medical assistance. All work will stop during emergency situations and the UXOSO and SUXOS will be notified.

15.9.1 Assessing the Emergency

Available information related to the emergency should be obtained and the on-site response capabilities should be evaluated. Obtained information should include the following to the extent possible:

- What happened:
  - Type of incident
- Casualties involved:
  - Victims (number, location, and condition)
  - Treatment required
  - Missing personnel
- Cause of incident
- Extent of damage to structures, equipment, and terrain
- What can be done to mitigate the situation; consider:
  - Equipment and personnel needed for rescue and hazard mitigation
  - Number of uninjured personnel available for response
  - Resources available on site
  - Resources available from off-site response groups and agencies
  - Time needed for off-site response resources to reach the site
  - Hazards involved in rescue and response

15.9.2 Rescue and Response Actions

Based on the information collected during the emergency assessment, take the general actions listed below, with some actions being conducted concurrently. No one is to attempt emergency response or rescue until the situation has been assessed and the appropriate response outlined by the UXOSO.

- Enforce the buddy system:
  - Allow no one to enter a hazardous area without a partner.

  - Personnel in the EZ should be in line-of-sight of or in communication with the UXOSO or their designee.
- Survey casualties:
  - Locate all victims and assess their condition.
  - Determine resources needed for stabilization and transport.
- Assess existing and potential hazards and determine:
  - Whether and how to respond,
  - The need for evacuation of site personnel and off-site population, and
  - The resources needed for evacuation and response.
- Request aid: Contact the required off-site/on-site personnel or facilities, such as ambulance, fire department, and police.
- Allocate resources: Allocate on-site personnel and equipment to rescue and initiate incident response operations.
- Control: Assist in bringing the hazardous situation under complete or temporary control, and use measures to prevent the spread of the emergency (control fire, secure site, and similar steps).
- Extricate: Remove or assist victims from the area.
- Stabilize:
  - Administer any medical procedures that are necessary before the victims can be moved.
  - Stabilize or permanently fix the hazardous condition.
  - Attend to what caused the emergency and anything damaged or endangered by the emergency (for example, drums and tanks).
- Transport: Using either on-site or off-site assets.
- Casualty logging: Record the name of the victim, time of injury, destination, and condition upon transport.
- Evacuate:
  - Move site personnel to the rally point, a safe distance upwind of the incident.
  - Monitor the incident for significant changes. The hazards may diminish, permitting personnel to re-enter the site, or hazards may increase and require public evacuation.
- Casualty tracking: Record disposition, condition, and location.

15.10 EMERGENCY ALERTING AND RESPONSE PROCEDURES

Emergency response procedures include all steps to be taken for notifying, evaluating, reacting to, documenting, and following up on a given emergency situation. To ensure all necessary elements are covered, implement the procedural steps outlined in this paragraph for each emergency, regardless of its nature.

15.10.1 Notification

Once the UXOSO has been informed of the emergency, the UXOSO will use radio communication to:

- Notify personnel and get their attention;
- Stop work activity as required;
- Lower noise levels to speed and simplify communication; and
- Begin emergency or evacuation procedures.

If on-site HGL personnel or off-site emergency personnel are to enter the site in response to the emergency, the UXOSO, to the extent possible, will notify response personnel about:

- What happened and when it happened;
- Where on the site the emergency situation occurred;
- Who is involved and, if possible, the cause of the emergency;
- The extent of damage and what hazards may be involved; and
- What response actions are required.

15.11 CRITIQUE OF RESPONSE AND FOLLOW-UP

Before normal site activities can resume, the site and personnel must be prepared and re-equipped to handle another emergency. It is also imperative that all federal, state, and local regulatory agencies be notified of the emergency. Therefore, the following activities must be conducted before restarting site activities:

- Notify all appropriate governmental agencies as required. OSHA must be notified if any fatalities occurred or if three or more personnel were hospitalized.
- Restock and clean all equipment and supplies used or damaged in the emergency.
- Investigate the accident to determine the cause of the emergency and what preventive measures could be taken.
- Complete the HGL incident form.
- Review and revise the site operational procedures as needed, and update the SSHP to reflect the new procedures if necessary.

15.12 DOCUMENTATION

Record information related to an emergency completely and accurately, and as soon as possible after the emergency while memory of the events is fresh. Record the following information:

- A chronological record of events
- A listing of the personnel involved, including personnel on site, site personnel who responded, personnel in charge, and off-site groups or agencies that responded
- A listing of the actions taken to minimize the effects of, or to mitigate, the emergency
- An assessment of the potential exposures received by site personnel and the surrounding public
- A recording of the injuries or illnesses that occurred as a result of the emergency

15.13 PPE AND EMERGENCY EQUIPMENT

Planned project PPE is Level D. Upgrades of Level D may be required based on site conditions. Additional PPE such as hard hats and hearing protection may be available from the UXOSO. HGL subcontractors will provide their own PPE for their field crews.

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16.0 EMERGENCY RESPONSE TEAM

Not applicable.

17.0 LOGS, REPORTS, AND RECORD KEEPING

17.1 SAFETY, TRAINING, AND VISITORS

The UXOSO will maintain a safety log to record all significant information related to workplace health and safety each day. The safety log should include the following:

- A record of safety briefings
- Details of any accidents, injuries, illnesses, or near misses
- Details related to the conduct and outcome of internal and external audits
- The reason for and duration of safety-related “stop work” orders
- Any other issues pertaining to site or personnel safety or health

The UXOSO will document all safety-related training sessions in a training log or on appropriate forms collected in a file or logbook and maintained on the site. This log will include the initial site-specific training conducted prior to the start of site activities, the safety briefings, hazard-specific training, and similar information.

The UXOSO will maintain a visitor log to record the entry and exit of all visitors. No visitors will be allowed to enter the project site without providing the information required.

17.2 INJURY/ILLNESS/ACCIDENT REPORTS

Accident reporting is discussed in Section 9.0 of the APP.

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ATTACHMENT D2
ACTIVITY HAZARD ANALYSES FORMS

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ACTIVITY HAZARD ANALYSIS

Date Prepared:
Project Name:
Activity/Work Task:
Activity Location(s):
Prepared By:
Task Start Date:
Task Duration:
Reviewed By:

Overall Risk Assessment Code (RAC) (Use highest code)	M

Risk Assessment Code (RAC) Matrix

Severity	Probability				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

	RAC Chart
"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.	
"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or	**E = Extremely High Risk** **H = High Risk**
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**M = Moderate Risk** **L = Low Risk**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Add Steps, Hazards, and Actions to Eliminate or Minimize Hazards based on conditions encountered in the field.			

Equipment	Inspection	Training
PPE Level D: • Hard hat (if there are overhead hazards) • Safety glasses • Safety-toed boots • Work gloves/chemical resistant gloves • ANSI Class 2 reflective warning vests Other Equipment: • Generator • Fire extinguishers • Emergency eyewash • First aid kit • Insect repellant–DEET • Hand tools • Spill containment supplies, if needed • First aid supplies • Containers as needed • Tarps • GFCI • Heavy duty extension cords • Drinking water • Weather radio • Wind sock • Smart phone apps (temperature stress, noise, weather)	Daily inspection (SSHO) _______________________ Housekeeping (daily) • Fire extinguisher (monthly) • Vehicle inspection (daily) • Eye wash (weekly) • Equipment and tools inspection (daily and before use) • Survey areas for poisonous plants, insects, and animals (each work area) • Check body for ticks (each evening during tick season) Identify closest usable severe weather shelter (ex. tornado shelter) that is available (each work area)	Competent Person (CP) / Qualified Person (QP): CP/SSHO______________________________ Alternate CP/SSHO______________________ QP/First Aid and CPR ____________________ Training Requirements (as determined by the SSHO): • HAZWOPER 40-hour • Site safety orientation • Tailgate meetings • Emergency procedures • Hazard communication • Hearing conservation • MEC awareness • Applicable AHAs • Fire extinguisher use • Biological hazard identification and control • Severe weather shelter location • Lightning safety procedures • Temperature stress prevention, controls, treatment

ACTIVITY HAZARD ANALYSIS

Date Prepared:

Project Name:

Activity/Work Task: Mobilization / Demobilization

Activity Location(s):

Prepared By:

Task Start Date:

Task Duration:

Reviewed By: Edie Scala-Hampson, CIH, CHMM

Overall Risk Assessment Code (RAC) (Use highest code)	**M**

Risk Assessment Code (RAC) Matrix

Severity	**Probability**				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

	RAC Chart
"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.	**E = Extremely High Risk** **H = High Risk**
"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or	
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**M = Moderate Risk** **L = Low Risk**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
1. Review-Health and Safety needs	Inadequate preparation which can lead to the pain and suffering of an accident or personal injury	Confirm all field personnel understand the project Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP) and are trained in the procedures corresponding to work assignments. Conduct pre-entry H&S briefing. Confirm all site hazards are recognized. Confirm all necessary equipment to evaluate and control site hazards is available and in good working condition. Confirm applicable engineering, administrative and personal protective equipment (PPE) controls are ready to be implemented as needed. Confirm emergency safety and first aid supplies are available. Review emergency procedures and evacuation plans.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
2. Mobilize Equipment, Tools and Safety Gear/Demob same.	Strains, sprains, awkward bending/lifts and ergonomic hazards	Use proper lifting techniques. Maintain good personal fitness Know your limitations Ensure walking pathway is clear Do not lift greater than 50 lbs. Use mechanical assistance or 2 man lift whenever possible Limit repetitive awkward motions See General Site Hazards AHA	M
3. Travel	Traffic (road and site traffic)	Assure vehicle is adjusted per your personal specifications and is in good working order and all cargo is secured and distractions are minimized. Familiarize yourself with the route and directions.	M
4. On-site Mobilization/Demob • Determine location for set up/staging equipment. Determine strategy for demob. • Develop capability at the site, to include installation of office/equipment storage trailers, etc., as needed • Set up/ take down trailers and other support services, as need	Traffic-Struck by hazards	Select location away from traffic Place barricades for work site protection, if necessary Wear high visibility vest Stay clear of traffic and equipment. Have all necessary PPE (hardhat, safety glasses, hearing protection, vest, etc.)	M
	Driving over soft ground Uneven and rough terrain	Choose location with level and firm soils	M
	Site access control-unwanted entry	Maintain a constant watch for intrusion of unauthorized personnel	L
	Electric shock	Require that all electrical power hook up, installations and disconnections be made or certified by a qualified electrician who will provide written certification of installation and grounding.	L
5. Removal and transport of equipment and supplies from the site	Take home toxics	Note a source of decon water on site. Do not bring contaminated PPE or boots into truck. Use liners to prevent contamination of truck	M
	Same hazards as in step 4 above	See action to eliminate or minimize hazards in step 4	M

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
6. General site work	General site hazards: Insect bites and stings. Contact dermatitis from poisonous and irritating plants (poison ivy, poison oak, and poison sumac). Vehicle traffic Severe weather Heat stress Cold stress Noise. Lifting Slips, trips, falls UV hazards, etc.	Refer to General Site Hazards AHA Pack what you will need for control of hazards	M

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Add Steps, Hazards, and Actions to Eliminate or Minimize Hazards based on conditions encountered in the field.			

Equipment	Inspection	Training
<u>Personal Protective Equipment</u>: Level D: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves/ Chemical resistant gloves ANSI Class 2 reflective warning vests <u>Other Equipment</u>: Generator Fire Extinguishers Emergency Eyewash First Aid Kit Insect repellant with DEET Repel Permanone™ Hand tools Spill containment supplies First aid supplies Containers as needed Tarps GFCI Heavy duty ext. cords Drinking water Weather radio Heat stress monitoring Wind sock Sampling equipment: including pumps, pump controllers, PID/OVM, water level probe, misc. hand tools	Daily site safety inspection (SSHO) ______________ Housekeeping (daily) Eye wash equipment (weekly) Fire extinguisher (monthly) Vehicle inspection daily Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals (each work area) Check body for ticks (each evening during tick season) Identify closest usable tornado shelter that is available (each work area).	Competent Person (CP) / Qualified Person (QP): CP/SSHO ______________ Alternate CP/SSHO ______________ QP/First Aid and CPR ______________ QP/First Aid and CPR ______________ Training Requirements (as determined by the SSHO): HAZWOPER 40 hour Site safety orientation Tailgate meetings Emergency procedures Hazard communication Hearing conservation MEC awareness Applicable AHAs Fire extinguisher use Biological hazard identification and control Tornado shelter location Lightning safety procedures Heat stress prevention and heat stroke treatment Cold stress prevention

ACTIVITY HAZARD ANALYSIS

Date Prepared:

Project Name:

Activity/Work Task: General Site Hazards

Activity Location(s):

Prepared By:

Task Start Date:

Task Duration:

Reviewed By: Edie Scala-Hampson, CIH, CHMM

Overall Risk Assessment Code (RAC) (Use highest code): **M**

Risk Assessment Code (RAC) Matrix

Severity	Probability				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Review–Health and Safety (H&S) Needs	Inadequate preparation that can lead to personal injuries, property damage and project delays Unfamiliarity-Addition of new personnel to work team Emergency response unfamiliarity	Confirm that all field personnel understand their responsibilities and the hazards covered in the project Site Safety and Health Plan (SSHP) and are trained in the procedures corresponding to work assignments. Conduct pre-entry H&S briefing and Tailgate Safety Meetings (TSMs) to accommodate unforeseen circumstances, or if working conditions change. Confirm that site hazards are recognized. Confirm that necessary equipment, to evaluate and control site hazards, is available and in good working condition. Confirm that applicable engineering, administrative and personal protective equipment (PPE) controls and equipment are available and ready to be used as needed. Confirm emergency, safety and first aid supplies are available. Review emergency procedures, contact numbers and evacuation plans. Confirm that all personnel know what to do in the event of an accident (personal or property damage). Complete preliminary and initial quality meeting with the U.S. Army Corps of Engineers (USACE), if required.	**L**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Transportation–Vehicle Maneuvering	Vehicle accidents	No cell phone use by driver while vehicle is in motion. Practice defensive driving and always wear safety belt. Adjust vehicle per your personal specifications and confirm that it is in good working order and all cargo is secured and distractions are minimized. Familiarize yourself with the route and directions. Keep vehicle speed appropriate to road conditions. Be aware of the set in of driving fatigue and take breaks as needed.	**M**
	Road conditions: ruts, snow, ice, puddles, poor traction	Be cognizant of road conditions and vehicle size limitations at all times. Match driving speed to the conditions.	**M**
	Maneuvering in tight areas/potential vehicle or personnel damage	Use a spotter to help maneuver in tight areas. Avoid backing if possible. Check all blind spots before you attempt to move vehicle. Sound horn before backing and move slowly. Remember that loaded haul trucks have the right of way.	**M**
General Site Hazards	Security/Site access control–unwanted entry	Establish positive site access control prior to on-site operations using barricades, signs, or other methods.	**L**
	Strains, sprains, awkward bending/lifting/ positions and ergonomic hazards	Maintain good personal fitness. Know your own limitations. Discuss and caution personnel about knowing their personal limitations when conducting strenuous activities. Follow safe work practices and daily task specific procedures. Don’t rush. Size up the load before the lift. Do not lift greater than 50 pounds by yourself. Review lifting techniques. Confirm walking pathway is clear. Use mechanical assistance or two-person lift for loads greater than 50 pounds and large awkward loads. Limit repetitive awkward motions and unbalanced lifting as much as possible. Develop appropriate work-rest cycles. DO NOT lift and twist torso at the same time.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General Site Hazards	Overhead hazards and struck by falling object	Wear hard hat when there is a potential for head injury and overhead hazards. Prohibit personnel under suspended loads.	**M**
	Traffic/Heavy Equipment–struck-by hazards, crushing hazards	Select work location away from traffic, if possible. Place barricades or stationary vehicles for work site protection, if necessary. Wear high visibility vest. Stay clear of traffic and equipment. Discuss active work areas in daily briefings. Respect active work zones. Make eye contact with operators of equipment to make sure they know your intentions. STAY CLEAR of earth moving equipment. Prohibit machinery or equipment, requiring an operator, to run unattended. Confirm all heavy equipment has functional backup alarms. Minimize the number of ground personnel working around heavy equipment. Never position yourself between moving and fixed objects	**L**
	Unhygienic conditions	Confirm that restroom facilities, if installed on site, are adequately provided and maintained. Maintain hand disinfectant, wipes, and wash stations.	**L**
	Fire	Maintain at least one dry chemical fire extinguisher having a minimum Underwriters Laboratory (UL) rating of 1A5BC on site. Require hot work permit or equivalent review for open flames and high-temperature operations. Store flammable and combustible liquids in approved containers and cabinets. Limit smoking to designated areas	**L**
	Driving over soft ground and uneven and rough terrain	Choose location with level and firm soils. Contact subcontractor and note that gravel or wood chips may be needed to prevent entrapment in mud or water. Maintain vehicle speed corresponding to road conditions.	**M**
	Getting lost/personal safety	Avoid traveling alone and bring a topographic and/or site map and compass or GPS. Use the buddy system when possible and maintain visual contact.	**L**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General Site Hazards	Unattended worker	Follow Lone Worker Procedure, if working alone: contact PM or alternate point of contact at work start, mid-day, and when leaving work site at end of day. Let others on site (non-HGL staff) know where you are working and establish a check in procedure.	**M**
	Electric shock	For new installations and repairs: Confirm that there is written certification of installation and grounding of all electrical power hook up installations and disconnections by a certified electrician. General Electrical safety: Make certain all electrical is de-energized if work is to be performed near live power; implement lockout/tagout procedures. Connect electrical tools through ground fault circuit interrupter for outdoor use or use in wet conditions. Do not operate portable electric tools unless they are grounded and double insulated.	**M**
	Slip, trip, and fall hazards	Wear slip-resistant footwear. Use sand or salt to control ice slip hazards, as needed. Keep work area picked up and as clean as feasible and free of tripping and fall hazards. Exercise caution to prevent entrapment in mud or wet soils and avoid walking on loose soils that can give way. Keep egress routes are as clear and unobstructed as possible. Use extra caution when working on uneven ground. Do not jump from vehicles or elevations.	**M**
	Stuck by flying debris–eye, head, etc.	Wear safety glasses when there is a potential for flying debris.	**L**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General Site Hazards	Biologicals–contact with poisonous plants, allergens, insects and animal kingdom hazards (for example: spiders, hornets, reptiles, snakes, ticks, mosquitoes, bird and rodent droppings, biting and stinging insects, thorny plants, etc.)	Note: All personnel have the option to complete the Voluntary Allergy/Sensitivity/Medical Questionnaire. Conduct visual inspection before work begins and note (mark) areas of poisonous vegetation, insect (hornet wasp) and snake habitats, for example. Use mosquito repellant with DEET, as required. Treat clothing with permethrin-based products if ticks are prevalent. Know the local fauna and review emergency preparedness measures. Review potential animal dangers specific to the site and precautions (actions to take if run-in with wild animal occurs) and treatments. Inspect your body and clothing for ticks during outdoor activity and at the end of the day. Wear light colored clothing so ticks can be more easily seen. Remove ticks right away to prevent infections. Wear long-sleeved shirts that should be tucked in. When in areas with tick potential tuck pants into socks and duct tape. Review information for poison ivy recognition and treatment.	M
		Use barrier cream, if poisonous plants are present (Ivy Block) Use existing footpaths when possible. Avoid walking in un-cleared areas with poison ivy or biological hazard potential. Use products such as Zanfel, Ivy Block, Tecnu, IvyX if poison ivy or poison oak is prevalent. • Always Wash hands using Ivy cleanser, prior to eating, using restroom, operating motor vehicle or after leaving field • Do not touch face with body parts or clothing while in the field • If operating cutting equipment (chainsaws, weed-eaters, etc.) consider face shields in addition to safety glasses • Ensure that hands are used to move brush/limbs that may contact face when walking thru woods • Remove contaminated work clothing with gloves. Store, bag and wash separately. Use poison ivy cleansers (not soap) to clean affected skin. Shower immediately upon leaving work. Wear snake chaps if poisonous snakes are prevalent.	M

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General Site Hazards	UV exposure–sunburn	Wear UVA/UVB SPF sunscreen (minimum 15 SPF) and reapply frequently. Wear hats and clothing that shield skin from direct sun.	M
	Noise–hearing loss	Wear hearing protection if noise levels from neighboring equipment exceeds 80 dBA (if you cannot be heard speaking in a normal voice at arm's distance). Look for ways to limit exposure to high level noise sources.	M
	Spills and leaks	Maintain a portable spill response kit (if spills are possible) containing absorbent materials, non-sparking shovel, PPE, and disposable supplies in a readily accessible location. Inventory materials every 6 months and train staff on use of spill kit.	L
	Hand tools/power tools-laceration hazards, jamming, pinch points, struck-by, caught between	Confirm that hand tools are in good repair and used correctly. Use the right tool for the right job. Inspect tools daily prior to use and remove defective tools from service immediately. Wear PPE with eye protection and leather gloves per the SSHP to prevent eye injuries and for all tasks with potential for cuts or lacerations. Use electric power tools and extension cords protected by a ground fault circuit interrupter.	M
	Temperature stress: Heat or cold stress	Review H&S program section regarding monitoring and controls necessary for heat or cold stress prevention. Take preventive and recovery measures as necessary. See SSHP. Develop a work/rest regimen. Take breaks as needed for rehydration and recovery. Dress appropriately.	L
	Severe weather related hazards (lightning, high winds, snow, rain, sleet)	Be tuned in to the local weather reports. STOP work as necessary when adverse weather conditions (high wind, lightning, or heavy rain) appear to be approaching the work area. Suspend work if storm is 5 miles away. Stop work if lightning is within a 30-second count (before thunder is heard) of the work area. Proceed to safe refuge. Return to work 30 minutes after last strike. (Follow the 30/30 rule.) Do not remain under trees in severe winds. Identify likely tornado refuge during site safety meeting. Confirm that trailers are installed with appropriate anchorage capable of withstanding anticipated wind forces and comply with state and local standards for the installation of mobile homes. Only authorized vendors will remove all strapping anchors and chocks in preparation for trailer removal from the work site.	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General Site Hazards	Inhalation of dust, irritants, allergens	Remain upwind of dust-generating activities as much as practical. Dust filtering face-pieces can be used if desired (optional). Use water as a dust suppressant, if necessary.	**L**
General maintenance and housekeeping	Exposure to chemicals: Use of cleaning compounds, paints, sealants, environmental preservatives	Read and follow SDS for each chemical used. Do not use any chemical that you have not been trained to safely use. Properly label all containers. Provide ventilation and proper storage/disposal as necessary. Wear required PPE for the exposure. Use green, nonhazardous products where possible.	**M**
Repetition of work tasks for periods longer than 8 hours	Fatigue associated with extended work shifts including general drowsiness and also associated driving fatigue.	Know your physical and psychological limitations. Stop work/driving when necessary to take breaks and hydrate. Stop work all together if fatigue endangers your safety or the safety of others. If appropriate find a replacement for your job tasks. Schedule more demanding tasks for when endurance and alertness is best. Postpone more demanding and hazardous jobs if you are fatigued. Follow guidelines of SSHP for work-rest regimens under adverse conditions of heat or cold stress. Limit moderate to heavy workloads by knowing your physical limitations to minimize the risk of musculoskeletal injuries.	**L**
Completion of work shift and clean-up	Take home toxics-Contact with potentially contaminated materials	Note a source of decontamination water on site. Do not bring contaminated PPE or boots into truck. Wear Tyvek as necessary and washable or disposable over-boots to keep personal clothing clean and free of contaminated soils. Store and dispose of contaminated materials in accordance with regulations. Use liners to prevent contamination of truck. Shower immediately at end of workday. Check body for ticks, bites and signs of irritation or cuts.	**L**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Completion of work shift and clean-up	Chemical exposure or burns during equipment decontamination (pressure washing) and use of any chemicals or contact with hazardous wastes	Read SDSs for all chemicals used such as methanol or hexane and follow procedures. Label all containers as to contents and associated hazards. Wear appropriate PPE (rain suit or equivalent) to prevent burns from hot water. Do not eat in contaminated areas. Prohibit pressure washing of PPE while it is being worn.	**L**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Add Steps, Hazards, and Actions to Eliminate or Minimize Hazards based on conditions encountered in the field.			

Equipment	Inspection	Training
PPE Level D: Hard hat (if there are overhead hazards) Safety glasses Safety-toed boots Work gloves/chemical resistant gloves ANSI Class 2 reflective warning vests Other Equipment: Generator Fire extinguishers Emergency eyewash First aid kit Insect repellant–DEET Hand tools Spill containment supplies, if needed First aid supplies Containers as needed Tarps GFCI Heavy duty extension cords Drinking water Weather radio Wind sock Smart phone apps (temperature stress, noise, weather)	Daily inspection (SSHO) ________________________ Housekeeping (daily) Fire extinguisher (monthly) Vehicle inspection (daily) Eye wash (weekly) Equipment and tools inspection (daily and before use) Survey areas for poisonous plants, insects, and animals (each work area) Check body for ticks (each evening during tick season) Identify closest usable severe weather shelter (ex. tornado shelter) that is available (each work area)	Competent Person (CP) / Qualified Person (QP): CP/SSHO__________________________ Alternate CP/SSHO______________________ QP/First Aid and CPR _____________________ Training Requirements (as determined by the SSHO): HAZWOPER 40-hour Site safety orientation Tailgate meetings Emergency procedures Hazard communication Hearing conservation MEC awareness Applicable AHAs Fire extinguisher use Biological hazard identification and control Severe weather helter location Lightning safety procedures Temperature stress prevention, controls, treatment

ACTIVITY HAZARD ANALYSIS

Date Prepared:

Project Name:

Activity/Work Task: MEC Avoidance – Biologist Survey and Surveyor Escort

Activity Location(s):

Prepared By:

Task Start Date:

Task Duration:

Reviewed By: Edie Scala-Hampson, CIH, CHMM

Overall Risk Assessment Code (RAC) (Use highest code)	**M**

Risk Assessment Code (RAC) Matrix

Severity	**Probability**				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.	**RAC Chart**
"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or	**E = Extremely High Risk** **H = High Risk**
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**M = Moderate Risk** **L = Low Risk**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Site access control	Unauthorized entry	Implement positive site access control prior to site operations. Maintain a constant watch or surveillance for intrusion of unauthorized personnel. Positive site access control will be established prior to on-site operations using barricades, signs or other methods to ensure unauthorized access during tasks that could cause exposure to MEC or other safety and health hazards. The MSD/EZ of 1,863 feet will be established prior to the initiation of surface clearance.	**L**
	MEC hazard/explosion, fire and overpressure	Deliver daily task specific briefings regarding the hazards associated with the task and the procedures used to control/mitigate the hazards. Use required PPE as indicated in the SSHP, by all personnel inside the EZ. Require attendance, of all personnel at the site specific hazards and health and safety training given by the HGL UXOSO. Escort all non-UXO personnel by a UXO Technician II. Instruct non-UXO personnel to not touch or disturb any potential MEC items. Non-UXO personnel will adhere to the instructions of the UXO Technician II. Have a fire extinguisher readily available	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Running precision control points as required for location surveying.	MEC hazard	Surveyor will be briefed on the AHA and site-specific MEC hazards and recognition of potential hazards.	M
	Traffic-Struck by hazards	Note all moving equipment in work areas. Wear high visibility vest.	L
	Walking over soft ground, uneven terrain/ Slip, trip and fall hazards	Wear slip resistant footwear with ankle support. Pay attention to footing and best path of travel to avoid tripping hazards. Be aware of rocks, brush, animal boroughs and other hazards. Choose firm ground for walking, if possible.	M
	Cuts, lacerations, flying debris from brush/vegetation	Wear thick clothing fabrics and appropriate PPE such as leather gloves when there is a potential for cuts and lacerations. Wear safety glasses if there is a potential for dust and flying debris. Ensure eye wash is available.	M
	Remote location	Determine accessibility to associates, communication needs, first aid and rescue equipment and procedure. Institute buddy system.	L
	General site hazards: Insect bites and stings. Contact dermatitis from poisonous and irritating plants (poison ivy, poison oak, and poison sumac). Vehicle traffic Severe weather Heat stress Cold stress Noise Lifting Slips, trips, falls UV hazards, etc.	See General Site Hazards AHA.	M
Using Digital GPS to lay-in and delineate the surface/ subsurface clearance grids	Injury from physical exertion, sprains, sprains, awkward bending/lifts and ergonomic hazards	Assure solid footing. Maintain good personal level of fitness. Be alert to signs and symptoms of overexertion. Know your personal limitations. Do not lift greater than 50 pounds. Use mechanical assistance or two-man lift whenever possible. Limit repetitive awkward motions. Have water available and first aid supplies.	M

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Install grid stakes or survey monuments	Injury from unintentional contact	Visually screen the location prior to placing stake or monument. Clear location with geophysical instrument prior to placing stake or monument (any soil penetrating activity). Any MEC items located during the location surveying or grid layout will be marked with cross red pin flags and reported to the SUXOS or UXOSO.	**M**
	Hand tools	Select hand tools and power tools that are right for the job. Inspect all tools daily, prior to use. Defective tools must be tagged and removed from service immediately.	**L**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Add Steps, Hazards, and Actions to Eliminate or Minimize Hazards based on conditions encountered in the field.			

Equipment	Inspection	Training
Hand tools Survey instruments	Daily inspection of hand tools Perform daily equipment/instrument function, location, calibration and control point check.	UXO personnel will be trained IAW DDESB TP 18

ACTIVITY HAZARD ANALYSIS

Date Prepared:

Project Name:

Activity/Work Task: MEC Surface and Subsurface Clearance

Activity Location(s):

Prepared By:

Task Start Date:

Task Duration:

Reviewed By: Edie Scala-Hampson, CIH, CHMM

Overall Risk Assessment Code (RAC) (Use highest code)					**M**
Risk Assessment Code (RAC) Matrix					
Severity	**Probability**				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

	RAC Chart
"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.	**E = Extremely High Risk**
"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	**H = High Risk**
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**M = Moderate Risk**
	L = Low Risk

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Site access control	Unauthorized entry	Implement positive site access control prior to site operations. Maintain a constant watch or surveillance for intrusion of unauthorized personnel. Positive site access control will be established prior to on-site operations using barricades, signs, visual, or other methods to ensure no unauthorized access during tasks that could cause exposure to MEC or other safety and health hazards. UXO teams will observe the team separation distance (TSD) when applicable.	**L**
Establish of subsurface grid or clearance area	MEC hazard/explosion, fire and over pressure	Deliver daily task specific briefings regarding the hazards associated with the task and procedures used to control/mitigate the hazards. Use required PPE as indicated by the SSHP, by all personnel inside the EZ. Require attendance of all personnel at the site specific hazards and health and safety training given by the HGL UXOSO. Escort all non-essential UXO personnel by a UXO Technician II or above. Instruct non-UXO personnel to not touch or disturb any potential MEC items. Non-UXO personnel will adhere to the instruction of the UXO Technician. Use only trained and qualified UXO Technicians to perform MEC surface and subsurface clearance activities as specified the training requirement section of this AHA. Suspend MEC operations when an electrical storm approaches to within 5 miles of the project location. If earth moving machinery (EMM) is used to remove overburden from an anomaly, the EMM will not be used within 12 inches of any anomaly.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Conduct mechanical and hand tool subsurface target anomaly investigation to clear MEC	MEC hazard/explosion, fire and over pressure	Same as above.	**M**
Conduct point detection magnetometer assisted excavations to investigate subsurface target anomaly	MEC hazard/explosion, fire and over pressure	Same as above.	**M**
Walking and working on site	General site hazards: Insect bites and stings. Contact dermatitis from poisonous and irritating plants (poison ivy, poison oak, and poison sumac). Vehicle traffic Severe weather Heat stress Cold stress Noise. Lifting Slips, trips, falls UV hazards, etc.	Refer to General Site Hazards AHA.	**M**
	Adverse weather and lightning	Monitor warnings or indications of severe weather, conditions and take appropriate precautions to protect personnel and property. Be aware of lightning, use the lightning 30/30 Rule: If it takes less than 30 seconds to hear thunder after seeing the flash, lightning is near enough to pose a threat; after the storm ends, wait 30 minutes before resuming work activities.	**L**
	Cave-in of excavated soil, open excavation and permits	Require that excavated soil be placed 2 feet away from the edge of the excavation area. A competent person will examine and determine if soil type requires protective measures using sloping or benching methods to protect employees from cave-ins. If anomaly is deeper than 4 feet stop excavation and notify the UXOSO. When excavation exceeds a depth of 4 feet sufficient egress measures are required. Excavations shall be backfilled upon completion of anomaly clearance. Excavations not immediately backfilled or covered will be cordoned off to prevent personnel, livestock and wildlife from entering or falling into the excavation. When required, an excavation permit will be obtained by the project manager from the appropriate authority.	**M**
	Contact with moving vehicles	Be aware of vehicle traffic. Stay off of roads.	**L**
	Cuts and lacerations	Wear Level D PPE with leather gloves per the APP for all tasks with the potential for cuts or lacerations. Personnel will be trained in the proper use and selection of personal protective equipment and tools they must use to complete their task and the protection needed for hazards of exposed metal and other cut hazards.	**L**
	Eye hazards	Wear protective eyewear which meets ANSI/ASSE Z81 to protect eyes from hazards associated with MEC operations.	**L**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Using mechanized equipment	Physical injury from mechanized equipment	Inspect mechanized equipment prior to it being placed in use on site, by a competent person IAW the manufacturer recommendations and requirements of this SSHP. All mechanized equipment will be inspected daily (while in use) to promote safe operating conditions. Inspections will be conducted by the operator or a designated competent person at the beginning of the day of use. Prior to daily use braking and operating systems will be function checked and all safety devices will be in place. Whenever an unsafe condition or discrepancy is found the equipment will be immediately removed from service and prohibited from use until the unsafe condition is corrected. ONLY qualified operators holding an appropriate certification are permitted to operate mechanized equipment. Equipment operations will be conducted in a manner as to not endanger personnel and IAW with manufacturer's instructions. Equipment will not be mounted nor dismounted while moving.	M
	Physical injury from mechanized equipment	Establish a clear safety zone at the maximum radius of the bucket. The safety zone will be clearly marked with orange safety cones or other demarcation. Personnel will remain clear and not enter the safety zone when the excavator is in operation. All personnel working near the safety zone will wear PPE consisting of a high-visibility vest and head, foot and eye protection.	M
	Overhead hazards	Wear Safety hard hats in those areas with the potential for head injury. All protective head gear shall meet the current requirements of ANSI Z89.1	M
	Sprains and strains	Wear sturdy footwear. Avoid twisting or turning while opening doors and walking with hand-pulled equipment. Personnel will be cautioned about physical strain associated with strenuous activities that may be conducted on site. Personnel will use caution to not over exert themselves of overstrain muscles and joints. Know your limitations.	L
	Slips, trips and falls	Wear sturdy footwear, and continually inspect work area for hazards and practice good housekeeping procedures and maintain clear work areas to remove trip hazards. Personnel will also be aware of uneven walking surfaces, animal boroughs, ground surfaces tree roots, small scrubs and the potential for rocks and other trip hazards associated with the work site. Avoid walking near cliffs or on inclined/slopes greater than 30 degrees.	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Add Steps, Hazards, and Actions to Eliminate or Minimize Hazards based on conditions encountered in the field.			

Equipment	Inspection	Training
Hand tools for excavating Mechanized equipment Handheld magnetometers	Daily inspection of hand tools. Daily inspections and tests IAW manufacturer's instructions and recommendations. Magnetometers will be response tested daily at the test plot to ensure proper operations. All magnetometer tests will be recorded in their respective equipment test log.	UXO Technicians shall meet the training/certification requirements of DDESB Technical Paper 18 40-hr HAZWOPER 8-hr HAZWOPER annual refresher Documentation of training will be kept on file at the project site Initial Site Safety/Task Hazard Training Current equipment operator certificate PPE Training

ACTIVITY HAZARD ANALYSIS

Date Prepared:

Project Name:

Activity/Work Task: MEC movement within a munitions response site, operational range, or installation

Activity Location(s):

Prepared By:

Task Start Date:

Task Duration:

Reviewed By: Edie Scala-Hampson, CIH, CHMM

Overall Risk Assessment Code (RAC) (Use highest code): **M**

Risk Assessment Code (RAC) Matrix

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Site access control	Unauthorized Entry	Implement positive site access controls prior to site operations. Maintain a constant watch for intrusion of unauthorized personnel. Positive site access controls will include as required: visual, barricades, signs or other methods to control unauthorized access during tasks that could cause exposure to MEC or other environmental/safety hazards. Establish the MSD as detailed in the project work plan.	L
Determining MEC as acceptable to move	MEC hazard/explosion, fire and overpressure	Determine acceptability to move: In accordance with EM 385-1-97, munitions encountered during munitions response or other activities can be determined acceptable to move when technically qualified personnel performing the functions of SUXOS and UXOSO determine the risk associated with movement is acceptable, and movement is necessary for the protection of people, property or critical assets, or the efficiency of the activities being conducted.	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Relocating acceptable to move MEC	MEC hazard/explosion, fire and overpressure	Read and sign off on the work plan and SSHP. Prior to commencing all explosive operations site personnel will be given task-specific briefings regarding the hazards associated with the task and the procedures used to control/mitigate the hazards. Deliver daily task specific briefings prior to commencing all explosive operations, regarding the hazards associated with the task and the procedures used to control/mitigate the hazards. Use authorized, trained and qualified UXO Technicians to perform MEC clearance activities. Use required PPE as indicated in the SSHP, by all personnel inside the EZ. (Minimum Level D). Every effort will be made to identify munitions items. Abide by the following do's and don'ts: • Under no circumstances will any MEC be moved in an attempt to make positive identification. Only MEC that has been positively identified can be determined acceptable to move. • Do not transport white phosphorous munitions unless they are immersed in water, mud, or wet sand. • If loose pyrotechnic, tracer, flare, or similar mixtures are to be transported, they will be placed in Number 10 mineral oil or equivalent to minimize the fire and explosion hazards. • Incendiary-loaded munitions will be placed on a bed of sand and covered with sand to help control the burn if a fire should start during transport. • If an unfired rocket motor will be transported, it will be positioned in the vehicle parallel to the rear axle and secured in place with sandbags. This will afford maximum protection for the personnel operating the vehicle. • MEC with exposed fillers, such as high explosives, will be places in appropriate containers with packing material to prevent migration of the hazardous fillers. Padding will be added to protect the exposed filler from heat, shock, and friction. • Arming wires and pop out pins on unarmed fuzes should be secured prior to moving MEC. • Do not depress plungers, turn vanes, or rotate spindles, levers, setting rings, or other external fittings on MEC. Such actions may arm or activate items. • Do not attempt to remove any fuze(s) from MEC. Do not dismantle or strip components from any MEC. • Do not rely on the color-coding of munitions for positive identification.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Relocating acceptable to move MEC	Slip, trip and fall hazards -Walking over soft ground, uneven terrain	• MEC with exposed fillers, such as high explosives, will be placed in appropriate containers with packing material to prevent migration of the hazardous fillers. Padding will be added to protect the exposed filler from heat, shock, and friction. • Arming wires and pop out pins on unarmed fuzes will be secured prior to moving MEC. • Do not rely on the color-coding of munitions for positive identification Determine best access route before transporting munitions, equipment, or walking in order to avoid tripping hazards. Wear slip resistant footwear with ankle support. Be aware of uneven walking surfaces, rocks, brush, animal boroughs and other hazards. Avoid walking near cliffs or on inclined/slopes greater than 30 degrees. Choose firm ground for walking, if possible. Continually inspect work area for hazards and practice good housekeeping procedures and maintain clear work areas to remove trip hazards.	M
	Lifting	Restrict lifts to 50 pounds or less. When lifting in excess of 50 pounds, but no more than 100 pounds two or more workers are required. Any item weighing more than 100 pounds will only be lifted using mechanical equipment or devices. Personnel will use safe lifting procedures and lift with their legs and not their backs and will be trained in proper lifting techniques. Know your limitations. Maintain good fitness.	L
	Cuts and lacerations	Wear thick clothing fabrics and appropriate PPE such as leather gloves when there is a potential for cuts and lacerations. Wear safety glasses if there is a potential for dust and flying debris. Maintain adequate first aid supplies Use Level D PPE per the APP for all tasks with the potential for cuts or lacerations. Personnel will be trained in the proper use and selection of the equipment and the tools they must use to complete their task and the hazards of exposed metal and other cut hazards.	L
	Contact with moving vehicles	Be aware of vehicle traffic. Stay off of roads.	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Relocating acceptable to move MEC	Spills and leaks-environmental damage	Maintain a portable spill response kit containing absorbent materials, non-sparking shovel, PPE and disposable supplies in a readily accessible location.	L
	Hand and power tools	Select hand tools to ensure the right tool is being used for the right job and being used in the manner which it was intended to be use. All hand tools will be inspected daily prior to use and any defective tools will be tagged and removed from service immediately. Employees will follow the procedures and safety precautions specified by the manufacturer to insure safe and proper use of all hand and power tools.	L
	General site hazards: Insect bites and stings. Contact dermatitis from poisonous and irritating plants (poison ivy, poison oak, and poison sumac). Vehicle traffic Severe weather Heat stress Cold stress Noise Lifting Slips, trips, falls UV hazards, etc.	See General Site Hazards AHA	**M**

Equipment	Inspection	Training
PPE Level D: • Safety glasses • Safety-toed boots • Work gloves Other Equipment: • Hand tools for excavating • Sandbags • Heavy equipment as required	Daily inspection of hand tools. Daily inspection and tests of manufactures recommendations. SUXOS and UXOSO evaluate the munition and authorize its movement.	UXO Technicians shall meet the training/certification requirements of DDESB Technical Paper 18 40-hr HAZWOPER 8-hr HAZWOPER annual refresher Documentation of training will be kept on file at the project site Initial Site Safety/Task Hazard Training Current equipment operator certificate PPE training

ACTIVITY HAZARD ANALYSIS

Date Prepared:

Project Name:

Activity/Work Task: MEC Disposal

Activity Location(s):

Prepared By:

Task Start Date:

Task Duration:

Reviewed By: Edie Scala- Hampson, CIH, CHMM

Overall Risk Assessment Code (RAC) (Use highest code): M

Risk Assessment Code (RAC) Matrix

Severity	Probability				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Site access control	Unauthorized entry	Implement positive site access control prior to site operations. Maintain a constant watch or surveillance for intrusion of unauthorized personnel. Positive site access control will be established prior to on-site operations using barricades, signs or other methods to ensure unauthorized access during tasks that could cause exposure to MEC or other safety and health hazards. The MSD/EZ will be established prior to initiation of MPPEH inspection and handling activities. UXO teams will observe the team separation distance (TSD) when applicable.	L
Using demolition explosives counter charge on MEC hazards to blow in place (BIP) or to conduct consolidated demolition shots.	MEC hazard/explosion, fire and overpressure	Evacuate all personnel outside the EZ prior to initiation of demolition explosive charges. Only those personnel essential to the performance of the demolition operations will be permitted inside the HFD while MEC items are being primed for demolition. To minimize the fragmentation hazard and potential re-contamination of adjacent grids with fragments the SUXOS may choose to utilize engineering controls as required to reduce the spread of fragments and effects of overpressure.as described in the ESS.	M

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Using demolition explosives counter charge on MEC hazards to blow in place (BIP) or to conduct consolidated demolition shots.	MEC hazard/explosion, fire and overpressure (continued)	Deliver daily task specific briefings, prior to commencing all explosive operations, regarding the hazards associated with the task and the procedures used to control/mitigate the hazards. Authorized, trained and qualified UXO Technicians will perform MEC explosive demolition and surface clearance activities. Use required PPE as indicated in the SSHP, by all personnel inside the EZ. All employees and subcontractors are required to read and sign-off on the HGL Work Plan and SSHP. Require attendance, of all HGL subcontractors, at the site specific hazards and health and safety training given by the HGL UXOSO. Escort all non-UXO personnel by a UXO Technician II. Instruct non-UXO personnel to not touch or disturb any potential MEC items. Non-UXO personnel will adhere to the instructions of the UXO Technician II. Have a fire extinguisher readily available.	M
	Slip, trip and fall hazards - Walking over soft ground, uneven terrain	Determine best access route before transporting equipment or walking in order to avoid tripping hazards. Wear slip resistant footwear with ankle support. Be aware of rocks, brush, animal boroughs and other hazards. Choose firm ground for walking, if possible.	M
	Cuts, lacerations, flying debris from brush/vegetation (eye hazards)	Wear thick clothing fabrics and appropriate PPE such as leather gloves when there is a potential for cuts and lacerations. Wear safety glasses if there is a potential for dust and flying debris. Ensure eye wash is available. Maintain adequate first aid supplies. Use Level D PPE per the APP for all tasks with the potential for cuts or lacerations. Personnel will be trained in the proper use and selection of the equipment and the tools they must use to complete their task and the hazards of exposed metal and other cut hazards.	M
	Remote location	Determine accessibility to associates, communication needs, first aid and rescue equipment and procedure. Institute buddy system.	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Using demolition explosives counter charge on MEC hazards to blow in place (BIP) or to conduct consolidated demolition shots.	General site hazards: Insect bites and stings. Contact dermatitis from poisonous and irritating plants (poison ivy, poison oak, and poison sumac). Vehicle traffic Severe weather Heat stress Cold stress Noise Lifting Slips, trips, falls UV hazards, etc.	See General Site Hazards AHA	M
	Flying debris, dust, dirt, rocks, sparks, abrasions-Eye hazards	Select hand tools and power tools that are right for the job. Inspect all tools daily, prior to use. Defective tools must be tagged and removed from service immediately. Wear safety glasses and other required PPE as indicated in the SSHP. Ensure that eyewash and first aid supplies are readily available. Wear abrasion resistant clothing (thick fabrics).	L
	Contact with moving vehicles	Be aware of vehicle traffic. Stay off of roads.	L
Using demolition explosives counter charge on MEC hazards to blow in place (BIP) or to conduct consolidated demolition shots.	Spills and leaks-Environmental damage	Maintain a portable spill response kit containing absorbent materials, non-sparking shovel, PPE and disposable supplies in a readily accessible location. Screw caps on tightly and store fuel in designated area.	L
	Noise-hearing loss	Wear hearing protection when noise levels are above 85 dBA (when you cannot be hear speaking in a normal voice at arm's length).	M
	Hand and power tools	Select hand tools to ensure the right tool is being used for the right job and being used in the manner which it was intended to be use. All hand tools will be inspected daily prior to use and any defective tools will be tagged and removed from service immediately. Employees will follow the procedures and safety precautions specified by the manufacturer to insure safe and proper use of all hand and power tools.	M

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Add Steps, Hazards, and Actions to Eliminate or Minimize Hazards based on conditions encountered in the field.			

Equipment	Inspection	Training
<u>Personal Protective Equipment</u>: • Safety glasses • Safety-toe boots • Work gloves <u>Other Equipment</u>: Hand tools Survey instruments-handheld magnetometers	Daily site safety inspection (SSHO) ___________ Daily inspection of hand tools Perform daily equipment/instrument function, location, calibration and control point check.	Competent Person (CP) / Qualified Person (QP): CP/SSHO ________________ Alternate CP/SSHO ____________ QP/First Aid and CPR ___________ QP/First Aid and CPR ___________ Training Requirements (as determined by the SSHO): UXO personnel will be trained IAW DDESB TP 18, DOD 4140.62, and USACE EM 1110-1-4009

ACTIVITY HAZARD ANALYSIS						
Date Prepared: **Project Name:** **Activity/Work Task:** MPPEH Processing **Activity Location(s):** **Prepared By:** **Task Start Date:** **Task Duration:** **Reviewed By:** Edie Scala-Hampson, CIH, CHMM	**Overall Risk Assessment Code (RAC) (Use highest code)**					H
	Risk Assessment Code (RAC) Matrix					
	Severity	**Probability**				
		Frequent	Likely	Occasional	Seldom	Unlikely
	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L
	Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)					
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.				**RAC Chart**	
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				**E = Extremely High Risk** **H = High Risk**	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.				**M = Moderate Risk** **L = Low Risk**	

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Site access control	Unauthorized entry	Implement positive site access control prior to site operations. Maintain a constant watch or surveillance for intrusion of unauthorized personnel. Positive site access control will be established prior to on-site operations using barricades, signs or other methods to ensure unauthorized access during tasks that could cause exposure to MEC or other safety and health hazards. The MSD/EZ of will be established prior to initiation of MPPEH inspection and handling activities. UXO teams will observe the team separation distance (TSD) when applicable.	L
UXO Technicians will inspect MPPEH, MD, RD and scrap to insure an explosive hazard does not exist	MEC hazard/explosion, fire and overpressure	Use only trained and qualified UXO Technicians to perform MMPEH inspection activities. Segregate all MPPEHH according to its classification as either Material Documented as an Explosive Hazard (MDEH) or Material Documented as Safe (MDAS). Stow separately in locked/sealed containers in a secure area until final disposition. Escort all non-UXO personnel by a UXO Technician. Instruct non-UXO personnel to not touch or disturb any potential MEC items. Non-UXO personnel will adhere to the instructions of the UXO Technician II. Have a fire extinguisher readily available.	M

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
UXO Technicians will inspect MPPEH, MD, RD and scrap to insure an explosive hazard does not exist (continued)	MEC hazard/explosion, fire and overpressure (continued)	Certify and verify documentation is completed using DD Form 1348-1A, *Material Transfer/Release* Form and the HGL Chain of Custody Manifest form before releasing physical control or custody of MPPEH.	**M**
	Chemical Hazards from Expray use and MEC: DMSO (Dimethyl sulfoxide) 45% of Expray. If the skin is in contact with any potentially hazardous chemicals (explosives, heavy metals such as lead VOCs/SVOCs) DMSO will act as a vehicle for absorption of the chemical into the body. This chemical is absorbed through the intact skin and acts as a carrier, transporting any chemicals in contact with the skin into the body. RDX Tetryl TNT	Use in well-ventilated area. Spray away from the body. Do not inhale. Wear proper PPE: Neoprene, butyl, Silver Shield brand, or 4H brand gloves. Flush with water-In case of accidental contact with eyes. Do not use near fire. Do not puncture aerosol can.	**H**
	Remote location	Determine accessibility to associates, communication needs, first aid and rescue equipment and procedure. Institute buddy system.	**L**
	General site hazards: Insect bites and stings. Contact dermatitis from poisonous and irritating plants (poison ivy, poison oak, and poison sumac). Vehicle traffic Severe weather Heat stress Cold stress Noise Lifting Slips, trips, falls UV hazards, etc.	See General Site Hazards AHA.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
UXO Technicians will inspect MPPEH, MD, RD and scrap to insure an explosive hazard does not exist (continued)	Injury from misidentification of MPPEH	Inspect (visual) all MPPEH by two independent 100 percent inspections by at least one UXO Technician II and one UXO Technician III to determine its status as either Material Documented as Explosive Hazard (MDEH) or Material Documented as Safe (MDAS). All MPPEH will undergo a quality control inspection by a UXO Quality Control Specialist as specified by the site specific Work Plan and/ or Explosive Safety Submission.	**M**
	Contact with moving vehicles	Be aware of vehicle traffic. Stay off of roads	**L**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Add Steps, Hazards, and Actions to Eliminate or Minimize Hazards based on conditions encountered in the field.			

Equipment	Inspection	Training
PPE Level D: • Safety glasses • Safety-toe boots • Work gloves Weigh scales	Perform calibration before each use	Competent Person (CP) / Qualified Person (QP): CP/SSHO ____________________________________ Alternate CP/SSHO ____________________________ UXO personnel will be trained DDESB TP 18, DOD 4140.62, and USACE EM 1110-1-4009 Documentation of training will be kept on file at the project site Initial Site Safety/Task hazard training PPE training 40-hr HAZWOPER 8-hr HAZWOPER annual refresher Training in survey instruments-magnetometers. All personnel operating hand tools will be trained in the proper inspection, maintenance and use. Initial Site Safety/Task Hazard training. PPE Training Training in proper inspection, maintenance and use of hand tools Survey personnel will be licensed IAW with local and state requirements

ACTIVITY HAZARD ANALYSIS						
Date Prepared: **Project Name:** **Activity/Work Task:** Vehicle Operations **Activity Location(s):** **Prepared By:** **Task Start Date:** **Task Duration:** **Reviewed By:** Edie Scala-Hampson, CIH, CHMM	**Overall Risk Assessment Code (RAC) (Use highest code)**					**M**

Risk Assessment Code (RAC) Matrix

Severity	**Probability**				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

	RAC Chart
"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.	
"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or	**E = Extremely High Risk** **H = High Risk**
Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**M = Moderate Risk** **L = Low Risk**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Project vehicle use on and off project site. Inspecting vehicles. Vehicle operations. Parking vehicles. Backing vehicles.	General	All company owned, leased, or rented vehicle operations shall comply with the requirements of HGL Procedure No. 16 *Driving Safety*. Subcontractors operating motor vehicles shall comply with all federal, state, and local traffic regulations. Subcontractors shall only use vehicles that are in good condition and safe to operate. All personnel shall drive defensively and wear seat belts while vehicles are in motion. Inspect vehicles before use – document inspection at least once daily. Keep alert for pedestrians. Always yield to and give pedestrians the right of way.	**M**
	Failure to properly plan daily activities	This AHA shall be reviewed and a pre-task safety and health analysis completed by the crew prior to commencing daily activities, as a component of the morning Tailgate Safety Meeting to accommodate conditions encountered in the field and at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Project vehicle use on and off project site. Inspecting vehicles. Vehicle operations. Parking vehicles. Backing vehicles.	Accidents	In the event of an accident: stop; call for medical assistance; notify police; complete Vehicle Accident Report and submit to the SSHO. If an employee is injured, an incident report must be completed and submitted to the SSHO.	**M**
	Equipment failure	Perform daily inspections of your vehicle. Any vehicle with mechanical problems that may endanger the safety of the driver, passengers, or the public shall not be used.	**L**
	Not prepared for emergency	Ensure safety equipment is in the vehicle. Safety equipment should include a spare tire, jack, first-aid kit, fire extinguisher, and flashlight. Flares and/or reflective triangles shall be available in larger trucks. Verify that the proper documentation is in the vehicle - documentation includes an operations manual for the vehicle, insurance card, vehicle registration, and HGL accident forms.	**L**
	Unfamiliar with the vehicle	Familiarize yourself with the vehicle before moving. Properly adjust mirrors and seat. Review the dashboard controls, steering radius, overhead, and side clearances. Locate windshield wipers and lights.	**M**
	Vehicle loading	Do not overload the vehicle. Secure all equipment within the body of the vehicle. Do not block side view mirrors with load. Do not transport Department of Transportation manifested hazardous materials without a commercial driver's license. Dispatch all equipment and personnel with proper forms and identification.	**M**
	Cellular phones	Do not use handheld cellular phones while driving. Pull over to the side of the road when making or receiving a call.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Project vehicle use on and off project site. Inspecting vehicles. Vehicle operations. Parking vehicles. Backing vehicles.	Influenced by drug and alcohol	Never drive under the influence of drugs or alcohol. Disciplinary action, including termination, will be taken against anyone who is convicted of or who pleads no-contest to the charges of driving under the influence in accordance with the HGL Substance Abuse Policy. Project-assigned hourly employees are not permitted to operate company owned, leased, or rented vehicles after 10:00 p.m. without written authorization from their supervisor.	**M**
	Driver attitude/fatigue	Do not operate any vehicle when abnormally tired or fatigued. Keep an even temper when driving. Do not let the actions of others affect your attitude. Avoid “highway-hypnosis” and “falling asleep at the wheel”. Take plenty of breaks when driving long distances or rotate driving responsibility with a passenger. Personnel, while on duty, shall not operate motor vehicles after being in a duty status (regardless of their role or function) for more than 12 hours during any 24-hour period without at least eight consecutive hours of rest. No employee may drive continuously for more than 10 hours in any single on-duty period (continuous period of more than 10 hours in any 24-hour period without at least eight consecutive hours of rest).	**M**
	Backing	Back into parking spaces upon arrival, whenever possible. When preparing to move or back vehicles, walk around the vehicle 360° before entering vehicle to identify any new conditions or obstructions. Use a spotter when backing whenever possible. Determine and agree upon hand signals (between spotter and driver) before attempting to back vehicle. Check the rear-view and side mirrors prior to backing (Note: All vehicles, other than automobiles, must have small convex mirrors attached to the side mirrors). Back slowly in areas of obstructed vision.	**M**
	Blind Spots	Become familiar with any blind spots associated with your vehicle. Adjust mirrors properly. Make sure you use your directional signals. Always look over your shoulder to assure the lane is clear when changing lanes. Exercise caution when approaching other driver’s blind spots.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Project vehicle use on and off project site. Inspecting vehicles. Vehicle operations. Parking vehicles. Backing vehicles.	Spacing/distance	Identify if your vehicle has Anti-Lock Brakes. Do not tailgate. Follow the 3-second rule. Increase the 3-second rule as necessary during hazardous travel conditions. Always leave yourself an “out” during travel – this applies to stoplights as well. When stopping, make sure that you leave enough distance between you and the car in front of you (you should be able to see the rear tires of the vehicle in front, when stopped). When at a red light, and it turns green, use the “delayed start” technique, by counting to three before you take your foot off the brake. Allow extra spacing and braking time for trucks and vehicles towing trailers. Trailers shall be equipped with brakes.	**M**
	Skids	If the vehicle has begun to skid out of control, turn the steering wheel in the direction of the skid and re-adjust the wheel, as necessary. Slow down during hazardous travel conditions. Use 4-wheel drive, if available, when driving vehicles off road, on steep inclines, muddy conditions, etc. Do not take vehicles “off road” if they cannot be operated safely.	**M**
	Speed	Obey all posted speed limits. Radar detectors are prohibited in all company owned, leased, or rented vehicles. Reduce travel speed during hazardous conditions (i.e., rain, fog, snow).	**M**
	High profile vehicle/low clearances	Determine actual height of vehicle during initial inspection - prior to moving vehicle. Maintain awareness of vehicle height while driving. Identify low clearance structures, such as motel overhangs, gas station canopies, bridges, tunnels, parking garages, fast-food drive-thrus, banks, etc. Determine the height of the low clearance structure prior to driving under it and verify that there is enough clearance to safely pass – use a spotter as necessary.	**M**
	Crossing railroad tracks	Stop, look, and listen before crossing railroad tracks. Be aware that multiple tracks may have more than one train using them, and the trains may be traveling in opposite directions. Never drive around crossing gates.	**M**
	High water/drowning	Never drive vehicles across flowing water on the road.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Add Steps, Hazards, and Actions to Eliminate or Minimize Hazards based on conditions encountered in the field.			

Equipment	Inspection	Training
<u>PPE</u> • Safety-toe boots <u>Equipment</u>: Emergency phone list Map to medical care facilities Operator's manual Insurance card Vehicle registration Shaw accident forms Fire Extinguishers First Aid Kit Spare tire and jack Flashlight Flares and/or reflective triangles shall be available in larger trucks	Daily vehicle inspections Vehicle inspections (prior to trips greater than 50 miles for HGL provided vehicles) Walk around the vehicle 360° before entering vehicle (each time)	Competent Person (CP) / Qualified Person (QP): CP/SSHO ________________ Alternate CP/SSHO ________________ Training Requirements (as determined by the SSHO): Site safety orientation Qualified vehicle operators Defensive driving

<table>
<tr><th colspan="7">ACTIVITY HAZARD ANALYSIS</th></tr>
<tr><td rowspan="13">Date Prepared:
Project Name:
Activity/Work Task: MRS Clearing and Grubbing
Activity Location(s):
Prepared By: Edie Scala-Hampson, CIH, CHMM
Task Start Date:
Task Duration:
Revised By:</td><td colspan="5">Overall Risk Assessment Code (RAC) (Use highest code)</td><td>M</td></tr>
<tr><td colspan="6">Risk Assessment Code (RAC) Matrix</td></tr>
<tr><td rowspan="2">Severity</td><td colspan="5">Probability</td></tr>
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<tr><td>L = Low Risk</td></tr>
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Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Site access control	Unauthorized entry	Implement positive site access control prior to site operations. Maintain a constant watch or surveillance for intrusion of unauthorized personnel. Positive site access control will be established prior to on-site operations using barricades, signs or other methods to ensure unauthorized access during tasks that could cause exposure to MEC or other safety and health hazards.	**L**
	MEC hazard/explosion, fire and overpressure	Deliver daily task specific briefings regarding the hazards associated with the task and the procedures used to control/mitigate the hazards. Use required PPE as indicated in the SSHP, by all personnel inside the EZ. Require attendance, of applicable personnel and subcontractors, at the site specific hazards and health and safety training given by the HGL UXOSO. Escort all non-UXO personnel by a UXO Technician II. Instruct non-UXO personnel to not touch or disturb any potential MEC items. Non-UXO personnel will adhere to the instructions of the UXO Technician II. Have a fire extinguisher readily available. Turn off all motorized equipment during fueling.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Inspection of grid prior to clearing	Traffic-Struck by hazards	Note all moving equipment in work areas. Wear high-visibility vest. Make eye contact with equipment operators to let them know you are there. Use a spotter when visibility is poor (backing).	L
	Slip, trip and fall hazards -Walking over soft ground, uneven terrain	Determine best access route before transporting equipment or walking in order to avoid tripping hazards. Wear slip resistant footwear with ankle support. Be aware of rocks, brush, animal boroughs and other hazards. Choose firm ground for walking, if possible.	M
	Cuts, lacerations, flying debris from brush/vegetation (eye hazards)	Wear thick clothing fabrics and appropriate PPE such as leather gloves when there is a potential for cuts and lacerations. Wear safety glasses if there is a potential for dust and flying debris. Ensure eye wash is available. Maintain adequate First Aid supplies.	M
	Remote location	Determine accessibility to associates, communication needs, first aid and rescue equipment and procedure. Institute buddy system.	L
	Environmental hazards Biologicals- Plants, insects, wildlife Adverse Weather Temperature Stresses UV Hazards	See General Site Hazards AHA actions.	M
Surface sweep area for vegetation removal. Use of Schonstedt Magnetic Locators for surface clearance.	Same hazards as in “Inspection of grid prior to clearing”	See above	M
	Injury from physical exertion, sprains, sprains, awkward bending/lifts and ergonomic hazards	Use proper lifting techniques Assure solid footing Maintain good personal level of fitness. Be alert to signs and symptoms of overexertion Do not lift greater than 50 lbs. Use mechanical assistance or 2 man lift whenever possible Limit repetitive awkward motions Have water available and first aid supplies Take adequate rest/recovery periods Switch sides when necessary	M

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Install flag locators, etc.	Injury from unintentional contact-MEC/explosion, fire and overpressure (as indicated above)	Visually screen the location prior to placing flag locators Clear location with geophysical instrument prior to placing stake or monument (any soil penetrating activity). Any MEC items located will be marked with cross red pin flags or encircling the hazard with red flagging tape. The location will be reported to the SUXOS or UXOS See Step 1 above for MEC	**M**
Hand brush cutting and clearing with hand tools	Flying debris, dust, dirt, rocks, sparks, abrasions	Select hand tools and power tools that are right for the job. Inspect all tools daily, prior to use. Defective tools must be tagged and removed from service immediately. Wear safety glasses and other required PPE as indicated in the SSHP Ensure that eyewash and first aid supplies are readily available Wear abrasion resistant clothing (thick fabrics) Watch for people, plants, rocks, animals and animal burrows during clearing and grubbing	**L**
	Injury from unintentional contact-MEC/explosion, fire and overpressure (as indicated above)	See Step above for MEC	**M**
	Hand tools-struck by hazards/pinch points, jamming from applied force	Follow the procedures and safety precautions specified by the manufacturer to ensure safe operation of all hand and power tools. When using machetes, no personnel will be within a 25 foot radius of the machete operator. The machete operator will use an attached wrist lanyard to prevent the machete from escaping operator control. Ensure that tools are in good repair with adequate grips.	**M**
Use of mechanical brush clearing equipment	Same hazards as previous steps	Inspect (inspection performed by UXO technician) all areas of the grid ahead of the vegetation removal crews with the aid of handheld magnetometers. Mark any MEC or other hazards by encircling the hazard with red flagging tape. Vegetation will be cut above the ground level if a bush hog or other mechanical equipment is used to avoid striking surface MEC. If no MEC or metallic debris is found the vegetation can be cut to within 6-12 inches above ground level.	**M**
	Spills and leaks-Environmental damage	Maintain a portable spill response kit containing absorbent materials, non-sparking shovel, PPE and disposable supplies in a readily accessible location Screw caps on tightly and store fuel in designated area	**L**
	Noise-hearing loss	Wear hearing protection when noise levels are above 85 dBA (when you cannot be hear speaking in a normal voice at arm's length)	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Walking the site	General site hazards: Insect bites and stings. Contact dermatitis from poisonous and irritating plants (poison ivy, poison oak, and poison sumac). Vehicle traffic Severe weather Heat stress Cold stress Noise. Lifting Slips, trips, falls UV hazards, etc.	See General Site Hazards AHA	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Add Steps, Hazards, and Actions to Eliminate or Minimize Hazards based on conditions encountered in the field.			

Equipment	Inspection	Training
Hand tools Survey instruments PPE • Gloves • Glasses • Safety-toe footwear • Hearing protection (if applicable) • Hard-hat with face shield (if applicable) • Chaps (if applicable)	Daily inspection of hand tools. Perform daily equipment/instrument function, location, calibration and control point check.	UXO personnel will be trained IAW DDESB TP 18 Training in survey instruments 40-hr. HAZWOPER 8-hr. HAZWOPER Initial Site Safety /Task Hazard Training PPE training Training in proper inspection, maintenance and use of hand tools Survey personnel will be licensed IAW with local and State requirements

ACTIVITY HAZARD ANALYSIS						
Date Prepared: **Project Name:** **Activity/Work Task:** Water Vehicle Operations **Activity Location(s):** **Prepared By:** Edie Scala-Hampson CIH, CHMM **Task Start Date:** **Task Duration:** **Revised By:**	**Overall Risk Assessment Code (RAC) (Use highest code)**					**M**
	Risk Assessment Code (RAC) Matrix					
	Severity	**Probability**				
		Frequent	Likely	Occasional	Seldom	Unlikely
	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L
	Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)					
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.				**RAC Chart**	
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				**E = Extremely High Risk** **H = High Risk**	
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Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Weather Evaluation	Severe Weather and Cold and/or Heat stresses and Water temperature hazards	Monitor weather forecasts for predicted inclement weather. Check weather prior to departure and reschedule if severe weather is forecasted. Coordinate planned activities with onshore staff. If a high winds small craft warning is issued the boat will not depart shore and/or return to shore. Lightning within 10 miles, personnel will depart water. Review heat and cold stress recognition and prevention instructions. Monitor heat stress index, air temperature, humidity and wind. Follow ACGIH guidelines for work-rest regimens, as necessary. (Free smart phone OSHA app for monitoring heat index - www.osha.gov/SLTC/heatillness/heatindex/heatapp.html Drink small amounts (4 oz.) of liquids for rehydration during breaks, per the work rest regimen required based on temperature, workload and acclimatization. Wear sunscreen. Suspend water based work at winds above 25 mph, rough water, freezing rain, or lightning/thunder or extreme temperatures.	M

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Weather Evaluation	Severe Weather and Cold and/or Heat stresses and Water temperature hazards	Check that communication devices function. Since prolonged exposure to cold air, or to immersion in cold water at temperatures well above freezing, can lead to dangerous hypothermia, adequate insulating clothing to maintain core temperatures above 36°C (96.8°F) will be provided to workers. Refer to General Site Hazards AHA for actions not listed here.	**L**
Water craft operation	Hazards of boat operation	Familiarize yourself with any movement of boat traffic on the body of water. Boat operator(s) must meet all education and licensing requirements of the State in which the boat will be operated. Attach license. Obtain information about water temperature, depths and be familiar with locations of rocks, ledges, and manmade surface obstructions noted within the study area. Observe all boating regulations. Tie down equipment when necessary if there are issues of boat instability. Acquire Marine Emergency and Rescue Equipment. Ensure function of communication equipment. Wear slip resistant footwear. Look before you step in order to ensure safe and secure footing. Keep work area picked up and as clean as feasible and free of tripping and fall hazards.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Float plan	Drowning	FLOAT PLAN Date: Project Name: Boat Operator: Company: Destination: Weather Forecast: 1. VESSEL INFORMATION (e.g., make/model or local identifier): 2. MEANS OF COMMUNICATION (e.g., adequate means of communication shall be provided including phone numbers): 3. EXPECTED TIME OF DEPARTURE, ROUTE, AND TIME OF RETURN: 3. DISCUSSION OF ACTIVITIES/ PRE-LAUNCH SAFETY DEMONSTRATION (Attended by all on-board personnel listed below): 4. PERSONNEL ON-BOARD (Print Names):	M

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Boat transportation	Water hazards-Falling overboard and or stranding Drowning	Remain seated except when working. Wear USCG approved PFDs if working near (≤ 6 feet) or over water deeper than 4 feet (EM 385-1-1 05.J). Require that boat operator be trained and experienced, per Engineer Manual (EM) 385 1-1 19.F. Boat operator must complete a Float Plan prior to each trip including a safety demonstration for all passengers. Motor kill switch and throw ring or cushion present on boat. One fire extinguisher with a rating of 1-A:10-B:C in a boat less than 26 ft; two fire extinguishers required for a boat greater than 26 ft. Cellular phones in areas that provide service and radios capable of reaching the National Parks Service (NPS) office. Cardiopulmonary Resuscitation (CPR) and First Aid training for at least two on-site personnel. Wear non-slip work shoes. Properly secure, guard and maintain the boat access and walking areas to be free of tripping and slipping hazards. Maintain an adequate number of USCG throw rings. Do not exceed maximum weight capacity for watercraft. Do not use water craft without shore support personnel. Maintain radio contact with shore personnel. Review float plan with shore personnel so they can track whereabouts. Review training for man overboard emergencies and conduct drills to verify personnel are aware of their responsibilities. Follow water safety rules. Use PFD at all times when on a boat. *Refer to Work Over Water or Adjacent to Water*, U.S. Army Corps of Engineers Safety and Health Requirements Manual EM 385-1-1, Sections 19 and 30, and any applicable TVA requirements or U.S. Coast Guard (USCG) regulations. For more extensive information on working on or around water, refer to the Marine Operations Requirements. Review the prepared plan for marine emergencies such as fire, sinking, flooding, severe weather, man overboard, etc. Keep adequate First Aid Kit and supplies.	**M**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
Boat transportation	Environmental hazards Biologicals – Plants, insects, wildlife Adverse Weather Temperature Stresses UV Hazards Etc.	See General site hazards AHA.	**M**
Landing	Unattended worker	Use the “buddy system.” Maintain visual contact with staff during all activities. Maintain communication with the boat.	**L**
	Slips and falls	Look before you step in order to ensure safe and secure footing.	**L**
Boat Refueling (if required)	Fire, fuel spills	Prohibit smoking while refueling. Turn motor off before refueling. Maintain a fully charged fire extinguisher that is readily accessible.	**L**

Equipment	Inspection	Training
Personal Protective Equipment: Level D: Hard Hat Safety Glasses Safety-Toed Boots PFDs Modified Level D: Refer to SSHP.	Daily site safety inspection (SSHO) ____________ Housekeeping (daily) Fire extinguisher (monthly) Vehicle inspection daily Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals (each work area)	Competent Person (CP) / Qualified Person (QP): CP/SSHO ____________ Alternate CP/SSHO ____________ QP/First Aid and CPR ____________ QP/First Aid and CPR ____________ Training Requirements (as determined by the SSHO): HAZWOPER 40 Site safety orientation Tailgate meetings Emergency procedures Hazard communication Hearing conservation MEC awareness (if applicable) Applicable AHAs Fire extinguisher use Biological hazard identification and control Tornado shelter location Lightning safety procedures Heat stress prevention and heat stroke treatment Cold stress prevention Boat safety and licensing training for the operator

ACTIVITY HAZARD ANALYSIS							
Date Prepared: **Project Name:** **Activity/Work Task:** Excavation and Trenching **Activity Location(s):** **Prepared By:** Edie Scala-Hampson CIH, CHMM **Task Start Date:** **Task Duration:** **Revised By:**	**Overall Risk Assessment Code (RAC) (Use highest code)**						**M**
	Risk Assessment Code (RAC) Matrix						
	Severity	**Probability**					
		Frequent	Likely	Occasional	Seldom	Unlikely	
	Catastrophic	**E**	**E**	**H**	**H**	**M**	
	Critical	**E**	**H**	**H**	**M**	**L**	
	Marginal	**H**	**M**	**M**	**L**	**L**	
	Negligible	**M**	**L**	**L**	**L**	**L**	
	Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)						
	"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely.					**RAC Chart**	
	"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or					**E = Extremely High Risk** **H = High Risk**	
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.					**M = Moderate Risk** **L = Low Risk**	

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
1. Conduct Training	Vehicle Operation.	Follow the guidelines in the SSHP.	**L**
	Training	All personnel shall attend a site safety orientation. After personnel are trained in the contents of the Accident Prevention Plan (APP) and the Site Safety and Health Plan (SSHP), they shall sign the APP Acknowledgment Form and the SSHP Acknowledgment Form. All training certifications held by personnel shall also be made available and kept in on-site personnel files. Review emergency procedures and evacuation plans. Personnel who may participate in intrusive activities shall attend Munitions and Explosives of Concern (MEC) Awareness training.	**L**
2. Accident Prevention Plan	Medical emergencies.	All personnel should complete the Voluntary Allergy/Sensitivity/Medical Questionnaire.	**L**
	Heavy lifting, strains, and sprains.	Proper lifting techniques shall be used. No individual worker is permitted to lift any object that weighs over 50 pounds. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50-pound limit.	**L**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
2. Accident Prevention Plan (continued)	Fire.	Fire extinguishers shall be available in work areas. A 4-A:40-B:C fire extinguisher shall be available when refueling at the project site. The SSHO shall establish smoking areas. Smoke only in designated areas. Only discard cigarette butts in proper receptacles – never discard cigarette butts onto the ground. Smoking shall not be permitted within 50 feet of fueling operations. Use caution when refueling vehicles. All spills will be contained and abated before returning to operations. Use caution with vehicle exhaust systems in grassy areas. Do not run vehicles while parked in grassy areas. Engines shall be shut off before refueling.	L
	Overhead utilities.	Complete a Site Layout Plan prior to mobilizing the equipment. The plan shall identify all overhead and underground hazards in the active work areas and travel routes. Power lines shall be assumed to be energized unless verified to be de- energized and visibly grounded. Operation beneath a power line that has not been verified as de-energized and grounded must maintain clearance distances stated above. A high-visibility elevated warning line or barricade shall be erected at the minimum approach distance. Each work crew member shall be trained in the electrocution hazards and emergency procedures associated with energized power lines. Remain aware of overhead power lines – use spotters when necessary. Post overhead hazard warning signs as necessary.	L
3. Conduct Excavation Operations	Underground utilities.	Follow the procedure for intrusive activities in the SSHP. Intrusive activities may not proceed until an Intrusive Activities Permit has been issued by the Construction Manager/Field Superintendent and SSHO.	L
	Excavation/Trenching hazards.	Follow the Excavation/Trenching Plan All excavations will be inspected and monitored by the excavation competent person (at least daily and when conditions change, at a minimum). The inspections are to be documented on the Excavation Inspection form. Soils testing for soil classification are to be documented on the Soils Classification Worksheet. Soils, equipment, and materials shall be kept at least 2 feet from the face of excavations.	L
	Hand injuries.	Items to be handled shall be inspected for sharp edges, splinters, burrs, rough surfaces, etc. prior to being handled. Personnel shall wear leather gloves when handling materials with sharp edges, splinters, burrs, rough surfaces, etc. Personnel shall be aware of and avoid pinch point hazards.	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
3. Conduct Excavation Operations (continued)	Use of mechanical equipment.	Only qualified personnel shall be permitted to operate equipment. Mechanical equipment shall be inspected daily. Deficiencies in equipment shall be noted on the inspection form. Equipment found to be unsafe shall be taken out of service. Equipment operators shall wear safety belts and hearing protection (as necessary). All equipment shall be operated at safe speeds and in a safe manner. Ground personnel shall not position themselves between equipment and stationary objects (stay out of swing radius). Personnel are only permitted to approach equipment after a signal from the operator.	L
	Dust.	Control dust by maintaining equipment operation rates. Personnel shall stay out of dust and work from upwind when possible. Perform visual dust monitoring to verify dust control is effective.	L
	Noise.	All personnel shall wear hearing protection when exposed to high noise levels. All personnel shall wear hearing protection when operating powered hand tools or noisy equipment. Personnel working in vicinity of noisy tools or equipment shall wear hearing protection. Noise level and exposure measurements shall be performed to verify hearing protection is adequate when necessary.	L
	Struck by and against (vehicles and equipment)	Wear PPE with high visibility vests when walking or working near moving equipment or vehicles. Personnel shall maintain a safe distance from operations. Personnel shall not be permitted in the swing radius of the equipment. Do not assume equipment and vehicle operators have seen you unless operator has made eye contact with you and signaled to you. Use warning signs and signalmen as necessary.	L
	Slips, trips, and falls.	Understand the hazards of slips, trips, and falls – consider the consequences. Do not jump from equipment or elevated surfaces. Clean-up work areas throughout the day and at the end of each workday. Use three-point contact rule for entering/exiting vehicles, trucks, and equipment. Use hand rails and other stationary objects (door frames, steering wheels, etc.) to increase stability. Use extra caution when walking on wet and muddy surfaces. Increase your awareness, keep alert, stay focused, and know your environment. Provide warning signs or cordon off areas where necessary. Consider postponing work as necessary and feasible. Avoid slippery areas when possible. Slow down - take smaller steps. Stay away from slopes, hills, and grades. Be cautious when using vehicle stairs. Lower your center of gravity when necessary. Fall protection must be provided and used when personnel are exposed to fall hazards greater than 6 feet. Follow Site-Specific Fall Protection and Prevention Plan.	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
3. Conduct Excavation Operations (continued)	Injury from use of tools.	Select the proper tool – do not improvise. Inspect all power and hand tools before each use (do not use damaged tools). Tools shall be appropriate for the task and maintained in good condition. Check your position, footing, and grip before tool use. Avoid distraction, keep your focus, and concentrate on the job. Personnel shall maintain a steady pace when using tools and take adequate rest periods. Proper guards or shields must be installed on all power tools before use. Keep electric cords untangled and out of the way of rotating tools. Personnel will not be allowed to utilize any power tools that are not in proper working condition. Use double-insulated power tools when possible. Power tools that are not double-insulated must have ground pin in place. Protect electric tools with ground-fault circuit interrupters (GFCIs). Air must be shut off or the electric cord unplugged before making tool adjustments. Air must be “bled down” before tool replacement or disconnection. Air compressors must have a relief valve and must be shut down during extended breaks, such as lunch.	**L**
	Use of operational chemicals.	Read and follow MSDS (SDS) for each chemical used. Do not use any chemical that you have not been trained to safely use. Provide ventilation as necessary. Wear proper PPE. Properly label all containers. Spill kits will be utilized in the event of material spillage.	**L**
	Unexploded Ordnance	All personnel will be trained in the hazards of unexploded ordnance. Only UXO trained Tech II and above will escort Non UXO trained personnel in the MRS. At least one UXO Tech II or above will assist the contractor in characterizing trenches. UXO Tech II will visually sweep the work area for UXO. No one is permitted to handle, move or disturb unidentified ordnance. A minimum of two (2) UXO Tech II’s or above will need to positively identify the UXO condition before taking any actions.	**M**
	Severe weather.	Follow the guidelines in the SSHP.	**L**
	Heat stress.	Follow the guidelines in the SSHP.	**L**
	Cold stress.	Follow the guidelines in the SSHP.	**L**
	Insect bites and stings.	Follow the guidelines in the SSHP.	**L**

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
3. Conduct Excavation Operations (continued)	Asbestos	All personnel will notify the site asbestos supervisor of the presence of asbestos. All personnel will follow the Asbestos Management Plan found in the SSHP.	M
	Contact dermatitis from poisonous and irritating plants (poison ivy, poison oak, and poison sumac).	Follow the guidelines in the SSHP.	L
	Use of portable generators.	Review operator manual before use. Check operator's manual for generator grounding requirements, if any. Keep the generator dry and do not use in rain or wet conditions. Dry your hands (if wet) before touching the generator. Use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads (S, ST, SO, STO, SJ, SJO, SJT, SJOT). Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin. Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite. Do not use portable generators in areas with dry grass unless area has been adequately cleared of the grass. A 4-A:40-B:C fire extinguisher shall be readily available in locations where a generator is being used. Use hearing protection when working near a generator. Use proper lifting procedures when moving portable generators. Do not use indoors or in areas with poor ventilation without performing air monitoring for carbon monoxide. A GFCI Circuit protector will always be used between the generator and the power cord.	L

<table>
<tr><th>Equipment to be Used</th><th>Training Requirements/Competent or Qualified Personnel Name(s)</th><th>Inspection Requirements</th></tr>
<tr><td><u>Personal Protective Equipment</u>

• Hard Hat
• Safety Glasses with side shields
• Safety-Toed Boots
• Work Gloves
• Class 2 high visibility vests
• Hearing protection, as necessary
• Face-shield – disconnecting hoses, when pressure testing pipe, or working with high pressure fluids
• Welding and cutting PPE - refer to SSHP.
• Fall protection - working at heights > 6’ Electrical PPE (NFPA 70E, 2012)

<u>Other Equipment</u>:

• Air monitoring instruments
• Noise dosimeter
• Fire Extinguishers
• First Aid Kit
• GFCI
• Heavy duty extension cords (S, ST, SO, STO, SJ, SJO, SJT, SJOT)
• Drinking water
• Weather radio
• Caution tape
• Excavation perimeter protection
• Tag lines
• Insect repellant with DEET (Deep Woods Off™ or equivalent) Repel Permanone™</td><td>Competent Person (CP) / Qualified Person (QP):

CP/SSHO_________________________________

Alternate CP/SSHO ________________________

QP/First Aid and CPR_______________________

QP/First Aid and CPR_______________________

Training Requirements (as determined by the SSHO):

• Site safety orientation
• Emergency procedures
• Hazard communication
• Hearing conservation
• MEC awareness
• Applicable AHAs
• Qualified equipment operators
• Lifting/back safety
• Fall protection
• Fire extinguisher use
• Biological hazard identification and control
• Tornado shelter location
• Lightning safety procedures
• Heat stress prevention and heat stroke treatment
• Cold stress prevention</td><td>Daily site safety inspection (SSHO)

Daily site safety inspection:

• Mechanized equipment (U.S. Army Corps of Engineers form prior to use)
• Mechanized equipment (daily)
• Overhead utilities (prior to operating equipment in area) Locate underground utilities (prior to intrusive activities)
• Excavation inspection (daily) Housekeeping (daily)
• Fall protection (before each use)
• Fire extinguisher (monthly)
• Vehicle inspection (daily)
• Equipment and tools inspection (daily and before use)
• Survey areas for poisonous plants, insects, and animals (each work area)
• Check body for ticks (each evening during tick season) Identify closest usable tornado shelter that is available (each work area)
• UXO sweep (prior to excavation of trenches, prior to moving excavation equipment)</td></tr>
</table>

ATTACHMENT D3
SAFETY PERSONNEL
PROOF OF TRAINING AND
COMPETENCY AND CERTIFICATIONS OF EMPLOYEE MEDICAL SURVEILLANCE PROGRAM PARTICIPATION

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Personnel Proof of Training and Competency and Certifications of Employee Medical Surveillance Program Participation to be provided to the COR and USACE Project PM prior to the commencement of field operations for their review and approval.

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ATTACHMENT D4
CONTAMINANTS OF INTEREST AND POTENTIAL ACUTE HEALTH EFFECTS

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Contaminant of Interest (CAS Number)	Highest Observed Concentration (air, soil, water)	Published Exposure Limits for 2016			Ionization Potential (eV)	Potential Acute Health Effects
		TLV/PEL	STEL/C	IDLH		
Explosives						
1,3,5-Trinitrobenzene (1,3,5-TNB) (99-35-4)		None available				
1,3-Dinitrobenzene (1,3-DNB) (99-65-0)		0.15/1 mg/m^3		50 mg/m^3	10.43	Bad taste, burning mouth, visual disturbances, anoxia
2,4,6-Trinitrotoluene (2,4,6-TNT) (118-96-7)		0.1/1.5 mg/m^3 Skin		500 mg/m^3	10.59	Irritant to skin, sneezing and coughing.
2,4-Dinitrotoluene (2,4-DNT) (121-14-2)		None available				
2,6-Dinitrotoluene (2,6-DNT) (606-20-2)		None available				
2-Amino-4,6-dinitrotoluene (2-Am-DNT) (35572-78-2)		None available				
2-Nitrotoluene (2-NT) (88-72-2)		5ppm/ 2ppm		200 ppm	9.43	Headache, lassitude, dizziness
3-Nitrotoluene (3-NT) (99-08-1)		5ppm/ 2ppm		200 ppm	9.48	Headache, lassitude, dizziness
4-Amino-2,6-dinitrotoluene (4-Am-DNT) (19406-51-0)		None available				
4-Nitrotoluene (4-NT) (99-99-0)		5ppm/ 2ppm		200 ppm	9.5	Headache, lassitude, dizziness
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) (2691-41-0)		None available				
Nitrobenzene (NB) (98-95-3)		1 ppm		200	9.96	Irritant to eyes, skin and mucous membranes.
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) (121-82-4)		0.5 mg/m^3				Irritant to eyes, skin and mucous membranes, nausea.
Methyl-2,4,6-trinitrophenylnitramine (tetryl) (479-45-8)		1.5 mg/m^3 Skin		750 mg/m^3		Skin, eyes and respiratory. Sensitization dermatitis.

CAS – Chemical Abstract Service
eV – electron volt
IDHL - immediately dangerous to life and health
mg/m^3 – milligrams per cubic meter
N/A – not applicable
PEL – permissible exposure limit
ppm – parts per million
STEL – short-term exposure limit
TLV – threshold limit value

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APPENDIX E

ENVIRONMENTAL PROTECTION PLAN

APPENDIX E
ENVIRONMENTAL PROTECTION PLAN

TIME CRITICAL REMOVAL ACTION (TCRA)
SPECIFIC AREAS WITHIN THE NORTHWEST PENINSULA
CULEBRA ISLAND, PUERTO RICO

DERP-FUDS Project No. I02PR006816

Contract No. W912DY-10-D-0023
Task Order No. 0022

Prepared for:

U.S. Army Engineering and Support Center, Huntsville

Prepared by:

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Reston, VA 20190

November 2016

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulation
DERP	Defense Environmental Restoration Program
DGM	digital geophysical mapping
DNER	Department of Natural and Environmental Resources
°F	degrees Fahrenheit
EPP	Environmental Protection Plan
ESA	Endangered Species Act
FUDS	Formerly Used Defense Site
HGL	HydroGeoLogic, Inc.
IAW	in accordance with
IDW	investigation derived waste
LE	Federally-listed Endangered
LT	Federally-listed Threatened
m	Meter
MEC	Munitions and explosives of concern
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWP	Northwest Peninsula
NWR	National Wildlife Refuge
OE	ordnance and explosives
OSHA	Occupational Safety and Health Administration
PM	project manager
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
SOP	standard operating procedure
SUXOS	Senior UXO Supervisor
TCRA	Time Critical Removal Action

USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USC	U.S. Code
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
UXOSO	UXO Safety Officer

1.0 ENVIRONMENTAL PROTECTION PLAN

1.0.1 This Environmental Protection Plan (EPP) describes the approach, methods, and operational procedures that will be employed to protect the natural environment during performance of all Time Critical Removal Action (TCRA) field tasks. The EPP has been developed to document site-specific environmental conditions on the Northwest Peninsula (NWP) of Culebra Island, Puerto Rico, specifically within portions of Carlos Rosario Beach, Flamenco Beach, Tamarindo Beach, the Flamenco Campground, and the Carlos Rosario Trail and adjacent areas. The EPP addresses the potential impacts that the proposed actions may have on the surrounding environment and suggests measures to be implemented during the proposed actions to protect identified environmentally sensitive areas.

1.1 PLAN OBJECTIVES

1.1.1 The plan also identifies environmental management controls that will prevent and/or decrease the environmental impact in and around the project location. The objectives of this plan are to:

- Define methods and procedures to minimize the polluting of air, water, and land resources;
- Protect identified, environmentally sensitive cultural and/or historical resources; and
- Execute TCRA field activities in the project work area in accordance with (IAW) all applicable federal, state, and local regulations.

1.2 POLLUTION MINIMIZATION METHODS

1.2.1 Based on the nature of the site work to be conducted, HydroGeoLogic, Inc. (HGL) anticipates minimal environmental impact to land, air, or water. Environmental impacts may include some removal of native vegetation (with the potential for associated slight, localized increases in storm water runoff), potential disturbance of sensitive species and/or habitats (e.g., turtle nesting sites) during MEC removal operations, and possible blast and fragmentation impacts resulting from on- site detonation of MEC. Hand-dug excavations will be on a very limited scale, not requiring runoff controls. Other than during the possible disposal of an unexploded ordnance (UXO) item by detonation, noise is not anticipated to be a concern. If HGL team personnel recognize an increase in pollution potential, the work will be stopped temporarily, and the HGL and the U.S. Army Engineering and Support Center, Huntsville (USAESCH) project manager (PM) will evaluate the situation, coordinate with the U.S. Fish and Wildlife Service (USFWS) and the Puerto Rico Department of Natural and Environmental Resources (DNER), and take the appropriate steps to mitigate environmental impacts.

1.3 INITIAL ENVIRONMENTAL SURVEY

1.3.1 Prior to beginning site activities, the Senior UXO Supervisor (SUXOS), UXO Safety Officer (UXOSO) and Project Biologist, along with representatives of DNER and USFWS and the U.S. Army Corps of Engineers (USACE) Ordnance and Explosives (OE) Safety Specialist, will conduct a joint environmental survey, and develop a layout plan of the operating area to document conditions of areas in and adjacent to the site of the work, storage areas, and access routes. The following items shall also be identified on the layout plan: wetlands endangered and protected species or habitats, and cultural or historical resource areas.

1.3.2 During the initial environmental survey and beach monitoring, photographs of the site and the surrounding area will be taken to document conditions prior to work activities. This includes taking generally representative photographs of the site and photographs of areas that will have vegetation removal and MEC intrusive investigation. The Project Biologist will prepare Daily Biologist Survey reports that document site conditions and potential environmental impacts (e.g., turtle activity). The Project Biologist will also train field personnel before intrusive activities regarding the importance of endangered species, in particular the status of sea turtles at this location, the potential penalties associated with violations, and measures for crawl and nest identification.

1.4 IDENTIFICATION AND LOCATION OF KNOWN NATURAL RESOURCES

1.4.1 A discussion of the existing environmental conditions and natural resources believed to be present at the NWP is presented in the following sections.

1.4.1 Federally or State Threatened or Endangered Plant and Animal Species

1.4.1.1 Current information regarding endangered, threatened, and protected species was compiled for Culebra Island Puerto Rico, using the National Oceanic and Atmospheric Administration (NOAA) and USFWS Endangered Species Act (ESA) lists for Puerto Rico (NOAA, 2016; USFWS, 2016. The information provided includes 23 animal species (7 birds, 5 amphibians, 10 reptiles and 1 mammal) and 50 plant species that potentially occur in habitats similar to those on the NWP.

1.4.1.2 The federal-listed threatened or endangered animal and plant species potentially occurring within the project area are presented in Tables 1.1 and 1.2. Status of the species is shown in both tables as either Threatened (LT) or Endangered (LE) with protection under the ESA.

1.4.1.3 The USACE document Standard Operating Procedures for Endangered Species Conservation and their Habitat on *Defense Environmental Restoration Program (DERP) Formerly Used Defense Site (FUDS) Project No. I02PR006802.Culebra, Puerto Rico* (Appendix I) provides a series of standard operating procedures (SOPs) to avoid or minimize impacts to threatened and endangered species during DERP-FUDS work at locations on Culebra Island and in surrounding waters that serve as habitat for these species. These SOPs "are IAW on-going communication with staff from the USFWS, the National Marine Fisheries Service (NMFS) and the Puerto Rico DNER, as well as pursuant to the Interim Guidelines provided by USFWS to work on lands of Culebra National Wildlife Refuge (NWR), with the USACE Regulations and Environmental Operating Principles". Species specifically referenced in the SOP include the endangered hawksbill (Eretmochelys imbricata) and leatherback (Dermochelys coriacea) sea turtles, the threatened green sea turtle (Chelonia mydas) and its designated critical habitat three nautical miles around Culebra and its surrounding islands and cays, the threatened elkhorn (Acropora palmata) and staghorn corals (Acropora cervicornis), the West Indian manatee

(Trichechus manatus), and avian species. Threatened and endangered sea turtle species are shown in Figure 1.1.

Table 1.1
Threatened and Endangered Terrestrial and Amphibious Animal Species, Culebra Island, Puerto Rico

Species	Common Name	Category	Status
Anolis roosevelti	Anole, Culebra Island giant Entire	Amphibian	LE
Agelaius xanthomus	Blackbird, yellow-shouldered Entire	Bird	LE
Epicrates monensis	Boa, Mona Entire	Reptile	LT
Epicrates inornatus	Boa, Puerto Rican Entire	Reptile	LE
Epicrates monensis granti	Boa, Virgin Islands tree Entire	Reptile	LE
Eleutherodactylus jasperi	Coqui, golden Entire	Amphibian	LT
Eleutherodactylus juanariveroi	Coqui, Llanero Entire	Amphibian	LE
Sphaerodactylus micropithecus	Gecko, Monito Entire	Reptile	LE
Eleutherodactylus cooki	Guajon Entire	Amphibian	LT
Buteo platypterus brunnescens	Hawk, Puerto Rican broad-winged Entire	Bird	LE
Accipiter striatus venator	Hawk, Puerto Rican sharp-shinned Entire	Bird	LE
Cyclura stejnegeri	Iguana, Mona ground Entire	Reptile	LT
Trichechus manatus	Manatee, West Indian Entire	Mammal	LE
Caprimulgus noctitherus	Nightjar, Puerto Rican Entire	Bird	LE
Amazona vittata	Parrot, Puerto Rican Entire	Bird	LE
Chelonia mydas	Sea Turtle, Green	Reptile	LT
Eretmochelys imbricata	Sea Turtle, Hawksbill	Reptile	LE
Lepidochelys kempii	Sea Turtle, Kemp's Ridley	Reptile	LE
Dermochelys coriacea	Sea Turtle, Leatherback	Reptile	LE
Caretta	Sea Turtle, Loggerhead	Reptile	LT
Sterna dougallii	Tern, roseate	Bird	LT
Peltophryne lemur	Toad, Puerto Rican crested	Amphibian	LT
Setophaga angelae	Warbler, elfin-woods	Bird	LT

Note - Some species listed (e.g., the Monito gecko, the Mona ground iguana) are found on Culebra, and thus not potentially occurring within the project area.

1.4.1.4 The document provides information on the nesting habits and nesting seasons for the *endangered* hawksbill and leatherback sea turtles and the *threatened* green sea turtle and proscribes specific measures to be taken to avoid or minimize possible impacts resulting from munitions clearance and detonation activities, specifically addressing vegetation removal, beach monitoring for turtle nesting activities, and designation of beach zones based on sea turtle nesting data, and site inspections to ensure sea turtle nest protection during vegetation removal and munitions detonation activities.

1.4.1.5 The document also includes Vessel Strike Avoidance Measures and Reporting for NMFS protected species, specifically addressing recommended training in identification of protected species, vessel strike avoidance procedures, and reporting requirements for injured or dead protected species.

Table 1.2
Threatened and Endangered Plant Species, Culebra Island, Puerto Rico

Species	Common Name	Status
Trichilia triacantha	Bariaco	LE
Buxus vahlii	Vahl's Boxwood	LE
Callicarpa ampla	Capa rosa	LE
Harrisia portoricensis	Higo Chumbo	LT
Pleodendron macranthum	Chupacallos	LE
Stahlia monosperma	Cobana negra	LT
Solanum drymophilum	Erubia	LE
Cyathea dryopteroides	Fern, Elfin tree	LE
Goetzea elegans	Beautiful Goetzea	LE
Crescentia portoricensis	Higuero de sierra	LE
Ilex cookii	Cook's Holly	LE
Calyptronoma rivalis	Palma de Manaca	LT
Adiantum vivesii	No common name	LE
Aristida Chaseae	No common name	LE
Auerodendron pauciflorum	No common name	LE
Catesbaea Melanocarpa	No common name	LE
Chamaecrista glandulosa var. mirabilis	No common name	LE
Cordia bellonis	No common name	LE
Cranichis ricartii	No common name	LE
Daphnopsis hellerana	No common name	LE
Elaphoglossum serpens	No common name	LE
Eugenia woodburyana	No common name	LE
Gesneria pauciflora	No common name	LT
Gonocalyx concolor	No common name	LE
Ilex sintenisii	No common name	LE
Lepanthes eltoroensis	No common name	LE
Leptocereus grantianus	No common name	LE
Lyonia truncata var. proctorii	No common name	LE
Mitracarpus maxwelliae	No common name	LE
Mitracarpus polycladus	No common name	LE
Myrcia paganii	No common name	LE
Polystichum calderonense	No common name	LE
Schoepfia arenaria	No common name	LT
Tectaria estremerana	No common name	LE
Ternstroemia subsessilis	No common name	LE
Thelypteris inabonensis	No common name	LE
Thelypteris verecunda	No common name	LE
Thelypteris yaucoensis	No common name	LE
Varronia rupicola	No common name	LT
Vernonia proctorii	No common name	LE
Ternstroemia luquillensis	Palo colorado	LE
Styrax portoricensis	Palo de jazmin	LE
Cornutia obovata	Palo de nigua	LE
Banara vanderbiltii	Palo de ramon	LE
Ottoschulzia rhodoxylon	Palo de rosa	LE
Aristida portoricensis	Pelos del diablo	LE
Peperomia wheeleri	Wheeler's Peperomia	LE
Zanthoxylum thomasianum	St. Thomas Prickly-ash	LE
Eugenia haematocarpa	Uvillo	LE
Juglans hamaicensis	West Indian Walnut (Nogal)	LE

Note - Some species listed (e.g., Higo Chumbo) are found on Culebra, and thus not potentially occurring within the project area.

1.5 PROTECTION OF NATURAL RESOURCES

1.5.0.1 Field activities outlined in this work plan will be conducted in a manner to minimize impacts to the natural resources listed in Section 1.4. All intrusive activities, including vegetation removal and MEC intrusive investigation, will be conducted to meet the requirements specified for Zones 1-3 in the Standard Operation Procedure for Endangered Species Conservation, USACE, Jacksonville District.

1.5.1 Beach Monitoring

1.5.1.1 The Project Biologist will begin beach surveys 75 days before vegetation removal tasks. A fully qualified and independent Project Biologist will conduct beach monitoring surveys on Culebra before clearance activities begin, including vegetation removal and removal of UXO. The biologist's qualifications will be submitted in advance to the contracting officer and the USFWS for approval. All beach clearance activities, including vegetation removal and removal or detonation of munitions and explosives of concern (MEC), will be closely coordinated with USFWS. The biologist will perform morning daily beach surveys before and during the nesting season and before crews begin daily activities, to determine whether sea turtle nesting has occurred and to ensure that activities may be accommodated in a window of time when no nests are present.

1.5.1.2 If sea turtle nests are found on beaches being cleared of MEC, the biologist, the SUXOS, and/or monitoring personnel will communicate daily with the USFWS Boqueron Endangered Species Specialist and the Culebra Islands NWR Manager as to whether new nests have been located, and if so, their locations within the work area. If agreed upon by USFWS, nest locations will be clearly marked to ensure clearance personnel avoid nests and no clearance activities will take place in the area until the hatchlings emerge and vacate the nest. Otherwise, nests will be relocated to a safe beach within 6-12 hours following nesting. The relocation program will be carried out by the biologist and experienced personnel with the required DNER endangered species permits. This approach has been used by DNER personnel on Vieques from 1990-2000 to protect sea turtle nests from military operations with a hatching success of relocated nests of over 80%.

1.5.1.3 The Project Biologist will train beach clearance crews before beginning vegetation removal, digital geophysical mapping (DGM), and MEC clearance activities regarding the importance of endangered species, in particular the status of sea turtles at this location, the potential penalties associated with violations of the ESA, measures for crawl and nest identification, and sea turtle biology.

1.5.2 Designation of Beach Zones for Vegetation Removal and Munitions Detonation

1.5.2.1 The Project Biologist will establish three work zones based on sea turtle nesting data and site inspections to ensure sea turtle nest protection during vegetation removal, anomaly investigations, and munitions detonation activities. The zones will be designated based on number of nests; restrictions within the zones, etc. will be developed in coordination with the USFWS to be specific to the site. The biologist will obtain specific nesting data for the beach areas planned for work. The HGL team understands that this data can be obtained from the

USFWS Ecological Services Office in Cabo Rojo or the DNER office on Culebra or Fajardo. The proposed work zones and supporting rationales are described in Table 1.3.

1.5.2.2 The document *Standard Operating Procedures for Endangered Species Conservation and their Habitat on DERP-FUDS Project No. I02PR006802.Culebra, Puerto Rico* (Appendix I) also includes the decision tree (provided as Figure 1.2) that applies to ground-intrusive beach work in Zones 2 and 3. Minor discrepancies exist between this EPP and the decision tree regarding required beach monitoring times prior to ground intrusive activities and the protective radius around nests. The HGL team will follow the more restrictive requirements of the EPP in all cases.

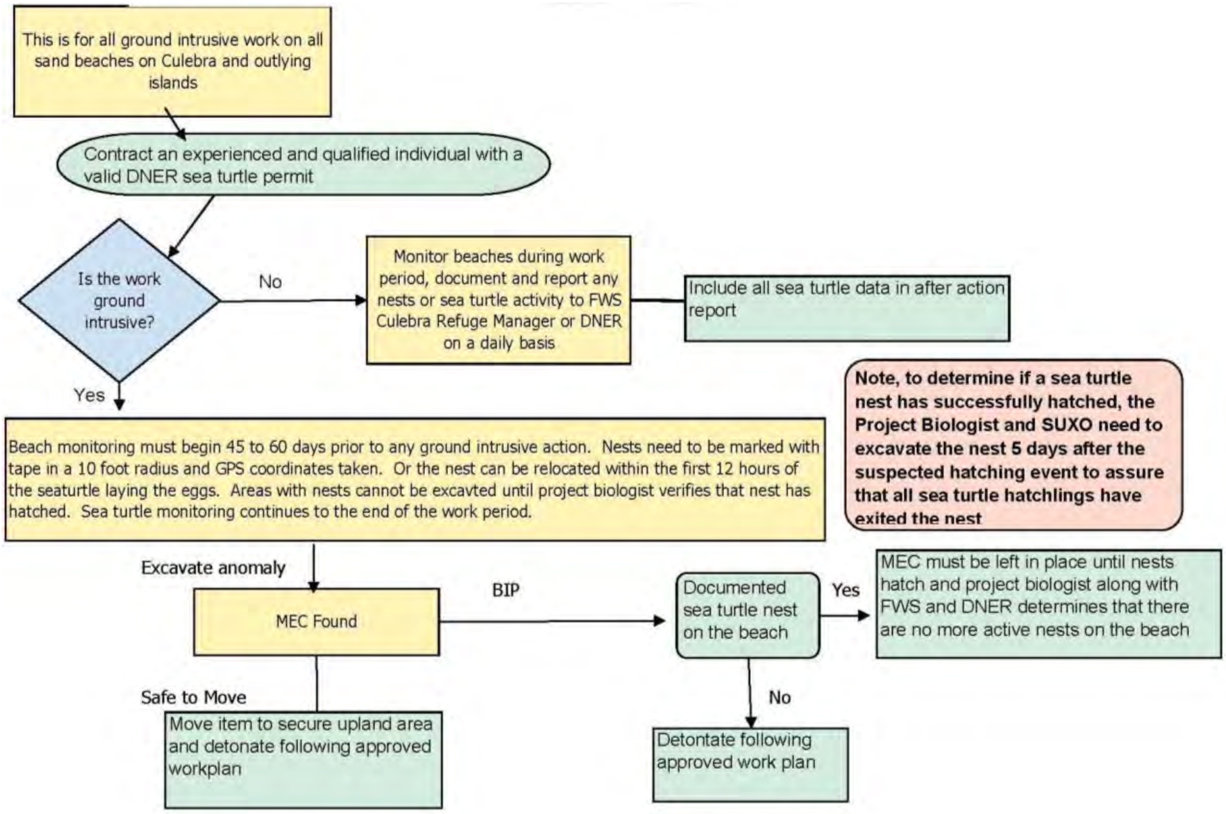
Table 1.3
Work Zones for Endangered Species Conservation

Zone	Restriction
Zone 1	No restrictions because sea turtle nesting is not expected within the area (rocky shore, no sand, etc.)
Zone 2	Minor restrictions because of low historical sea turtle nesting events. Driving on the beach will not occur. If no nests are found, cutting of trees smaller than 3 inches in diameter may occur. Manual cutting using machetes is the preferred alternative to allow for re-growth. If power tools such as chain saws are required, the USFWS recommended pruning low branches instead of removing the trees (except for mesquite trees). Both techniques would allow for re-growth of suitable habitat. Mechanized removal of vegetation using mowers or vehicles will not be conducted near beach areas. When nests are found, a protection or exclusion zone of 8 meters (m) will be established with flagging tape. Vegetation removal outside of the exclusion zone may occur if conducted manually. Vegetation removal within the nest area will be postponed until five days after hatching is documented, unless UXO is found in the vicinity of the nest. Vegetation removal within the hawksbill sea turtle nesting habitat will not occur from June to mid-December (peak of the nesting season). Hawksbill sea turtle nesting habitat varies from 10 m to 25 m from the edge of the woody vegetation.
Zone 3	Major restrictions because four or more historical sea turtle nesting events have occurred within the zone. Zone 3 beaches will be surveyed every morning by a qualified biologist using pedestrian surveys beginning 75 days before the scheduled start date of the project and until ordnance or vegetation removal actions are completed. Minimizing the amount of woody vegetation, such as sea grape, would help minimize impacts to nesting hawksbill sea turtles. The rest of the conditions are the same as Zone 2. When no nests are found on Zone 3 beaches, vegetation cutting may be conducted outside of the peak nesting season of the hawksbill sea turtle. A protection zone of 10 m (measured landward from the edge of the woody vegetation) should be established to protect leatherback and green sea turtle nesting habitat. If leatherback and/or green sea turtle nests are left in place, vegetation removal activities will not occur within 10 m of the landward edge of the nest track. If nests are left in place, the preferred alternative for cutting the vegetation is hand cutting using machetes or power tools.

Figure 1.1
Threatened and Endangered Sea Turtles

Green Sea Turtle	Hawksbill Sea Turtle
	
Kemps Ridley Sea Turtle	**Leatherback Sea Turtle**
	
Loggerhead Sea Turtle	
	

Figure 1.2
Sea Turtle Conservation Measures for Ground Intrusive Beach Work



1.5.3 Wetlands

1.5.3.1 Wetlands are saturated areas where water is present all the time or for varying periods of time during the year. Wetlands provide habitat for waterfowl, fish, other terrestrial and aquatic animals, and a wide variety of plant life. Wetlands also provide resting and feeding places on migration routes, as well as food, shelter, breeding areas, and nurseries for many species. Wetlands protection is mandated by Executive Order 11990.

1.5.3.2 No on-site wetlands are expected to be impacted by the project. If wetlands are to be impacted, the USFWS Refuge Manager will be contacted and mitigation measures will be taken to reduce the impact on the wetland ecosystem.

1.5.4 Water Resources

1.5.4.1 Water resources and floodplain protection is mandated by Executive Order 11988. Based on available aerial photography, no water resources appear to be located within the project area, except for the Caribbean Sea to the north, south, west, and east and several lagoons spread along the coast. No inland water resources are expected to be impacted by the project. Storm water impacts to surface water are not anticipated and are unlikely primarily because excavations will be hand-dug and very limited, creating minimal disturbance.

1.5.5 Coastal Zones

1.5.5.1 Beach areas of varying widths and lengths exist along the coastal zones of the NWP. DGM and intrusive investigations will be performed in selected areas. The HGL team will perform some vegetation clearance and DGM on access routes to these beaches, which will impact the areas landward of the shoreline.

1.5.6 Trees and Shrubs

1.5.6.1 The Project Biologist will be on site and approve any vegetation that is required to be trimmed to allow DGM of the beach areas. In the Flamenco Campground area, all vegetation removal will also be coordinated with the Authority of Conservation and Development of Culebra. It is anticipated that DGM may require trimming of shrubs, undergrowth, and small trees within the project area. Following approval, vegetation clearance will consist of hand clearing to the extent necessary to facilitate investigation operations. The removal of trees will be avoided. If it is decided that a tree must be removed, advance justification will be provided to the Commonwealth, USFWS or DNER. The Commonwealth, USFWS or DNER must then provide ***written*** permission before the field crew can remove the tree. Because of the limited vegetation removal activities planned in the MRS, no tree or shrub restoration is planned after clearance activities are completed.

1.5.7 Cultural or Historical Resources

1.5.7.1 Past investigations at the site do not indicate the presence of any cultural or archaeological resources. Because of the nature of the proposed work, any cultural or archaeological resources that may exist within the project area are not expected to be impacted. If any cultural or archaeological materials or resources are discovered within the project area, the SUXOS will immediately report the find to the on-site USACE OE Safety Specialist so a qualified archaeologist can be notified, and will provide guidance on performing further work in the area. Site work will be suspended and will resume only after obtaining approval from USAESCH. Cultural and archaeological issues will be addressed by contacting the State Historic Preservation Office at 787-721-3737. All personnel will receive a review/training of potential archeological items that may be present to assist with identifying items if encountered.

1.5.8 Existing Waste Disposal Sites

1.5.8.1 There are no known existing waste disposal sites within the project area. However, discarded glass and metal could represent a safety hazard to field team members. If a waste site is identified, field crews will avoid all such sites and notify the site manager. Site avoidance may consist of adjusting the survey area boundaries or working around existing waste disposal sites within the clearance area.

1.5.9 Compliance with ARARs

1.5.9.1 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) response actions are exempted by law from the requirement to obtain federal, state, or local permits related to any activities conducted completely on site. It is the policy of the U.S.

Environmental Protection Agency (USEPA) and the Department of the Army to ensure that all activities conducted on site are protective of human health and the environment; however, this does not eliminate the requirement to meet (or waive) the substantive provisions of permitting regulations that are applicable or relevant and appropriate requirements (ARARs). The primary laws and regulations that may apply to actions planned for this project are listed below:

- 40 Code of Federal Regulation (CFR) 264, Resource Conservation and Recovery Act (RCRA): Subpart M (Military Munitions Rule)
- 40 CFR 264, RCRA: Subpart X
- 40 CFR 264.601: Environmental Performance Standard
- 33 U.S. Code (USC) 1251, et seq.: Clean Water Act
- 33 USC 403: Rivers and Harbors Act of 1899
- 16 USC 1536(a)(2) and (c); 16 USC 1538(a)(1); 50 CFR 402.01 and .04: ESA of 1973
- 16 USC 703, et seq. and 50 CFR 20-21: Migratory Bird Treaty Act
- 16 USC 460: National Historic Preservation Act of 1966
- 16 USC 470: Archeological Resources Protection Act
- Executive Order 11990: Protection of Wetlands

1.5.9.2 This list is subject to modification if additional ARARs are encountered and discussed. The evaluation of the ARARs is an iterative process to be performed throughout the life of the project.

1.5.10 Sensitive Environments

The main island of Puerto Rico and its associated islands support more than 73 federally listed threatened and endangered species (between terrestrial and marine organisms). Among this diverse group of fauna and flora are multiple species, such as migratory birds, that are known to exist, potentially exist, or temporarily use areas within the Culebra Islands. Of the 70 federally listed species, nine species are known or are suspected to occupy Culebra Island and/or the associated cays. In addition to the federally listed species, 13 state-listed species are known to occupy Culebra Island and/or the associated cays. The federally listed species of most concern for the wildlife refuge are the Culebra Island giant anole, Virgin Islands tree boa, roseate tern, green sea turtle, hawksbill sea turtle, leatherback sea turtle, loggerhead sea turtle, Leptocereus grantianus (cactus), and Wheeler’s peperomia.

According to the NWR System, portions of Culebra Island are considered NWR area. Vegetation ranges from moderate to extremely dense.

According to the DNER, the conservation priority areas within the Southern Portion of NWP are as follows:

- All the lagoons
- All beaches
- The designated critical habitat area for the Virgin Islands Boa
- Flamenco Peninsula

1.6 SITE-SPECIFIC MITIGATION MEASURES

1.6.1 Waste Disposal

1.6.0.1 All waste generated will be properly characterized and disposed of IAW all applicable regulations and through approved channels. It is expected that only uncontaminated trash will be generated as a result of this project.

1.6.1.1 Nonhazardous Wastes

6.6.1.1.1 Environmental sampling may generate several waste streams requiring disposal. Investigation derived waste (IDW) may include personal protective equipment (PPE), solid waste, and decontamination water. In addition, scrap metal may be generated as a result of the investigation of metallic geophysical anomalies. Based on the nature of the site and existing data, it is expected that only nonhazardous IDW will be generated during the field sampling event. Nonhazardous IDW such as decontamination fluids from washing and rinsing sampling equipment will be collected and properly disposed of. It is expected that solid IDW (for example, rubber gloves and other plastics) will be collected separately in trash bags and disposed of as municipal solid waste.

1.6.1.2 Hazardous Wastes

6.6.1.2.1 The HGL team does not anticipate generating contaminated or hazardous wastes during the execution of the project; however, if hazardous wastes are generated they will be disposed of IAW with the procedures described in the following sections.

1.6.1.3 Packaging, Labeling, Storage, and Disposal

6.6.1.3.1 All hazardous materials will be stored in authorized containers and labeled IAW applicable regulations. Any waste generated by the HGL team will be collected, stored, and labeled IAW applicable regulations.

1.6.1.4 Manifesting and Transporting Wastes

6.6.1.4.1 The HGL team does not anticipate there will be any hazardous wastes that will need to be manifested or transported. However, in the unlikely event that hazardous materials and wastes are generated, they will be manifested and transported IAW applicable U.S. Department of Transportation (USDOT) and USEPA regulations.

1.6.1.5 Compliance with USDOT Shipping Regulations

6.6.1.5.1 Transportation of all wastes and materials will be conducted IAW applicable USDOT regulations, including use of labels and placards, and documentation of transportation.

1.6.2 Security of Hazardous Materials

6.6.2.1 HGL personnel will provide security during working hours for the work area. Hazardous materials, such as cleaning agents, oil, insect repellents, etc. will be securely stored during working hours.

1.6.3 Burning Activities

1.6.3.1 No burning activities are planned for this project.

1.6.4 Dust and Emission Control

1.6.4.1 USEPA has established National Ambient Air Quality Standards pursuant to Sections 109 and 301(a) of the Clean Air Act. These standards, expressed in micrograms per cubic meter, establish safe concentration levels for each criteria pollutant. Standards have been set for six pollutants: particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and lead. The proposed project would result in a minimal amount of air pollution in the form of smoke and fugitive dust emissions. Smoke and fugitive dust emissions may result from support vehicles; however, impact from these operations should not be significant and should not have any long-term environmental impact on air quality.

1.6.5 Noise Control and Prevention

1.6.5.1 It is expected that mechanical equipment (e.g. trucks, chainsaws) will be the primary source of noise on this project. The HGL team will control the noise emissions from this equipment by ensuring that trucks and equipment are properly functioning. Given the distance to any populated structures, it is unlikely that the equipment will create a nuisance noise effect. The Occupational Safety and Health Administration (OSHA) permissible exposure limit for noise is 85 decibels (29 CFR 1910.95). It is considered highly unlikely that this noise level would be reached.

1.6.6 Spill Control and Prevention

1.6.6.1 Spill Potential

1.6.6.1.1 Due to the nature of the operations, the potential for a spill of pollutants during operations is low. The highest probability for a spill will occur during refueling operations of vehicles or equipment (chainsaws). All fueling and maintenance of vehicles will be performed off site at appropriate commercial or private facilities.

1.6.6.2 Spill Control Measures

1.6.6.2.1 All containers of liquid containing petroleum products or other chemicals with potentially hazardous chemical constituents will be carefully managed and kept closed. The containers will be stored away from the main operations to decrease the chances of container damage and chances of spoilage.

1.6.6.2.2 Vehicles will be maintained in good operating condition and left running only when necessary. As indicated earlier all vehicles will be fueled, maintained, and serviced at an off-site location. Routine cleaning or washing of vehicles or equipment will not be permitted on site.

1.6.6.2.3 Safety cans or other approved portable service containers of flammable liquids having a flash point at or below 73 degrees Fahrenheit (°F) will be clearly marked. Drums, barrels, and flammable-liquid containers will be tightly capped.

1.6.6.2.4 When refueling vehicles or equipment, the following measures will be taken to minimize the potential for and impact from any spills:

- A spill pan will be placed beneath the vehicle/equipment fuel inlet during fueling or refueling.
- The operator will not leave the fueling operation, will be present, and will continually monitor the activity throughout the time it takes to complete the operation.
- When the vehicle/equipment is full, the fuel flow will be suspended and the nozzle will be carefully removed from the equipment to ensure no fuel drips from the nozzle.

1.6.6.3 Spill Response

1.6.6.3.1 Any spills originating from small containers (e.g. gasoline cans) will be contained with absorbent materials. The HGL team will arrange for spill kits to be present on site for the immediate cleanup of any petroleum products that may be inadvertently spilled. If fuel or oil spills onto the ground, the following measures will be taken:

- The spill area will be isolated and contained.
- The appropriate emergency response agencies will immediately be notified. A spill of over one gallon is required to be reported to the USAESCH on-site representative. If human health or the environment is threatened, the National Response Center and the state will be notified as soon as possible.
- The liquid and affected soils will be removed and placed into plastic bags. The bags will then be placed into USDOT-approved containers for disposal at a permitted facility.
- Each of the USDOT-approved containers will be labeled to identify the contents.

1.6.7 Storage Areas and Temporary Facilities

1.6.7.1 The HGL team anticipates establishing a temporary field office and storage area to support operations required during this project. Upon project completion, the HGL team will remove all temporary facilities and associated debris from the site.

1.6.8 Access Routes

1.6.8.1 Crews entering and exiting the work sites will use existing roads and easements. Off-road vehicle travel will be minimized; before establishing any off-road routes necessary to gain access to sites, the possible consequences resulting from the channeling of run-off water in ruts will be considered. Additionally, local agencies, USFWS, DNER, and the USACE OE Safety Specialist will be notified and approval from proper authority will be obtained before beginning off-road travel or operations. In such cases, the following measures will be taken to minimize the environmental effects:

- Personnel will remain at the off-road site until investigations are completed for the day. For example, field crews will not start work at an off-road site, leave for a lunch break, and subsequently return to finish the job.
- Any ruts or new roads or tracks created by field activities will be restored. The ruts will be filled in and leveled.
- In a situation where the area is wet and rut damage to the environment is certain, the crews should drive on roads and paths to a point as close to the site as possible, and then walk the remaining distance to the site.

1.6.9 Trees and Shrubs Protection and Restoration

1.6.9.1 Protection of trees and shrubs is described in Section 1.5.6. It is unlikely that any trees will be removed during the MEC Investigation. Therefore, no provisions for tree restoration are required. Brush clearing will be restricted to the minimum necessary to effectively investigate and identify anomalies. Demolition and excavation holes will be backfilled.

1.6.10 Control of Water Run-on and Runoff

1.6.10.1 The HGL team will conduct work associated with this investigation in a manner that prevents the discharge of pollutants into adjacent waterways within and outside of the project area. No excavation or major soil disturbance activities are anticipated during the project tasks. No sediment or erosion control measures are expected to be required during the TCRA. If the need to employ sediment and stormwater control measures arise (based on the size of excavation needed or the potential size of the area to be impacted by a blow-in-place action), measures including the use of silt fences or hay bales will be used to protect nearshore resources.

1.6.11 Decontamination and Disposal of Equipment

1.6.11.1 Nondisposable PPE and equipment will be decontaminated prior to reuse as indicated in Section 1.6.1.

1.6.12 Minimizing Areas of Disturbance

1.6.12.1 All activities associated with this project will be conducted in a manner that will minimize impacts to land resources within and outside the project boundaries. Areas affected by the project will be restored, as practical, to their original condition. Ruts and excavation holes will be backfilled with the native materials removed. No additional fill material will be brought on site. The area of soil that will be disturbed is not anticipated to be above the threshold that requires an erosion and sediment control plan.

1.7 PROCEDURES FOR POST-ACTIVITY CLEANUP

1.7.1 All wastes will be removed from each site immediately upon completion of each day's field activities. Therefore, no post-activity cleanup will be required.

1.8 AIR MONITORING PLAN

1.8.1 Air monitoring is not being performed during this investigation. The HGL team's work procedures are designed to minimize vapors, gases, and particulate emissions. Control of fugitive emissions will involve measures such as watering down dry or barren areas, roadways and soil disturbance areas, and covering spoils piles and stockpiled soil with plastic/tarp. Throughout operations, the UXOSO will monitor the production of dust, which if produced in significant quantities will dictate the donning of protective masks by on-site personnel.

1.9 REFERENCES

National Oceanic and Atmospheric Administration, 2016. Puerto Rico's Threatened and Endangered Species. http://sero.nmfs.noaa.gov/protected_resources/section_7/threatened_endangered/Documents/puerto_rico.pdf. Accessed July 19.

U.S Fish and Wildlife Service, 2016. Threatened and Endangered Species List for Puerto Rico. http://ecos.fws.gov/ecp0/reports/species-listed-by-state-report?state=PR&status=listed. Accessed July 19.

APPENDIX F

FORMS

TABLE OF CONTENTS

Page

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FORM DD 1348: ISSUE RELEASE/RECEIPT DOCUMENT

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PREVIOUS EDITION MAY BE USED

PerFORM (DLA)

1 2 3	4 5 6	7	23 24	25 26 27 28 29	45 46	47 48 49 50	51	52 53	54 55 56	57 58 59	60	61 62	63 64 65	66 67	68 69	70	71	72 73	74 75 76 77 78 79 80
DOC IDENT	RI FROM	M&S	UNIT ISS	QUANTITY	SER	SUPPLEMENTARY ADDRESS	SIG	FUND	DISTRIBUTION	PROJECT	PRI	REQD	DEL DATE	ADV	RI	O/P	COND	MGT	UNIT PRICE (DOLLARS / CTS)

1. TOTAL PRICE (DOLLARS / CTS)

2. SHIP FROM

3. SHIP TO

4. MARK FOR

5. DOC DATE | 6. NMFC | 7. FRT RATE | 8. TYPE CARGO | 9. PS

10. QTY. REC'D | 11.UP | 12. UNIT WEIGHT | 13. UNIT CUBE | 14. UFC | 15. SL

16. FREIGHT CLASSIFICATION NOMENCLATURE

17. ITEM NOMENCLATURE

Munitions Debris - Steel, Brass and Copper,

18. TY CONT | 19. NO CONT | 20. TOTAL WEIGHT | 21. TOTAL CUBE

22. RECEIVED BY | 23. DATE RECEIVED

24. DOCUMENT NUMBER & SUFFIX (30-44)

25. NATIONAL STOCK NO. & ADD (8-22)

26. RIC (4-6)
UI (23-24)
QTY (25-29)
CON CODE (71)
DIST (55-56)
UP (74-80)

27. ADDITIONAL DATA

NOTICE: This form will used when Munitions Debris (MD) and range debris (RD) are processed together.

"This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, are free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials."

DoD Contractor Title: Senior UXO Supervisor (SUXOS)

Print Name ____________________

Signature:____________________
Company: HydroGeoLogic, Inc., Munitions Response Team
Address: 8202 Louisiana Blvd NE, Albuquerque, NM 87113

Telephone #:(505) 341-2010

Container No. HGL-00____________________

Seal No: ____________________

DoD Agency Representative or USACE Ordnance and Explosive Safety Specialist

Print Name:____________________

Signature:____________________

Address: ____________________

Telephone: ____________________

Origin of the Material: (Site Name/City/State:

____

____

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

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FORM 15.05/15.02/15.04: EXPLOSIVES ACCOUNTABILITY FORMS

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HGL HydroGeoLogic, Inc.

Explosive Material Disposition Record – Bill of Lading

Date:	Site Name/Location:	Grid #/Area or GPS coordinate:	Distributee Explosive License #: 1-AL-089-20-7F-00632

This form will be used as a Bill of Lading anytime explosives are transported in a HGL vehicle under DOT regulations and kept with the explosive driver in the vehicle until the explosives are issued, expended or returned to storage.

SECTION I. Explosive Material Issued for Demilitarization/Demolition Operations:

Lot Number/Manufacturer's Marks of Identification	Brand Name, Nomenclature or Description	Quantity	Hazard/ Class	Receipt Initials

Print Explosive Driver Name:	Explosive Driver Signature:

SECTION II. Explosive Material Expended by Detonation:

Lot Number/Manufacturer's Marks of Identification	Brand Name, Nomenclature or Description	Quantity	Hazard/ Class	Receipt Initials

SECTION III. Explosive Material Returned to Storage:

Lot Number/Manufacturer's Marks of Identification	Brand Name, Nomenclature or Description	Quantity	Hazard/ Class	Receipt Initials

Demolition Supervisor Signature:	SUXOS Signature:

HGL MR Form 15.05 (Revised Apr 2012)

Manufacturer of Explosives Record of Acquisition

Site Name/Location:	HGL License Number: 1-AL-089-20-4F-00632
Project Site Activity:	Supervisor's Name/Position:

Date of Manufacture or other Acquisition	Lot Number or Manufacturer's Marks of Identification	Brand Name, Nomenclature or Description and Size (when mixing binary materials)	Quantity Acquired	Name, Address and License or Permit Number of Distributor

HGL MR Form 15.02 (Revised Apr 2014)

Page______of ______.

HGL

Munitions and Explosives of Concern Demilitarization/ Disposal by Detonation Accountability Record

Site Name:	Site Location:	Contract Number:	Delivery/Task Order No:

Anomaly No.	Grid or GPS Coordinates Location	Depth Detected (feet)	Identification/Nomenclature (include DMM, MC, MEC or UXO)	Date Located	Date of Demil/ Disposal	Method of Demil/Disposal	Comments

SUXOS review and acceptance (print name):	SUXOS signature:	Date:

HGL MR Form 15.04 (Apr 2012)

Page _____ of _____.

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FORM 15.14: DAILY QUALITY CONTROL REPORT

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Daily Quality Control Report

Report No.:	Contract No:	Delivery/Task Order:	Date:

Site/Installation Name:	City:	State:	Date:

Weather:
Clear ☐ Fog ☐ Cloudy ☐ Rain ☐ Snow ☐ Windy ☐ ______ mph

Temperature:
Minimum: _____ °F Maximum: _____ °F

Employer:	Position:	Name:	Activity:
	Project Manager		
	Site Manager		
	Senior UXO Supervisor		
	Senior Geophysicist		
	Site Safety and Health Officer		
	UXO Quality Control Specialist		
	UXO Safety Officer		

Team ONE

Team TWO

Team THREE

HGL MR Form 15.14 (Oct 2008)

Page 1 of 3

HGL HydroGeoLogic, Inc.

Daily Quality Control Report

Team FOUR

Team FIVE

1. Work perform today:

2. Worked performed today by subcontractors:

3. Inspections performed (include name of team present, specifications, plans and submittals required for definable feature of work [DFOW]). Indicate 3-Phase inspection level with by inserting: Preparatory = P; Initial = I; Follow-up = F.

Phase	Team name:	DFOW	Comments

		Grid #	Grid #	Grid #	Grid #	Grid #	Grid #

HGL MR Form 15.14 (Oct 2008)

Page 2 of 3

Daily Quality Control Report

GRID INSPECTIONS PERFORM:							
QC inspections completed today:				QA inspections completed to date:			
Pass	Fail	Total		Pass	Fail	Total	Remaining

DFOW:	Team (indicate by: UXO = U; or Geo = G; and No:					Pass	Fail	NA
Proper work attire (PPE)								
Equipment calibration check								
Vehicle condition								
Equipment condition								
Emergency equipment								
Proper grid layout								
Proper search techniques								
Team leader daily log								
SUXOS daily log								
GIS and map data								
Exclusion zone								
Field office interior								
Field office exterior								
Proper demolition operations								
Safety violations								

4. Soil samples taken:

Pre-Detonation: ☐ No ☐ Yes ☐ None required

Post-Detonation: ☐ No ☐ Yes ☐ None required

5. Verbal instructions received by the Government representative or client and actions taken:

6. Non-conformances/deficiencies reported:

7. Site safety monitoring activities performed today :

HGL:	**Subcontractor:**
PPE Level worn:	PPE level worn:
Safety violations observed: ☐ No ☐ Yes	Safety violations obesrved ☐ No ☐ Yes

CERTIFICATION: *I certify the above information is complete and correct and that I, or my representative, have inspected all work identified on this report performed by HGL and our subcontractor(s) and have determined to the best of my knowledge and belief that noted work activities are in compliance with the plans and specifications, except as may be noted above.*

Contractor Quality Control Systems Manager	Signature

HGL MR Form 15.14 (Oct 2008)

Page 3 of 3

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FORM 15.18: SAFETY MEETING / TRAINING ATTENDANCE LOG

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HGL HydroGeoLogic, Inc.

Safety Meeting/Training Attendance Log

Date:		**Time:**		**Conducted by:**	
Site Name/Location:					
Contract Number:			**Delivery/Task Order Number:**		
Project Manager:			**Site Manager** (when applicable):		
(Senior) UXO Supervisor:			**Site Safety Officer/Unexploded Ordnance Safety Health Officer:**		

Training Provided: ☐ Initial Site Hazard ☐ Weekly Safety Training ☐ Daily Safety Meeting ☐ Task/Hazard Specific ☐ Other:

Weather Conditions: ☐ Fair ☐ Poor **Temperature (Low/High):** to °F **Wind speed:** mph **Direction:** **Precipitation:** % **Humidity:** %

I. TRAINING TOPICS COVERED

☐ Planned Site Activities	☐ Heat or Cold Stress	☐ Respirator Use
☐ Demolition Operations	☐ Biological Hazards	☐ Decontamination Procedures
☐ Site Controls	☐ Chemical Hazards	☐ Emergency Procedures/Route
☐ Exclusion Zone/Personnel Limits	☐ Routes of Chemical Exposure	☐ First Aid Procedures
☐ Site Communications	☐ Chemical Exposure Symptoms	☐ Buddy Team Procedures
☐ Physical Hazards	☐ Level/Type of PPE	☐ Other (describe topic(s) below)

Explain: ____

Hospital/Clinic:	**Address:**	**Phone:**

II. SITE PERSONNEL / TRAINING ATTENDEES (Continued on 2nd page)

	Name	Signature	Company
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

III. SAFETYBRIEF / TRAINING VERIFICATION

I certify that the personnel listed on this roster have received the safety and health training described above.

____________________________ ____________________________

Site Manager or Senior UXO Supervisor Site Safety and Health Officer or UXO Safety Officer

HGL MR Form 15.18 (Oct 2010)

Page _____ of _____.

FORM 15.19: TAILGATE SAFETY MEETING LOG

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HGL HydroGeoLogic, Inc.

Tailgate Safety Meeting Log

Date:	Time:	Team No:
Site Name/Location: CSAR and SWPRR, Craig CO		Grid/Location:

1. SAFETY TOPICS DISCUSSED:

- ☐ Site Description
- ☐ Site Controls
- ☐ Personal Protective Equipment
- ☐ Emergency Procedures / Equipment
- ☐ Site Evacuation
- ☐ Physical/Biological Hazards
- ☐ Heat or Cold Stress
- ☐ Communication/Radio Procedure
- ☐ Environmental Concerns/Hazards
- ☐ Emergency Procedures/Route
- ☐ First Aid Procedures
- ☐ Injury Reporting
- ☐ Safe Work Practices
- ☐ Other:
- ☐ Other:
- ☐ Other:

2. TASK OPERATION AND REMARKS:

____

____

3. ATTENDEES:

	Print Name	Signature	Company
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			

Meeting Conducted by:	Signature:

HGL MR Form 15.19 (Nov 2007)

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FORM 15.20: SAFETY INSPECTIONS LOG

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Site Safety Inspection Log

Date:	Time:	Project location (site name, city and state):	Project number:
Lost time accidents (hours):	**Days since last reported injury:**	**Last reportable injury:**	**Total project mileage driven:**

Weather condition/summary: ☐ Sunny ☐ Partly cloudy ☐ Cloudy High temperature°: Low temperature°:

Type of Inspection: ☐ Daily: ☐ Weekly ☐ Monthly ☐ Special ☐ Re-inspection

I. ACTVITY INSPECTED (indicate results by an "X")	SATISFACTORY	UNSATISFACTORY	NOT APPLICABLE
a. Site Mobilization/Demobilization			
b. Surface Sweep Operations			
c. Subsurface Operations			
d. Geophysical Operations			
e. Survey/Vegetation Removal Operations			
f. Heavy Equipment/Earth Moving Machinery			
g. Personal Protection Equipment			
h. Safe Work Practices			
i. Site Controls			
j. First Aid/Medical Equipment			
k. Fire Extinguisher/Fire Fighting Equipment			
l. Demolition Operations			
m. Explosive Storage			
n. Explosive Transportation Procedures			
o. Emergency Procedures			
II. OVERALL INSPECTION RESULTS			

III. COMMENTS:

IV. ACTIONS (indicate results by an "X")	YES	NO	COMMENTS
Work stopped due to safety violations:			
Safety violation noted:			
Personnel involved:			
Corrective measures:			
Re-inspection required:			
Demolitions Operations Conducted:			

V. SITE VISITORS (Name, organization and purpose of visit)

VI. SIGNATURES. I acknowledge that I have been briefed on the results of this inspection and will take corrective actions as necessary.

Recipient (print name/signature)	Site Safety & Health Officer (print name/signature)	SUXOS/Project Manager (print name/signature)

HGL MEC Form 15.20 (Revised Jul 2012)

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FORM 15.21: SITE VISITOR LOG

HGL

Health and Safety Site Visitor Log

Project Name:		Project Number:		Delivery/Task Order:	
Site Name:		Location:			

This form shall be used to track entry into and departure from the ***EXCLUSION ZONE, CONTAMINATION REDUCTION ZONES, OR OTHER WORK ZONES*** on all HydroGeoLogic, Inc. sites. All Personnel shall sign in and out on the form by printing their name, initializing the form and noting the time in/out.

Date	Name	Representing	Purpose of visit	Escort Required		Equipment/ PPE Level	Time	
				Yes	No		In	Out

HGL MR Form 15.21 (Sep 2008)

Page _____ of _____

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FORM 15.26: KEY CONTROL REGISTER AND INVENTORY LOG

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HGL HydroGeoLogic, Inc

Key Control Register and Inventory Log

SITE NAME/LOCATION:	PERIOD COVERED:
Former Conway Bombing and Gunnery Range	FROM: 8/31/15 TO:

KEY CONTROL NUMBER(S)
(Enter serial number or other identifying number from key)

1.	13.	25.	37.
2.	14.	26.	38.
3.	15.	27.	39.
4.	16.	28.	40.
5.	17.	29.	41.
6.	18.	30.	42.
7.	19.	31.	43.
8.	20.	32.	44.
9.	21.	33.	45.
10.	22.	34.	46.
11.	23.	35.	47.
12.	24.	36.	48.

KEY ISSUE AND TURN IN

KEY NUMBER	ISSUED (Date/Time)	ISSUE BY (Printed Name/Signature)	ISSUED TO (Printed Name/Signature)	TURNED IN (Date/Time)	RECEIVED BY (Printed Name/Signature)

Page 1 of 3

HGL HydroGeoLogic, Inc.

Key Control Register and Inventory Log

KEY ISSUE AND TURN IN					
KEY NUMBER	ISSUED (Date/Time)	ISSUE BY (Printed Name/Signature)	ISSUED TO (Printed Name/Signature)	TURNED IN (Date/Time)	RECEIVED BY (Printed Name/Signature)

Page **2** of **3**

HGL HydroGeoLogic, Inc.

Key Control Register and Inventory Log

KEY ISSUE AND TURN IN

KEY NUMBER	ISSUED (Date/Time)	ISSUE BY (Printed Name/Signature)	ISSUED TO (Printed Name/Signature)	TURNED IN (Date/Time)	RECEIVED BY (Printed Name/Signature)

Page **3** of **3**

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FORM 15.27: DAILY REPORT OF MEC-RELATED OPERATIONS

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Site Daily Production Report

Page 1 of 4

Contract No:	Click here to enter	**Date:**	Click here to enter
Delivery Order No:	Click here to enter	**Report No:**	Click here to enter

1. Location of Work: Enter installation/ name, City and State

2. Personnel Summary:

Position/Company	Position/Team Assigned	Name

3. Manpower Summary

Position	Total Positions Assigned	Hours Per Position	Total Hours

HGL MR Form 15.27 (Jul 2010)

Site Daily Production Report

Page 2 of 4

Contract No: Click here to enter **Date:** Click here to enter

Delivery Order No: Click here to enter **Report No:** Click here to enter

Site Manager			
SUXOS			
UXOSO			
UXOQCS			
UXO Technician III			
UXO Technician II			
UXO Technician I			
UXO Sweep Personnel			
Geophysical Personnel			
Subcontractors			

4. Work Summary

Work Activity	Daily Total	Weekly Total	Project Total
Anomalies Dug			
Grids Completed			
Grids QC'd			
Grids QA'd			
Summary of today's work activities:			

5. Inspections:

Inspection	Total Daily		Total Weekly		Total Project	
	Pass	Fail	Pass	Fail	Pass	Fail
Grids QC's						
Grids QA'd						
Safety						

6. Explosive Usage:

Item	Quantity	Comments

HGL MR Form 15.27 (Jul 2010)

Site Daily Production Report

Page 3 of 4

Contract No:	Click here to enter	**Date:**	Click here to enter
Delivery Order No:	Click here to enter	**Report No:**	Click here to enter

7. MEC Summary:

Item	Grid	Classification			Disposition
		UXO	MPPEH	DMM	

8. Non-MEC Scrap (pounds).

Type	Daily Total (lbs)	Weekly Cumulative Total	Project Total
Munitions Debris (MD)			
Cultural Debris (CD)			
Range Related Debris (RRD)			

9. Equipment Usage:

Item Description	Quantity	Hours (each)	Total Hours	Comments (Rent/Own)
Truck, pickup, 4x4				
Suburban, 4x4				
Mini Track Hoe				
Radio, handheld				
Radio, truck mount				
Radio, base station				
Radio, Repeater				
White XLT				
Schonstedt				
Camera, digital				
Range finder				
Lightning detector				
PDA/GPS				
GPS RTK Rover				
First aid kit				
Team gear				
Demo kit				
Site Safety Officer Kit				
Computer, laptop				
Computer, desktop				
Printer/copier/scanner/fax				
Telephone				
Cellular Telephones				

HGL MR Form 15.27 (Jul 2010)

HGL HydroGeoLogic, Inc.

Site Daily Production Report

Page 4 of 4

Contract No:	Click here to enter	**Date:**	Click here to enter
Delivery Order No:	Click here to enter	**Report No:**	Click here to enter

10. Discrepancies.

11. Guidance or Instructions Received From Client.

12. Attachment Summary.

13. Continuation/other.

14. Signature.

CERTIFICATION: I certify the above information is complete and correct and that I, and have determined to the best of my knowledge and belief that noted work activities are in compliance with the plans and specifications, except as may be noted above.	
Site Manager or SUXOS	Signature

HGL MR Form 15.27 (Jul 2010)

FORM 15.28: GRID DRAWING SHEET

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Grid Drawing Sheet

Site Name:	**Site Location** (city/state):	
Grid or Polygon ID:	**Team Number:**	**Date:**

Grid X and Y Dimensions (check the appropriate box):
☐ 30m x 30m ☐ 90ft x 90ft ☒ 100ft x 100ft ☐ 200ft x 200ft ☐ Other _______

Draw in the Grid Box the areas not cleared due to obstacles, terrain, and etcetera. Draw MEC locations and other key data.

N
W E
S

Comments:

HGL MR Form 15.28 (Sep 2010)

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FORM 15.31: TEAM LEADER GRID SHEET

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Team Leader Grid Sheet

Project Site Location (name, city and state):		Team Number:	Date:
Grid or Polygon ID:	Total Anomalies Dug:	Area Completed Yes ☐ No ☐	Percent Complete:

I. MEC items located.

Item	Grid or Poly	Classification DMM	MPPEH	UXO	Comments
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	

II. Non−MEC items located.

Type	Daily Total (pounds)	Comments
Other Debris		
Munitions Debris (MD)		
Range-related Debris (RD)		

III. Comments:

Team Leader (print name):	Signature:

HGL MR Form 15.31 (Jan 2012)

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DAILY QUALITY CONTROL REPORT FOR ENVIRONMENTAL SAMPLING ACTIVITIES

DAILY QUALITY CONTROL REPORT FOR ENVIRONMENTAL SAMPLING ACTIVITIES

Project Name:	TCRA NWP Culebra	**Project Number:**	
Contract No.:	W912DY-10-D-0023	**Project Location:**	Culebra Island, Puerto Rico
Task Order:	0022	**DQCR Date:**	

List all field and quality control samples collected on date of DQCR (list below or provide attachment)

Sample ID Number	Medium	Time	Analyses	Shipment Date	Analytical Laboratory	Comments/Notes
	Soil					

DAILY QUALITY CONTROL REPORT FOR ENVIRONMENTAL SAMPLING ACTIVITIES

Project Name:	**TCRA NWP Culebra**	**Project Number:**	
Contract No.:	**W912DY-10-D-0023**	**Project Location:**	**Culebra Island, Puerto Rico**
Task Order:	**0022**	**DQCR Date:**	

Water Sample Equipment Calibrations (list or provide attachment)

	Calibration Time	Conductivity (µS/cm)	Turbidity (NTU)	Temp. (°C)	pH (s.u.)
Equipment Reading:	n/a	n/a	n/a	n/a	n/a

Field Instrument Measurements (list or provide attachment):

Sample ID Number	Sample Time	Conductivity (µS/cm)	Turbidity (NTU)	Temp. (°C)	pH (s.u.)

Departures from approved Sampling and Analysis Plan (SAP)

Sampling instructions given by Government personnel

Other relevant sampling and analysis details

Attachments (check all that apply)

	Field sampling forms (*in separate submittal*)
	Field-generated analytical results
	Quality assurance sample tables
X	Chain-of-custody (CoC) forms (*in separate submittal*)

Signed by: **Date:**

Name: *Sample Lead, Parsons* **Phone (Cell):**

Copies sent to:

Mr. Derek Anderson (Project Manager, HGL) *Ms. Becky Terry (Project Manager, USAESCH)*

Mr. Scott Schroeder (Dep. PM, HGL) *Mr. Wilberto Cubero (Project Manager, CESAJ)*

Ms. Tommy Cheng (Project Chemist, Parsons) *Ms. Kelly Longberg (Tech. Manager, USAESCH)*

Ms. Patti Berry (TM, Parsons)

EQUIPMENT CALIBRATION LOG

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EQUIPMENT CALIBRATION LOG

Project: Craig Small Arms Range/Sand Wash Rocket Range Contract No.: W9128F-15-D-0023
Team: Team Leader: Delivery Order No.: 0023

Date	Cal. Standard (IVS, test strip etc.)	White Sconstedt MineLab #1		White Sconstedt MineLab #2		White Sconstedt MineLab #3		White Sconstedt MineLab #4		White Sconstedt MineLab #5		White Sconstedt MineLab #6		White Sconstedt MineLab #7		White Sconstedt MineLab #8		
		P/F	Optr	P/F	Optr	P/F	Optr	P/F	Optr	P/F	Optr	P/F	Optr	P/F	Optr	P/F	Optr	
06/01/16	test strip																	
06/02/16	test strip																	
06/03/16	test strip																	
06/04/16	test strip																	
06/05/16	test strip																	
06/06/16	test strip																	
06/07/16	test strip																	
06/08/16	test strip																	
06/09/16	test strip																	
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06/26/16	test strip																	
06/27/16	test strip																	
06/28/16	test strip																	
06/29/16	test strip																	
06/30/16	test strip																	

Equipment Serial Numbers: Instrument 1: ____________________ Instrument 2: ____________________

Instrument 3: ____________________ Instrument 4: ____________________ Instrument 5: ____________________

Instrument 6: ____________________ Instrument 7: ____________________ Instrument 8: ____________________

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SAMPLES CHAIN OF CUSTODY

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PARSONS

3577 Parkway Lane, Norcross, GA 30092

Chain of Custody Record

Client / Reporting Information	Project Information
Company Name	Project Name:
Address	Street
City State Zip	City State
Project Contact:	Project #
Phone #	EMAIL:
Sampler's Name	Client Purchase Order #

Requested Analysis

Matrix Codes
S - Soil
SD - Sediment
A - Aqueous

Sample ID	Collection Date	Collection Time	Matrix	# of bottles	Ice	HCl	HNO3	H2SO4	NaOH	NaHSO4	MEOH	ENCORE												Comments

(Number of preserved Bottles: Ice, HCl, HNO3, H2SO4, NaOH, NaHSO4, MEOH, ENCORE)

Turnaround Time (Business days)

- ☐ 21-Day (standard)
- ☐ 10 Day
- ☐ 5 Day
- ☐ 2-3 Day

Shipping/Tracking

Carrier: ☐ Fed-Ex ☐ UPS

Waybill # ____________________

Coolers in this shipment: ______

Comments / Remarks

' Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler: 1	Date Time:	Received By: 1	Relinquished By: 2	Date Time:	Received By: 2
Relinquished by: 3	Date Time:	Received By: 3	Relinquished By: 4	Date Time:	Received By: 4
Relinquished by: 5	Date Time:	Received By: 5	Custody Seal #	Appropriate Bottle / Pres. Y / N Labels match COC? Y / N	Headspace Y / N · On Ice Y / N · Cooler Temp. ________oC

White: Laboratory returns with data package *Yellow: Laboratory Copy* *Pink: Sampler Copy*

FIELDWORK VARIANCE REQUEST

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Field Work Variance

PROJECT NO.: DATE: __ VARIANCE NO.: __

PROJECT NAME: __ PAGE _1_ OF __

CONTRACT NO.: _ TASK ORDER NO.: _

PRESENT REQUIREMENTS: REQUESTED BY:

PROPOSED CHANGE:

TECHNICAL JUSTIFICATION:

COST/SCHEDULE IMPACT:

REASON FOR CHANGE: _____ ADDITION ________ DELETION

CHANGE ORDER REQUIRED: _____ NO _____ YES CHANGE ORDER NO. ____

APPLICABLE DOCUMENT:

Final RI/FS Work Plan, Former Southwestern Proving Grounds MRS-3, Hempstead County, Arkansas

cc: Distribution

APPROVED BY ______________________________ DATE ____________

HGL Project Manager

APPROVED BY ______________________________ DATE ____________

HGL Quality Control Manager

APPROVED BY ______________________________ DATE ____________

USACE Contracting Officer's Representative

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THREE-PHASE INSPECTION FORMS

Quality Control Preparatory Phase Checklist

Contract No.: ______________________________ Date: ___________________

Definable Feature of Work: ________________________ Spec. Section: ________________

I. Personnel Present:

Government Rep Notified: (circle) Y / N Hours in advance: ______________

Name Position Company/Government

1. ____
2. ____
3. ____
4. ____
5. ____
6. ____
7. ____

(List additional personnel on reverse side)

II. Submittals

1. Review submittals and/or submittal log. Have all submittals been approved?

   Yes _____ No _____

   If No, what items have not been submitted?

   a. ____

   b. ____

   c. ____

2. Are all materials on hand? Yes _____ No _____

   If No, what items are missing?

   a. ____

   b. ____

   c. ____

3. Check approved submittals against delivered material. (This should be done as material arrives.)

   Comments: ____

III. Material Storage

Are materials stored properly? Yes _____ No _____

If No, what action is taken? ____

____

IV. Specifications

1. Review each paragraph of specifications.

____

____

____

2. Discuss procedures for accomplishing the work.

____

____

____

3. Clarify any differences.

V. Preliminary Work and Permits

Ensure preliminary work is correct and permits are on file.

If not, what action is taken: ____

____

____

VI. Testing

1. Identify test to be performed, frequency, and whom.

____

____

2. When is it required? ____

_____

3. Where is it required? ____

4. Review Testing Plan: ____

____

5. Has the test facility been approved: Yes _____ No _____

If not, what action has been taken?: ________________________________

____

VII. Safety

1. Review applicable portion of EM 385-1-1. ______________________________

   ____

2. Activity Hazard Analysis approved? Yes _____ No _____

VIII. USACE Representative comments during meeting.

____

____

____

____

____
QC Manager / Date

Quality Control Initial Phase Checklist

Contract No.: ______________________ **Date:** ______________

Defineable Feature of Work: ______________________

Reference Contract Drawings: ______________________

A: Planned attendants:

	NAME	POSITION	COMPANY
1.			
2			
3.			
4.			

B. Materials being used are in strict compliance with the contract plans and specifications:
Yes ☐ No ☐ **If not explain:**

C. Procedures and/or work methods witness are in strict compliance with the contract specifications:
Yes ☐ No ☐ **If not explain:**

D. Workmanship is acceptable: Yes ☐ No ☐
State areas where improvement is needed:

E. Safety violation noted: Yes ☐ No ☐
If yes, corrective action taken:

______________________ ______________
Quality Control Representative **Date**

HGL MR Form 15.11 (Jul 2008)

HGL HydroGeoLogic, Inc.

Quality Control Follow-up Inspection Checklist

Contract No.: ______________________ **Date:** ______________

Delivery/Task Order No: ______________ **Project No:** ______________

Project/Area of Inspection: ______________________________

____

A: Definable Feature of Work: | Status of Inspection:

1. ______________ ______________
2. ______________ ______________
3. ______________ ______________
4. ______________ ______________
5. ______________ ______________
6. ______________ ______________

I hereby certify, that to the best of my knowledge and belief, that the work inspected is complete and all materials and equipment used and work performed were completed in accordance with plans submitted and approved.

____

B. Final Acceptance is Approved, Subject to the Correction of the Punchlist Items below:

____

____

____

____

____

C. Persons in Attendance (see meeting attendance sheet attached:

D. Resolution of Punchlist:

____

____

____

____

HGL MR Form 15.12 (Jan 2012) 1

Quality Control
Follow-up Inspection Checklist

Meeting:		Date:
Name	**Organization**	**Phone Number**

HGL MR Form 15.12 (Jan 2012) 2

EXCAVATION/TRENCHING INSPECTION

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HGL HydroGeoLogic, Inc

Excavation/Trenching Inspection

THIS INSPECTION IS TO BE COMPLETED BY THE COMPETENT PERSON EACH DAY THAT EMPLOYEES WILL BE ENTERING AN EXCAVATION.

Project Name:______________________________ Project Number: ________________________

Date:______________ Time:______________ Competent Person: ____________________

Soil Classification (see Soil Classification Worksheet): ______________________________________

Excavation/Trench Depth: ______________ Excavation/Trench Width: _______________

		Yes	No	NA
1.	**GENERAL:**	**Yes**	**No**	**NA**
	Surface encumbrances removed or supported			
	Employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation.			
	Hard hats, steel-toed boots, and safety glasses worn by all employees.			
	Spoils, materials, and equipment set back at least 2 feet from the edge of the excavation.			
	Walkways over excavations 6 feet or more above lower levels are equipped with standard guardrails.			
	Warning vest or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic.			
	Employees required to stand away from vehicles being loaded or unloaded.			
	Warning system established and utilized when mobile equipment is operating near excavation edge.			
	Employees prohibited from going under suspended loads.			
2.	**UTILITIES:**			
	Utility companies contacted and/or utility locations delineated.			
	Underground installations protected, supported, or removed while excavation is open.			
3.	**MEANS OF ACCESS AND EGRESS:**			
	Lateral travel to means of egress no greater than 25 feet in trench excavations 4 feet or more in depth.			
	Ladders used in excavations secured and extended 3 feet above the edge of the trench.			
	Structural ramps used by employees designed by a competent person.			
	Structural ramps used for equipment designed by a registered professional engineer.			

Page 1 of 2

HGL HydroGeoLogic, Inc

Excavation/Trenching Inspection

4.	**WET CONDITIONS:**			
	Precautions taken to protect from the accumulation of water.			
	Water removal equipment monitored by a competent person.			
	Surface water or runoff diverted or controlled to prevent accumulation in the excavation.			
	Inspections made after every rainstorm or other hazard-increasing occurrence.			
5.	**HAZARDOUS ATMOSPHERE:**			
	Atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficient, combustible, or otherwise hazardous atmosphere. See Real Time Air Monitoring Results Log.			
	Adequate precautions taken to protect employee from exposure to a hazardous atmosphere.			
	Testing conducted to ensure that the atmosphere remains safe.			
	Emergency equipment, such as breathing apparatus, safety harness and line, and basket stretcher readily available where hazardous atmosphere does exist.			
6.	**SUPPORT SYSTEMS:**			
	Type of Support System Used: Shielding ___ Shoring ___ Sloping ___ Benching ___			
	Materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads.			
	Materials and equipment used for protective systems inspected and in good condition.			
	Damaged materials and equipment used for protective systems inspected by a Registered Professional Engineer after repairs and before being placed back into service.			
	Protective systems installed without exposing employees to the hazards of cave-ins, collapses, or from being struck by materials or equipment.			
	Members of support systems securely fastened to prevent failure.			
	Support systems provided to insure stability of adjacent structures, buildings, roadways, sidewalks, walls, *etc.*			
	Excavations below the level of the base or footings approved by a registered professional engineer.			
	Removal of support systems progresses from the bottom, and members are released slowly as to note any indication of possible failure.			
	Excavation of material to a level of greater than 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth.			
	Shield system placed to prevent lateral movement.			
	Employees are prohibited from remaining in shield system during vertical movement.			
	Notes:			

Page 2 of 2

APPENDIX G

EXPLOSIVES SAFETY SUBMISSION

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Explosives Safety Submission

TIME CRITICAL REMOVAL ACTION

Specific Areas within the Northwest Peninsula, Culebra Island, Puerto Rico

Formerly Used Defense Site (FUDS)
Property Number I02PR0068

September 2016

Prepared for:
U.S. Army Corps of Engineers
Engineering and Support Center, Huntsville

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TABLE OF CONTENTS

Page

1.0 SITE

1.1 Name: Specific Areas within the Northwest Peninsula, Culebra Island, Puerto Rico (FUDS Property Number IO2PR0068)

1.2 State: Commonwealth of Puerto Rico

2.0 ANTICIPATED DATES

2.1 Start: October 2016

2.2 End: March 2017

3.0 PURPOSE

This Explosives Safety Submission (ESS) is being submitted to support a time critical removal action (TCRA) at Specific Congressionally Authorized Areas within the Northwest Peninsula (NWP), Culebra, Puerto Rico. The purpose of the TCRA is to conduct a surface and subsurface clearance of 31.83 acres within areas of the NWP of Culebra Island that include portions of Carlos Rosario Beach, Flamenco Beach, Tamarindo Beach, the Flamenco Campground, and the Carlos Rosario Trail. The U.S. Army Corps of Engineers (USACE) has determined that an imminent threat to human health, welfare, and the environment exists due to the presence of munitions and explosives of concern (MEC) within the specified areas of Culebra Island as a result of historical military training activities. The TCRA is required to mitigate the imminent threat to human health, welfare, and the environment posed by the presence of MEC from past uses of the site for training.

The TCRA will be performed in accordance with the *Action Memorandum for Time Critical Removal Action at the Specific Congressionally Authorized Areas within the Northwest Peninsula, Culebra, Puerto Rico* (CESAJ, May 2016). Munitions response activities will be conducted in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (as amended by the Superfund Amendments and Reauthorization Act of 1986 [SARA]); the National Contingency Plan; and U.S. Department of Defense (DoD) and U.S. Army Corps of Engineers (USACE) safety requirements.

4.0 SITE BACKGROUND AND CURRENT CONDITIONS

Culebra is located about 17 miles east of the main island of Puerto Rico (Figure 1). The Culebra property, consisting of Culebra Island and surrounding cayos, was acquired via land transfers, purchases, donations, and leases, and was utilized as a coaling and communications station, for aerial bombing, maneuvers, naval gun and artillery firing, and amphibious training by the U.S. Marine Corps and the U.S. Navy during various periods between 1903 and 1975.

Naval rounds were fired onto the NWP, including 5 inch (") /38 caliber (cal) and 5"/54 cal projectiles and 3"/50 cal, 6"/47 cal, and 8"/55 cal gun ammunition. Additionally, 5" High

Explosive (HE) naval projectiles, 2.75" rockets, 3" naval projectiles, 40mm projectiles, 75mm projectiles, 81mm mortars, 100-pound General Purpose (GP) bombs, a 500-pound GP bomb, and Bomb and Dummy Unit (BDU)-33 practice bombs have all been found on the NWP.

The Southern Portion of NWP and Flamenco Beach are managed by the Conservation and Development Authority of Culebra (ACDEC) for recreational use. Current land use is recreational within the Flamenco, Tamarindo, and Carlos Rosario Trail and Beach areas and the Flamenco Campground area. Many people visit the areas throughout the year. Local workers are regularly present within these locations to manage recreational areas. The Flamenco Beach Campground consists of 11 commercial vendor structures and an expansive tent-camping area. Additionally, areas such as Flamenco Beach, Carlos Rosario Trail and Beach, and Tamarindo Beach receive thousands of visitors yearly. Appendix A, Figures 1 and 2, show the location of these recreational areas. It is anticipated that the land use will remain as recreational and that development for similar purposes will likely continue on site.

5.0 EXECUTING AGENCIES

- United States (U.S.) Army Engineering and Support Center, Huntsville (USAESCH)
- U.S. Army Corps of Engineers (USACE), Jacksonville District
- Contractor, HydroGeoLogic, Inc. (HGL)

6.0 SCOPE OF REMOVAL ACTION

Table 6.1a identifies the MEC operations to be performed during the TCRA. A surface and subsurface removal action will be performed within specific areas of the 31.83 acre TCRA boundary utilizing the survey methods indicated in Table 6.1b. Selected anomalies will be manually investigated. Manual excavation will occur within 12 inches of an anomaly and will begin to the side of the anomaly. The excavation will continue until the excavated area has reached a depth below the top of the anomaly, as determined by frequent inspection with an appropriate geophysical instrument. Once the item is exposed for inspection, the unexploded ordnance (UXO) team will inspect, classify, and dispose of the item in accordance with Section 7.0 of this ESS.

Table 6.1a
Scope of TCRA for Culebra NWP

MRS	Munitions Response Action	Total Acreage of the MRS [1]
Specific Congressionally Authorized Areas within the NWP	• Surface and subsurface clearance • Manage and dispose of recovered MEC/material potentially presenting an explosive hazard (MPPEH)	31.83 acres

[1] The NWP includes 408 acres; however, the boundary of the TCRA encompasses 31.83acres.

Table 6.1b
Survey Methods for NWP TCRA

Location	Acreage	Survey Method	Advanced Classification
Flamenco Beach	4.30	Digital Geophysical Mapping (DGM)	Yes
Flamenco Campground Open Areas	9.06	DGM	Yes
Flamenco Campground Vegetated	8.00	Analog	No
Carlos Rosario Trail	3.67	Analog	No
Carlos Rosario Beach	1.61	DGM	No
Carlos Rosario Vegetated Area	3.39	Analog	No
Tamarindo Beach	0.67	DGM	No
Tamarindo Vegetated Area	1.13	Analog	No

Earth Moving Machinery (EMM) may be used to excavate overburden from suspected MEC. EMM will not be used to excavate within 12 inches of suspect MEC. If utilized, this excavation method will be conducted in accordance with EM 385-1-97, I.2.U.03.01, 15 Sep 08.

7.0 SAFETY CRITERIA

7.1 Munition with the Greatest Fragmentation Distance.

The Munition with the Greatest Fragmentation Distance (MGFD) at the site is identified in Table 7.1. The MGFD was chosen due to the history of 5-inch HE projectiles being discovered during past investigations or removal actions in the TCRA boundary. Although historical documents report use of munitions from small arms up to the size of 1,000-lb bombs and a 500-lb bomb was recovered during the 2011 Site Inspection (SI) of the NWP, no MEC items larger than 5-inch projectiles have been discovered within the specific Congressionally authorized areas of the NWP included under the scope of this TCRA.

If MEC with a greater fragmentation distance is encountered, the minimum separation distances (MSDs) will be adjusted in accordance with (IAW) Defense Explosives Safety Board (DDESB) Technical Paper (TP) 16, operations will continue, and an amendment to this ESS will be submitted for approval (a copy of this document will be available on-site). Explosives Safety Quantity Distance (ESQD) arcs will be adjusted accordingly.

During intrusive investigation of anomalies (targets of interest) identified by advanced classification (AC), the MSD may be reduced for the munition size type being excavated based on the data from the AC library.

Only unexploded ordnance (UXO) personnel qualified IAW DDESB TP 18 will perform MEC operations.

Table 7.1 and Appendix A, Figure 2, present the MSDs. See Appendix B for the Fragmentation Data Sheets. The MGFD is based on the munitions found in the TCRA area during the SI.

Table 7.1
Minimum Separation Distances for Munition with the Greatest Fragmentation Distance

		MSD (feet) [1]			
		Unintentional Detonations		Intentional Detonations	
Area	**MEC**	**K 40[2]**	**Hazard Fragment Distance (HFD)[3]**	**Without Engineering Controls**	**Using Single Sandbag Mitigation**
Specific Congressionally Authorized Areas within the NWP	5 in Mk 28 AA Common (Composition A- 3 filled)	80	***377***	2,206	220
	5 in Mk 41	74	359	2,377	220
	5 in Mk 24 Mod 0 Zuni Rocket	88	364	1,888	220

NOTES:
***** All values in Bold Italics are the MSDs to be used on-site.***
[1] See Appendix B for Fragmentation Data Sheets.
[2]The K40 is the Team Separation Distance for manual MEC operations.
[3]The HFD is the MSD for non-essential personnel.

7.2 Q-D MEC Area Unintentional Detonation.

MSDs for the MGFDs are shown in Table 7.1 and illustrated on Figure 2 of Appendix A.

Any occupied buildings or public roadways in the MSD areas during MEC-related operations will be evacuated and/or roadways blocked to prevent non-essential personnel from entering during the conduct of MEC-related operations.

Areas within the exclusion zone (EZ) will require evacuations during intrusive investigations operations due to the proximity of campgrounds and popular beaches.

7.3 Q-D Intentional Detonation Activities.

Q-Ds are shown in Table 7.1 and illustrated on Figure 2 of Appendix A.

The UXO Team will dispose of MEC by detonation within the sited TCRA boundary. All explosives operations will follow the procedures outlined in Site Standard Operating Procedures, Work Plan, and Engineer Manual (EM) 385-1-97, Explosives Safety and Health Requirements Manual. These guidance documents will be available on-site. Demolition operations will be performed after coordination with the agencies identified below. Items will be guarded by local security personnel until operations can be conducted. No off site demolition will be utilized.

Any occupied buildings or public roadways in the MSD areas (Figure 2) during MEC-related operations will be evacuated and/or roadways blocked to prevent non-essential personnel from entering during the conduct of MEC-related operations.

Areas within the EZ will require evacuations during demolition operations due to the proximity of campgrounds and popular beaches. HGL will coordinate with USACE for notification of the local population and appropriate regulatory agencies before a demolition event.

HGL will notify the following agencies in advance of performing any demolition operations. These agencies will also be used to assist in securing the area, as appropriate, where the item presenting an explosive hazard is located until demolition operations have occurred.

- USCG, Mr. Efrain Lopez, Marine Information Specialist (787) 289-2097), efrain.lopez1@uscg.mil, USCG Sector San Juan and, CWO Anthony Cassisa, (787) 289-2073, anthony.j.cassisa@uscg.mil. Warning broadcast to mariners over VHF for a scheduled demolition shot (Notice to Mariners [NOTMAR]).
- FAA Coordination Facility (787) 253-8664, Mr. Felipe Fraticelli, for a Notice to Airmen on flight restriction above the demolition area. Additional points of contact include Mr. Hector Plaza, (787) 525-6070, and Mr. Hector Rivera, FAA Office (404) 520-4241.
- Municipal Police (787) 742-0106 for any activity on Flamenco Beach. The HGL Senior UXO Supervisor (SUXOS) or UXO Safety Officer (UXOSO) will coordinate directly with the police department to overcome any language difficulties on demolition operations.
- Puerto Rican State Police (787) 742-3501, for any activities on Culebra. The HGL SUXOS or UXOSO will coordinate directly with the police department to overcome any language difficulties on demolition operations.

HGL will coordinate with the USACE to evacuate the public during the demolition of a UXO item if all other engineering controls are not adequate. HGL will conduct demolition operations only after all personnel protective measures have been completed and reported to the SUXOS. Personnel will be permitted to re-enter the area only after the demolition point has been inspected and the “all clear" has been given by the SUXOS.

Collection points are those areas used to temporarily accumulate MEC pending destruction at the end of the day using consolidated shots. MEC items at collection points must be laid out as shown IAW USAESCH publication “Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites, August 1998 with Terminology update March 2000.” A copy of this report will be available at the site. The maximum net explosive weight (NEW) at a collection point will be limited such that the K40 overpressure distance for the total NEW does not exceed the hazardous fragmentation distance (HFD) for the area. MEC will not be left unattended at collection points.

The UXO Team will consolidate multiple MEC for disposal IAW USAESCH publication “Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites, August 1998 with Terminology Update March 2000.” A copy of this report will be available at the site. The maximum NEW during a consolidated shot must be limited such that the

K328 overpressure distance for the total NEW (including donor charges) does not exceed the MSD for the intentional detonation.

All MPPEH procedures will be IAW DoD Instruction 4140.62 and EM 385-1-97. Copies of these documents will be available on-site. MPPEH will be assessed and its explosives safety status determined and documented prior to transfer within the DoD or release from DoD control. Prior to release to the public, MPPEH will be documented by authorized and technically qualified personnel as Material Documented as Safe (MDAS) after a 100 percent (%) inspection and an independent 100% re-inspection to determine that it is safe from an explosives safety perspective.

7.4 Q-D Demolition Explosives Storage Magazines.

A Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) Type II magazine with an attached cap box may be used to store donor explosives at the designated explosives storage facility location (approximately 18º20’4.884"N; 65º19’27.1992"W). The total maximum net explosive weight (NEW) stored in the magazine will not exceed a total of 31 pounds (lbs). In accordance with DoD Manual 6055.09-M, Table V3.E3.T2, Q-Ds are 120-feet for Public Transportation Routes (PTR) and 200-feet for Inhabited Building Distance (IBD) for a maximum explosive storage weight of 31 lbs, and are illustrated on Figure 3 of Appendix A. The explosives magazine will be located no less than 51 feet from the existing explosives magazine (intermagazine distance for 100 lbs NEW) based on the unbarricaded distance in Table V3.E3.T6 of DOD 6055.09-M, Volume 3) as indicated on Appendix A, Figure 3.

The magazine is positioned in accordance with EP1110-1-18 and Section 55.206 of ATFP 5400.7, Alcohol, Tobacco, and Firearms (ATF) Explosives Law and Regulations. The magazine will be grounded in accordance with DoD Manual 6055.09-M, Department of the Army Pamphlet (DA PAM) 385-64, National Fire Protection Agency (NFPA) 780, and EM 385-1-97. The commercial explosives will have assigned DOD hazard division/storage compatibility groups (HD/SCG) and will be stored in accordance with DOD 6055.09-M, DA Pam 385-64, and any local regulations. A Standard Operating Procedure is in place for accountability and security.

7.5 Engineering Controls.

For intentional detonations, the UXO Team will use earth tamp as an engineering control (single or multiple rounds) IAW the DDESB Buried Explosion Module (BEM), Version 6.3.3 or a later version if released by DDESB, and DDESB TP 16.

In addition to earth tamp, sandbag mitigation may be used as an engineering control for intentional detonations. The sandbag controls will be used IAW HNC-ED-CS-98-7, Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions, August 1998, and Amendment 1, February 2011, and Amendment 2, November 2014; CEHNC-EMM Memorandum, Safety Advisory: Use of Jet Perforator During Intentional Detonation While Using Sandbag Mitigation for Engineering Controls, 7 November 2011; and DDESB-PD memorandum of 22 May 2014, Subject: Revision of DDESB Approval for Use of Sandbags for Mitigation of Fragmentation and Blast Effects Resulting From Intentional Detonation of Munitions.

The BEM, TP 16, and reports for all mitigation methods used will be available on site.

7.6 Individuals with Authority to Determine if MEC is Acceptable to Move.

MEC items encountered will normally be detonated in place. The exceptions are when technically qualified personnel who are performing the functions of the SUXOS and UXOSO determine the risk associated with movement is acceptable, and movement is necessary for the protection of people, property, or critical assets, or the efficiency of the activities being conducted. In such cases, the SUXOS and UXOSO responsible for the MEC activities being performed may evaluate the munition and authorize its movement within the sited TCRA boundary.

8.0 MAPS

Refer to Appendix A for the figures. Figure 1 shows a general location map and the TCRA boundary. Figure 2 illustrates the Q-D arcs that will be used during the TCRA. Figure 3 illustrates the location and Q-D arcs for the explosives storage magazine.

APPENDIX A

MAPS

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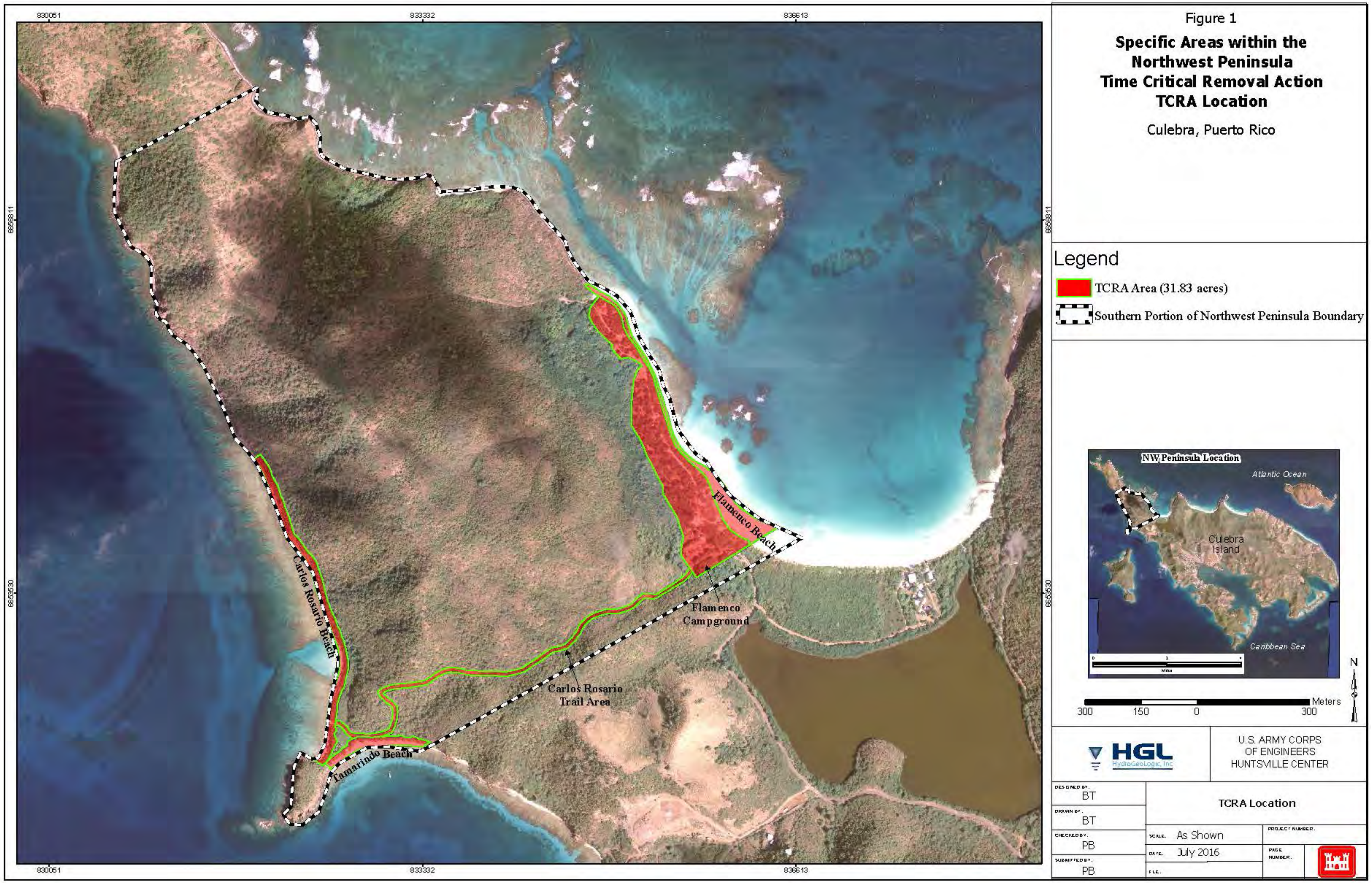
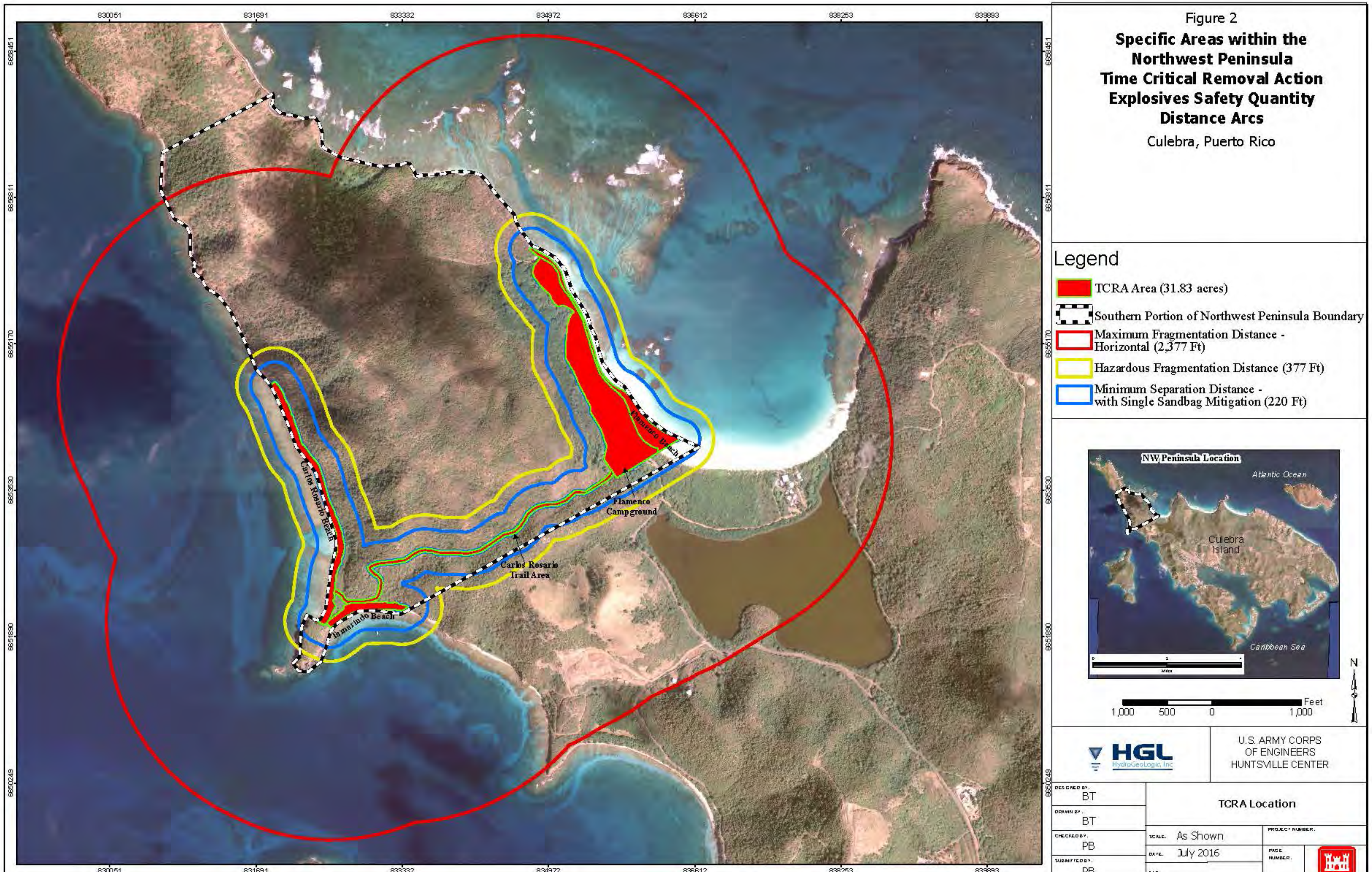


Figure 1
Specific Areas within the Northwest Peninsula
Time Critical Removal Action
TCRA Location
Culebra, Puerto Rico
Legend
TCRA Area (31.83 acres)
Southern Portion of Northwest Peninsula Boundary
Flamenco Beach
Flamenco Campground
Carlos Rosario Beach
Carlos Rosario Trail Area
Tamarindo Beach
NW Peninsula Location
Atlantic Ocean
Culebra Island
Caribbean Sea
Meters
300
150
0
300
N
830051
833332
836613
HGL
HydroGeoLogic, Inc.
U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER
DESIGNED BY: BT
DRAWN BY: BT
CHECKED BY: PB
SUBMITTED BY: PB
TCRA Location
SCALE: As Shown
DATE: July 2016
PROJECT NUMBER:
PAGE NUMBER:
FILE:


830051
831691
833332
834972
836612
838253
839893
6658451
6656811
6655170
6653530
6651890
6650249
Flamenco Beach
Flamenco Campground
Carlos Rosario Beach
Carlos Rosario Trail Area
Tamarindo Beach
Figure 2
Specific Areas within the Northwest Peninsula Time Critical Removal Action Explosives Safety Quantity Distance Arcs
Culebra, Puerto Rico
Legend
TCRA Area (31.83 acres)
Southern Portion of Northwest Peninsula Boundary
Maximum Fragmentation Distance - Horizontal (2,377 Ft)
Hazardous Fragmentation Distance (377 Ft)
Minimum Separation Distance - with Single Sandbag Mitigation (220 Ft)
NW Peninsula Location
Atlantic Ocean
Culebra Island
Caribbean Sea
N
Feet
1,000 500 0 1,000
HGL HydroGeoLogic, Inc
U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER
DESIGNED BY: BT
DRAWN BY: BT
CHECKED BY: PB
SUBMITTED BY: PB
TCRA Location
SCALE: As Shown
DATE: July 2016
PROJECT NUMBER:
PAGE NUMBER:
FILE:

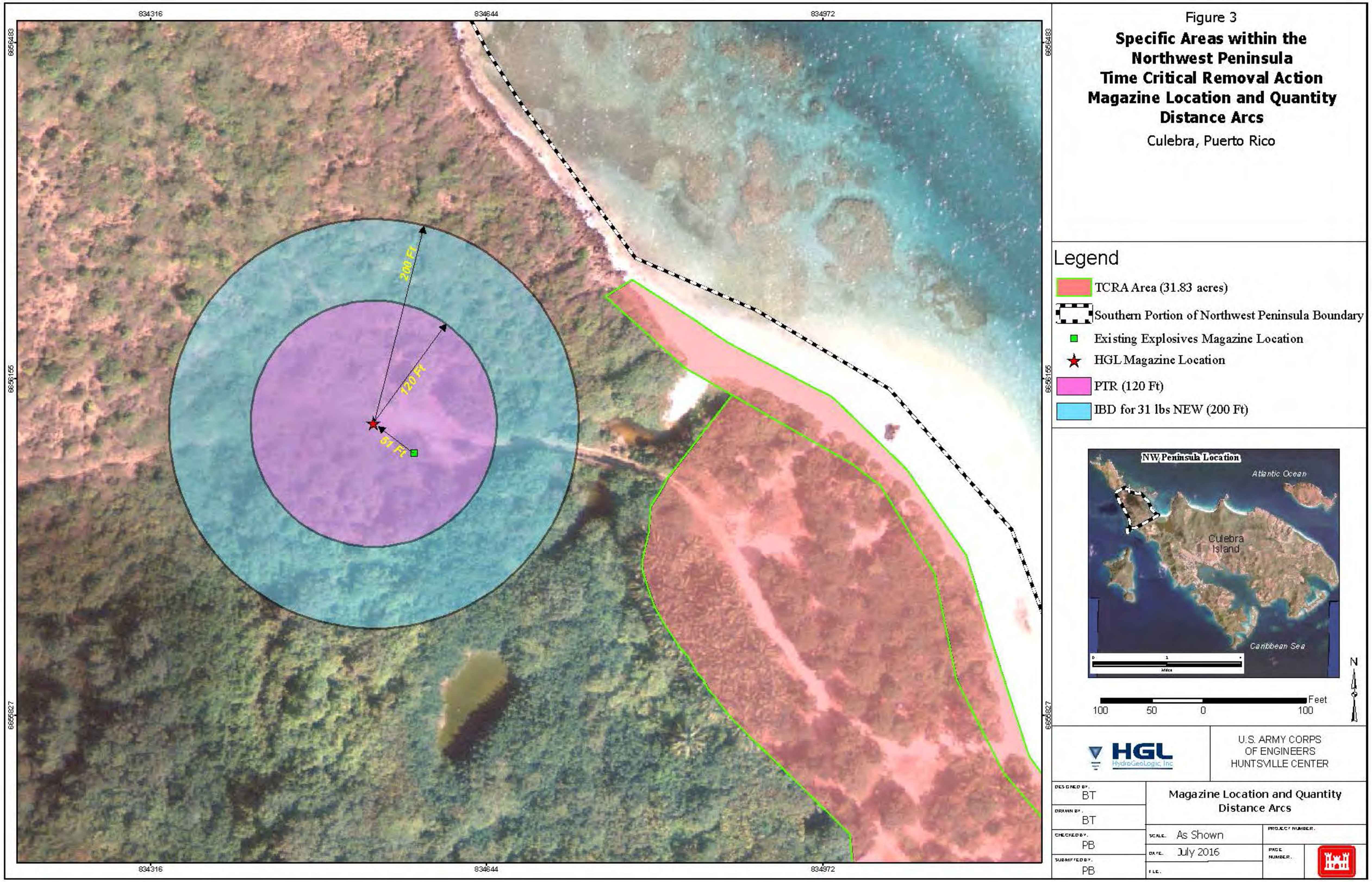


Figure 3
Specific Areas within the Northwest Peninsula Time Critical Removal Action Magazine Location and Quantity Distance Arcs
Culebra, Puerto Rico
Legend
TCRA Area (31.83 acres)
Southern Portion of Northwest Peninsula Boundary
Existing Explosives Magazine Location
HGL Magazine Location
PTR (120 Ft)
IBD for 31 lbs NEW (200 Ft)
200 Ft
120 Ft
61 Ft
834316
834644
834972
NW Peninsula Location
Atlantic Ocean
Culebra Island
Caribbean Sea
Feet
100 50 0 100
N
HGL
HydroGeoLogic Inc
U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER
DESIGNED BY: BT
DRAWN BY: BT
CHECKED BY: PB
SUBMITTED BY: PB
Magazine Location and Quantity Distance Arcs
SCALE: As Shown
DATE: July 2016
FILE:
PROJECT NUMBER:
PAGE NUMBER:

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APPENDIX B

FRAGMENTATION DATA REVIEW FORMS

5 in Mk 28 (Composition A-3 filled)

5 in Mk 41

5 in Mk 24 Mod 0 Zuni Rocket

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Fragmentation Data Review Form

Database Revision Date 3/7/2016

Category:	Surface-Launched HE Rounds
Munition:	5 in Mk 28 (Composition A-3 filled)
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	
Date Record Created:	8/4/2011
Record Created By:	SDH
Last Date Record Updated:	
Individual Last Updated Record:	
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Composition A-3
Explosive Weight (lb):	7.33
Diameter (in):	4.9300
Cylindrical Case Weight (lb):	32.18000
Maximum Fragment Weight (Intentional) (lb):	0.2877
Design Fragment Weight (95%) (Unintentional) (lb):	0.0422
Critical Fragment Velocity (fps):	4531

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1.07
TNT Equivalent Weight - Impulse (lbs):	7.843
Kinetic Energy 10^6 (lb-ft²/s²):	2.9542

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	377
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2206
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1711

Overpressure Distances

TNT Equivalent (Pressure):	1.09
TNT Equivalent Weight - Pressure (lbs):	7.990
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	36
Public Traffic Route Distance (2.3 psi); K24 Distance:	48
Inhabited Building Distance (1.2 psi), K40 Distance:	80
Intentional MSD (0.0655 psi), K328 Distance:	656

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	11.05	5.09
Mild Steel:	2.12	0.99
Hard Steel:	1.74	0.81
Aluminum:	4.16	2.04
LEXAN:	9.17	5.74
Plexi-glass:	7.69	4.13
Bullet Resist Glass:	6.85	3.44

Item Notes

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

Fragmentation Data Review Form

Database Revision Date 3/7/2016

Category:	Surface-Launched HE Rounds
Munition:	5 in Mk 41
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	D320
Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Explosive D
Explosive Weight (lb):	7.38
Diameter (in):	5.0000
Cylindrical Case Weight (lb):	51.30473
Maximum Fragment Weight (Intentional) (lb):	0.6726
Design Fragment Weight (95%) (Unintentional) (lb):	0.1367
Critical Fragment Velocity (fps):	2538

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.81
TNT Equivalent Weight - Impulse (lbs):	5.978
Kinetic Energy 10^6 (lb-ft²/s²):	2.4521

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	359
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2377
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1748

Overpressure Distances

TNT Equivalent (Pressure):	0.85
TNT Equivalent Weight - Pressure (lbs):	6.273
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	33
Public Traffic Route Distance (2.3 psi); K24 Distance:	44
Inhabited Building Distance (1.2 psi), K40 Distance:	74
Intentional MSD (0.0655 psi), K328 Distance:	605

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	9.17	4.80
Mild Steel:	1.77	0.92
Hard Steel:	1.45	0.75
Aluminum:	3.43	1.86
LEXAN:	8.58	5.73
Plexi-glass:	7.05	4.13
Bullet Resist Glass:	6.32	3.49

Item Notes

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Fragmentation Data Review Form

Database Revision Date 3/7/2016

Category:	Surface-Launched HE Rounds
Munition:	5 in Mk 24 Mod 0 Zuni Rocket
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Rocket
Munition Case Classification:	Robust
DODIC:	H930
Date Record Created:	9/4/2008
Record Created By:	MC
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Composition B
Explosive Weight (lb):	9.1
Diameter (in):	5.0000
Cylindrical Case Weight (lb):	20.05365
Maximum Fragment Weight (Intentional) (lb):	0.1475
Design Fragment Weight (95%) (Unintentional) (lb):	0.0280
Critical Fragment Velocity (fps):	6354

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1.14
TNT Equivalent Weight - Impulse (lbs):	10.374
Kinetic Energy 10^6 (lb-ft²/s²):	2.6811

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	364
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	1888
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1493

Overpressure Distances

TNT Equivalent (Pressure):	1.16
TNT Equivalent Weight - Pressure (lbs):	10.556
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	39
Public Traffic Route Distance (2.3 psi); K24 Distance:	53
Inhabited Building Distance (1.2 psi), K40 Distance:	88
Intentional MSD (0.0655 psi), K328 Distance:	720

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	12.66	5.53
Mild Steel:	2.26	1.02
Hard Steel:	1.86	0.84
Aluminum:	4.53	2.15
LEXAN:	9.15	5.61
Plexi-glass:	7.65	4.00
Bullet Resist Glass:	6.71	3.26

Item Notes

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APPENDIX H

CONTRACTOR PERSONNEL QUALIFICATION LETTER

HGL
HydroGeoLogic, Inc
MUNITIONS RESPONSE TEAM

August 2, 2016

Rebecca Terry
Contracting Officer Representative
U.S. Army Corps of Engineers – Huntsville
4820 University Square
Huntsville, AL 35816-1822

RE: Contract No. : W912DY-10-D-0023 Task Order 0022
Time Critical Removal Action
Northwest Peninsula, Culebra, Puerto Rico

Dear Sir or Madam:

This letter is to certify that the following individuals from HGL are fully qualified to fill the positions listed below in order to perform Munitions Response operations at the subject project site.

Position	Name
SUXOS / Tech III	Dustin Easton
UXOSO/UXOQCS	Scott Schroepfer
UXO Tech II	Rebecca Powers
UXO Tech II	Charlie Richardson

The above mentioned individuals are fully qualified to fill the UXO positions and perform all required Munitions Response activities per DDESB TP-18 dated 16 July 2015.

Sincerely,

Neil Feist
UXO Operations Manager

EXAMPLE

5030 Bradford Drive, Building 1, Suite 230
Huntsville, AL 35805
Phone: (256) 970-2102

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APPENDIX I

FIELD STANDARD OPERATING PROCEDURES

LIST OF STANDARD OPERATING PROCEDURES

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Procedure # AC-01	Title: Assemble the 2x2 System and Verify Correct Operation	Revision # 0.0
Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

1. PURPOSE

The purpose of this SOP is to identify the methods to be employed when assembling the 2x2 sensor system and verifying that all components are correctly assembled, operating normally, and are capable of acquiring data of sufficient quality.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Confirms that sensor was assembled correctly, either in person or through review of notes, photographs, and QC checklist.
QC Geophysicist	Reviews QC testing results and verifies results are documented in the QC database.
Field Team Leader	Operates geophysical sensor during data collection.
Data Processor	Processes collected data and documents QC results in the project QC database.

3. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
2x2 System (either TEMTADS or Geometrics MetalMapper)	The 2x2 system is an advanced electromagnetic induction sensor designed for the detection and classification of buried metal objects. Original development of the system went by the name of the TEMTADS 2x2, with the commercialized Geometrics version now known as the MetalMapper 2x2.
small ISO80	A schedule 80 small Industry Standard Object (small ISO80) mounted in the Delrin mounting ring to confirm that the geophysical sensor is functioning correctly.
RTK GPS or RTS	A real-time kinematic Global Positioning System (RTK GPS) or robotic total station (RTS) used to record the location of the small ISO80 test item and the collected geophysical data.
IMU	An Inertial Measurement Unit (IMU) used to measure yaw, pitch, and roll of the sensor. Data is used to correct advanced sensor data positions.
Digital Camera	Digital camera or cell phone used to take photographs of the sensor (Note: personnel should not have cell phones when operating the 2x2).

Procedure # AC-01	Title: Assemble the 2x2 System and Verify Correct Operation	Revision # 0.0
Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

4. PROCEDURE AND GUIDELINES

The 2x2 system is an advanced electromagnetic induction sensor designed for the detection and classification of buried metal objects. The sensor consists of four sensor elements arranged on 40-centimeter (cm) centers in a 2x2 array. Each sensor element consists of a 35-cm square transmit coil for target illumination with an 8-cm three-axis receive cube centered in the transmit coil. The transmitters are energized in sequence and the decay curve is recorded up to 25 milliseconds after the transmitters are turned off for each of the 12 (4 cubes with 3 axes each) receive channels. A schematic of the sensor coil configuration is shown in **Exhibit 1**.

Positioning of the 2x2 is accomplished using an RTK GPS or RTS. The 2x2 orientation is measured using a six-degree-of-freedom IMU. For proper functioning it is important to verify that the IMU has been mounted to the 2x2 in the correct orientation.

4.1. Assemble the 2x2

All assembly operations are described in the TEMTADS 2x2 unpacking instructions and user guide available from the Naval Research Laboratory (NRL), and the detailed instructions contained there should be followed precisely. **Exhibit 2** shows a schematic overview of the assembly steps which are briefly described below:

1) Remove the sensor assembly from the packing crate following the instructions in the unpacking guide.
2) Attach the wheels or sled.
3) Securely attach the GPS/RTS antenna to the top of the mounting platform.
4) Set the IMU onto its position below the GPS/RTS. The attachment will be secured after correct IMU orientation is verified.
5) Connect the sensor cable bundle to the sensor. This includes the sensor TX and RX cables and the cables to the GPS/RTS and IMU.
6) Remove the electronic housing from its shipping container and attach it to the backpack.
7) Attach the Tx, Rx, and IMU cables to the electronics box. The GPS/RTS cable will be attached after booting the computer.

4.2. Turn On and Initialize the Data Acquisition Computers

Following the instructions in Section 5 of the TEMTADS 2x2 Users Guide, start the data acquisition system. After the main computer in the electronics housing boots, plug the GPS/RTS cable into the electronics. The last step in Section 5 involves observing the IMU output. Leave the system in this state for the next operation.

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4.3. Verify IMU Orientation

The procedure to verify the correct orientation of the IMU is shown in **Exhibit 3** and instructions for this test follow.

1. Facing the direction of travel, rotate the IMU around the along-track axis to produce a positive ROLL as shown in **Exhibit 4**. Verify that the data acquisition system records a positive ROLL, **Exhibit 5**. If it does not, reorient the IMU on its mount and test again.

2. Standing on the side of the sensor with the direction of travel to your right, rotate the IMU around the cross-track axis to produce a positive PITCH as shown in **Exhibit 4**. Verify that the data acquisition system records a positive PITCH. If it does not, reorient the IMU on its mount and return to step 1.

3. Looking down on the sensor from above, rotate the IMU around the vertical axis to produce a positive YAW as shown in **Exhibit 4**. Verify that the data acquisition system records a positive YAW. If it does not, reorient the IMU on its mount and return to step 1.

4.4. Verify GPS Operation

Turn on the GPS/RTS receiver, allow it time to lock onto a position, and verify that GPS/RTS readings are being received at the data acquisition computer.

4.5. Photograph the Sensor

Using a digital camera or a cell phone, photograph the installed sensor. Verify that the photograph(s) depict the locations and orientations of the GPS/RTS and IMU sensors.

4.6. Set up the Data Acquisition Parameters

In preparation for the sensor function test, use the [Setup] tab in TEMDataLogger or TEMTablet to set the correct data acquisition parameters for the dynamic survey. The easiest way to accomplish this is to use [Standard Dynamic] or [Standard Cued] button, **Exhibit 6**. The standard parameters are listed in **Exhibit 7**.

4.7. Perform a Sensor Function Test

If there is a reference response for the combination of hardware and data acquisition parameters you are using, the [Sensor Function] tab will be available on the data acquisition computer. Access that tab to perform a sensor function test.

1. Position the sensor in a spot known to be clear of buried metal. Often the clear position in the Instrument Verification Strip (IVS) will be the best choice. Collect a background measurement from [Sensor Function] tab of the data acquisition software.

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2. Without moving the sensor, mount the ISO80 test item in the hole on the top of the sensor housing (**Exhibit 8**, left panel).

3. Collect sensor function data. If the results agree with the reference values, a green LED is displayed. If they do not agree, a red LED is displayed and a summary of the incorrect results is displayed.

4. Transfer the background and sensor function data files to the QC Geophysicist for archiving.

5. DATA MANAGEMENT

The following sections describe the data that is needed to perform this SOP and the resulting data

5.1. Input Data Required

Input data consists of the assembly and operation instructions contained in the TEMTADS 2x2 unpacking instructions and user guide available from NRL.

5.2. Output Data

The sensor function test described in Section 4.6 will be saved in the project database. Also, the QC checklist in **Exhibit 9** of this SOP will be completed, signed, and filed with the assembly photograph as proof of correct assembly.

6. QUALITY CONTROL

As this definable feature of work is accomplished only during the preparatory phase, only preparatory QC checks will be performed on this DFW. QC consists of performing the inspections on the Preparatory Phase Quality Control Checklist that is included as **Exhibit 9** of this SOP. This checklist will be completed by the Field or Project Geophysicist; the QC Geophysicist will also sign the checklist, confirming that the collected data indicates that the instrument is functioning correctly.

6.1. Measurement Quality Objective (MQOs)

The MQOs for this task are presented in Worksheet 22 of the QAPP. The 2x2 will not be tested on the Instrument Verification Strip (IVS) (SOP AC-02) until the MQOs for DFW 1 are documented as being met as described below.

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Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

7. REPORTING

Achievement of the sensor assembly and initial system functionality MQOs (Worksheet #22) will be documented by the Field or Project Geophysicist by completion of the Preparatory QC Checklist in **Exhibit 9** to this SOP and will be verified by the QC Geophysicist.

The delivered data package for the assembled and tested 2x2 will be

- A brief description of the assembly and test process along with the photograph(s) taken in Section 4 will be included in the IVS letter report;
- The completed Preparatory QC Checklist signed by the Field or Project Geophysicist and QC Geophysicist verifying the assembly and orientation tests described above; and
- The sensor Function Test results

8. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
TEMTADS MP 2X2 Cart User's Guide, v2.00, MTADS Program, US Naval Research laboratory, Chemistry Division, Washington, DC, May 2014	Provides detailed instructions for the assembly and operation of the 2x2 sensor system.

9. EXHIBITS

Exhibit 1 Orientation of the Four 2x2 Sensor Elements (top view)

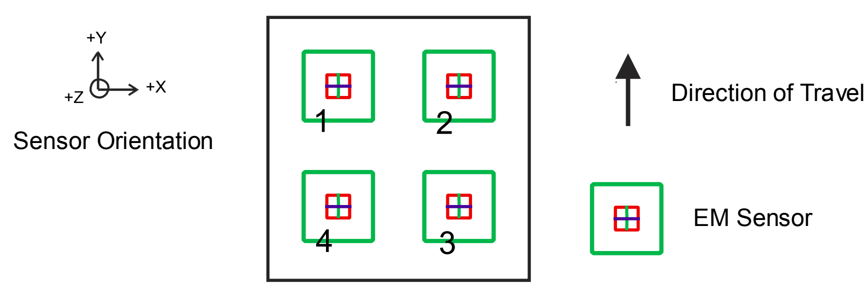

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Exhibit 2 Overview of the 2x2 System Assembly

1. Remove the 2x2 Sensor from Its Shipping Crate

↓

2. Attach Wheels or Sled

↓

3. Securely Attach GPS Antenna to Platform

↓

4. Loosely Mount IMU to Platform

↓

5. Connect Sensor Cable Bundle to the Sensor

↓

6. Attach the Electronic Housing to the Backpack

↓

7. Connect Tx, Rx, and IMU Cables to Electronics

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Exhibit 3 Procedure for Verifying IMU Orientation

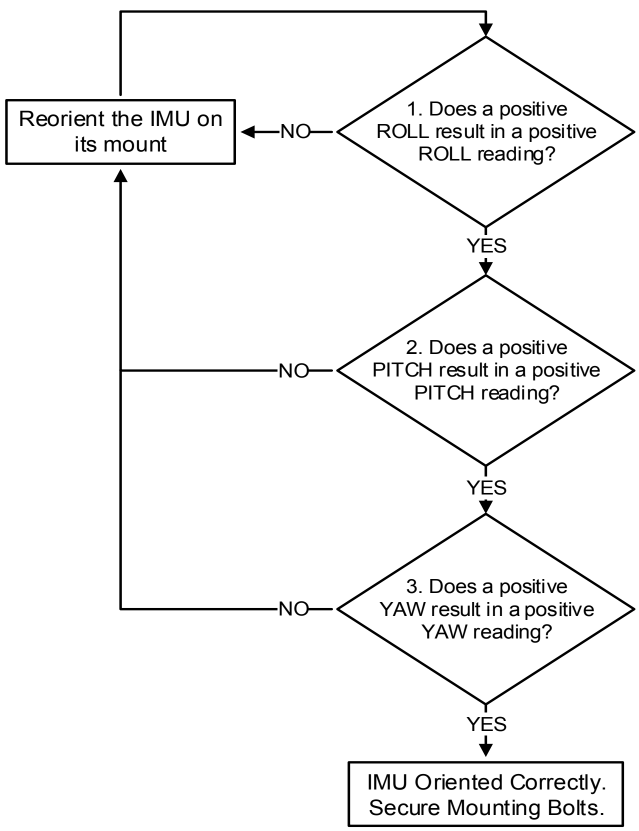

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Exhibit 4 Positive ROLL, PITCH, and YAW rotations of the IMU

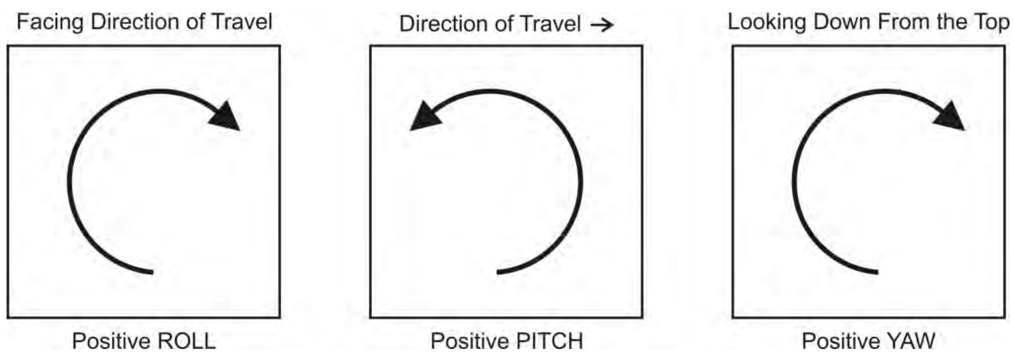

Exhibit 5 Electronics Box Screen Showing Orientation Inputs

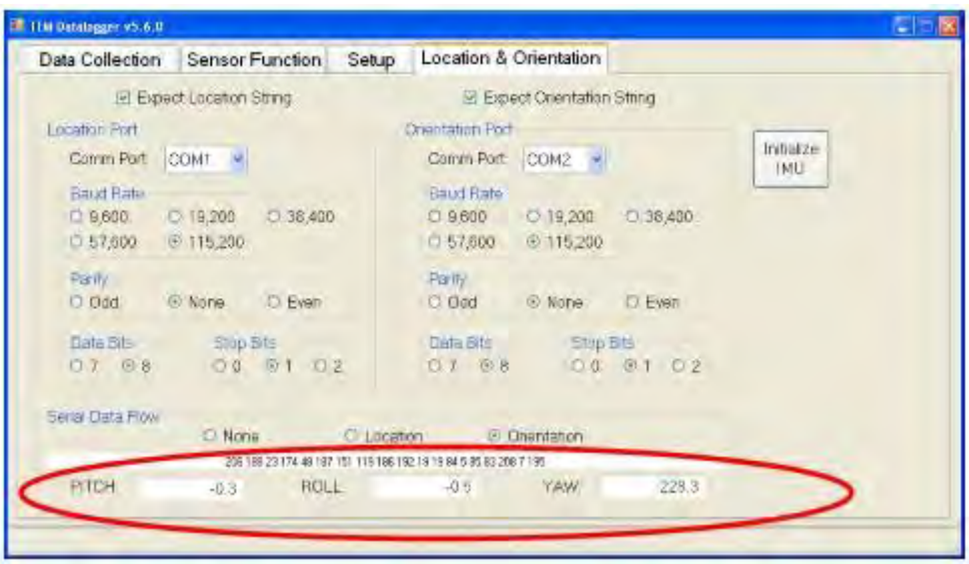

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Exhibit 6 Standard Acquisition Parameters for Dynamic Surveys

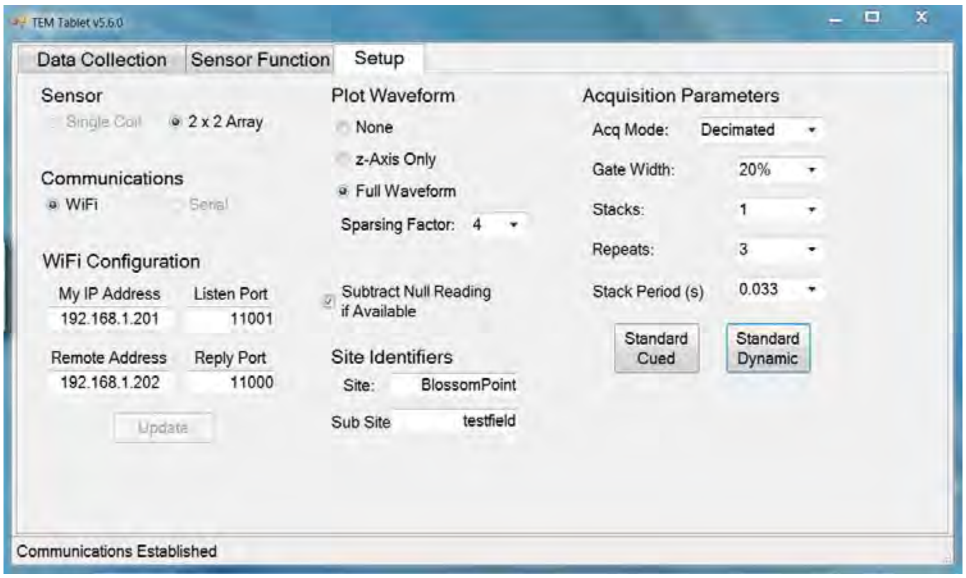

Exhibit 7 Standard Data Acquisition Parameters

Parameter	Cued Survey	Dynamic Survey
Acq Mode	Decimated	Decimated
Gate Width	5%	20%
Stacks	18	1
Repeats	9	3
Stack Period	0.9	0.033

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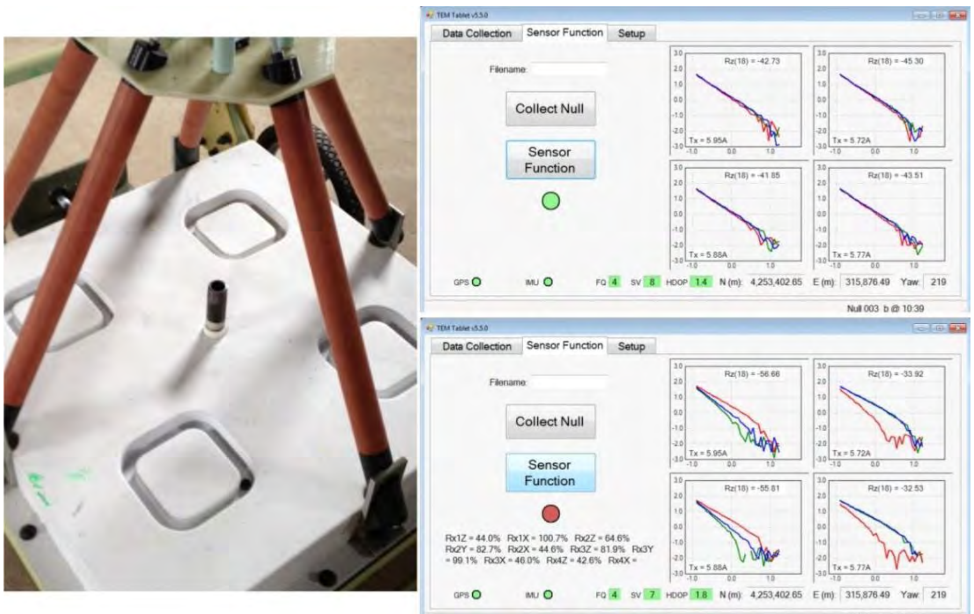
Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

Exhibit 8 Test item Positioned for a Sensor Function Test (left panel) and Examples of the Test Results (right panels)



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Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

Exhibit 9 Preparatory 2x2 Assembly QC Checklist

This checklist is to be completed by the Site Geophysicist during assembly and initial testing of the 2x2.

QC Step	QC Process and Guidance Reference	Yes/No	Initial of Field or Project Geophysicist
1. Qualifications	Are the qualifications of the Project and Field Geophysicists and the Data Processor in accordance with QAPP Worksheet 4, 7, & 8?		
2. Assembly	Is the 2x2 assembled in accordance with the published instructions and in the sequence specified in Section 4.1?		
3. Testing: IMU orientation verification	Has the procedure and tests for verification of the IMU orientation been completed (Section 4.3)?		
4. Testing: GPS	Was the GPS warmed up and allowed time to lock onto position (Section 4.4)?		
5. Photograph the installation	Was a photograph of the 2x2 showing the placement of the GPS and IMU taken?		
6. 2x2 Sensor Function Test	Was the 2x2 sensor function test performed in accordance with Section 4.7 and were the results saved in the project database?		
7. MQO Documentation	Have the MQOs for DFW 1 from Worksheet 22 been achieved?		

Field Geophysicist: ______________________________Date:___________

Project Geophysicist: ____________________________Date:___________

Data Processor: ________________________________Date:___________

Procedure # AC-01	Title: Assemble the 2x2 System and Verify Correct Operation	Revision # 0.0
Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

10.REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	8/02/16	Initial Release	n/a

Procedure # AC-02	Title: Advanced Classification Instrument Verification Strip (IVS)	Revision # 0.0
Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

1. PURPOSE

The purpose of this SOP is to identify the means and methods to be employed when verifying the operation of an advanced digital geophysical mapping system prior to and during site surveys. The Instrument Verification Strip (IVS) is constructed of a series of buried inert munitions or industry standard objects (ISO). During the IVS process the advanced electromagnetic induction (EMI) sensor system measures the response of each item in the IVS and these responses are compared to a library of expected responses to ensure and document proper functioning of the system.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Designs IVS and reviews IVS testing results; responsible for production of IVS Technical Memorandum
QC Geophysicist	Reviews IVS testing results and verifies IVS results are documented in the QC database.
Field Team Leader	Documents IVS seed data (position, depth, type) and operates geophysical and positioning equipment over the IVS and noise strip.
Data Processor	Processes IVS data and documents results in the QC database.
UXO Escort	Conducts MEC escort and anomaly avoidance activities during IVS construction and testing. Must be a qualified UXO Technician II or higher.

Note: Multiple geophysicist roles may be performed by a single individual (e.g. the Site Geophysicist may also perform the roles of Field Geophysicist and Data Processor).

3. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
Advanced EMI Sensor	The advanced electromagnetic induction (EMI) sensor is designed for the detection and classification of buried metal objects. Available sensor options are the MetalMapper, the 2x2 and the MPV systems.
(Optional) Transport Vehicle	If the MetalMapper system is the sensor of choice for the project, a transport vehicle (Skid steer, tractor, extended reach forklift) is required to move the sensor around for data collection.
Industry Standard Objects	Industry Standard Objects (ISOs) or inert munitions are buried along the IVS as test items to confirm that the geophysical sensor is functioning correctly.
GPS Unit	Used to record the location of IVS items and geophysical data

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Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

Inertial Measurement Unit	Measures yaw, pitch, and roll of sensor. Data used to correct advanced sensor data positions
Excavation Tools	Picks, shovels, or an excavator are used to dig holes for the IVS test items and to backfill the hole.
Measuring Tape	A measuring tape or ruler is used to measure the depth of each IVS test item.
Markers	Nonmetallic pin flags, stakes, tent pegs, or spray paint are used to mark the locations of the IVS test items and the beginning and end of the IVS.
Analog Instrument	A handheld metal detector such as a Schoenstedt GA-52/Cx or White's EM sensor that emits an audio tone used search for buried metal or confirm there are no significant metallic items in a specific location.

4. PROCEDURE

4.1. Health and Safety

All elements of this procedure will be conducted in accordance with the approved site safety and health plan, including but not limited to specified requirements for training, personal protective equipment (PPE), exposure monitoring and air sampling, etc. The UXOSO or designated representative will review the relevant site-specific activity hazard analyses (AHAs) prior to implementing this SOP.

4.2. Instrument Verification Strip Construction

Verification of the digital geophysical mapping (DGM) system is accomplished using an IVS. Multiple IVS locations may be constructed during the project for convenience (for example, to avoid long travel times to reach the IVS on large sites). The constructions details and verification procedures described in this document apply to each IVS location.

4.2.1. Location and Configuration of the IVS

IVS locations will be determined during initial site reconnaissance by the DGM field team. The IVS should be established in an area that is easily accessible, not prone to flooding and other weather-related phenomena, and is determined to be relatively free of subsurface metal objects. The IVS is constructed as one or more survey transects. An IVS location will be selected with preference for the following (although none of the conditions are vital for IVS success):

- Terrain, geology, and vegetation similar to that of a majority of the DGM survey area.
- Geophysical noise conditions similar to those expected across the survey area.
- Large enough site to accommodate all necessary IVS tests and equipment and for adequate spacing (at least 3-m separation and preferably greater) of the ISO items to avoid ambiguities in data evaluation.
- Readily accessible to project personnel.
- Close proximity to the actual survey site (if not within the site).

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Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

4.2.2. IVS Objects

ISOs or inert munitions serve as the seed objects in the IVS. Using inert munitions that match those expected to be found on the site may be preferable as this demonstrates to stakeholders that the system is able to accurately classify the exact MEC of concern. However, using ISOs is the technical equivalent and extraordinary measures to obtain inert munitions are not warranted. ISOs, if used, should approximate the size of the MEC expected to be found on the site and more than one type of ISO should be used if MEC of various sizes are expected. Small, medium, or large ISOs, singly or in combination, can be selected. **Table 1** shows the specifications for the possible ISOs and **Exhibit 1** is a photograph of the three sizes of ISO.

TABLE 1. INDUSTRY STANDARD OBJECT DIMENSIONS AND PART NUMBERS

Item	Nominal Pipe Size	Outside Diameter	Length	Part Number (1)	Schedule
Small ISO80	1"	1.315" (33 mm)	4" (102 mm)	4550K226	80
Medium ISO40	2"	2.375" (60 mm)	8" (204 mm)	44615K529	40
Large ISO40	4"	4.500" (115 mm)	12" (306 mm)	44615K137	40

(1) Part number from the McMaster-Carr catalog (http://www.mcmaster.com/).

4.3. IVS Setup Procedures

Exhibit 2 illustrates the overall IVS process and the procedures to be followed during the siting, emplacement, and use of the IVS.

4.3.1.1.

4.3.2. IVS Background Survey

The Field Team Leader will perform a background DGM survey with an advanced EMI sensor or other DGM instrument using RTK GPS. The purpose of this step is to document the appropriateness of the location (e.g. few existing anomalies), and will verify that IVS targets are not seeded near existing anomalies. The data from this IVS pre-survey will be processed and evaluated before any seeding is performed.

4.3.3. IVS Test Item Location Selection

Once the IVS area is deemed suitable for use, (i.e. free of significant subsurface anomalies or containing anomalies that are clearly identified so that they can be avoided during seeding), targets will be buried at a depth below ground surface of approximately 5 times their respective nominal sizes. This depths is intended to provide adequate signal to noise ratio for detecting the targets. Targets will typically be buried horizontally, although different orientations may be used if the types of seeds used are limited at sites with very specific munitions types. The generalized diagram of the seeded IVS transect is presented as **Exhibit 3**. In this example, only one target is shown. This is the minimum requirement for an IVS. Local custom, stakeholder comfort, or other similar reasons may lead to larger number of items in the IVS. Rarely will more than three or four items be required.

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4.3.4. IVS Test Item Burial and Metadata Recording

4.3.4.1. Measurements of the item depths will be to the center of mass of each item. The UXO escort will bury the IVS targets using shovels to dig the holes to the appropriate depths for burial of the seed items in coordination with the Project Geophysicist. The UXO escort will implement MEC avoidance procedures in accordance with the MEC Avoidance and Escort SOP. The Field Geophysicist will record the following information for each IVS test item:

- The transect endpoints;
- Test item description (e.g. Small ISO80);
- Test item location;
- Test item depth to the center of mass;
- Test item inclination (e.g. horizontal, vertical, degrees [0 is horizontal, 90 is vertical]);
- Test item orientation (e.g. N-S, E-W, inline, Degrees 0-360 [0 is North]);

4.3.4.2. Holes will be backfilled once the appropriate data have been recorded. No physical marking of seed locations is necessary once GPS measurements of the seed locations have been recorded. Data collection at/over the seeds will be guided using the GPS locations displayed on the advanced EMI sensor screen.

4.4. IVS Data Processing Procedures

Prior to collecting production data and each morning before beginning field operations, a function test and dynamic and/or cued data will be collected with the advanced EMI sensor of choice for the project). The raw .tem files and converted .csv files for all collected data will be passed to the data processor who will perform the following steps for each of the IVS test.

4.4.1. Instrument Function Test

- Import and background correct the function test measurement
- Determine the absolute value of the maximum/minimum response measured for each transmitter/receiver pair
- Compute the percent difference between the measured response for each receiver and the baseline value determined during the ongoing function baseline test performed during initial operational testing (SOP AC-01)
- Verify that each response meets the ongoing function test measurement quality objective (MQO)

4.4.2. Dynamic

- Import data and level first time age using a median 100-point rolling statistics filter
- Examine the response profiles for each of the receivers to verify that all data is valid and that responses and background measurements are similar
- Identify the location of the peak z-component response measured over each of the IVS seed items
- Verify that the selected target locations are within 0.25m of the initial location measured for each seed. The initial location will be determined by averaging the results of the five surveys of the IVS performed during initial testing.

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4.4.3. Cued

- Examine the cued data from each IVS location and verify that all measured decays are valid
- Use the measurement over the blank space to background correct the other data points and invert the corrected data
- Verify that the resulting polarizabilities meet the ongoing derived polarizabilities precision (IVS) MQO. Ongoing IVS results will also be tracked using a control chart
- Verify that modeled position for each seed is within 0.25m of the ground truth location

4.4.4. Evaluation of IVS MPCs/MQOs

4.4.4.1. If the measurement performance criteria (MPCs)/measurement quality objectives (MQOs) have not been met, the Project or QC Geophysicist will initiate a root cause analysis to determine the source of the discrepancies. If modifications to the instrument or procedures can be made so that the MPCs/MQOs can be met, these modifications will be made. If the MPCs/ MQOs cannot be met the Project and QC Geophysicists will discuss potential resolutions with the project team.

4.4.4.2. Once the initial (or modified) MPCs/ MQOs have been met, the IVS survey will be complete and the system is verified for field data collection.

5. DATA MANAGEMENT

5.1. Input Data Required

Input data required for this SOP are the ongoing function baseline test results and the locations and identities of the IVS items and the library polarizabilities for each.

5.2. Output Data

Performance and acceptability of the initial IVS data will be documented in an IVS Memorandum. The results of the ongoing function and IVS testing described in Section 4.4 will be saved in the project database.

6. QUALITY CONTROL

This definable feature of work (DFW) is performed throughout the project. Performance of the required QC checks will be documented by the Field or Project Geophysicist in the project database, which will be updated daily. A comprehensive root cause analysis will be performed and a corrective action determined for any data failing the applicable MQOs. The Project and/or QC Geophysicist will be notified of any sudden changes identified on the cued IVS data control chart even if the confidence does not drop below the MQO. Any such changes will require a thorough examination of the individual decays for the failing point(s) to identify any obvious transmitter/receiver problems. The QC Geophysicist may also request preliminary classification results for all points collected on the day of the change to compare against QC seeds.

Procedure # AC-02	Title: Advanced Classification Instrument Verification Strip (IVS)	Revision # 0.0
Effective Date: 8/02/16	Approved By:	Last Reviewed/Revised: 8/02/16

6.1. Measurement Quality Objective (MQOs)

The MQOs for the IVS are presented in Worksheet 22 of the QAPP. The advanced EMI sensor of choice for the project will not be used for field data collection until it is able to meet these MQOs or until the project team agrees on modifications to these MQOs.

7. REPORTING

IVS construction, implementation, and results with regard to proposed MQOs (Worksheet 22) will be documented in an IVS Memorandum. Daily function test and IVS results will be maintained in the project database, which will be updated daily. In addition to tracking in the database, a control chart developed in Excel will be updated with daily cued IVS results. The database and Excel spreadsheet will be included with weekly data deliverables or upon request and will also be included with the Final Report.

8. REFERENCES

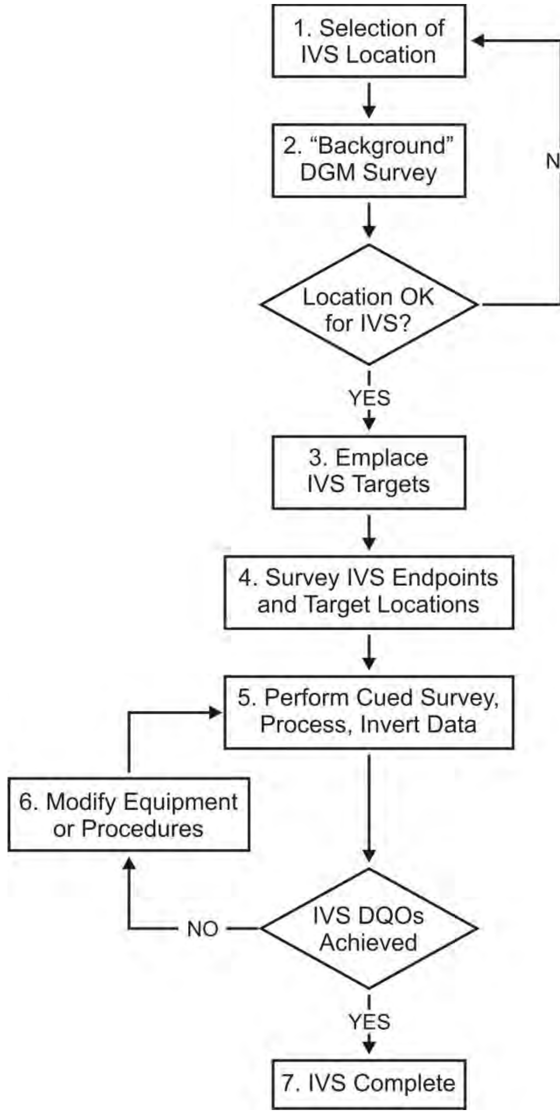
Reference Title (Author)	Brief summary of relevance to this procedure
None	Not applicable.

9. EXHIBITS

Exhibit 1 Small, Medium and Large ISOs

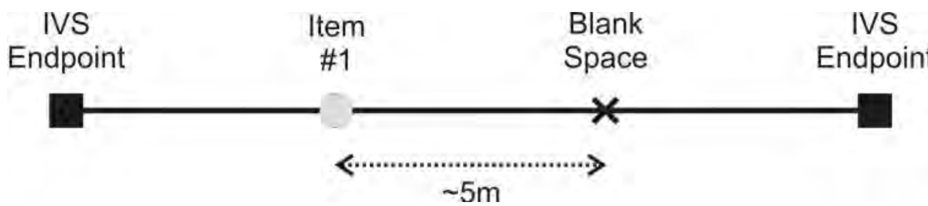
Procedure # AC-02	Title: Advanced Classification Instrument Verification Strip (IVS)	Revision # 0.0
Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

Exhibit 2 IVS Siting, Emplacement, and Use



Procedure # AC-02	Title: Advanced Classification Instrument Verification Strip (IVS)	Revision # 0.0
Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

Exhibit 3 Example Layout of Instrument Verification Strip



10.REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	8/27/15	Initial Release	n/a
01	8/02/16	Generalized for any advanced EMI sensor	Previously targeted to MetalMapper

Procedure # AC-05	Title: Collect Static Background Measurements	Revision # 0.0
Effective Date: 8/27/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/27/15

1. PURPOSE

The purpose of this SOP is to identify the means and methods to be employed when selecting the positions for background measurements using an advanced digital geophysical mapping system and verifying the usability of the resulting background data. The observed signal in a cued measurement using advanced sensors is composed of 1) the EMI response of the buried target, 2) the self-signature of the sensor system, and 3) any response from the ambient environment in which the target is buried. The objective of taking background measurements is to independently measure the last two contributors to the overall EMI response. These "non-target" values can then be subtracted from the overall signal response to determine the signal response from only the unknown buried object being evaluated. For this to be successful the background measurements must be collected in an area without any buried targets and with a geology representative of that where the unknown items are located. They must also be taken throughout the survey day because environmental changes such as large changes in ambient temperature, significant changes in background moisture (morning dew evaporating, rain showers passing through, etc.), or significant changes to the sensor itself (cable replacement, new GPS antenna, etc.) will cause the sensor or environmental contribution to the background reading to change.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Confirms selected background locations are acceptable; reviews results for initial background collections at each location surveyed
QC Geophysicist	Reviews QC testing results and verifies results are documented in the QC database.
Field Team Leader	Operates geophysical sensor during data collection
Data Processor	Identifies preliminary locations for background points by reviewing detection data; processes collected data and documents QC results in the project QC database

3. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
Geometrics MetalMapper	The MetalMapper is an advanced electromagnetic induction sensor designed for the detection and classification of buried metal objects. The sensor consists of three orthogonal 1-m x 1-m transmit coils for target illumination and seven, three-axis receive cubes. Its sampling is electronically programmable and therefore flexible. It measures the decay curve up to 8-ms after the transmitters are turned off for each of the 21 receive channels.
Transport Vehicle	Transport vehicle (Skid steer, tractor, extended reach forklift) is used to move the MetalMapper during data collection.
Industry Standard Objects	Industry Standard Objects (ISOs) or inert munitions are buried along the IVS as test items to confirm that the geophysical sensor is functioning correctly.
GPS Unit	Used to record the location of IVS items and collected geophysical data

Procedure # AC-05	Title: Collect Static Background Measurements	Revision # 0.0
Effective Date: 8/27/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/27/15

Inertial Measurement Unit	Measures yaw, pitch, and roll of sensor. Data used to correct position measured by the GPS
Personal Computer	Manage geophysical data and processing software.
Geosoft Oasis Montaj with UX-Detect module (Parsons)	Software used for geophysical data processing

4. PROCEDURE

Background measurements will be recorded no less than four times each survey day, preferably evenly spaced in time, and at one or more geographic locations as required to document the EMI signatures of near-surface soils present at the site. Background measurements involve positioning the sensor and collecting static measurements over a pre-identified set of background locations. In combination with SOPs for sensor assembly (SOP AC-01) and testing at the IVS (SOP AC-02), background data are collected that are used to collect the static data described in SOP AC-06.

Prior to cued data collection, the correct operation of the geophysical sensor and navigation and orientation systems must be verified at the Instrument Verification Strip (IVS) as described in SOP AC-02. IVS results will be reported in the project database.

4.1. Choose Locations for the Background Measurements and Verify Their Suitability

One or more locations for background measurements will be planned at each site. The number and location of the background measurements will be influenced by the following considerations:

- The background measurements should be collected at locations that are similar to that of the production survey area with regard to geophysical noise, terrain, geology, and vegetation. If these factors change appreciably, additional background measurements, taken at a more representative location, will be required.
- The background measurements should be collected at locations devoid of buried metal objects. If a suitable object free area cannot be identified, attempts should be made to create a “clear” 2-m square area by surveying and removing all metal objects. Once cleaned, the background measurements should be re-collected in the “clear” area.
- For efficiency, background measurements should be collected in areas that are close to the survey area(s) to minimize travel time.
- Initial measurement of the production area background locations should be collected as five background measurements: one centered at the flag and one offset 40cm in each cardinal direction. All measurements should be below the project background threshold.

Once an adequate number of background locations have been identified, an initial measurement should be collected over each of the background locations in turn as illustrated in Exhibit 1**.**

1. Initial locations for the background measurement are chosen most easily by referring to the dynamic survey data. These data can be used to guide the geophysicist to suitable locations that satisfy the considerations noted above.

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2. Once an adequate number of initial locations have been identified an initial measurement should be collected over each of the background locations as follows:
    a. Center the MetalMapper over the location chosen as a background point. Mark the corners of the sensor with non-metallic pin flags to allow this same location to be found again for future background readings.
    b. Record the stationary geophysical data at location and at the four offset locations and verify that the signal amplitudes for all decays measured are below the threshold chosen for this project. If higher amplitude decays are observed, the location should be inspected and any metal contamination found should be removed. If an apparent subsurface source cannot be cleared quickly, another nearby location can be chosen. If no metal contamination is present, the applicability of the selected point should be considered with regard to local background conditions. If local background conditions (i.e. increased geologic response over a wide area) suggest that the measured background accurately reflects local background, the project background threshold may need to be revised. The USACE Geophysicist will be consulted prior to any change in background threshold.
3. Continue this process at each of the chosen locations until their suitability for background measurements has been verified.
4. Once this process is complete, the decays for the highest acceptable background measurement recorded will serve as the baseline values for succeeding background measurements.

4.2. Collect Background Measurements Throughout the Survey Day

Background measurements should be collected with a maximum spacing of two hours throughout the survey day. Additional background measurements can be taken if the Site Geophysicist or Field Team Leader determines that changes made to the sensor or natural environmental changes may have caused the sensor or environmental contribution to the background reading to change. Careful field notes should be made to document the reasons for extra background readings to guide the Data Processor in choosing the correct background for each cued data set.

The procedure for taking background measurements is as follows:

1. Return the sensor to one of the previously verified background measurement location taking care to positioning the sensor as closely as possible to the initial location and orientation.
2. Collect a background measurement.
3. Compare the measured decays to previous measurements at this location. If there are significant deviations in the measured amplitudes, repeat the measurement.
4. If the deviations persist, document the environmental changes that may have led to this deviation in the field notes.

5. DATA MANAGEMENT

The following sections describe the data that is needed to perform this SOP and the resulting data.

Procedure # AC-05	Title: Collect Static Background Measurements	Revision # 0.0
Effective Date: 8/27/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/27/15

5.1. Data Inputs

In initial list of suitable background locations, identified from the survey data, is required to begin this SOP. After the locations have been verified, they become the final background location list.

5.2. Output Data

The decays for collected background files will be plotted with a single background point considered to define the project threshold. Plots will be made to compare the five points collected for the initial measurements collected at location to the threshold and to compare each day's background points to the threshold. Initial background data points will be saved in files containing only the five initial points for each location and in a file containing all of the background points collected during the project. Subsequent background collections will be added to the master background file.

The QC checklists in Exhibits 2 and 3 of this SOP will also be completed, signed, and filed as background locations are identified and initial testing is performed.

6. QUALITY CONTROL

Proper selection of background locations and the results of initial testing will be documented on the Preparatory and Initial and QC checklists in Exhibits 1 and 2 to this SOP.

DFW 2 ensures that the MetalMapper is working properly and that the field geophysical team is collecting data of adequate quality. Therefore, for routine background measurements, this DFW requires only Follow-on QC inspections which are documented by overlaying collected decays with a single background point selected to represent the project threshold. Plots will be made for the initial background measurements at each new background location and for all backgrounds collected during a single day. Exceedances of the reference threshold at new locations will be evaluated as described in Section 3.1 (2b). Exceedances for standard daily background measurements that are not the result of changing environmental conditions documented by the field team will be rejected for use. If little variation in background is noted throughout the day and production measurements have been collected over one general location on site, an earlier or later background point will be considered acceptable for data correction. If intra-day background response is variable due to changing environmental conditions, or if the rejected background is specific to points collected in a certain location, the affected data will be recollected.

6.1. Measurement Quality Objectives (MQOs)

The MQOs for background measurements are presented in Worksheet 22 of the QAPP. Measured backgrounds will not be used to correct field data until these MQOs are met or until the project team agrees on modifications to these MQOs.

7. REPORTING

SOP AC-05 will be documented through the completion of the Preparatory and Initial and QC Checklists in Exhibits 2 and 3 by the Field or Project Geophysicists. The completed checklists will be used to document the selection and preparation of the background areas (Preparatory Inspection Checklist in Exhibit 2 and the initial background readings taken at each selected area (Initial Inspection Checklist in Exhibit 3. Decay plots comparing initial backgrounds at new points and daily measurements to a reference threshold will be delivered with their applicable data sets. Rejected backgrounds and the consequences of rejection (i.e. points to be re-collected) will be recorded in the project QC database.

Procedure # AC-05	Title: Collect Static Background Measurements	Revision # 0.0
Effective Date: 8/27/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/27/15

8. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
None	Not applicable.

9. EXHIBITS

Exhibit 1 Choosing and verifying locations for background measurements

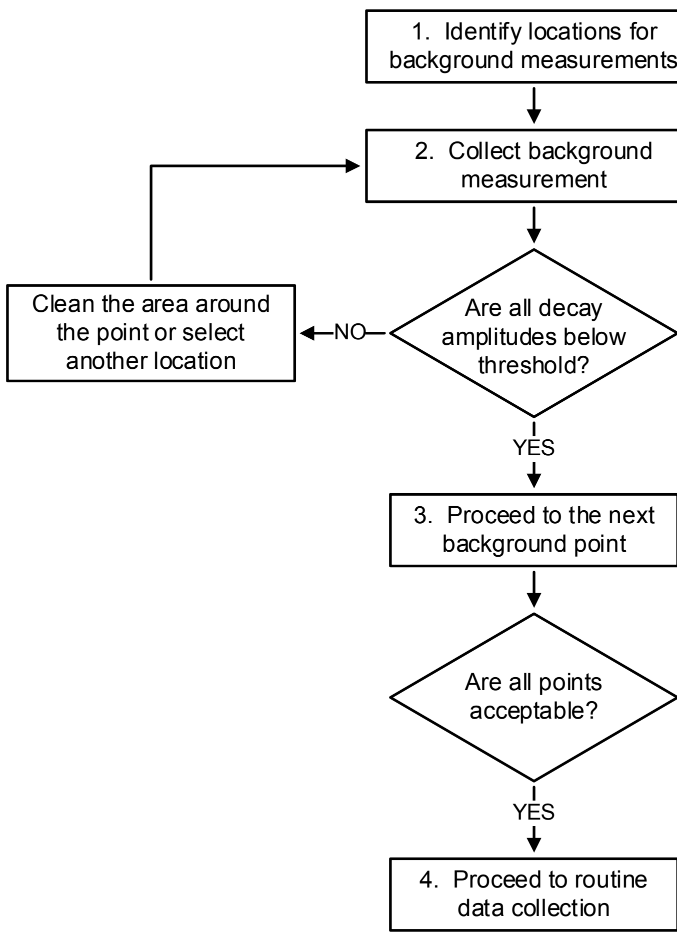

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Exhibit 2 Preparatory Background Data Collection QC Checklist

This checklist is to be completed by the Field or Project Geophysicist during selection and preparation of the background areas.

QC Step	QC Process	Yes/No	Initial of Field or Project Geophysicist
1. Qualifications	Are the same geophysical personnel being used as in SOP AC-01? If not, are the qualifications of the new personnel in compliance with the requirements of Worksheet 4, 7, & 8?		
2. Background area selection	Do the selected background areas have similar geophysical noise, terrain, geology and vegetation as the production survey area they represent (Section 3.1)?		
3. Background area selection and preparation	Are the selected background areas devoid of buried metal objects (Section 3.1)?		
4. Background area selection	Are the selected background areas sufficiently close to the production area to minimize travel (Section 3.1)?		

Field Geophysicist: ______________________________Date:___________

Project Geophysicist: ____________________________Date:___________

Data Processor: ________________________________Date:___________

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Effective Date: 8/27/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/27/15

Exhibit 3 Initial Background Data Collection QC Checklist

This checklist is to be completed by the Field or Project Geophysicist during the initial data collection at each background area.

QC Step	QC Process and Guidance Reference	Yes/No	Initial of Field or Project Geophysicist
1. Qualifications	Are the same geophysical personnel being used as in SOP 1? If not, are the qualifications of the new personnel in compliance with Worksheet 4, 7, & 8?		
2. Preparation	Has the SOP AC-01 Preparatory Checklist been successfully completed?		
3. Preparation	Have the IVS procedures from SOP AC-02 been successfully completed?		
4. Data collection	Is the MetalMapper properly centered on the background location and are the corners of the sensor marked with non-metallic pin flags (3.1 (2.a))?		
5. Data collection	Was the background data recorded at the center point and at the 4 offset points (3.1 (2.b))?		
6. Data collection	Is background data recorded for each currently identified background location (3.1 (3))?		
7. Data analysis	Are the signal amplitudes for all five points verified to be below the selected threshold (3.1 (4))?		

Field Geophysicist: ______________________________Date:___________

Project Geophysicist: ____________________________Date:___________

Data Processor: ________________________________Date:___________

10. REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	8/27/15	Initial Release	n/a

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Procedure # AC-06	Title: Collect Cued Target Measurements	Revision # 0.0
Effective Date: 8/27/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/27/15

1. PURPOSE

The purpose of this Standard Operating procedure (SOP) is to identify the means and methods to be employed when collecting cued measurements using a MetalMapper advanced electromagnetic induction (EMI) sensor for target classification. Cued data collection involves navigating the sensor to the precise anomaly location, collecting static, advanced electromagnetic sensor data at this location, and verification of the integrity and validity of the collected data. Verification includes using the sensor data to derive an estimate of the target position relative to the center of the sensor. If this position estimate falls outside a predetermined threshold, the sensor will be repositioned and a second data collection event will be performed.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Designs geophysical approach for the project and monitors advanced sensor data acquisition.
QC Geophysicist	Reviews QC testing results and verifies results are documented in the QC database.
Field Geophysicist	Acquires geophysical data and documents obstructions to collecting geophysical data.
Data Processor	Processes collected data and documents testing results in the QC database.

3. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
Geometrics MetalMapper	The MetalMapper is an advanced electromagnetic induction sensor designed for the detection and classification of buried metal objects. The sensor consists of three orthogonal 1-m x 1-m transmit coils for target illumination and seven, three-axis receive cubes. Its sampling is electronically programmable and therefore flexible. It measures the decay curve up to 8-ms after the transmitters are turned off for each of the 21 receive channels.
Transport Vehicle	Transport vehicle (Skid steer, tractor, extended reach forklift) is used to move the MetalMapper around for data collection.
GPS Unit	Used to record the location of IVS items and geophysical data
Inertial Measurement Unit	Measures yaw, pitch, and roll of sensor. Data used to correct advanced sensor data positions.

Procedure # AC-06	Title: Collect Cued Target Measurements	Revision # 0.0
Effective Date: 8/27/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/27/15

4. PROCEDURE

Cued investigation for target classification involves positioning the sensor and collecting static measurements over a pre-identified set of anomalies. In combination with SOPs for sensor assembly (SOP AC-01), testing at the IVS (SOP AC-02) and taking background measurements (SOP AC-05), a set of static data measurements are collected using the MetalMapper over each anomaly. At each anomaly the data acquisition will be performed using the steps shown in **Exhibit 1**.

Prior at cued data collection, the correct operation of the geophysical sensor and navigation and orientation systems must be verified at the Instrument Verification Strip (IVS) as described in SOP AC-02.

The following is a description of each of the steps shown above:

1. **Navigate to the Anomaly Location**. Navigation to the anomaly location may be performed visually or, more commonly with the MetalMapper, through the use of the RTK GPS positioning system. Visual navigation requires marking the anomalies (usually with survey pin flags) in advance. The MetalMapper has the ability to direct the operator to an anomaly location based upon the geophysical signal received, and the first measurement will be taken using the received signal. If the first measurement location appears to be more than 40 cm from the selected dynamic target location, a second measurement will be collected directly over the dynamic location. Distance between measured locations and selected dynamic targets will be determined during data processing. Re-shots will be collected directly over any dynamic targets without cued measurements within 40 cm.
2. **Collect a set of static sensor measurements**. Initiate the collection of a set of measurements. During this measurement, care will be taken to ensure that the sensor does not move, and all external sources of EM signals (i.e. metal) are kept away from the sensor.
   Any metal associated with the sensor and deployment mechanism (e.g. console, support structures) that cannot be reasonably distanced from the sensor must be kept in the same physical relation with the sensor as was maintained during background measurements.

5. DATA MANAGEMENT

The following sections describe the data that is needed to perform this SOP and the resulting data.

5.1. Data Inputs

An anomaly list consisting of anomaly IDs and UTM Northing and Easting coordinates in meters.

5.2. Output Data

The output data from this SOP will consist of one raw sensor data file (.tem or .hdf5) per anomaly interrogated. These data files will be transferred daily (or more often as dictated by site procedures) to the data analyst.

6. QUALITY CONTROL

QC checks for this SOP are performed during the implementation of SOP AC-02, “Testing the System at the IVS”. SOP AC-02 ensures that the MetalMapper is working properly and that the field geophysical team is

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collecting data of adequate quality. Therefore, this DFW requires only Follow-on QC inspections which will be documented during initial data processing.

Daily data packages, containing the geophysical data from that day, will be reviewed by the QC Geophysicist to ensure that the Measurement Quality Objectives (MQOs) are being achieved. A comprehensive root-cause analysis will be performed and a corrective action will be determined if the QC Geophysicist determines that the MQOs are not being met or if a trend toward the MQO limits is observed.

6.1. Measurement Quality Objectives (MQOs)

The MQOs for cued target measurements are presented in Worksheet 22 of the QAPP. Cued data will not be used to classify targets until these MQOs are met or until the project team agrees on modifications to these MQOs.

7. REPORTING

SOP AC-06 will be documented in the project database. The database will report the results of the twice daily IVS testing (SOP AC-02) and will include a list of all a targets requiring re-shots due to instrument functionality failures (transmit current, GPS, or IMU failures) or offset exceedances between the dynamic target and cued measurement locations or the cued measurement and modeled source locations. The Field Geophysicist will also maintain a field notebook and the Project Geophysicist will review this notebook daily to note issues that potentially affect quality.

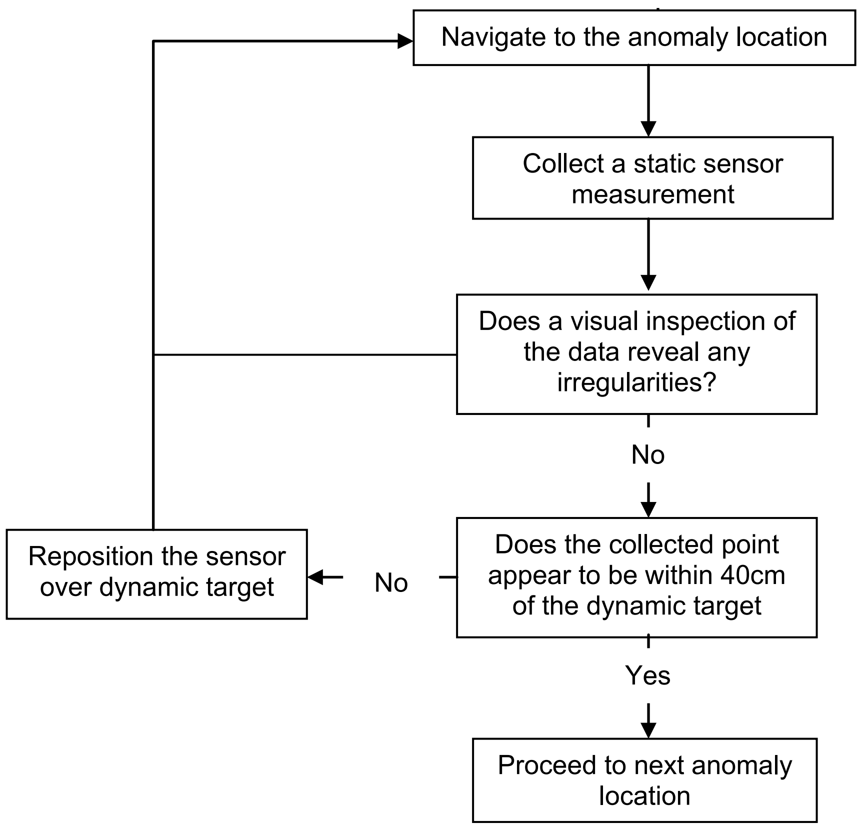
8. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
None	Not applicable.

Procedure # AC-06	Title: Collect Cued Target Measurements	Revision # 0.0
Effective Date: 8/27/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/27/15

9. EXHIBITS

Exhibit 1 Procedure to Collect a Cued Target Measurement



Procedure # AC-06	Title: Collect Cued Target Measurements	Revision # 0.0
Effective Date: 8/27/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/27/15

10. REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	8/27/15	Initial Release	n/a

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Procedure # AC-07	Title: Process Cued 2x2 Data	Revision # 0.0
Effective Date: 8/02/16	**Approved By:**	**Last Reviewed/Revised:** 8/02/16

1. PURPOSE

The purpose of this Standard Operating procedure (SOP) is to identify the means and methods to be employed when processing cued measurements collected using a 2x2 advanced electromagnetic induction (EMI) sensor for target classification. Cued surveys include the collection of cued data over predetermined target locations and background locations. Cued measurements are also performed over instrument verification strip (IVS) targets for quality control (QC) purposes. This SOP details the steps required to verify the quality of these measurements, process these measurements to derive features related to the physical characteristic of the target, and use these features to classify the targets.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Designs geophysical approach for the project; monitors advanced sensor data acquisition; reviews compiled ranked dig lists
QC Geophysicist	Reviews QC testing results and verifies results are documented in the QC database; confirms that QC seeds have been correctly classified as targets of interest (TOI)
Data Processor	Processes collected data and documents testing results in the QC database; makes classification decisions based on data results

3. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
Personal Computer	Manage geophysical data and processing software.
Geosoft Oasis Montaj with UXAnalyze-Advanced Module	Software used for geophysical data processing and classification

4. PROCEDURE

4.1. Data Import/Initial QC

The raw *.TEM data are converted to ASCII *.csv files using the Em3D software. The data are then imported into Geosoft's UXAnalyze-Advanced (UXA) purpose built processing environment. Once imported the data are inspected and assessed against the measurement quality objectives (MQOs) provided in QAPP WS 22 for:

- Transmit (Tx) current within limits

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- Global positioning system (GPS) fit quality
- Valid inertial measurement unit (IMU) data

4.2. Background Corrections

Background corrections are used to remove the self-signature of the 2x2 system and the soil response from the measured anomaly data. Background measurements are taken at locations selected from the detection survey data set. Prior to utilizing these locations for background measurements, they need to be verified to be devoid of metal. Additionally each background measurement needs to be verified as suitable prior to using it for background correction of the target measurement data.

4.2.1. Background Location Verification

Each background location is verified by comparing a set of 5 measurements taken at the intended location: one measurement at the location and one more with the sensor offset by ½ sensor spacing in each cardinal direction (SOP AC-05). The background location is considered valid if the 48 decays for all 5 points qualitatively match each other and are below the decays for the background point selected to represent the project threshold. These images will be saved and presented in a background summary report.

4.2.2. Background Measurement Verification

Individual background measurements must be verified prior to their use for background corrections. Background measurements will be compared to the initial background verification measurement using the same decay plot utility functionality qualitatively verified. These images will be saved and presented in a background summary report. Invalid measurements will be removed from background database to ensure that they are not used.

4.2.3. Background Corrections

Background corrections are applied using a purpose built tool in UXA that automatically finds the closest background (chronologically and spatially) and will only apply the background corrections that were collected within a preset time limit relative to the target measurement. This preset time limit will generally be set to 2 hours. The background corrected data channel will be submitted to the inversion processes to derive target features.

4.3. Function Test Measurements

Function test measurements (described in SOP AC-01) are performed in conjunction with the background measurements to confirm that all transmit and receive components of the 2x2 sensor are operational. These data are background corrected, then the monostatic components are compared to a benchmark set of values to confirm that all components are fully operational. The data processor should perform the same background corrections and log the results for QC/quality assurance (QA) purposes.

4.4. Target Feature Estimated

After background corrections are applied, intrinsic and extrinsic features are estimated for the target anomalies as well as the daily QC measurements collected at the IVS.

Single target and multi-target inversion routines in UXA are used to determine the parameters of a target, or constellations of targets, that would produce responses that closely match the observed responses. These parameters include extrinsic parameters (location and orientation) as well as the intrinsic parameters (principal axis polarizabilities) related to the object size shape and composition. The intrinsic

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parameters, otherwise known as betas (β) are used for classification. Model results will only be used for classification if they pass the MQOs identified to confirm that they support classification (QAPP WS #22).

4.5. Daily IVS Survey

Prior to the start and at the end of each day of data collection, measurements of the set of IVS targets are performed (described in SOP AC-02). These measurements are processed as described above and the derived features are assessed against the MQOs presented in WS 22. These results will be recorded in the project database.

4.6. Classification

Classification of targets will be based upon objective numeric criteria using algorithms incorporated into the UX-Analyze software package. Separate single and multiple-object inversions of each processed data point will be performed. As the names suggest, the single-target inversion solves for a single target and the multi-target inversion posits multiple targets. The multi-source solver not only presupposes multiple sources, it will also produce a number of candidate 'realizations' of targets. Each candidate realization proposes a configuration of targets whose modeled response reasonably fits the observed data. For example, one candidate realization may have three targets, while a second candidate realization for the same measurement may have two or four targets. This process reflects the fact that, with an unknown number of potential targets of different sizes and shapes, a number of different models can closely match the observed data. A separate fit coherence value is derived for each candidate realization as well as for the single solver.

Using these criteria, a prioritized list is created with high likelihood target of interest (TOI) placed at the top of the dig list (just after digs classified as "training data" and "inconclusive") and high likelihood non-TOI placed at the bottom of the list. The primary method for classification will be library matching, supplemented by cluster analysis and feature space analysis.

4.6.1. Site Specific Munitions Library

4.6.1.1. A site specific library of βs for candidate munitions items identified in the conceptual site model (CSM) will be used as the primary means of classification. The site specific library will consist of polarizabilities from the standard 2x2 library included with UX-Analyze, together with polarizabilities collected by Parsons as part of an ESTCP library update and expansion project. Various examples of the types of the munitions presented in the CSM will be included in the site-specific library, although the examples in the library will generally not be limited to specific marks/mods presented in the CSM unless specific information suggests there is no possibility that other marks/mods are present on site. The project geophysicist will verify that the site specific library contains examples of all munitions presented in the CSM, and a qualified unexploded ordnance technician will verify that the marks/mods present in the library are generally representative (i.e. size, shape, and wall-thickness are similar to expected munitions even if all marks/mods are not specifically included in the library) of expected munitions. Intrinsic parameters for items listed in the CSM not confirmed to be in existing libraries will be derived from test measurements prior to the start of the classification process.

4.6.1.2. In addition to comparison versus the site specific library, cued data will also be compared to a comprehensive library containing βs for items not expected at the site. Close matches to these items in this library will be requested as training data as described below. The initial site specific and comprehensive libraries will be distributed to the project team at the start of cued data collection, and the site specific library will be distributed any time a change is made.

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4.6.2. Library Matching

4.6.2.1. Classification will be based primarily on the goodness of fit metric (values from 0.0 to 1.0) generated by UXA during a comparison of the β values estimated for each surveyed target and the β values in the munitions libraries developed for the project. This comparison will be performed via the library match utility in UXA. The goodness of fit metric is a measure of the fit correlation between a target and the library entry that best fits that target, with higher values indicating a better fit between the target and the corresponding item in the library. The library fit analysis matches the following four combinations of βs to those of the candidate library TOIs:

- β1, β1/β2, β1/β3
- β1, β1/β2
- β1/β2, β1/β3
- β1

The confidence metrics for each fit combination are averaged to derive a 'decision metric'.

4.6.2.2. This library matching process is performed for each single-solver model and every target in each of the multi-source solver candidate realization models. For each flag position, the best library fit from the single-solver and multi-solver targets is used as the decision metric. This decision metric is used to rank and classify the target list. Values below the analyst's threshold (nominally 0.8) are considered non-TOI.

4.6.2.3. A set of training digs may be identified by the analyst during this step, dependent on the results of the comparison to the comprehensive library. Cued data with high confidence matches to items in the comprehensive library not already present in the site specific library will be considered for addition to the training dig list. High confidence will be defined as a decision metric ≥ 0.95 for small items (40mm or less) and ≥ 0.85 for larger items. If the intrusive investigation identifies a hazardous item, a representative signature is placed in the site specific library and the matching process will be repeated to ensure that all similar items are classified as TOI. The intrusive investigation results of these digs as well as decision metrics derived for other known TOI (IVS and Seed items) are used to finalize the analyst threshold which represents the stop dig point (Section 4.6.4).

4.6.3. Cluster Analysis/Feature Space Analysis

4.6.3.1. Cluster analyses are performed whereby the clusters of anomalies with similar β signatures are identified using the self match utility in UXA. The self match utility will be set to identify any clusters with match metrics of 0.9 or greater, and any group of 2 or more self-similar sources will be examined by the analyst. For each identified cluster, a representative sample may be intrusively investigated as part of the training data at the discretion of the analyst. Training items identified as TOI will be added to the site specific library.

4.6.3.2. Individual items that do not match any library items but have βs that indicate a large, axially symmetric, thick-walled object will be identified and may be investigated as part of the training data and added to the site specific library if they are identified as TOI.

4.6.4. Stop Dig Point

An ordered dig list will be created based on the objective decision metric described in 4.6.2.1. The stop-digging point (the point where items further down the list are deemed non-TOI and hence left in the ground) will be selected based on analyst judgment of library matches. While this stop dig point will be determined based on the expert judgment of the analyst, it will be rigorously verified by ensuring that the decision statistic at the stop dig point lies well below the decision statistic for all QC seeds and TOI

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revealed during training data verification. Further confirmation will come from all blind QA seeds reporting decision statistics above the stop dig point. Finally, additional validation and verification digs, as specified in QAPP WS #22 and discussed in SOP AC-09, will reveal ground truth information for sources beyond the stop dig point.

5. DATA MANAGEMENT

5.1. Data Inputs

The data inputs required for performing a cued advanced analysis data acquisition are:

- A list of target anomalies including identifier (ID) and position (X, Y)
- A list of Background locations (ID, X, Y)
- A list of IVS locations (ID, X, Y)
- 2x2 measurement data including those for target anomalies, daily IVS, backgrounds, and function tests
- Digital copies of field notes for all data collection activities
- Site specific and comprehensive library signatures

5.2. Output Data

The data outputs of the cued advanced analysis data processing for each delivered survey unit (contiguous subset of the survey site) are:

- Project database documenting performance relative to QAPP WS 22 for:
    - IVS results,
    - Function Test Results
    - Background measurements
    - Target Anomaly Measurements
- Prioritized target list
- Target measurement data, background measurement data, and target feature databases
- Supporting documents for classification (PNG, JPG, or PDF images)
- Cued survey data usability assessment

6. QUALITY CONTROL

6.1. Measurement Quality Objectives (MQOs)

The MQOs for cued target measurements are presented in WS #22 of the QAPP. Performance relative to the MQOs will be assessed during the processing of the collected data. Cued data will not be used to classify targets until these MQOs are met or until the project team agrees on modifications to these MQOs.

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Every effort will be made to ensure that the selected result(s) for each target either passes the MQOs specified in WS 22 or that there is an adequate explanation for why the selected result does not pass an MQO. Typically, selected results that do not pass an MQO are chosen to represent a target because they are a much closer match to a TOI than another result for that target which did pass all of the MQOs.

7. REPORTING

Reporting of the activities associated with this SOP will consist of:

- QC Report - detailing the system performance against the MQOs identified on QAPP WS 22 (including MQOs for daily IVS and Function Test performance as well as for individual measurement metrics).
- Classification Report – detailing specific approach to classification including final library make-up, cut-off threshold, cluster analysis approach and results, and feature space analysis approach and results

8. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
None	Not applicable.

9. EXHIBITS

No Exhibits

10.REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	8/02/16	Initial Release	n/a

Procedure # AC-08	Title: Verify Recovered Objects are Compatible with Predictions	Revision # 0.0
Effective Date: 8/28/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/28/15

1. PURPOSE

The purpose of this SOP is to identify the means and methods to be employed when comparing the results of an intrusive investigation against the target parameters resulting from analysis of advanced sensor data.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Compares intrusive results to classification decisions; recommends additional intrusive activity if necessary.
QC Geophysicist	Reviews QC checklist to confirm results

3. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
Personal Computer	Manage geophysical data and processing software.
Geosoft Oasis Montaj with UX-Analyze Module	Software used for review of classification data
Results of Intrusive Investigation	Results of the intrusive investigation to include recovery depths, photographs and descriptions. These will be checked against the sources predicted during classification.

4. PROCEDURE

Each item recovered during the intrusive investigation of an anomaly should be compared to the results of the data analysis. Specific parameters to compare include burial depth, rough size, and item shape. Any significant deviations will require a re-examination of the anomaly and/or a re-analysis of the advanced sensor data.

4.1. Compare Recovered Item(s) Against Predictions

In the case where only a single item is predicted to be the source of the anomaly, this comparison is relatively straightforward.

1. Compare predicted depth to actual burial depth. These should agree to within 10 cm.
2. Compare recovered item size to predicted size band. The project database will contain a predicted size for the item within three bands. Items defined as small will be the size of a 37-mm

Procedure # AC-08	Title: Verify Recovered Objects are Compatible with Predictions	Revision # 0.0
Effective Date: 8/28/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/28/15

projectile and smaller, items defined as medium will be larger than a 37-mm projectile and smaller than a 105-mm projectile, and items defined as large will be the size of a 105-mm projectile and larger.

3. Compare the shape of the recovered item to the predicted shape. The predicted shape is inferred from the polarizability decay curves in the project database. Three examples of symmetric (or near-symmetric) items are shown in **Exhibit 1**. If all three curves are different, then the object is predicted to be non-symmetric.

If the analysis indicates the anomaly results from multiple items, then a comparison will be required for each item recovered.

4.2. Resolution of a Mismatch

There are two common causes for a mismatch between the recovered object and the analysis predictions. The resolution of these cases is straightforward.

1. A small item is recovered from a shallow depth when the prediction is for a larger item more deeply buried. This often results from a failure of the intrusive crew to clear the hole after recovering a shallow frag item.
2. A small item (or no item) is recovered when the prediction is for a very deeply buried large item. This often results when the anomaly resulted from geologic interference. In attempting to reproduce the measured anomaly, the inversion routine is driven toward a very deep large anomaly.

Any other mismatch between prediction and observations will require an examination of the anomaly location or the analysis or both.

5. DATA MANAGEMENT

The following sections describe the data that is needed to perform this SOP.

5.1. Data Inputs

The analysis predictions for depth, size, and shape are contained in the project database in Oasis montaj. The parameters of the recovered items are contained in the intrusive results file.

5.2. Output Data

The resolution of any mismatches between the recovered items and analysis predictions will be documented in an Analysis Verification Report to be submitted by the Project Geophysicist.

6. QUALITY CONTROL

QC consists of performing the inspections on the Recovered Object Verification Checklist that is included as **Exhibit 2** to this SOP. This checklist will be completed by the Project Geophysicist and will be reviewed by the QC Geophysicist.

6.1. Measurement Quality Objectives (MQOs)

The MQOs for SOP AC-08 are presented in Worksheet 22 of the QAPP.

Procedure # AC-08	Title: Verify Recovered Objects are Compatible with Predictions	Revision # 0.0
Effective Date: 8/28/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/28/15

7. REPORTING

Achievement of the Recovered Object Verification MQOs (see the MQOs Worksheet 22) will be documented by the Project and QC Geophysicists by completion of the QC Checklist in Exhibit 2 to this SOP.

8. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
None	Not applicable.

9. EXHIBITS

Exhibit1 Three Examples of Symmetric (or near-symmetric) Items

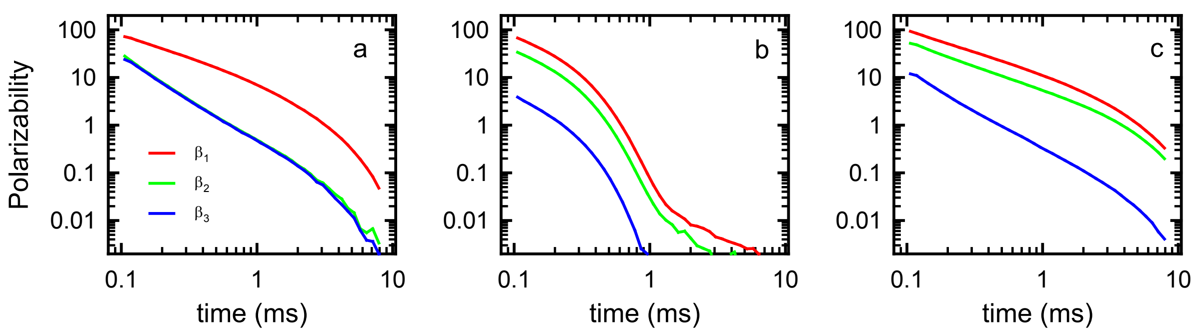

Exhibit1. Examples of the polarizability decay curves for a variety of symmetric (or near-symmetric) objects. The curves in plot (a) depict a cylindrical object with one large response and two smaller, but equal responses. In addition, the polarizabilities decay slowly indicating a thick-walled object. The curves in (b) result from a plate-like object with two large, and nearly equal, responses and one smaller response. These polarizabilities decay quickly indicating a thin-walled object. The object in plot (c) is also plate-like but thicker walled as indicated by the slowly decaying polarizabilities.

Procedure # AC-08	Title: Verify Recovered Objects are Compatible with Predictions	Revision # 0.0
Effective Date: 8/28/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/28/15

Exhibit2 Recovered Object Verification Checklist

This checklist is to be completed by the Project and QC Geophysicist for a series of recovered items.

Series of anomalies covered by this verification: From __________ To ___________

Date:__________ Time:__________

QC Step	QC Process	Yes/No	Initial of Data Processor
1. Qualifications	Is the same QC Geophysicist being used? If not, are the qualifications of the new personnel in compliance with the requirements of Section 1.2.1?		
2. Recovered object comparison	Did the QC Geophysicist compare each recovered item to the analysis predictions (Section 3.1)?		
3. Resolution of mismatches	Was each mismatch successfully resolved (Section 3.2) and the resolution documented in a verification report (Section 4.2)?		
3. MPC Documentation	Have the MPCs for DFW 13 from Worksheet 9 been achieved?		

QC Geophysicist: ______________________________Date:___________

Project Geophysicist: ____________________________Date:___________

10.REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	8/28/15	Initial Release	n/a

Procedure # AC-09	Title: Validate Classification Process	Revision # 0.0
Effective Date: 8/28/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/28/15

1. PURPOSE

The purpose of this SOP is to identify the means and methods to be employed when validating the classification process at the completion of a munitions response. The items dug as TOI have validated the ability of the analyst to correctly classify UXO. This procedure is intended to validate the remaining question: was the analyst able to classify non-TOI correctly. To accomplish this validation, the site team will randomly select a number of anomalies classified as due to non-TOI. The analyst will provide the rationale for classifying these items as non-TOI. The items will be excavated and compared to this rationale.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Reviews QC checklist to confirm results; responsible for RCA/CA implementation for failure
QC Geophysicist	Compares intrusive results to data analyst's reasoning for non-TOI decision
Data Analyst	Provides rationale for non-TOI decision for validation targets

3. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
Personal Computer	Manage geophysical data and processing software.
Geosoft Oasis Montaj with UX-Analyze Module	Software used for review of classification data
Results of Intrusive Investigation	Results of the intrusive investigation to include recovery depths, photographs and descriptions. These will be checked against the sources predicted during classification.

4. PROCEDURE AND GUIDELINES

The project team will choose a number of items (to be specified in Worksheet 22 of the QAPP) from the list of items classified as non-TOI for validation digs. These items may be chosen randomly or based on particular characteristics of the item (e.g. a large "cluster" of items with similar polarizabilities that have not been investigated). This list will be provided to the analyst and intrusive team.

4.1. Provide Rational for Classification Decision

For each item on the validation list, the analyst will provide a brief rationale for the classification decision. In many cases, this will be a simple statement such as "item too small to be TOI," "thin-walled plate like object," or "item recognized as a baseplate." If a more detailed narrative is required, the analyst will provide it.

4.2. Excavate the Anomaly

In parallel with the analysts work, the intrusive team will return to the listed anomalies and excavate them using standard procedures. The excavated items should be saved for examination by the QC Geophysicist. If this is not possible, a series of photographs should be recorded.

4.3. Compare Excavated Item to Prediction

Each excavated item will be compared by the QC Geophysicist to the prediction generated by the analyst. Each recovered item should qualitatively support the rationale provided for the classification decision. For a single-source inversion this comparison is straightforward. For a multi-source inversion with several realizations, the comparison may be more involved but the principle remains the same.

In the unlikely event a TOI is recovered during this validation effort, all work should stop and the site manager notified of this serious systemic failure. Otherwise, the QC Geophysicist will prepare a Validation Report documenting the analyst's predictions and the actual recoveries from the intrusive investigation.

5. DATA MANAGEMENT

The following sections describe the data that is needed to perform this SOP.

5.1. Data Inputs

The list of validation anomalies chosen by the site team is the input to this SOP.

5.2. Output Data

The comparison of the recovered items and analysis predictions will be documented in a Validation Report to be submitted by the QC Geophysicist.

6. QUALITY CONTROL

QC consists of performing the inspections on the Validation Checklist that is included as **Exhibit 1** to this SOP. This checklist will be completed by the QC Geophysicist and will be reviewed by the Project Geophysicist.

6.1. Measurement Quality Objectives (MQOs)

The MQOs for SOP AC-09 are presented in Worksheet 22 of the QAPP.

7. REPORTING

Achievement of the Recovered Object Verification MQOs (see the MQOs Worksheet 22) will be documented by the QC Geophysicist by completion of the QC Checklist in **Exhibit 1** to this SOP.

Procedure # AC-09	Title: Validate Classification Process	Revision # 0.0
Effective Date: 8/28/15	**Approved By:** John Baptiste	**Last Reviewed/Revised:** 8/28/15

8. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
None	Not applicable.

9. EXHIBITS

Exhibit1 Validation of the Classification Process

This checklist is to be completed by the QC Geophysicist for a series of recovered items.

Series of anomalies covered by this verification: From __________ To ___________

Date:___________ Time:___________

QC Step	QC Process	Yes/No	Initial of Data Processor
1. Qualifications	Is the same QC Geophysicist being used? If not, are the qualifications of the new personnel in compliance with the requirements of Section 1.2.1?		
2. Recovered object comparison	Did the QC Geophysicist compare each recovered item to the analysis predictions (Section 3.1)?		
3. Submission of Validation Report	Was the Validation Report (Section 4.2) submitted?		

QC Geophysicist: ________________________________Date:____________

Project Geophysicist: ______________________________Date:____________

10.REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	8/28/15	Initial Release	n/a

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Procedure # DGM-01	Title: IVS CONSTRUCTION AND TESTING	Revision # 01
Effective Date: 8/27/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 27, 2015

1. PURPOSE

The purpose of this SOP is to provide the minimum procedures applicable to the construction of an Instrument Verification Strip (IVS) and testing of geophysical systems at an IVS. This SOP applies to IVSs for projects using both standard geophysical mapping and advanced classification instruments.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Designs IVS and reviews IVS testing results.
QC Geophysicist	Reviews IVS testing results and verifies IVS results are documented in the QC database.
Site Geophysicist	Oversees IVS construction and testing.
Field Geophysicist	Documents IVS item data (position, depth, type) and operates geophysical and positioning equipment over the IVS and noise strip.
Data Processor	Processes IVS data and documents results in the QC database.
UXO Escort	Conducts MEC escort and anomaly avoidance activities during IVS construction and testing. Must be a qualified UXO Technician II or higher.

Note: Multiple geophysicist roles may be performed by a single individual (e.g. the Site Geophysicist may also perform the roles of Field Geophysicist and Data Processor).

3. RELEVANT DEFINITIONS

Term	Definition
Cued Classification	The method of collecting data for geophysical classification that involves placing the classification sensor directly over the source and recording data while stationary.
Geophysical Classification	The use of geophysical data to classify anomalies as related to targets of interest or other source categories.
Geophysical System	All equipment used for geophysical data collection, including the geophysical sensor, data logger, software and positioning equipment (e.g. RTK GPS or line and fiducial equipment).
ISO	Industry Standard Object; a readily available standard-sized metallic test item.
Multi-sensor Array	A geophysical system that includes multiple sensors.

Procedure # DGM-01	Title: IVS CONSTRUCTION AND TESTING	Revision # 01
Effective Date: 8/27/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 27, 2015

4. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
Geophysical Sensor	Instrument used to detect surface and/or subsurface anomalies indicating potential MEC. Typically instruments used are analog but may also be digital instruments (e.g., EM61-MK2).
Industry Standard Objects	Industry Standard Objects (ISOs) or inert munitions are buried along the IVS as test items to confirm that the geophysics system is functioning correctly.
GPS Unit	Used to record the location of IVS items and geophysical data (not required if using line/fiducial positioning).
Excavation Tools	Picks, shovels, or a mini-excavator are used to dig a hole for the IVS test items and to backfill the hole.
Measuring Tape	A measuring tape or ruler is used to measure the depth of each IVS test item.
Marker	Nonmetallic pin flags, stakes, tent pegs, or spray paint are used to mark the locations of the IVS test items and the beginning and end of the IVS.
Analog Instrument	A handheld metal detector such as a Schoenstedt GA-52/Cx or White's EM sensor that emits an audio tone used search for buried metal or confirm there are no significant metallic items in a specific location.

5. PROCEDURE

5.1. Health and Safety

All elements of this procedure will be conducted in accordance with the approved site safety and health plan, including but not limited to specified requirements for training, personal protective equipment (PPE), exposure monitoring and air sampling, etc. The UXOSO or designated representative will review the relevant site-specific activity hazard analyses (AHAs) prior to implementing this SOP.

5.2. Instrument Verification Strip Construction

Verification of the digital geophysical mapping (DGM) system is accomplished using an IVS. Multiple IVS locations may be constructed during the project if needed (for example, to avoid long travel times to reach the IVS on large sites). The construction details and verification procedures described in this document apply to each IVS location.

5.2.1. Location and Configuration of the IVS

The Project Geophysicist may propose an IVS location prior to mobilization. At project startup the field team will visit potential locations and determine which is most appropriate for an IVS with preference for the following (although none of the conditions are vital for IVS success):

- Terrain, geology, and vegetation similar to that of a majority of the DGM survey area.
- Geophysical noise conditions similar to those expected across the survey area.
- Large enough site to accommodate all necessary IVS tests and equipment and for adequate spacing of the ISO items (at least 5-m separation and preferably greater) and the noise strip (at least 5-m separation and preferably greater) to avoid ambiguities in data evaluation.

Procedure # DGM-01	Title: IVS CONSTRUCTION AND TESTING	Revision # 01
Effective Date: 8/27/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 27, 2015

- Readily accessible to project personnel.
- Close proximity to the actual survey site (if not within the site).

5.2.2. IVS Objects

ISOs or inert munitions serve as the seed objects in the IVS. Small, medium, or large ISOs, singly or in combination, can be selected. **Table 1** shows the specifications for the possible ISOs and **Exhibit 1** is a photograph of the three sizes of ISO.

TABLE 1. INDUSTRY STANDARD OBJECT DIMENSIONS AND PART NUMBERS

Item	Nominal Pipe Size	Outside Diameter	Length	Part Number (1)	Schedule
Small ISO40	1"	1.315" (33 mm)	4" (102 mm)	44615K466	40
Small ISO80	1"	1.315" (33 mm)	4" (102 mm)	4550K226	80
Medium ISO40	2"	2.375" (60 mm)	8" (204 mm)	44615K529	40
Large ISO40	4"	4.500" (115 mm)	12" (306 mm)	44615K137	40

(1) Part number from the McMaster-Carr catalog (http://www.mcmaster.com/).

5.3. IVS Procedures

5.3.1. IVS Background Survey

The Field Geophysicist will perform a background DGM survey with the geophysical system. The purpose of this step is to document the appropriateness of the location (e.g. few existing anomalies), and avoid burying the IVS test items near existing anomalies. The data processor will analyze the IVS pre-survey work with the project geophysicist to select IVS test locations that will not be affected by existing anomalies.

5.3.2. IVS Test Item Location Selection

Once the IVS area is deemed suitable for use, (i.e. free of significant subsurface anomalies or containing anomalies that are clearly identified so that they can be avoided during seeding), the Field Geophysicist will bury test items at depths below ground surface between 3 and 7 times their diameter. These depths are intended to provide adequate signal to noise ratio for detecting the items. The generalized diagram of the seeded IVS transect is presented as **Exhibit 2**. A list of specific item types, depths, and orientations are provided in the work plan. In this example, only one target is shown. This is the minimum requirement for an IVS. Local custom, stakeholder comfort, or other similar reasons may lead to larger number of items in the IVS. Rarely will more than three or four items be required unless the IVS is designed to accommodate a multi-sensor array. The blank space is only required if the IVS is also used to test advanced sensors (e.g. MetalMapper or TEMTADS) in cued mode for the purposes of classifying anomalies detected in the geophysical data. If cued classification is not expected as part of the project, or a different IVS is used for the testing of advanced sensors, the blank space is unnecessary.

5.3.3. IVS Test Item Burial and Metadata Recording

5.3.3.1. Measurements of the item depths will be to the center of mass of each item. The UXO escort will bury the IVS targets using shovels to dig the holes to the appropriate depths for burial of the seed items in coordination with the Project Geophysicist. The UXO escort will implement MEC avoidance

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Effective Date: 8/27/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 27, 2015

procedures in accordance with the MEC Avoidance and Escort SOP. The Field Geophysicist will record the following information for each IVS test item:

- The transect endpoints;
- Test item description (e.g. Small ISO80);
- Test item location;
- Test item depth to the center of mass;
- Test item inclination (e.g. horizontal, vertical, degrees [0 is horizontal, 90 is vertical]);
- Test item orientation (e.g. N-S, E-W, inline, Degrees 0-360 [0 is North]);

5.3.3.2. The UXO escort will then fill the holes with soil and place a suitable non-metallic marker at each buried item location as well as the start and end points of the IVS.

5.3.3.3. Once the IVS test items have been buried the Field Geophysics will conduct the initial IVS survey to establish a baseline response. This is done by collecting geophysical data over the IVS and noise strip five times.

5.3.4. IVS Data Processing

Prior to collecting production data and each morning before beginning field operations, field geophysicists will collect geophysical data over each of the item locations in the IVS and along the noise strip. The Field Geophysicist will pass the raw files the Site Geophysicist or data processor who will perform the following steps:

1. Import and level data as described in detail in the data processing SOP.
2. Select the peak or trough (for horizontal items) response measured over each of the IVS seed items.
3. For initial IVS surveys, establish the baseline expected response by averaging the first five responses recorded over each item, or by the method described in the MEC-QAPP.
4. For daily IVS datasets, verify that the measured values meet the MPCs/MQOs for IVS response and positioning.
5. Document the IVS results in the project QC database.

5.3.5. Evaluation of IVS MPCs/MQOs

5.3.5.1. If the measurement performance criteria (MPCs)/ measurement quality objectives (MQOs) have not been met, the Project or QC Geophysicist will initiate a root cause analysis to determine the source of the discrepancies. If modifications to the instrument or procedures can be made so that the MPCs/MQOs can be met, these modifications will be made. If the MPCs/ MQOs cannot be met the Project and QC Geophysicists will discuss potential resolutions with the project team.

5.3.5.2. Once the initial (or modified) MPCs/ MQOs have been met, the IVS survey will be complete and the system is verified for field data collection.

6. REFERENCES

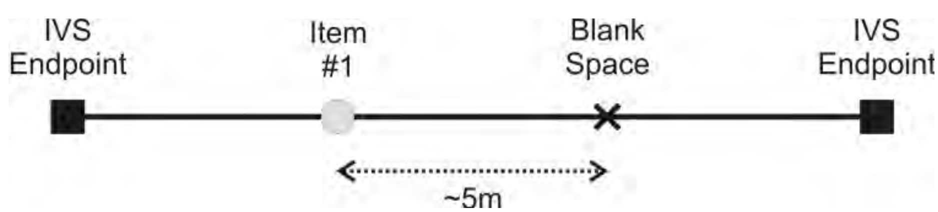
Reference Title (Author)	Brief summary of relevance to this procedure
None	Not applicable.

Procedure # DGM-01	Title: IVS CONSTRUCTION AND TESTING	Revision # 01
Effective Date: 8/27/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 27, 2015

7. EXHIBITS

Exhibit 1 Small, Medium and Large ISOs

Exhibit 2 Example Layout of Instrument Verification Strip



8. REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	2/13/2015	Initial Release	n/a
01	8/27/2015	Change from 3 meters to 5 meters between IVS items to provide more background response in IVS data and be consistent with ESTCP GSV report. Clarify depths measured to center of mass. Remove medium and large ISO80s from list of ISOs because those are not typically used. Clarify that initial responses established by surveying IVS five times at beginning of project. Editorial changes.	Be consistent with ESTCP GSV report and standard industry practice. Add more detail about IVS procedures. Improve document clarity and consistency.

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Procedure # DGM-02	Title: SEEDING	Revision # 01
Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

1. PURPOSE

The purpose of this SOP is to provide the minimum procedures applicable to the burial and tracking of seed items for digital geophysical mapping (DGM).

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Designs geophysical approach for the project, including the seed type, depth, and frequency.
QC Geophysicist	Implements or delegates the DGM seeding portion of the project, designates and coordinates with the seeding team, and tracks the geophysical results.
Site Geophysicist	Manages field DGM operations. *Should not be involved in seeding an area if they will be collecting field data or selecting anomalies in that area.*
Field Geophysicist	Acquires geophysical data and documents obstructions to collecting DGM data. *Should not be involved in seeding an area if they will be collecting field data or selecting anomalies in that area.*
Seed Team Leader	Buries blind seed items, records position, orientation, and photographs and completes Production Area QC Seeding Checklist.
Data Processor	Processes DGM data and selects geophysical anomalies.
UXOQCS	Overall responsible for quality control (QC) and MEC related activities.
UXO Escort	Conducts UXO Escort and anomaly avoidance activities for non-UXO qualified personnel during seed burial in potential MEC hazard areas. Must be a qualified UXO Technician II or higher.

Note: Multiple geophysicist roles may be performed by a single individual (e.g. the Site Geophysicist may also perform the roles of Field Geophysicist and Data Processor).

3. RELEVANT DEFINITIONS

Term	Definition
Geophysical Classification	The use of geophysical data to classify anomalies as related to targets of interest or other source categories.
Cued Classification	The method of collecting data for geophysical classification that involves placing the classification sensor directly over the source and recording data while stationary.
ISO	Industry Standard Object; a readily available standard-sized metallic test item.
Geophysical System	All equipment used for geophysical data collection, including the geophysical sensor, data logger, software and positioning equipment (e.g. RTK GPS or line and fiducial equipment).

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Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

Multi-sensor Array	A geophysical system that includes multiple sensors.

4. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
Geophysical Sensor	Instrument used to detect surface and/or subsurface anomalies indicating potential MEC. Typically instruments used are analog (e.g., Schonstedt magnetic locator, White's metal detector), but may also use digital instruments (e.g., EM61-MK2).
Industry Standard Objects	Industry Standard Objects (ISOs) or inert munitions are buried along the IVS as test items to confirm that the geophysics system is functioning correctly.
GPS Unit	Used to record the location of seed items and geophysical data (not required if using line/fiducial positioning).
Excavation Tools	Picks, shovels, or a mini-excavator are used to dig a hole for the seed items and to backfill the hole.
Measuring Tape	A measuring tape or ruler is used to measure the depth of each seed item.
Level or Inclinometer	The level or inclinometer is used to measure the inclination of the seed items.

5. PROCEDURE

5.1. Health and Safety

All elements of this procedure will be conducted in accordance with the approved site safety and health plan, including but not limited to specified requirements for training, personal protective equipment (PPE), exposure monitoring and air sampling, etc. The UXOSO or designated representative will review the relevant site-specific activity hazard analyses (AHAs) prior to implementing this SOP.

5.2. GPS Function Tests

If using a GPS the Seed Team Leader will perform the GPS functionality test at least once per day by placing the sensor directly over a known point, and recoding the measured position either in the GPS controller or in the field team's logbook. The calculated distance between the measured and known point should meet the MPC/MQO for positioning listed in the work plan.

5.3. Seeding Team

The QC Geophysicist or their designee will lead the seeding team. A UXO Escort will accompany the Seed Team Leader to perform anomaly avoidance and excavations. ***No member of the seeding team will be involved with DGM data acquisition or anomaly selection in the area(s) where they bury seed items***.

Procedure # DGM-02	Title: SEEDING	Revision # 01
Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

5.4. Seed Item Locations

The QC geophysicist will prepare a list of proposed seed item locations, descriptions, depths, and orientations and provide the list to the Seed Team Leader. The list will comply with the seeding requirements in the work plan. The seed items shall be placed at depths and orientations for which the minimum expected response is known and can be compared with the responses measured during DGM.

5.4.1. Seed Items

ISOs or inert munitions serve as the seed items. If inert munitions are used the UXO Escort will paint them blue prior to seeding to clearly indicate that they are inert. **Table 1** shows the specifications for the possible ISO and Exhibit 1 is a photograph of the three sizes of ISO.

TABLE 1. INDUSTRY STANDARD OBJECT DIMENSIONS AND PART NUMBERS

Item	Nominal Pipe Size	Outside Diameter	Length	Part Number (1)	Schedule
Small ISO40	1"	1.315" (33 mm)	4" (102 mm)	44615K466	40
Small ISO80	1"	1.315" (33 mm)	4" (102 mm)	4550K226	80
Medium ISO40	2"	2.375" (60 mm)	8" (204 mm)	44615K529	40
Large ISO40	4"	4.500" (115 mm)	12" (306 mm)	44615K137	40

(1) Part number from the McMaster-Carr catalog (http://www.mcmaster.com/).

5.5. Seeding Procedures

5.5.1. Seed Location

The seeding team will use a GPS or other navigational methods to find the proposed seed locations provided by the QC Geophysicist. The UXO Escort will implement MEC avoidance procedures in accordance with the MEC Avoidance and Escort SOP. The seeding team will modify the seed item locations as needed to avoid pre-existing geophysical anomalies.

5.5.2. Seed Emplacement

The UXO Escort will dig a hole to the appropriate depth to bury the seed item as described on the list provided by the QC geophysicist. While the seed team has latitude to change the location of the seed items to avoid preexisting anomalies, they will bury the items described on the list at the intended depth and orientation.

5.5.3. Seed Items Data Recording

After the seed item has been placed in the hole, the Seed Team Leader will record the location of the center of the seed item. An RTK GPS will be used in areas where the instrument's view of satellites is clear enough to achieve RTK fixed quality. Other positioning systems such as robotic total stations, conventional surveying instruments, or tape measures from established grid corners may be used in areas where RTK GPS is not effective. If the depth (to center of mass), orientation, inclination, or type of seed item differs from the proposed seed item list the Seed Team Leader will note the differences and inform the QC Geophysicist. In addition the Seed Team Leader will fill out the **Exhibit 2**, Parsons Seeding Form or use other means of recording the data (i.e., electronic forms). If required by the work plan photos will be taken of the seed items and provided to the QC Geophysicist.

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Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

5.5.4. Seed Item Burial

After placing the seed item at the correct depth to the center of mass the UXO Escort will replace the dirt in the hole as completely as possible. He will level the location and if possible replace any grass or vegetation plug over the burial location.

5.5.5. Seed Item Documentation

The QC Geophysicist will record the seed item ID in the project QC database. They will also maintain a separate list of the seed items which will include the location coordinates, depth, and description of the item. This separate list will not be available to the data acquisition teams or the data processor.

5.5.6. Seed Item Tracking

5.5.6.1. After the data processor completes anomaly selection and datasets are checked for quality, the QC Geophysicist will compare the seed item coordinates with the anomaly selections to determine if an anomaly was selected that meets the seed item offset requirements. The QC Geophysicist will compare target list with the seed item list to determine if the seed item MPC/MQO has been met. The QC geophysicist will document the results of QC seed items in the project QC database or blind seed tracking files.

5.5.6.2. The QC Geophysicist will notify the Project Geophysicist and Project Manager immediately if a dataset does not meet either of the seed item MPCs/MQOs. The Project Geophysicist will perform a Root Cause Analysis to determine why the seed item MPCs/MQOs were not met.

6. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
None	Not applicable.

Procedure # DGM-02	Title: SEEDING	Revision # 01
Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

7. EXHIBITS

Exhibit 1 Small, Medium and Large ISOs

Seeding Form
Parsons

Site: ______________________ Date: ______________ Seed Team Lead: ______________________

Item ID	Location	Description	Depth (m)	Orientation	Inclination	Photo #/Name	X	Y	Comments

Notes:
Location: Grid, IVS, Dataset, Lot, etc.
Description: Small ISO40, Small ISO80, Medium ISO40, 37mm Projectile, etc.
Depth: measured to center of item in meters.
Orientation: Direction of Nose, Degrees 0-360 (0 is North). For ISOs will be between 0 and 180.
Inclination: inclination of nose, degrees 0-360 (0 is horizontal, 90 is vertical nose down). For ISOs will be between 0 and 90.
Photo: Enter photo number or name (photo should include ID).
X, Y: Enter here if using tape measures, or refer to point ID if using GPS. Measure center and each end for items larger than Small ISOs.

List all Seed Team Personnel

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Procedure # DGM-02	Title: SEEDING	Revision # 01
Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

8. REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	2/13/2015	Initial Release	n/a
01	8/28/2015	Added Seed Team Leader to personnel list. Added description of daily GPS QC test. Removed Medium and Large schedule 80 ISOs from SOP. Added Seed Form. Clarified depth measurements are to center of mass.	More complete description of personnel and procedures. Schedule 40 is industry standard for Medium and Large ISOs. A seed form will facilitate more consistent data recording. Clarifies description of data to be recorded during seeding.

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Procedure # DGM-03	Title: EM61-MK2 DATA ACQUISITION	Revision # 01
Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

1. PURPOSE

The purpose of this SOP is to provide the minimum procedures applicable to the acquisition of EM61-MK2 data.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Designs geophysical approach for the project and monitors EM61-MK2 data acquisition.
Site Geophysicist	Manages field DGM data collection operations.
Field Geophysicist	Acquires geophysical data and documents obstructions to collecting DGM data.
Data Processor	Evaluate the instrument QC test data and document the results in the project QC database.
UXO Escort	Conducts UXO Escort and anomaly avoidance activities for non-UXO qualified personnel during data collection activities in potential MEC hazard areas. Must be a qualified UXO Technician II or higher.

Note: Multiple geophysicist roles may be performed by a single individual (e.g. the Site Geophysicist may also perform the roles of Field Geophysicist and Data Processor).

3. RELEVANT DEFINITIONS

Term	Definition
Geophysical System	All equipment used for geophysical data collection, including the geophysical sensor, data logger, software and positioning equipment (e.g. RTK GPS or line and fiducial equipment).
Multi-sensor Array	A geophysical system that includes multiple sensors.
Grids	Areas where DGM data acquisition is performed with the intent of fully covering all accessible areas along parallel paths set at a predetermined line spacing.
Transects	DGM data collection mode that involves traversing the investigation area along parallel lines.
Line/Station/Fiducial	Method for positioning DGM data without the use of GPS by linearly interpolating positions along parallel paths set at a predetermined line spacing.

Procedure # DGM-03	Title: EM61-MK2 DATA ACQUISITION	Revision # 01
Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

4. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
EM61-MK2	Time domain electromagnetic induction sensor that records four channels of data used to detect subsurface metallic items.
RTK GPS	Real-time Kinematic (RTK) Global Positioning System (GPS). Measures precise position of antenna and transmits position along a serial cable or wirelessly.
Data Logger	Handheld computer that records data from the EM61-MK2 and RTK GPS.
Standard Test Item	Metallic item that is used to test the function of the EM61-MK2 sensor in static mode.
Measuring Tape	A measuring tape is used to measure the start, end, and intermittent points during line and fiducial positioning.
Digital Camera	A digital camera may be used to document inaccessible areas: Some portions of the investigation area may be inaccessible due to rough terrain, obstructions or vegetation

5. PROCEDURE

5.1. Health and Safety

All elements of this procedure will be conducted in accordance with the approved site safety and health plan, including but not limited to specified requirements for training, personal protective equipment (PPE), exposure monitoring and air sampling, etc. The UXOSO or designated representative will review the relevant site-specific activity hazard analyses (AHAs) prior to implementing this SOP.

5.2. EM61-MK2 Data Acquisition Team

The Field Geophysicist leads the data acquisition team. A UXO Escort will accompany the team leader if the work area has not previously been surface swept. If no UXO Escort is required, at least one additional person will work with the Field Geophysicist. At some sites with rough terrain or difficult conditions there may be a third or fourth team member.

5.3. EM61-MK2 Data Acquisition Procedures

5.3.1. Daily QC Tests

5.3.1.1. The data acquisition team will perform all of the daily QC tests described below that are listed in the work plan. The Data Processor will review the QC test results and document those results in the project QC database.

5.3.1.2. ***Static Response Test***: The Field Geophysicist performs the static response test at least once on each day of EM61-MK2 data acquisition. This test will involve collecting background data with the instrument in a static (stationary) mode for approximately one minute, collecting data using a test item for approximately one minute, and then collecting background data again for approximately one minute. The test item will be constructed to position the metallic test item in a consistent position. The Data Processor will review the response for each individual time gate used for target selection and compared it to expected responses for this item. The Data Processor will document the measured responses in the project

QC database and notify the Project Geophysicist if the Static Response Test MPC is not met. If the EM61-MK2 includes an embedded QC coil, the coil response may be recorded instead of using a metallic test item. The response measured by each coil will be dependent on both the type of system being used (towed array vs. man portable) and, in the case of the towed array, the location of the coil in the array. Therefore, expected responses for each coil will be developed based on the results of testing performed at the beginning of data collection.

5.3.1.3. ***IVS Data Collection***: The DGM team will collect data over the IVS as described in ***SOP DGM-01, IVS Construction and Testing***.

5.3.2. Dynamic EM61-MK2 Data Acquisition

5.3.2.1. Dynamic survey for digital geophysical mapping (DGM) involves collecting data along data collection lines across the survey area. The geophysical team will collect data along each line at a spacing appropriate to the site and project needs, as defined in the work plan. The instrument operator uses the data acquisition software to assign a numerical ID to each line and start/stop data collection at the beginning/end of each. When an obstacle is encountered along a line, the obstacle can be avoided by either altering the path of the line or stopping data collection when the obstacle is encountered and resuming a new ID line on the other side of the obstacle. Data gaps that are the result of obstacles will be recorded by the Field Geophysicist and submitted to the Data Processor. Data gaps that are the result of line spacing over the defined acceptable spacing will be determined by the Data Processor and provided to the Field Geophysicist for recollection as necessary. Data acquisition will be performed using the following steps:

1. The instrument operator confirms that the geophysical and positioning equipment is functioning and the data logger is recording data.
2. Beginning along one edge of the survey area, the instrument operator tows or carries the equipment to the far side of the investigation area
3. The instrument operator reverses direction and tows or carries the equipment back across the investigation area along a line parallel to the previous line.
4. The instrument operator repeats steps 1 though 3 until completing the entire investigation area.

5.3.2.2. ***Navigation***: Navigation along lines is performed visually with the assistance of markers, which are determined at the discretion of the Field Geophysicist. They may include, but are not limited to, following a pre-marked path on the GPS screen, ropes, tapes, spray paint, or flags. This can be accomplished by marking the track of the inside wheels as the sensor moves along a line.

5.3.2.3. ***Positioning***: Positioning in the data is captured through the use of the GPS system or line/station/fiducial (L/S/F) identifiers in the data. RTK GPS will be used to position all data collected in areas where it is expected that GPS initialization can be maintained (i.e. no overhead canopy to block GPS signal), hand-held GPS positioning will be used for density transect data collection under canopy, and L/S/F positioning will be used for dig transect data collection under canopy. Robotic Total Station (RTS) equipment may be used for positioning data under canopy in some site conditions. EM61 data collected with RTK GPS, RTS or L/S/F positioning are considered usable for the reacquisition and intrusive investigation of anomalies identified in the data. Data positioned using hand-held GPS are only considered acceptable for determining across-site anomaly densities.

5.3.2.4. ***Data Quality Monitoring***: During data acquisition, the Field Geophysicist will monitor the integrity and quality of the data by inspecting the EM61 data collection screen to ensure that the EM61-MK2 and position data are being recorded on the data logger and that the responses measured by each receiver coil appear reasonable (i.e., not ‘flat-lined’ or excessively variable).

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5.3.2.5. ***Documenting Inaccessible Areas***: Some portions of the investigation area may be inaccessible due to rough terrain, obstructions or vegetation. The field team will document the inaccessible areas by one of the following methods:

- Collecting a line of data outlining the inaccessible area and using the line name to indicate the type of obstruction;
- Collecting GPS points defining the inaccessible area; or
- Outlining the inaccessible area on a map of the investigation area.

5.3.2.6. The Field Geophysicist may also take a digital photograph of each obstruction.

5.3.3. Documentation

The Field Geophysicist will be responsible for documenting the following information each day of EM61-MK2 data acquisition:

- Date
- Team ID
- Team Members
- Work completed
- Raw data file names
- Inaccessible areas
- List of photographs

6. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
None	Not applicable.

7. EXHIBITS

None.

8. REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	2/13/2015	Initial Release	n/a
01	8/28/2015	Added Line/Station/Fiducial to definition list. Added digital camera to required equipment. Editorial Changes.	Previously undefined. To allow DGM team to take photos.

Procedure # DGM-04	Title: EM61-MK2 DATA PROCESSING	Revision # 01
Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

1. PURPOSE

The purpose of this SOP is to provide the minimum procedures applicable to the processing of EM61-MK2 data.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Designs geophysical approach for the project, monitors EM61-MK2 data processing, and regularly reviews project QC database.
Site Geophysicist	Manages field DGM operations and transfers field data to the Data Processor.
Data Processor	Processes DGM data, enters QC test results into project QC database, and selects geophysical anomalies.
Field Geophysicist	Acquires geophysical data and documents obstructions to collecting DGM data.

Note: Multiple geophysicist roles may be performed by a single individual (e.g. the Site Geophysicist may also perform the roles of Field Geophysicist and Data Processor).

3. RELEVANT DEFINITIONS

Term	Definition
EMI	Electromagnetic Induction.
Geophysical System	All equipment used for geophysical data collection, including the geophysical sensor, data logger, software and positioning equipment (e.g. RTK GPS or line and fiducial equipment).
Latency	A difference in time delays between recording positioning and EM sensor data that results in misalignment of the two datasets and requires correction during data processing.
Leveling	A site-specific de-median or other filter is applied to the raw response data to derive an estimate of the background model. This model is subtracted from the raw data to provide a background removed or 'leveled' data set.
Multi-sensor Array	A geophysical system that includes multiple sensors.
Grids	Areas where DGM data acquisition is performed with the intent of fully covering all accessible areas along parallel paths set at a predetermined line spacing.
Polygonal Anomaly	Anomaly with large spatial extent that cannot be adequately resolved by selecting a single point.
Transects	DGM data collection mode that involves traversing the investigation area along parallel lines.

Procedure # DGM-04	Title: EM61-MK2 DATA PROCESSING	Revision # 01
Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

Line/Station/Fiducial	Areas where DGM data acquisition is performed without the use of GPS with the intent of fully covering all accessible areas along parallel paths set at a predetermined line spacing.

4. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
Geosoft Oasis Montaj	Software used for geophysical data processing and anomaly selection.
Trackmaker	Software used to convert raw EM61-MK2 data files collected with the NAV61 data acquisition system to ascii format and merge EMI and positioning data.
DAT61MK2	Software used to convert raw EM61-MK2 data files collected with standard EM61-MK2 data acquisition system to ascii format and either merge EMI and positioning data or assign positions to EMI data using line and fiducial methods.
Magmap	Software used to merge EMI and GPS data collected with a multi-sensor array using Maglog software.
Personal Computer	Manage geophysical data and processing software.

5. PROCEDURE

5.1. EM61-MK2 Data Processing

The processing of dynamic EM61 data is achieved in the following steps:

1. Data import/Initial QC
2. Leveling (i.e. background removal)
3. Latency Correction
4. Target selection

5.1.2. Data Import/Initial QC

5.1.2.1. For line/station/fiducial (L/S/F)-positioned data, DAT61MK2 is used to locate the start and end points for each line as well as any mid-line fiducial points recorded. For data collected with GPS positioning the Data Processor will use DAT61MK2, Magmap, or Trackmaker to merge collected GPS data with the collected EM61 response data. Trackmaker is used for data collected with NAV61 data acquisition system (*.p61 files), DAT61MK2 is used with standard EM61-MK2 data files (*.r61), and Magmap is used for multi-sensor array data files collected with Maglog software. Once data have been positioned, the Data Processor will export ASCII format *.xyz files. For GPS-positioned data, the following export parameters will be used:

- 5 second time gap
- Output file format: Geosoft
- Amplitude: linear
- Geodetic coordinate system: UTM format (or other system described in the work plan)
- Export Time, Quality Indicator and STD-4 data

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5.1.2.2. The Data Processor will import the ASCII *.xyz files into to a Geosoft Database (*.gdb) using a purpose built utility in Oasis Montaj.

5.1.3. Leveling

A site-specific de-median filter is applied to the raw response data to derive an estimate of the background model. This model is subtracted from the raw data to provide a background removed or 'leveled' data set. **Exhibit 1** shows an example of raw data (top panel, red trace), the background model derived from these data (top panel, green trace) and the resulting background removed data. In some areas with high anomaly density the Data Processor may need to modify the default parameters of the Geosoft leveling tool to ignore some percentage of the data in order to remove background without lowering the amplitude of anomalies. In extreme cases the de-median filter may not automatically identify background responses and the Data Processor may need to manually identify background measurements in the dataset and remove a linearly interpolated background from the dataset.

5.1.4. Latency Correction

After the data have been leveled the Data Processor will examine either the profiles or a map with gridded data to determine the appropriate latency correction. The Data Processor applies a range of latency corrections and determines which correction either aligns the peaks of profiles collected in opposite directions, or removes the chevron shapes in larger anomalies from the gridded dataset. The correct application of latency time will result in anomalies with straight edges unbiased by line direction.

5.1.5. Target Selection

5.1.5.1. Single pass transect anomalies selected for use in determining across-site anomaly densities are selected using the Oasis Montaj "pick peaks along profiles" .gx. Anomalies selected for subsequent excavation in multi-pass transects are selected using Geosoft's Blakely test algorithm with three iterations of a Hanning smoothing filter. Other anomalies characteristics identified as useful in target selection, such as footprint size, decay constant and SNR, are used to add or remove targets, as appropriate. The Data Processor may also remove anomalies associated with known surface features or obstacles. If the dataset contains large anomalies that cannot be adequately investigated with a single anomaly, the Data Processor will either select multiple anomalies to cover the entire anomaly footprint, or will define the corners of a polygon covering the entire large anomaly footprint.

5.1.5.2. The Project Geophysicist or their designee will review the anomaly selections and manually make additions or deletions to this list. All targets above the response threshold as well as any manual additions are added to the Access database anomaly table, with all pertinent response and secondary characteristic information. Those removed from dig consideration for any reason (i.e. duplicate picks on a single anomaly, failed secondary characteristic tests, known objects) are unchecked in the "dig" column. All remaining targets are checked.

5.1.6. Assessment of Quality Control of Dynamic Survey Data

5.1.6.1. During the course of a dynamic survey, the field team records QC measurements on a daily basis to verify the operation of the sensor and associated components, as described in the work plan. The Data Processor will evaluate the QC measurements to confirm that the geophysical system was functioning correctly to validate the survey data collected on that day.

5.1.6.2. The Data Processor will record the static background and response values in the project QC database and confirm that they meet the Static Test MPC. The process for evaluating the IVS tests is described in **SOP DGM-01, IVS Construction and Testing**. The Data Processor will also assess other MPCs specified in the work plan (e.g. along line spacing, velocity, coverage, and seed item

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detection/location, as necessary), and record the results in the project QC database. The Data Processor will notify the Project Geophysicist of any results that do not pass the MPCs. The Project Geophysicist will take the appropriate action specified in the work plan. Depending upon the findings of the root cause analysis, the survey data associated with the MPC failure may need to be re-collected.

5.1.6.3. The Data Processor or their designee will produce a daily QC report listing the daily MPC results.

5.1.7. Data Outputs

The Data Processor will produce the following data products:

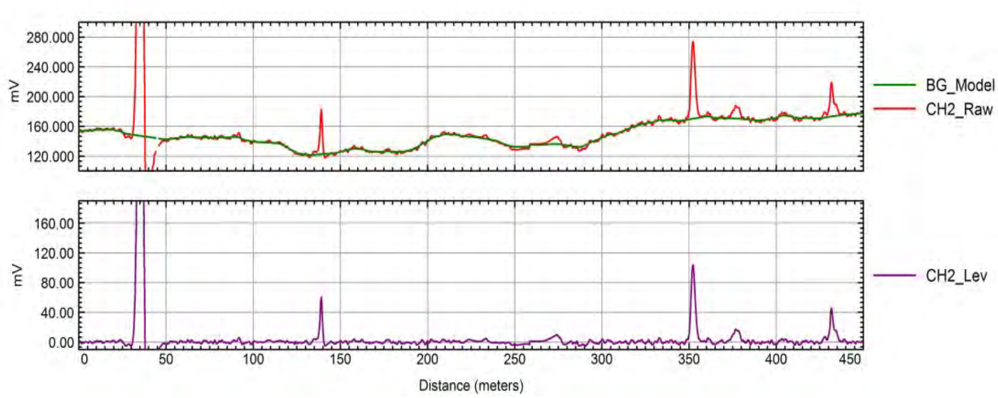
- Daily QC report summarizing QC measurement results;
- Final response data in Geosoft format (*.gdb and *.xyz);
- Final grids of EMI response in Geosoft format (*.grd);
- Geophysical data maps containing picked targets in Geosoft (*.map) and image (*.jpg, *.pdf, or *.tif); and
- Selected anomaly list.

6. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
None	Not applicable.

7. EXHIBITS

Exhibit 1 Example of Raw (top) and Leveled Data (bottom).



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8. REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	2/18/2015	Initial Release	n/a
01	8/28/2015	Added definitions of leveling and line/station/fiducial. Editorial Changes.	Previously undefined.

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Procedure # DGM-05	Title: EM61-Mk2 REACQUISITION & ANOMALY RESOLUTION	Revision # 00
Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

1. PURPOSE

The purpose of this SOP is to provide the minimum procedures applicable to anomaly reacquisition and resolution.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Geophysicist	Designs geophysical approach for the project and regularly reviews project QC database.
Site Geophysicist	Manages field DGM operations and records the results of daily reacquisition QC tests in the project QC database.
Field Team Leader	Reacquires geophysical anomalies, measures remaining EM61-MK2 response after excavation, and records reacquisition and anomaly resolution results.
UXO Escort	Conducts UXO Escort and anomaly avoidance activities for non-UXO qualified personnel during reacquisition and intrusive activities in potential MEC hazard areas. Must be a qualified UXO Technician II or higher. May also perform field team leader role described above.

Note: Multiple geophysicist roles may be performed by a single individual (e.g. the Site Geophysicist may also perform the roles of Field Geophysicist and Data Processor).

3. RELEVANT DEFINITIONS

Term	Definition
Grids	Areas where DGM data acquisition is performed with the intent of fully covering all accessible areas along parallel paths set at a predetermined line spacing.
Transects	DGM data collection mode that involves traversing the investigation area along parallel lines.

4. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
EM61-MK2	Time domain electromagnetic induction sensor that records four channels of data used to detect subsurface metallic items.
Advanced Classification	The use of geophysical data to classify anomalies as related to targets of interest or other source categories.
RTK GPS	Real-time Kinematic (RTK) Global Positioning System (GPS). Measures precise position of antenna.

Procedure # DGM-05	Title: EM61-Mk2 REACQUISITION & ANOMALY RESOLUTION	Revision # 00
Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

Standard Test Item	Metallic item that is used to test the function of the EM61-MK2 sensor in static mode.
Measuring Tape	A measuring tape is used to measure the distance from markers at known locations in areas where RTK GPS systems are not effective.
Marker	Non-metallic pin flags and/or spray paint is used to mark anomaly locations.

5. PROCEDURE

5.1. Health and Safety

All elements of this procedure will be conducted in accordance with the approved site safety and health plan, including but not limited to specified requirements for training, personal protective equipment (PPE), exposure monitoring and air sampling, etc. The UXOSO or designated representative will review the relevant site-specific activity hazard analyses (AHAs) prior to implementing this SOP.

5.2. Reacquisition

The Field Team Leader will be supplied with a dig list containing the IDs and locations of anomalies identified in the dynamic surveys. The field team leader will locate the picked location of each anomaly using either RTK GPS or tape measures and then refine the location using the EM61.

5.2.1. Function Tests

5.2.1.1. The Field Team Leader will perform the GPS functionality test at least once per day by placing the sensor directly over a known point, and recoding the measured position either in the GPS controller or in the field team's logbook. The calculated distance between the measured and known point should meet the MPC for positioning listed in the work plan.

5.2.1.2. The field team leader will perform an EM61-MK2 static test at least once per day according to the instructions in **SOP DGM-03, EM61-MK2 Data Acquisition**. The field team leader will record the results of these tests and provide these data to the Site Geophysicist, who will enter the results in the project QC database.

5.2.2. Anomaly Reacquisition in Grids (not using Advanced Classification)

5.2.2.1. Prior to beginning intrusive activities, the Field Team Leader will use a RTK GPS unit (dynamic data positioned using GPS), robotic total station (dynamic data positioned using RTS or line/station/fiducial methods), or tape measures (dynamic data positioned using RTS or line/station/fiducial methods) to navigate to the location of each anomaly to be investigated intrusively. Once the anomaly location has been reacquired, field team members will perform a survey in multiple directions in a 1-meter radius (or search radius defined in the work plan) around the location using the EM61-MK2 metal detector with a handheld Allegro or similar computer capable of displaying response data in real-time. The team will then flag for excavation the location of the highest response value within the search radius. If the location of highest response is more than 0.5 meters from the selected location the Field Geophysicist will record the offset distance and direction. The flagged location is recorded with the RTK GPS or by noting the offset from the initial measured location.

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Effective Date: 8/28/2015	**Approved By:** Craig Murray	**Last Reviewed/Revised:** August 28, 2015

5.2.2.2. If no single point within the search radius can be determined to be an anomaly location (i.e., if all readings remain below the anomaly selection threshold), the reacquisition result will be recorded as a "no contact."

5.2.2.3. In the case of polygonal anomalies, the reacquisition team will flag the identified corner points of the polygon.

5.2.3. Anomaly Reacquisition for Advanced Classification Data

Anomaly locations derived from Advanced Classification data inversion will be re-located using a RTK GPS or tapes as described above in Section 5.2.2.2, but an EM61 will not be used to pinpoint anomaly locations. Flags will be placed at the location indicated by the GPS/tapes. A measurement of pre-excavation EM61 response will still be taken with the EM61 at the flag location for the purposes of ensuring that the anomaly source has been successfully removed at the completion of the intrusive investigation.

5.2.4. Anomaly Reacquisition for Transects (not using Advanced Classification)

As described above for grid-based data, the field team leader will use a GPS unit to navigate to the location of each anomaly to be investigated intrusively. If it is determined that RTK GPS is effective along a transect (i.e., canopy does not prevent initialization), the field team leader will reacquire anomalies as described for grid-based data. If a handheld GPS is used for transect data collection, the reacquisition team will identify the anomaly nearest the indicated position that has a response at least as high as the picked value from the dynamic survey. Because these anomaly investigations are only being used to determine the presence/absence of munitions-related debris, the excavation of exact anomalies is not necessary.

5.3. Anomaly Resolution

5.3.1.1. After the intrusive team has excavated at the reacquired location and removed the source of the geophysical anomaly, the anomaly resolution team will recheck the location with an EM61-MK2 to confirm that the anomaly has been adequately resolved. Resolved is defined as:

1. There is no geophysical signal remaining at the flagged/selected location;
2. A signal remains but is below the anomaly selection threshold or is less than 25% of the initial value measured at that location;
3. A signal remains but is associated with surface material which when moved results in low, or no, signal at the interpreted location; or
4. A signal remains and a complete rationale for its presence exists. If the anomaly has not been adequately resolved, the intrusive team will resume investigation until the source has been resolved.

5.3.1.2. In the case of polygonal anomalies, the field team leader will recheck the entire polygon with an EM61-MK2 to confirm that all anomalies within the area have been adequately resolved.

5.4. Data Outputs

5.4.1.1. The field team leader will record the following information:

- Offset distance and direction from the selected to reacquired points (if offset is >0.5 meters);
- Peak geophysical sensor response prior to excavation;
- "No Contact" reacquisition results;
- Peak geophysical response after excavation; and

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- Comments describing visible anomaly causes or explanations for geophysical responses remaining after excavation.

5.4.1.2. The field team leader or their designee will transfer the information above to the project QC database.

6. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
None	Not applicable.

7. EXHIBITS

None

8. REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	2/18/2015	Initial Release	n/a
01	8/28/2015	Added Advanced Classification to list of definitions. Distinguished between reacquisition procedures for standard DGM anomalies (refine positions with an EM61-MK2) and procedures for Advanced Classification anomalies (no position refining). Added additional path to resolve anomalies – demonstrating response is <25% of initial DGM response. Editorial Changes.	Previously undefined. Positions of Advanced Classification anomalies are expected to be more accurate than real time search with an EM61. In areas with high geologic response or metallic clutter the response can sometimes not be reduced below the anomaly selection threshold.

Procedure # ENV-01	Title: SOIL SAMPLING	Revision # 03
Effective Date: 03/11/15	**Approved By:** Thomas Mills, PG	**Last Reviewed/Revised:** 10/07/15

1. PURPOSE

The purpose of this SOP is to describe the general methods to be employed when collecting surface or subsurface soil samples for analysis during munitions response projects. Types of surface soil samples may include discrete, seven-point wheel, incremental sampling method (ISM), and/or Terra Core® samples. Subsurface soil samples may be collected using hand augers or direct push methods (e.g. Geoprobe®). This procedure also applies to the collection of dry sediment samples.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Chemist	Specifies the types and quantities of soil samples to be collected. Monitors sample collection through communication with project team and field document review to confirm required samples are collected. Coordinates with analytical laboratory during sampling.
Sampling Team Leader	Responsible for implementing the sampling activities outlined in the work plan. Ensures required QC and QA samples are collected. Records sample collection on field documents.
Sampling Team Assistant	Assists the Sampling Team Leader with sample collection and other sampling activities. The role of Sampling Team Assistant may be performed by the accompanying UXO Tech II.
UXO Tech II (or higher)	If explosive hazards are present at the sample location, acts as MEC escort and conducts anomaly avoidance prior to sample collection. May act as Sampling Team Assistant.

3. RELEVANT DEFINITIONS

Term	Definition
None	Not applicable.

4. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
Sampling tools	A stainless steel or disposable spoon/trowel/ or scoop (s), incremental sampling method (ISM) sampling tool(s), hand augers, etc. for sample collection.
Sample containers	Jars, bottles, or pre-cleaned bags as specified in the approved work plan for sample containerization. Coolers for sample shipment.
Logbook	For documenting sampling activities.
GPS Unit	To record sample coordinates.
Chain-of-custody (CoC) forms	For tracking sample details and chain-of-custody, and for providing instruction on sample analysis to analytical laboratory.

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Effective Date: 03/11/15	Approved By: Thomas Mills, PG	Last Reviewed/Revised: 10/07/15

5. PROCEDURE

5.1. Health and Safety

All elements of this procedure will be conducted in accordance with the approved site safety and health plan, including but not limited to specified requirements for training, personal protective equipment (PPE), exposure monitoring and air sampling, etc. The UXOSO or designated representative will review the relevant site-specific activity hazard analyses (AHAs) prior to implementing this SOP.

5.2. General Requirements for all Sample Methods

5.2.1. Documentation

The Sampling Team Leader or designee shall record the description of sample locations, soil type, and any other relevant or notable details in the Field Sampling Logbook and/or on project-specific sampling forms. The Sampling Team Leader or designee shall also record the sample locations using a global positioning system (GPS) unit (e.g., Trimble® GeoXT™ or similar) and document sample coordinates in the Field Sampling Logbook. The Sampling Team Leader or designee shall record other information as specified in the approved work plan, including completion of a Daily Quality Control (QC) Report (DQCR) in accordance with **SOP ENV-00, Daily Quality Control Report**.

5.2.2. Sampling Handling and Shipment

The Sampling Team Leader is responsible for ensuring samples are packaged and shipped to the analytical laboratories in accordance with the approved work plan. The Sampling Team Leader or designee shall document sample details on the CoC form. The completed CoC form will be included with the shipped sample(s).

5.2.3. Sample Analysis and Quality Control Samples

Collected soil samples shall be analyzed in the field and/or at the analytical laboratory as described in the approved work plan. The Sampling Team Leader or designee shall collect the quantities and types of Quality Assurance (QA)/QC samples specified in the approved work plan to ensure proper QC review of each sampling event.

5.2.4. Anomaly Avoidance

If munitions and explosives of concern (MEC) hazards are present at the proposed sample location, a MEC Escort will practice anomaly avoidance in accordance with **SOP MEC-03, MEC Avoidance and Escort** before sample collection. Once the proposed location has been cleared for subsurface anomalies, the sample can be collected. If a subsurface anomaly is detected at the planned sample location, the sample location will be moved to a nearby alternative point and the process will be repeated until a suitable sample location is found. The Sampling Team Leader or designee shall record sampling locations that are moved from those proposed in the work plan in the Field Sampling Logbook, along with a brief explanation.

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Effective Date: 03/11/15	Approved By: Thomas Mills, PG	Last Reviewed/Revised: 10/07/15

5.3. Sampling Methods for Surface Soil

5.3.1. Preparation for Surface Soil Sampling

The following steps shall be completed when preparing for collection of surface soil samples:

1. The Sampling Team Leader shall review the applicable section(s) of the work plan to confirm the sample location, quantities, required sample containers, and other relevant information.
2. The Sampling Team will navigate to the sample location, make initial observations, and complete the required documentation (see Section 5.2.1).
3. If MEC hazards are present, the MEC Escort shall practice anomaly avoidance (see Section 5.2.4).
4. The Sampling Team shall don clean gloves before each sampling event.
5. The Sampling Team shall assemble the necessary sampling equipment and supplies, sample containers, decontamination materials, etc in the sampling area.

5.3.2. Discrete Sampling Method for Soil (or Dry Sediment)

5.3.2.1. The discrete sampling method is best suited to identifying localized contamination. Discrete sampling may be used to collect a sample from a biased area of soil (e.g. stained soil, underneath observed MEC/munitions debris, the bottom of an excavation). Discrete sampling is also used when collecting IDW samples from drums or spoils piles to characterize waste.

5.3.2.2. Following the preparatory actions (Section 5.3.1), the Sampling Team shall complete the following steps to collect discrete surface soil samples:

1. Collect the sample using an approved sampling tool (e.g., stainless steel or disposable spoon, trowel, or scoop).
2. Transfer the collected soil from the sample tool directly into the sample container(s).
3. When sample containers are filled, secure the caps tightly on the containers and place on ice as soon as possible (if required by sample preservation method).
4. After sampling is completed, backfill the hole with remaining soil to return the site to as close to original condition as possible.
5. Perform post-sampling activities (Section 5.3.6).

5.3.3. Seven-point Wheel Method for Soil (or Dry Sediment)

5.3.3.1. The seven-point wheel composite sampling method (*also referred to as the Cold Regions Research and Engineering Laboratory's [CRREL] Seven-point Wheel Sampling Approach*) is used to collect composite soil samples. Composite sampling is generally used to characterize the immediate vicinity of a chosen location (e.g., a detonation crater).

5.3.3.2. Following the preparatory actions (Section 5.3.1), the Sampling Team shall complete the following steps to collect seven-point wheel surface soil samples:

1. Prepare an approved sampling tool (e.g., stainless steel or disposable spoon, trowel, or scoop).
2. Collect seven small sub-samples from an approximately 4-foot diameter area. Collect six of the sub-samples at evenly spaced intervals around the circumference of the circle and one sub-sample in the center of the circle (**Exhibit 1**).
3. Place the seven sub-samples into a large disposable or stainless steel bowl and mix the combined soil thoroughly to ensure a representative sample.
4. Transfer the mixed soil into the sample container(s). When sample containers are filled, secure the caps tightly on the containers and place on ice as soon as possible (if required by sample preservation method).

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5. After sampling is completed, backfill the hole with remaining soil to return the site to as close to original condition as possible.
6. Perform post-sampling activities (Section 5.3.6).

5.3.4. Incremental Sampling Method for Soil (or Dry Sediment)

5.3.4.1. ISM samples are collected to evaluate contamination over larger areas. ISM defines one or more sampling units (SU) to be sampled at a site, from which multiple sample "increments" are then collected and composited into a single, representative incremental sample from each SU. The purpose of ISM is to provide a more accurate measure of the mean concentration of contaminants in each SU by providing reproducible, scientifically defensible data. Surface soil samples collected using the ISM will follow the *ITRC Incremental Sampling Methodology Technical and Regulatory Guidance*, published by ITRC in February 2012. **Note**: *ISM samples are best suited to evaluating inorganic and non-volatile organic analytes. ISM samples will not be used to evaluate chemical agent or agent breakdown products*.

5.3.4.2. In addition to the standard preparatory actions (Section 5.3.1), the following actions also need to be completed to prepare for collecting ISM samples:

1. Identify SU Size(s) and Location(s): The size and location of SUs, sample depth, and the required number of sample increments, are specified in the approved work plan. Note that for ISM samples, only the SU corner locations need to be recorded using GPS; the locations of individual sample increments do not need to be recorded.
2. Determine Increment Grid Configuration and Interval: Once the SU has been designated, the Sampling Team Leader or designee will determine the approximate configuration and interval(s) at which sample increments will be collected. These will be designed to be regularly spaced throughout the collection grid to the extent possible. For example, if 30 sample increments are required, five increments should be collected along six rows (i.e., a 5 x 6 sampling grid). If the SU was 100 feet by 100 feet, then the sample spacing would be approximately 20 feet and the rows would be approximately 17 feet apart. Note these distances do not need to be exact, but the Sampling Team shall attempt to collect regularly spaced samples. The sampling interval(s) for each SU shall be recorded by the Sampling Team Leader or designee. An example 10 x 10 sampling grid for an ISM sample is shown in **Exhibit 2**.
3. Select Sample Collection Origin. Once the sample increment interval has been determined, the Sampling Team will randomly select the starting point for sample collection and begin the collection of individual sample increments from each grid cell using the determined sample increment interval. The Sampling Team will endeavor to collect each sample increment from the same relative location in each cell of the sampling grid (see **Exhibit 2**).

5.3.4.3. Following the preparatory actions (Sections 5.3.1 and 5.3.4.2), the Sampling Team shall complete the following steps to collect ISM surface soil samples:

1. Prepare an approved sampling tool (e.g., stainless steel sample corer designed not to discriminate in size, shape or concentration of particles collected for the range of particle sizes of interest).
2. Collect sample increments from the SU as specified in the work plan using the same sampling tool for each increment. Sample increments shall be collected in an unbiased and uniform manner throughout the SU, with each increment having the same size and mass to the greatest extent practicable. Increments shall be combined into a single certified, pre-cleaned plastic bag. These additional measures shall be observed during sampling:

   (a) Vegetated areas will not be avoided and vegetation shall not be removed from sample increment locations where possible.

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(b) If pieces of explosive residue (raw high explosives) are present at the sample location, the MEC Escort shall move them prior to sampling, and their location shall be documented.
(c) If a sample increment cannot be collected from a particular location (e.g., rock refusal), then a second increment will be collected next to the original location and documented in the Field Sampling Logbook.
(d) The total weight of all sample increments in each incremental sample will be at least 1 kilogram but no more than 2 kilograms.

3. Once the sample is collected, weigh, label and seal the certified plastic bag. Place on ice as soon as possible (if required by sample preservation method).
4. Perform post-sampling activities (Section 5.3.6).

5.3.5. Terra Core® Sampling Method for Soil (or Dry Sediment)

5.3.5.1. Samples requiring VOC analysis may be collected using EnNovative Technologies Terra Core® samplers. Terra Core® samplers limit the amount of volatilization that occurs during sampling, which allows for a more accurate and valid analytical result.

5.3.5.2. Following the preparatory actions (Section 5.3.1), the Sampling Team shall complete the following steps to collect Terra Core® surface soil samples:

1. Prepare a Terra Core® sampler, and a 40mL VOA vial containing the proper preservative (deionized [DI] water or methanol) and a magnetic stirring bar (if required).
2. With the plunger seated in the handle, push the Terra Core® sampler into the soil until the sample chamber is filled. Wipe all soil or debris from the outside of the Terra Core® sampler. *The soil plug should be flush with the mouth of the sampler*.
3. Rotate the plunger that was seated in the handle to 90° until it is aligned with the slots in the sampler body. Place the mouth of the sampler into the 40mL VOA vial and extrude the sample into the container by pushing the plunger down.
4. Quickly replace the lid of the 40mL VOA vial. *When capping the VOA vial, be sure to remove any soil or debris from the top or threads of the vial*. Place the collected sample on ice as soon as possible (if required by sample preservation method).
5. Perform post-sampling activities (Section 5.3.6).

5.3.6. Post Sampling Activities for Surface Soil Sampling

The following steps shall be completed once surface soil sample collection is complete:

1. The Sampling Team Leader or designee shall label each sample container with the Sample ID, date, time, analysis, and other information required on the sample label.
2. The Sampling Team Leader or designee will confirm the required samples have been collected, including necessary QC samples as specified in the approved work plan.
3. The Sampling Team Leader or designee shall record the sample location GPS coordinates.
4. The Sampling Team will decontaminate reusable sampling equipment as described in Section 5.5 or as specified in the approved work plan.
5. The Sampling Team Leader or designee shall complete the CoC and other required documentation (see Section 5.2.1) and prepare the sample for shipment (see Section 5.2.2).

5.4. Sampling Method for Subsurface Soil

5.4.1. Preparation for Subsurface Soil Sampling

The following steps shall be completed when preparing for collection of subsurface soil samples:

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1. The Sampling Team Leader shall review the applicable section(s) of the work plan to confirm the sample location, quantities, required sample containers, and other relevant information.
2. The Sampling Team Leader will obtain any necessary excavation permits and, if necessary, contact a local underground utility locating service to perform a utility clearance for all subsurface sample locations.
3. The Sampling Team will navigate to the sample location, make initial observations, and complete the required documentation (see Section 5.2.1).
4. If MEC hazards are present, the MEC Escort shall practice anomaly avoidance (see Section 5.2.4).
5. The Sampling Team shall don clean gloves before each sampling event.
6. The Sampling Team shall assemble the necessary sampling equipment and supplies, sample containers, decontamination materials, etc in the sampling area. If on-site decontamination is required, arrange the necessary supplies in a nearby but separate location, away from the borehole. All equipment entering the borehole shall be decontaminated.
7. The Sampling Team shall calibrate required equipment and document the calibration on an equipment calibration form.

5.4.2. Direct Push or Hand Auger Method for Subsurface Soil

5.4.2.1. This section provides procedures for subsurface soil sampling using a direct push type rig (e.g., Geoprobe®) or hand auger. If a direct push rig is used, it shall be operated by an appropriately licensed driller.

5.4.2.2. Prior to the advancement of any equipment into a borehole, down hole anomaly avoidance will be conducted in accordance with **SOP MEC-03, MEC Avoidance and Escort**. If a subsurface anomaly is detected during augering or drilling, the borehole will be terminated for safety reasons, the detection depth and location will be noted in the field log, and a sample will be collected at the termination depth.

5.4.2.3. Following the preparatory actions (Section 5.4.1), the Sampling Team shall complete the following steps to collect soil samples from the soil borings advanced by hand augering or direct push rig:

1. Spread clean plastic sheeting on the ground or table at each sampling location to keep sampling equipment clean and prevent cross-contamination.
2. Advance the hand auger or direct push tool to the desired sample depth.
3. Collect the sample using an approved sampling tool (e.g., stainless steel or disposable spoon, trowel, or scoop) and scoop the soil from the auger bucket or acetate liner from the direct push rig starting at representative depth ranges as detailed in the work plan. For hand augering, use a new, clean auger bucket once the top of the sampling depth is reached.
4. Transfer the sample from the auger bucket or trowel into a large disposable or stainless steel bowl and mix the combined soil thoroughly to ensure a representative sample.
   EXCEPTION: If collecting subsurface samples for VOC analysis, the sample will be collected directly from the sample equipment (e.g., auger bucket or acetate sleeve) using a Terra Core® sampler as described in Section 5.3.5. The soil shall not be mixed before sample collection.
5. Collect suitable quantities with the approved sampling tool and transfer directly into the sample container(s).
6. Repeat these steps as necessary to obtain sufficient sample volume.
7. When sample containers are filled, secure the caps tightly on the containers and place on ice as soon as possible (if required by sample preservation method).
8. After sampling is completed, backfill the hole with remaining soil to return the site to as close to original condition as possible.
9. Perform post-sampling activities (Section 5.4.3).

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5.4.3. Post Sampling Activities for Subsurface Soil Sampling

The following steps shall be completed once subsurface soil sample collection is complete:

1. The Sampling Team Leader or designee shall label each sample container with the Sample ID, date, time, analysis, and other information required on the sample label.
2. The Sampling Team Leader or designee will confirm the required samples have been collected, including necessary QC samples as specified in the approved work plan.
3. The Sampling Team Leader or designee shall record the sample location GPS coordinates. *Note that for ISM samples, only the center point of the SU needs to be recorded using GPS; the locations of individual sample increments do not need to be recorded*.
4. The Sampling Team will decontaminate reusable sampling equipment as described in Section 5.5 or as specified in the approved work plan.
5. The Sampling Team Leader or designee shall complete the CoC and other required documentation (see Section 5.2.1) and prepare the sample for shipment (see Section 5.2.2).

5.5. Sampling Equipment Decontamination

5.5.1 Disposable equipment shall be used wherever possible to limit the potential of cross-contamination. However, If reusable equipment is used (e.g. stainless steel bowls and spoons, direct push tooling or cutting shoes) decontamination shall be performed.

5.5.2 Sampling equipment decontamination shall be conducted in an uncontaminated area free of dust. Unless otherwise specified in the approved work plan, sampling equipment will be decontaminated using the following process:

1. Wash equipment with tap/potable water and laboratory-grade detergent (e.g., Alconox™ or Liquinox™). A scrub brush will be used to remove any dirt and/or surface film.
2. Rinse equipment thoroughly with tap water.
3. Rinse equipment thoroughly with ASTM Type II or distilled water.
4. Remove excess water and allow equipment to dry.
5. Wrap equipment in aluminum foil, shiny side out.

5.5.3 If required by the Waste Management Plan in the approved work plan, sampling equipment decontamination water shall be containerized for subsequent chemical analysis and for proper disposal of decontamination water. Equipment blanks shall be collected as specified in the approved work plan.

6. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
Incremental Sampling Methodology, ITRC Technical and Regulatory Guidance (ITRC, 2012)	Guidelines discussing reasoning and procedure for incremental sampling.

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7. EXHIBITS

EXHIBIT 1
CRREL 7-POINT WHEEL DIAGRAM

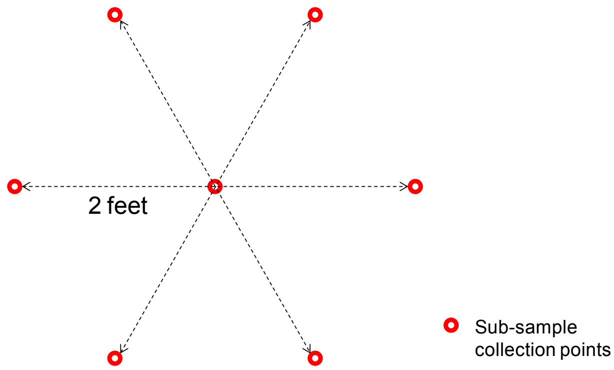
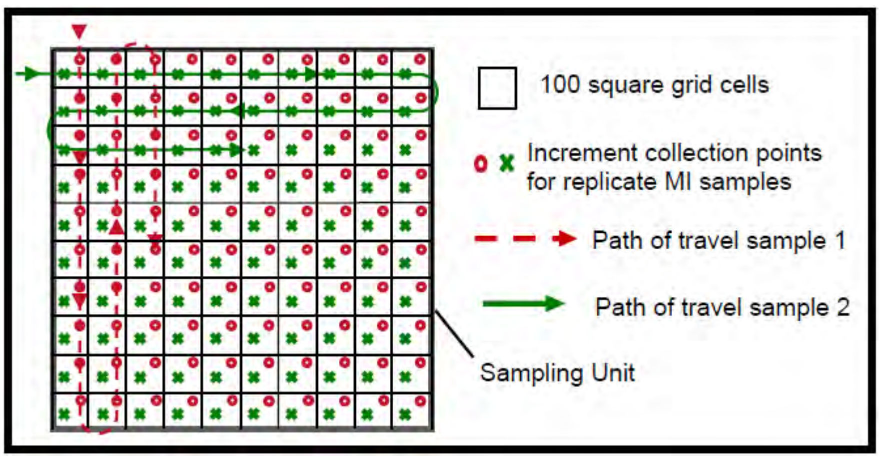


EXHIBIT 2
INCREMENTAL SAMPLING EXAMPLE (USACE, 2009)



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8. REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	02/18/15	Initial Release	n/a
01	03/11/15	Minor revisions to ISM text	Scheduled review
02	04/30/15	Ruled out ISM for chemical agent sampling	External comments
03	10/07/15	Added reference to Terra Core® sampling for subsurface soil samples.	External comments

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Procedure # CHEM-01	Title: CHEMISTRY DATA REVIEW AND MANAGEMENT	Revision # 00
Effective Date: 05/20/2015	**Approved By:** Tammy Chang	**Last Reviewed/Revised:** 05/20/2015

1. PURPOSE

The purpose of this SOP is to describe the general procedures involved in chemistry data review and management for environmental projects. The elements involved include data verification, data validation, data usability assessment, and documentation, flagging conventions, electronic data deliverables, and data archiving.

2. RESPONSIBILITIES

Role	SOP-specific Responsibilities
Project Chemist	Ensures laboratory analytical data are managed, reviewed, validated, reported, and stored in accordance with approved requirements.
Data Manager	Ensures laboratory analytical electronic data are managed, reviewed, validated and reported in accordance with approved requirements and that data integrity is maintained.

3. RELEVANT DEFINITIONS

Term	Definition
Data Verification	The first step in the data review process. Data verification involves a completeness check to determine whether the analytical laboratory has provided the required information to permit adequate data validation and review.
Data Validation	The second step in the data review process. Data validation extends data verification and is the systematic process of evaluating whether data comply with pre-defined, project-specific requirements and criteria.
Data Usability Assessment	The third step in the data review process. The usability assessment is an evaluation based on the findings of the data verification and validation steps. It includes discussion of the final data flags applied to the sample results and assessment of whether the data meet project method and data quality objectives.
Data flags	Project-specific notations applied to individual analytical results to provide the data user with a qualitative assessment of the data (e.g., "estimated" or "rejected"). Data flags are also sometimes called “qualifiers.”

4. REQUIRED EQUIPMENT

Equipment	Brief Description of Function and Purpose
None	Not applicable.

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Effective Date: 05/20/2015	**Approved By:** Tammy Chang	**Last Reviewed/Revised:** 05/20/2015

5. PROCEDURE

5.1. Overview

5.1.1 The Project Chemist shall ensure that all data generated by the analytical laboratory is reviewed and managed in accordance with the project-specific work plan and/or Quality Assurance Project Plan (QAPP). Data verification, data validation, and usability assessment are the three steps of the data review process by which data adequacy and quality are examined and evaluated. After the data verification and validation steps have been performed, a data usability assessment can be completed. The usability assessment includes the discussion of the results based on the verification and validation, as well as discussion of how final data qualifiers, also known as data flags, are properly applied to the sample results. The final data flags as they were described in the usability assessment are applied to the electronic data results in the project database. The following sections of this SOP address these steps.

5.1.2 Note that not all data may require verification or validation for a given project. For example, for projects with large quantities of data, a representative selection may be verified and validated. The rest of the data may be verified without validation. Also, waste characterization and screening data are not typically subject to validation. The quantity and/or types of data to be verified and validated will be specified in the project-specific work plan and/or QAPP.

5.2. Data Verification

The Project Chemist or designee shall verify data packages received from the analytical laboratory as required during the project. Data verification will involve the reviewer conducting a completeness check to determine whether the analytical laboratory has provided the required information to permit adequate review and validation. The required information to be provided by the laboratory for the project is described in the project-specific work plan and/or QAPP. Data verification will be documented as specified in the project-specific work plan and/or QAPP.

5.3. Data Validation

Following verification, the Project Chemist or designee shall validate data packages received from the analytical laboratory as required during the project. Data validation is the systematic process of evaluating whether the data comply with pre-defined requirements and criteria of a specific project. There are three levels of data validation: Level 2, Level 3, and Level 4; with Level 2 being a more basic level of review and Level 4 being the most comprehensive. Each higher level of validation includes the level(s) below (i.e., Level 3 validation also includes Level 2 validation and Level 4 also includes Levels 2 and 3). The level of data validation required for the project and the project-specific validation criteria to be used are described in the project-specific work plan and/or QAPP.

5.3.1. Level 2 Validation

Level 2 validation of the laboratory analytical data package comprises a series of assessments concerning the compliance of sample receipt conditions, sample characteristics, and analytical results. **Table 1** shows the validation steps and requirements for Level 2 validation.

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TABLE 1
VALIDATION STEPS AND REQUIREMENTS FOR LEVEL 2 DATA VALIDATION

Validation Step (Review Items)	Validation requirement
Case Narrative	Verify necessary information are included and discussed as appropriate (e.g., parameters analyzed, description of all analytical and sample receipt problems, discussion of reasons for any QA/QC exceedances, and discussion regarding any occurrences that adversely impact sample integrity or data quality).
Corrective Action Reports (CARs), if applicable	Review report for completeness ensuring the cause and corrective action are identified, and the corrective action has been implemented.
Chain-of-Custody (COC) documentation	Examine traceability of the data from time of sample collection through reporting of results. Examine chain-of-custody records against QAPP requirements.
Sample condition upon receipt, and storage records	Verify required sample handling, receipt, and storage procedures were followed, and deviations were documented.
Sample chronology	Verify date and time samples were received, extracted and analyzed.
Sampling Methods and Procedures	Verify required analytical methods were performed, including preparation and cleanup when needed.
Holding Times	Ensure samples were prepared and analyzed within holding times specified in method, procedure, and contract requirements. If holding times were not met, confirm deviations were documented, appropriate notifications were made (consistent with procedural requirements), and appropriate approval to proceed was received prior to analysis.
Sample results	Confirm required target analytes are reported and data includes the original laboratory data qualifiers. Confirm requested concentration units are reported for each method. Review sample results and confirm requested reporting limits for all samples are present; verify results and limits are adjusted for dilutions and dry weight for soils where applicable. Determine which result should be used to make project decisions if multiple analyses were performed for any analyte.
QA/QC Samples	Evaluate all sample-related quality control (QC) data against designated acceptance criteria for accuracy and precision listed in the project specific work plan and/or QAPP (including method blank detections, surrogate recoveries, laboratory control sample [LCS] recoveries, duplicate precision, and matrix spike/matrix spike duplicate [MS/MSD] recoveries and precision). Verify laboratory QC is linked to sample data via batch identifiers. Verify QC samples were performed at the required frequency.

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5.3.2. Level 3 Validation

Level 3 validation of the laboratory analytical data package consists of the Level 2 validation plus an assessment of the compliance of instrument-related QC. **Table 2** shows the validation steps and requirements for Level 3 validation.

TABLE 2
VALIDATION STEPS AND REQUIREMENTS FOR LEVEL 3 DATA VALIDATION

Validation Step (Review Items)	Validation requirement
Initial instrument calibration records	Confirm compliance with project requirements and/or acceptance criteria included in the project work plan and/or QAPP.
Secondary source standard (initial calibration verification)	
Continuing calibration verification	
Calibration blanks	
Method specific instrument performance checks (e.g., tunes for mass spectrometry methods, DDT/Endrin breakdown checks for pesticides and Aroclors, instrument blanks and dilution test, post digestion spike, and interference checks for Inductively Coupled Plasma (ICP) methods)	
Sample Results	Evaluate sample results by comparing instrument-related QC data to the requirements and guidelines present in the project work plan and/or QAPP.

5.3.3. Level 4 Validation

Level 4 validation of the laboratory analytical data package consist of all items listed for Level 2 and Level 3 validation, plus the validation of the overall data set. **Table 3** shows the validation steps and requirements for Level 4 validation.

5.3.4. Flagging Conventions

The final data flags used to qualify data shall be applied by the Project Chemist during the data validation process. Final data flags applied to data are discussed in the project-specific data usability assessment, then the Data Manager uses the final data flag discussion from the usability assessment to apply those flags to the electronic data in the project database. The type of final data flags and their definitions are specific to the project and are listed in the project specific work plan and/or project QAPP.

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TABLE 3
VALIDATION STEPS AND REQUIREMENTS FOR LEVEL 4 DATA VALIDATION

Validation Step (Review Items)	Validation requirement
Patterns and Trends	Review project data for patterns and trends in the sample and/or QC data that may indicate systematic issues/bias across the entire data set.
Raw instrument data	Review chromatograms, ion spectra, and manual spot check of electronic calculations, including chromatograms from dual column and/or dual detectors.
Manual Integrations	Review all manual integrations to ensure they were properly performed and documented. Raw data records where manual integrations were performed must include the following: (1) chromatogram before manual integration and after manual integration, (2) notation of the cause and justification for performing the manual integration, (3) date and signature or initials of the person performing the manual integration.
Laboratory Sensitivity	Evaluate lab sensitivity by identifying whether reporting limits met those required by the project work plan and/or QAPP and that non-detect values were reported at concentrations below the required Project Action Limits listed in the project work plan and/or QAPP (as applicable). Evaluate low-level detections to identify possible false-positive results below the limit of detection but detected at or above the detection limit based on data reproducibility, blank detections, and chromatographic interference.
Standards	Determine the traceability of all chemical standards used in preparation and analysis and that they method or procedural requirements.
Deviations (if applicable)	Review any deviations from planned activities (e.g. work plan and/or QAPP deviations) and their impacts on the data usability.

5.4. Corrective Actions

If the data reviewer assesses the data package to be incomplete, in error, or otherwise requiring revision, the Project Chemist or designee shall contact the Laboratory Project Manager (PM) and ensure corrective actions are initiated as soon as possible to rectify the issue(s). If necessary, the Project Chemist shall instruct the Laboratory PM to correct and reissue the applicable data package(s). Data verification and validation shall be repeated for the revised elements of the data package(s).

5.5. Data Usability Assessment and Documentation

Following validation, the Project Chemist or designee shall conduct a usability assessment for the data packages received from the analytical laboratory as required during the project. The data usability assessment uses the results of the data verification and validation steps, including discussion of the final data flags applied to the sample results (see Section 5.3.4). The data usability assessment involves evaluating whether the data meet project method and data quality objectives. The Project Chemist or designee shall document the findings of the data usability assessment in the format specified in the project-specific work plan and/or QAPP (e.g., report, checklist, etc.).

Procedure # CHEM-01	Title: CHEMISTRY DATA REVIEW AND MANAGEMENT	Revision # 00
Effective Date: 05/20/2015	**Approved By:** Tammy Chang	**Last Reviewed/Revised:** 05/20/2015

5.6. Electronic Data Deliverables (EDD)

5.6.1 The Data Manager shall import and store electronic analytical data in a project-specific database using electronic processing as a means to maintain and assure the accuracy, consistency, and integrity of the data. Electronic data evaluation will follow a systematic process of review using a set of logical data queries and/or validation software to ensure that electronic data comply with pre-defined project requirements. The Data Manager shall apply data flags to electronic data as determined during the validation process (see Section 5.3.4) and then the Data Manager shall use the validated data to generate data summary tables that include the validation flags. The Data Manager is responsible for verifying the data summary tables for accuracy and completeness by comparison to the validated hard copy laboratory reports.

5.6.2 The required EDD format and government database submittal deliverables are specific to the project and are described in the project-specific work plan and/or QAPP. The Data Manager is responsible for ensuring data are uploaded to required government databases in accordance with project requirements.

5.7. Data Archive

Electronic project files, such as laboratory data (reports and EDDs), validation checklists and/or validation reports, project database, and data tables shall be stored and maintained as described in the project-specific work plan and/or QAPP. Hard-copy project files shall be stored at the Parsons office where the Project Chemist is located until project closeout, at which point the documents shall be moved to the Parsons Project Manager’s Office or an approved off-site storage location. All Department of Defense project related laboratory and validation documents shall be stored for minimum of seven years from the acceptance of data by the client.

6. REFERENCES

Reference Title (Author)	Brief summary of relevance to this procedure
Uniform Federal Policy for Quality Assurance Project Plans Part 1: UFP-QAPP Manual, Final Version 1 March 2005.	Defines and describes requirements for data review elements: verification, validation and data usability.

7. EXHIBITS

None.

8. REVISION HISTORY

Rev.	Date	Summary of Changes	Reason for Revision
00	05/20/15	Initial Release	n/a

HGL HydroGeoLogic, Inc Exceeding Expectations	**STANDARD OPERATING PROCEDURE**

Explosive Materials Accountability and Management	**SOP No.: 501.01.1**
	SOP Category: MMRP and Geophysics
	Revision No.: 1
	Revision Date: January 2016
	Review Date: January 2017

Approved by:

Jan Kool Digitally signed by Jan Kool Date: 2016.01.25 18:18:31 -05'00' 1/25/2016

Jan Kool, Ph.D. Date
Corporate QA Manager

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Neil Feist Date
MMRP Operations Manager

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LIST OF ATTACHMENTS

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	SOP Category: MMRP and Geophysics
	Revision No.: 1
	Revision Date: January 2016
	Review Date: January 2017

1.0 PURPOSE

This standard operating procedure (SOP) guides HydroGeoLogic, Inc. (HGL) employees in accountability for and management of explosive materials encountered on project sites. It also ensures that all explosive operations described herein are conducted in compliance with the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) Publication (ATFP) 5400.7, *Federal Explosives Law and Regulations*, and the U.S. Department of Defense (DoD) Manual 6055.09-M, *DoD Ammunition and Explosives Safety Standards*.

2.0 SCOPE AND APPLICATION

This SOP applies to HGL employees assigned to Military Munitions Response Program (MMRP) project-specific explosive operations. Only those individuals listed as "*cleared*" on the most recent ATF Federal Explosive Licensing Center (FELC) Notice of Clearance are authorized to have direct physical access to explosive materials during explosive operations. The current FELC Notice of Clearance is on file at the HGL Huntsville, Alabama, office if needed to verify individual clearance status.

Personnel who use this procedure must complete the SOP Acknowledgement Sheet (see Attachment 1) and submit it to the Unexploded Ordnance (UXO) Safety Manager and project Senior UXO Supervisor (SUXOS) as evidence that they have read and understand this SOP. The UXO Quality Control Specialist (UXOQCS) retains this document in the project file.

Deviations from specified requirements must be approved by the MMRP Operations Manager before they can be implemented. The MMRP Operations Manager will discuss and include approved deviations in the project plans. Any approved deviation cannot compromise federal law, and both the deviation and the newly modified process must be described fully in the justification documentation.

3.0 DEFINITIONS

3.1 DEFINITIONS

<u>*Constructive Possessor*</u>: Any person who has access to explosive materials but does not physically handle them. For example, a Demolition Supervisor who keeps keys for storage magazines in which explosives are stored for use in construction activities, or an individual who directs the use of explosive materials by other employees.

<u>*Employee Possessor (EP)*</u>: Any employee under HGL's explosive license who has or will have actual physical possession (direct access) of explosive materials or who has or will have constructive possession of explosive materials. This includes HGL employees assigned to UXO positions who directly handle explosive materials as part of the production process, employees

who handle explosive materials to ship or transport them, and employees who actually use explosive materials, such as blasters and their helpers.

Responsible Person (RP): An employee under HGL's explosive license who has the power to direct the management and policies pertaining to explosive materials.

3.2 ACRONYMS

ATF	Bureau of Alcohol Tobacco, Firearms and Explosives
ATFP	ATF Publication
CFR	Code of Federal Regulations
CMV	commercial motor vehicle
DDESB	DoD Explosives Safety Board
DoD	U.S. Department of Defense
DOT	U.S. Department of Transportation
DSMT	Daily Summary of Magazine Transactions
EP	ATF "Employee Possessor"
EPQ	employee possessor questionnaire
ESP	Explosives Site Plan
ESS	Explosives Safety Submission
FELC	Federal Explosive Licensing Center
HAZMAT	hazardous material
HGL	HydroGeoLogic, Inc.
IAW	in accordance with
IME	Institute of Makers of Explosives
MEC	munitions and explosives of concern
MERA	Manufacturer of Explosives Record of Acquisition
MMRP	Military Munitions Response Program
MR	munitions response
NEW	net explosive weight
PTR	public transportation route
RP	ATF "Responsible Person"

SOP	standard operating procedure
SUXOS	Senior Unexploded Ordnance Supervisor
USACE	U.S. Army Corps of Engineers
USBDC	U.S. Bomb Data Center
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer

4.0 EXPLOSIVE ACCOUNTABILITY AND MANAGEMENT PROCEDURES

For the purpose of this SOP, the SUXOS position also refers to all instances when a UXO Technician III is assigned the Demolition Supervisor responsibilities on HGL projects involving munitions and explosives of concern (MEC) support during construction activities.

Employees must perform all explosive operations in a manner consistent with ATFP 5400.7, DoD Manual 6055.09-M, and this SOP. For all HGL project sites where explosive operations are conducted, include a section in the work plan that describes specific procedures for accountability and management of explosive materials associated with that site.

0 W A R N I N G 0

Every HGL employee who transports, stores, or uses explosive materials must clearly understand their responsibilities for properly safeguarding, securing, and storing explosive materials.

Disregarding these procedures will result in being denied physical access to explosive materials and possible termination of employment.

Any violation of the Federal Explosive Law and Regulations could result in being charged with a criminal offense.

4.1 GENERAL

This section outlines the procedures for proper accountability and management of explosives materials purchased, stored, transported, and used on HGL project sites. These procedures were developed using the following references:

≠ ATFP 5400.7 (27 Code of Federal Regulations [CFR] Parts 555 and 841 § A0K)
≠ ATFP 5400.15
≠ ATFP 5400.17

- ATFP 5400.20
- DoD Manual 6055.09-M
- U.S. Department of Transportation (DOT) (49 CFR §§ 146 to 149)

4.2 EXPLOSIVE LICENSE

HGL holds an ATF Type 20 - Manufacturer of High Explosives license to purchase and use explosives on project sites (see Attachment 2). The original license is posted at the HGL office in Huntsville, Alabama.

0 N O T I C E 0

Post a copy of this license at each HGL project site where explosive materials are stored and used; ensure it is available for Federal, State, or local inspections.

4.3 HGL AUTHORIZED INDIVIDUALS

Only HGL employees listed on the FELC Notice of Clearance are authorized to have direct access to explosive materials. The SUXOS and the UXO Safety Manager determine which project personnel are required to have direct access to explosive materials and confirm that they are listed on the FELC Notice of Clearance.

HGL is required to provide commercial explosives suppliers with a list of employees who are authorized to receive and issue explosives. For HGL projects, this individual is the SUXOS; if the SUXOS is not available, the individual will be an identified and authorized UXO technician.

4.3.1 Responsible Person

HGL employees who are designated by the HGL Chief Operating Officer to fill a “Responsible Person” position must submit the following to the UXO Operations Manager:

- An ATF Form 5400.28 employee possessor questionnaire (EPQ)
- An FD-258 fingerprint card
- A 2 by 2-inch color photograph

The UXO Operations Manager verifies that all forms are properly completed and submitted to the FELC.

4.3.2 Employee Possessor

HGL employees who are EPs and therefore required by their position to have direct access to explosive materials must complete and submit a completed ATF 5400.28 EPQ to the UXO Safety

Manger. The UXO Safety Manager then verifies proper completion of the form and submits it to FELC. Once FELC receives the EPQ, the employee is authorized to have direct access to explosive materials, unless denied by ATF.

4.4 ACQUISITION OF EXPLOSIVE MATERIALS

Record all explosive materials acquisitions on the day of the acquisition, manufacture, or receipt using the Manufacturer of Explosives Record of Acquisition (MERA) form in accordance with (IAW) ATFP 5400.7 (27 CFR § 555.123(b)) (see Attachment 3). Submit an electronic copy of this form to the UXO Safety Manager within 48 hours of the acquisition.

Coordinate acquisition arrangements with the sources (commercial explosive dealers) identified in the project work plan.

4.4.1 Binary Explosives

Mixing binary explosive materials into a single solution and holding it for storage is considered "*manufacturing explosives.*" Record this action as an "*acquisition*" on the MERA within 24 hours of mixing and follow the procedures outlined in Section 4.4. Until the compounds are mixed, they are not classified as explosives and, therefore, are not subject to control. However, once mixed, binary explosives are "explosive materials" and are subject to all applicable federal requirements.

0 E X C E P T I O N 0

IAW ATFP 5400.7 (27 CFR § 555.123(d)(3)), a licensed manufacturer is exempt from recordkeeping requirements if the explosive materials are manufactured for their own use and used within a 24-hour period at the same site. For example, mixing binary explosives.

4.4.2 Order Quantity

The SUXOS for each project site coordinates with the Project Manager to purchase and have available an initial quantity of commercial explosives before beginning MEC demilitarization and disposal operations. Based on usage requirements and demand, they may increase the quantity in stock.

Do not at any time allow the net explosive weight (NEW) to exceed the storage limit established by the DoD Explosives Safety Board (DDESB)-approved Explosive Safety Submission (ESS) or Explosives Site Plan (ESP) for the project site.

4.4.3 Acquisition Source and Delivery

HGL purchases commercial explosives only from ATF-licensed explosive dealers that deliver explosive materials to the project site. The SUXOS coordinates with the UXO Safety Manager to ensure the following:

- All project explosive materials acquisition sources are identified.
- A listing of explosive material requirements is developed during the project planning phase.
- Purchase orders are submitted to the explosive dealer(s) for the required amount of explosive materials.
- The explosive dealer receives a copy of the HGL Authorized Agent list of the site employees who are authorized to purchase and receive explosive materials.
- The explosive dealer receives a copy of the HGL Manufacturer of Explosives - Type 20 license with the original signature of an HGL cleared RP.
- Explosive material delivery arrangements are established.

4.5 INITIAL RECEIPT OF EXPLOSIVE MATERIALS

When explosive materials arrive at a project site, the site SUXOS accomplishes the following:

- Immediately checks the lot number or manufacture's marks and nomenclature/ description of each explosive item against the explosive delivery manifest/invoice;
- Records this information on the MERA;
- If placed in magazines, records this information on the Daily Summary of Magazine Transactions (DSMT) (see Attachment 4);
- Maintains on site a copy of the original delivery invoice/manifest receipt document;
- Maintains the completed DSMT record in the magazine with the explosive materials;
- Annotates and updates the DSMT upon each issue, receipt, and weekly/yearly inventory;
- Keeps a duplicate DSMT record in the project files;
- Submits DMST records to the UXO Operations Manager upon project completion and/or when explosive magazines are emptied and taken out of service; and
- Retains DSMT records for no less than 5 years from the transaction date.

4.5.1 Explosive Materials Accountability

The SUXOS properly documents and verifies all explosive material receipts, issues, turn-ins, and inventories through physical count. The UXOQCS confirms the count on the DSMT and the Explosive Material Disposition Record (see Attachment 5).

4.5.2 Request for Explosives

To ensure that all issued explosive materials are accounted for while in the possession of individual users, follow the procedure outlined below:

- The SUXOS reviews all requests for explosives from the individual operating sites and issues only the required amount of explosives for the day's operations.
- The SUXOS records explosive issues using the Explosive Material Disposition Record, deducts issues from the DSMT record, and annotates explosives usage in the Daily Production Report. The explosive materials end user signs the Explosive Material Disposition Record to certify that the explosives were expended for their intended purpose.
- When withdrawing or turning in explosive materials, the Demolition Supervisor and SUXOS verify through physical count the entries made on the Explosive Material Disposition Record and the DSMT record.

The UXOQCS or the UXO Safety Officer (UXOSO) verifies the accuracy of all explosive transactions.

4.5.3 Reconcile Receipt Records

When necessary, the SUXOS reconciles the delivery shipping documentation with the requested amounts ordered and amounts received, and immediately reports shortages or overages to the Project Manager. The Project Manager then contacts the explosives dealer to reconcile differences.

At the end of each explosive demolition operation, the Demolition Supervisor and either the UXOQCS or the UXOSO reconciles the entries on the Explosive Material Disposition Record with the DSMT record and gives the records to the SUXOS for final verification and acceptance.

4.6 STORAGE

4.6.1 Establish Explosive Storage Magazines

Establish explosive storage magazines at HGL project sites IAW ATFP 5400.7 (27 CFR § 555, Subpart K - Storage), DoD Manual 6055.09-M, and the applicable DDESB-approved ESS/ESP.

- When not in use, properly store and secure all explosive materials in a Type 2 portable outdoor magazines meeting the design specifications of ATFP 5400.7, (27 CFR § 555.203(b)) and ATFP 5400.17. Placard the magazine with the appropriate DOT hazard class/division and fire symbols, and post emergency notification information clearly.
- When storing explosive materials on DoD facilities, comply with the local DoD components explosive safety, security, and siting requirements.
- When site security conditions necessitate additional safeguarding of explosive materials, fence the explosive storage area using a minimum 6-foot-high fence with a lockable gate or a suitable intrusive detection system.
- Install lightning protective systems (grounding) IAW DoD 6055.09-M. Inspect the lightning protective system annually. Test the lighting protective system every 2 years.
  - Fences located within 6.5 feet of a magazine shall be bonded to the magazine's lightning protective system.
  - When more than one magazine is used, separate them by a minimum of 6.5 feet and ground them separately. If the 6.5-foot distance is not feasible, bond the magazines to a common grounding system.
- When siting explosives storage magazines, including locating, installing, and maintaining the magazines:
  - Comply with all ATF, federal, DoD, state, and local storage and compatibility criteria and procedures.
  - Comply with magazine criteria and quantity distance requirements established in ATFP 5400.7 (27 CFR, § 555, Subpart K - Storage) and DoD Manual 6055.09-M, Volume 3.

4.6.2 Physical Security of Explosive Materials

Maintain strict physical security and safeguarding of explosive materials at all times on HGL project sites where these materials are being used and stored. The SUXOS and UXOQCS enforce access, control, transportation, and security of all explosives materials on site. Place explosive storage magazines in the most secure locations practicable IAW the following:

- ATFP 5400.7 (27 CFR §§ 555.207 and 555.208),
- ATFP 5400.15, *Volunteer Security Checklist*,
- DoD Manual 6055.09-M, and
- HGL SOP 503.01.1, *Explosive Storage Inspection and Security*.

4.6.3 Physical Security of MEC

On known munitions response (MR) sites where intentional physical contact with MEC or chemical warfare materiel is planned or anticipated, comply with the DDESB-approved ESP or ESS concerning the physical security of all MEC discoveries.

On project sites where intentional physical contact is not planned or anticipated but MEC is discovered, the site supervisor immediately notifies the project manager, who then immediately notifies the client to obtain safeguarding instructions.

Record all instances of discovered MEC items using the MEC Demilitarization/Disposal by Detonation Accountability Record (see Attachment 6).

4.6.4 Required Notifications

The SUXOS coordinates with the UXO Operations Manager to notify the local ATF office in writing 5 days before an explosives storage magazine is added to the project location IAW ATFP 5400.7 (27 CFR § 555.63). Include the following information in the written notification to the local ATF:

- HGL Huntsville office telephone number and address,
- HGL explosives license number,
- Explosives storage magazine address/location (latitude/longitude coordinates),
- Magazine identification number, and
- Emergency contact name, address, and telephone number.

The SUXOS notifies local fire authorities orally before the end of the day that storage of the explosive materials begins, and again in writing within 48 hours from the time such storage begins IAW ATFP 5400.7 (27 CFR § 555.21). Include the following information in both oral and written notifications to the local fire authorities:

- Type(s) of explosive materials,
- Magazine capacity (NEW amount), and
- Location of each storage site where explosive materials are stored.

The SUXOS confirms to the HGL MMRP Operations Manager when all notifications to fire authorities are completed.

4.6.5 Access and Control

The SUXOS and the UXOQCS establish a key-control system for access to and control of explosives through the following:

- ≠ Only personnel authorized by the MMRP Operations Manager are issued keys to explosive storage magazines and trucks loaded with explosives.
- ≠ Keys not currently in use are secured in an unmarked area located separately from other keys on the premises.
- ≠ Procedures for magazine key control, access restriction, and accountability as explained in HGL SOP 503.01.1, *Explosives Storage Inspection and Security*, are followed.
- ≠ Only those HGL employees listed as "*cleared*" on the current FELC Notice of Clearance and on the HGL Authorized Agent list may purchase and receive explosive materials.

4.7 TRANSPORTATION

Comply with all DOT (49 CFR §§ 171 through 173, 383 and 397), state, and local regulations regarding transportation of explosive materials. Permits are not required when transporting explosive materials within the project site and off public transportation routes (PTRs). Select and use at all times the most expeditious route when transporting explosive materials on or off a PTR.

Comply with DOT regulations (49 CFR §§ 172, 173, 387, and 397) when transporting 1,000 pounds or less of Compatibility Groups 1.4B and 1.4S explosives. Comply with DOT regulations (49 CFR §§ 172, 173, 387, and 397) when transporting 99 pounds or less of detonating cord Compatibility Group 1.4D if the explosive content does not exceed 100 grains per linear foot. Under these circumstances a commercial driver's license, vehicle placarding, and written travel route are not required.

4.7.1 Procedures for Transporting Explosive Materials from Storage to Disposal Location

When explosive materials must be transported on public highways and PTRs, the SUXOS and UXOSO coordinate to provide the driver with a safe transportation route plan with the least public exposure. This transportation route plan is not required when only Compatibility Group 1.4 explosives are being transported as described in Section 4.7.

Comply with the following when transporting demolition explosive materials:

- ≠ Keep initiating explosives, such as blasting caps, separated from other explosives at all times.
  - o Blasting caps may be transported in the same vehicle if they are in a separate Type 3 magazine (day box) conforming to Institute of Makers of Explosives (IME) requirements and secured away from other explosive items.
  - o Place high explosives in a Type 3 magazine (day box) meeting the design specification of ATFP 5400.7 (27 CFR § 555.203(c)).

  - Place ATF Type 3 day boxes in the bed of a vehicle; block and brace the boxes separately using ratchet tie-down straps, bolts, or other suitable means to keep the containers from shifting. When placed in a vehicle, secure the ATF Type 3 day box using a locking system containing a chain or cable and a padlock.

- If the explosive load being transported is in an open vehicle, place explosives in Type 3 magazines.
- Do not ride in the cargo compartment of a vehicle transporting explosives.
- Always observe compatibility requirements.
- The receiving party signs the receipt documents.
- Comply with posted speed limits but do not exceed a safe and reasonable speed for road/field conditions, which may mean traveling at speeds slower than those posted. Do not exceed 25 miles per hour in vehicles transporting explosives off road.
- Properly record all explosive materials being transported using a Bill of Lading (see Attachment 5).

4.7.2 Explosives Transportation Personnel Requirements

Requirements for HGL employees assigned to operate motor vehicles transporting explosive material are as follows:

- Qualified IAW DOT regulations (49 CFR §§ 387 and 391),
- Listed on the FELC Notification of Clearance,
- UXO-qualified to have direct access to explosive materials,
- Possesses a valid state driver's license, and
- Possesess a commercial Class C driver's license with a hazardous material (HAZMAT) endorsement when transport vehicle is classified as a commercial motor vehicle.

4.7.3 Explosives Transportation Vehicle Requirements

Transport explosives in closed vehicles whenever possible. Adhere to the minimum requirements for vehicles transporting explosives as follows:

- Inspect the vehicle using the Motor Vehicle Inspection-Hazardous Material form (see Attachment 7).
- Properly placard the vehicle on all sides and at each end IAW DOT regulations (49 CFR).
- Equip vehicle with a first aid kit, two 100BC fire extinguishers, and a means of communication with the UXOSO.

- Shut off the engine when loading or unloading explosive materials.
- Chock the wheels during loading and unloading to prevent movement.
- Do not allow bare explosive to contact spark-producing metal. Ensure vehicle cargo beds have wooden or plastic liners, dunnage, or sand bags to prevent the explosive materials from coming into contact with the metal bed and fittings.
- Properly segregate all explosive materials being transported IAW their hazard/class division compatibility requirements.

4.8 RECEIPT PROCEDURES AND AUTHORIZED ACCESS

The SUXOS is strictly accountable for control of all explosive materials from the time of initial receipt until expenditure, return of explosives to an authorized explosive dealer, or relieved of accountability by an authorized agent.

If a discrepancy exists between inventoried and on-hand quantities of explosive materials, the SUXOS and UXOQCS review the DSMT record and the Explosive Material Disposition Record to verify the accuracy of the inventory records.

If the records review does not reconcile the discrepancy, the following actions are taken:

- The SUXOS immediately reports the discrepancy to the Project Manager and the UXO Safety Manager.
- The SUXOS or UXOQCS notifies the appropriate U.S. Government representative when the project is under U.S. Government contract. For example, on a U.S. Army Corps of Engineers (USACE) project, notify the Ordnance and Explosive Safety Specialist or the Contracting Officer.
- The Project Manager immediately initiates an investigation to determine the cause of the discrepancy.
- The SUXOS reports discrepancies that cannot be reconciled within a 24-hour period IAW ATFP 5400.7 (27 CFR § 555.30).

4.9 INVENTORY

4.9.1 Special Inventories

The SUXOS and the UXOQCS conduct a true and accurate physical inventory of all explosive materials on hand at HGL project sites. The UXOSO conducts the inventory when the SUXOS or UXOQCS is not available. Special inventories are required under the following conditions:

- On initial physical receipt of explosive materials at a project site,
- When permanently changing location of the premises to another project site,
- When project field operations are temporarily suspended,
- When project field operations resume after suspension,
- Annually, and
- When required by the ATF or an HGL RP.

Annotate the purpose of these inventories on the DSMT record. For example, annotate the annual inventory as “Annual Inventory” and annotate a project field season completion as “Field Season Suspended.”

Prepare each special inventory in duplicate. Submit the original to the UXO Safety Manager, who will then forward the inventory to the ATF regional office. Keep a copy in the project files.

4.9.2 Physical Inventory and Inspections

The SUXOS and the UXOQCS (or UXOQCS designee) conduct a true and accurate physical inventory of all explosive materials stored at HGL project sites **once every 30 days.** The inventory will adhere to the following procedures:

- Record the results of the physical inventory on the DSMT form.
- Write “Monthly Inventory” through both the “Quantity Received” blocks.
- Conduct complete inventories after any issues/turn-ins of demolition material.

Begin weekly (not to exceed 7 days) inspections of the explosive magazines immediately after explosive materials arrive on the project site. The weekly inspection (not to exceed 7 days) is necessary to determine if unauthorized entry into the magazine(s) or unauthorized removal of the magazine contents has been attempted. Refer to HGL SOP 503.01.1, *Explosive Storage Inspection and Security*, Section 5.1.3, for additional guidance on 7-day explosive magazine inspections.

4.10 REPORTING LOSS OR THEFT OF EXPLOSIVE MATERIALS

Upon discovery of any theft or loss of explosive materials, the SUXOS immediately notifies the following points of contact in the order listed below:

1. HGL UXO Operations Manager[1,2]	256-970-2103	7:30 a.m.–4:30 p.m. CDT
	256-714-5808	After hours
2. ATF[1]	800-461-8841	8:00 a.m.05:00 p.m. EST
	800-800-3855	After hours
3. Local Law Enforcement Office[1,2]		24 hours
4. Project Client Representative[1]		8:00 a.m.05:00 p.m. local
5. ATF U.S. Bomb Data Center (USBDC)	866-927-4570 (fax) USBDC@atf.gov	5:00 p.m.08:00 a.m. EST

Notes:
1. Phone in the notification.
2. Fax or email the completed ATF Form 5400.5, Report of Theft or Loss-Explosive Materials, within 24 hours from the time of the incident (see Attachment 8).

0 N O T E 0

1. *Failure to report the theft or loss of any explosive materials missing from stock **within 24 hours** of discovery to the appropriate federal and local authorities is a felony offense.*
2. *For munitions response projects under contract to USACE, the Project Manager notifies the USACE Contracting Officer immediately by telephone and in writing within 24 hours of the discovery.*
3. *Submit the completed Report of Loss or Theft-Explosive Materials form to the USBDC **within 24 hours** of discovery of any theft or loss of explosive materials. Coordinate report submission with the UXO Safety Manager.*

Additional reporting procedures are provided in ATFP 5400.15, *Safety and Security Information for Federal Explosive Licensees and Permittees*.

For unused explosives, the Demolition Team Leader conducts the following:

≠ Returns explosive materials issued for use but not expended to the storage magazine, and records the transaction on the Explosive Disposition/Usage Record and DSMT, and

≠ Classifies returned explosives as “turn-ins.”

4.11 DISPOSAL OF REMAINING EXPLOSIVES

ATF requires an accurate accounting of all explosive materials purchased and used. When work is completed or temporarily suspended at a project site, all unused explosives are either

≠ Disposed of by detonation;

≠ Returned to the ATF-licensed explosives dealer (original acquisition source) where the explosive materials were originally purchased; or

- ≠ Properly stored IAW ATFP 5400.7 (27 CFR § 555), the work plan, and the ESS or ESP.

4.12 DISASTER PREPAREDNESS

Many natural disasters such as floods, forest fires, hurricanes, or tornados occur with little or no warning; therefore, it is critical to anticipate and prepare for response actions.

When a natural disaster threatens an HGL project site, the SUXOS takes preliminary measures to secure explosive materials from potential loss, including the following:

1. Develops a contingency plan for immediately relocating explosive materials to a compliant explosives magazine in an area less susceptible to weather-related damage, if possible.
2. Notifies the nearest ATF field office and supplies the following information:
   - HGL project location,
   - Telephone number and address for the licensed premise (HGL Huntsville office),
   - Explosive license number,
   - Explosive storage magazine address/location (latitude/longitude coordinates),
   - Magazine identification number, and
   - Emergency contact name, address, and telephone number.
3. Under the verbal authorization of the ATF field supervisor, immediately moves stored explosives to compliant storage magazine in an alternate location.
4. Verifies that backup copies of critical records are collected and maintained off site.
5. <u>If explosives are missing or stolen, completes the required notifications immediately IAW Section 4.10</u>. If the missing or stolen explosives are found or recovered and returned, notifies the USBDC and any investigating agency personnel of all recovered explosives. USBDC is responsible for tracking all stolen, lost, and recovered explosives. Prompt reporting of the recovery of explosives previously reported as missing or stolen saves valuable investigative time and resources.
6. If damaged explosive materials are an immediate threat to public safety, contacts local law enforcement authorities and the ATF 24-hour hotline. ATF hotline personnel notify the appropriate ATF Field Division personnel who then coordinate the ATF field response.
7. If the damaged explosive materials are not an immediate threat to public safety, contacts the manufacturer for instructions on the appropriate means of destruction. Contacts the local ATF office for any additional guidance.
8. If ATF required records have been damaged, lost or destroyed:
   - Immediately inventories explosive materials and attempts to reconstruct any records destroyed, lost, or rendered illegible.

- o Contacts the acquisition source/explosive dealer to obtain copies of recent sales and acquisition records.
- o Contacts the local ATF office for assistance or further information.

5.0 QUALITY CONTROL

Proper and careful accountability and management of explosives is critical to the success and safety of all explosive operations involving HGL employees, the public, and properties. The assigned SUXOS for each project site assumes primary responsibility and accountability for the use of the explosives.

HGL could be engaged in multiple MR projects at any given time. This section describes the lines of authority and responsibility of employees who have direct administrative and operational management responsibility on HGL projects involving the security, storage, transportation, and use of explosive materials. RP or EP positions are so designated IAW ATFP 5400.7 (27 CFR § 841(s)).

5.1 CHIEF OPERATING OFFICER

RP position that oversees the accountability and management of HGL's explosive materials program and policy. The RP verifies that explosive operations are conducted in compliance with all federal, state, and local regulations under HGL's ATF license.

5.2 MMRP DIRECTOR

RP position that directs and enforces the accountability and management of HGL's explosive materials program to ensure that all explosive material purchase, use, storage, and transportation operations are conducted IAW applicable federal, state, and local regulations.

5.3 MMRP OPERATIONS MANAGER

RP position that implements the accountability and management of HGL's explosive materials program and provides direct administrative, operational, quality control, safety, and security oversight on all munitions projects and explosive operations. Coordinates all logistical arrangements and requirements for explosives with the UXO Safety Manager.

5.4 UXO SAFETY MANAGER (CURRENTLY FILLED BY OPERATIONS MANAGER)

RP position that manages the overall accountability, administrative quality control, safety, and security of the explosive materials program, including the following:

- Communicating directly with the MMRP Operations Manager on all matters concerning this program;
- Ensuring that all explosive operations procedures comply with this SOP and applicable regulations;
- Coordinating with the Project Manager to stop any explosive operation deemed unsafe, and preventing operations from resuming until the unsafe condition is corrected; and
- Periodically auditing quality assurance, safety, and security at HGL MR project sites where explosive materials are used and stored.

5.5 PROJECT MANAGER

RP or EP position responsible for ensuring that all munitions projects under their direction comply with this directive, the associated work plan, and the requirements of this SOP. Directly oversees all field activities involving explosive operations.

5.6 SUXOS

RP or EP position directly responsible for safe and secure execution of all field activities involving explosive operations.

- Supervises and verifies that all explosive operations are carried out in compliance with this SOP, the work plan, and the applicable DDESB-approved ESP/ESS (when applicable);
- Acts as the single point of contact for receipt and release of explosive materials to an authorized ATF-licensed explosives dealer or agents, including the safeguarding and security of explosive material purchased and stored on the project site; and
- Coordinates all explosive materials logistical support through the HGL Senior Operations Manager and UXO Safety Manager.

5.7 UXOSO

EP position with direct oversight of explosive safety and security on the MR project site to which they are assigned.

- Communicates directly with the UXO Safety Manager, or the MMRP Operations Manager if the UXO Safety Manager is unavailable, on all matters concerning explosive safety and security;
- Ensures that all explosive safety procedures are performed IAW this directive, associated site SOPs, the work plan, and the approved ESP/ESS; and

- ≠ Is authorized to stop any explosive operation deemed unsafe and to delay resumption of operations until the unsafe condition is corrected.

5.8 UXOQCS

EP position that maintains explosive management quality control on the MR project assigned.

- ≠ Liaises directly with the Site Managers and SUXOS concerning proper administration of the explosive management program; and
- ≠ Oversees quality control of all site explosive operations procedures, inventories, and stock cards and ensures compliance with this directive, SOPs, the work plan, approved ESP/ESS, and all federal, DoD, state, and local regulations.

5.9 DEMOLITION SUPERVISOR

≠ EP position that plans, directs, and executes the project site explosive demolition operation for the destruction or demilitarization of MEC/material documented as an explosive hazard. This person ensures positive control and security of the explosive material, and the safe conduct of explosive operations. The SUXOS may delegate the Demolition Supervisor responsibilities to a qualified UXO Technician III .

5.10 EXPLOSIVES DRIVER

EP position for HGL employees who transport explosive materials (explosives driver). This person must

- ≠ Possess a current state driver’s license, a valid DOT commercial Class C driver’s license with a hazardous materials endorsement IAW 49 CFR §§ 383 and 397.
- ≠ Comply with all federal, state, local, and HGL requirements when operating explosive-laden vehicles.

5.11 DEMOLITION TEAM MEMBERS

Demolition team members work under the direct supervision of an ATF RP or EP, the SUXOS, or the Demolition Supervisor. They are allowed to handle explosive materials without an ATF clearance when directly supervised by an ATF RP or EP.

6.0 SECURITY

Before establishing explosives storage or conducting explosives operations on an HGL project site, the SUXOS and UXOQCS jointly conduct an explosive security survey IAW HGL SOP 503.01.1, *Explosive Storage Inspection and Security*, as follows:

- ≠ Document the inspection and any discrepancies and their disposition in the SUXOS daily log and the UXOQC quality control daily report.
- ≠ Notify the local law enforcement or security agency closest to the project site when explosive materials are stored in the on-site magazines.
- ≠ Notify the local law enforcement or security agency about the project site business hours as an added security measure.

7.0 DATA AND RECORDS MANAGEMENT

7.1 PERMANENT RECORDS

As an explosive licensee, HGL is required to keep permanent records of explosive materials for 5 years from the date of transactions including importation, production, shipment, receipt, sale, or other disposition, whether temporary or permanent, of explosive materials as regulated by ATFP 5400.7 (27 CFR § 555.121). ATF officers may examine or inspect these records at any time.

7.2 RECORD MAINTENANCE AND CORRECTING ERRORS

Maintaining accurate records of explosives is essential in preventing errors. The SUXOS manages all explosives-related records for accuracy and completeness, and verifies that information is properly documented on all applicable record forms.

If an error is made, the individual who made the error performs the following:

1. Draws a single line through the error,
2. Writes in the correct information in the space closest to the error,
3. Initials and dates the correction, and
4. Verifies that an individual witnessed the correction by having them write their initials and the date next to the corrected error.

7.3 SPECIAL INVENTORY

When a special inventory is required as specified by ATFP 5400.7 (27 CFR § 555.123(a)), the UXO Safety Manager prepares a record of the inventory in duplicate and submits the original to the ATF regional director's office as specified by ATFP 5400.7 (27 CFR § 555.123(a)(4)).

A true and accurate physical inventory is taken at the following:

- ≠ When the location of a business changes to another ATF region,
- ≠ When the business is discontinuing operations, and
- ≠ At any time when the ATF regional director requests that one be taken.

7.4 RECORDKEEPING

The SUXOS maintains records of all explosive material acquisitions, purchases, issuances, usages, and inventories records on site and makes them available for inspection by authorized agencies. Recordkeeping includes the following:

- ≠ Tracking explosive items by their respective lot number or manufacturer's marks of identification until the items are expended, transferred to another ATF licensee, or returned to the original explosive acquisition source, and
- ≠ Recording and maintaining all documentation and records generated as a result of all explosive material transactions using the forms listed below. (Attachment 9 provides additional instructions for using and maintaining explosives records.)

7.4.1 Manufacturer of Explosives Record of Acquisition

The SUXOS completes the MERA upon receipt of any explosive materials by HGL IAW ATFP 5400.7 (27 CFR § 555.123) and submits an electronic copy of the MERA within 48 hours of the acquisition to the UXO Operations Manager.

7.4.2 Daily Summary of Magazine Transactions

Properly record all issues, returns, and inventories using the DSMT and IAW ATFP 5400.7 (27 CFR §§ 555.123 and 555.127). Keep this record with each explosive item stored at each magazine as follow:

- ≠ Maintain and update duplicate DSMT records at the same time as the original record; keep these records separate from the project files.
- ≠ Update DSMT records no later than the close of the next business day with the manufacturer's name or brand name, the total quantity received in and removed from each magazine during the day of transaction, and the total remaining on hand at the end of the day.
- ≠ Submit an electronic copy of the DSMT within 48 hours of any transaction to the UXO Operations Manager.

7.4.3 Explosive Material Disposition Record 0 Bill of Lading

The Explosive Material Disposition Record - Bill of Lading serves two purposes:

1. For recording all explosive material
    - o Issued for demilitarization/demolition operations;
    - o Expended by detonation; or

- Returned to the magazine for storage; and

2. As a bill of lading whenever explosive materials are being transported by vehicle on HGL project sites.

7.4.4 Munitions and Explosives of Concern/Unexploded Ordnance Accountability Record

The SUXOS uses the MEC Demilitarization/Disposal by Detonation Accountability Record to record the demilitarization/disposal of all MEC items discovered on HGL project sites.

7.4.5 Motor Vehicle Inspection-Hazardous Materials

The explosive driver uses the Motor Vehicle Inspection - Hazardous Materials form (Attachment 7) when hazardous materials are transported by vehicle on HGL project sites. Follow the procedures shown in Section 4.7.

7.5 RECORDS DISTRIBUTION

The SUXOS, upon completion of project field operations, distributes all MEC and explosive material records as indicated below:

0 N O T I C E 0

As required by the ATF, send an electronic copy of the most recent explosive record transaction to the HGL Huntsville office (premise location) within 24 hours from the time of the transaction occurred.

1. Send original records to the HGL Huntsville, Attention UXO Operations Manager; maintain records for a period of 5 years from the time of the latest transaction IAW ATFP 5400.7 (27 CFR § 555.121(a)(2)).
2. Archive records older than 5 years throughout the life of HGL's Manufacturer of Explosives License.
3. Distribute records as shown below.

Record	Huntsville Office	Project Manager
Manufacture of Explosives Record of Acquisition Form	Original	
DSMT Form	Original	
Explosive Material Disposition Record Form	Original	
Bill of Lading Form	Original	
MEC Demilitarization/Disposal Accountability Record Form	Original	Copy
Report of Theft or Loss of Explosive Material	Original	Copy

8.0 REFERENCES

Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), 2008. Publication 5400.15, ATF Safety and Security Information for Federal Explosives Licensees and Permittees. March.

ATF, 2011. Publication 5400.18, Daily Summary of Magazine Transactions. October.

ATF, 2011. Publication 5400.19, Recordkeeping Requirements for Explosive Material Manufacturers. October.

ATF, 2012. Publication 5400.7, Federal Explosives Laws and Regulations (27 CFR § 555). April.

HydroGeoLogic, Inc. (HGL), 2016. HGL Standard Operating Procedure 503.01.1, Explosives Storage Inspection and Security. January.

U.S. Army Corps of Engineers (USACE), 2008. Engineer Manual 385-1-97, Explosives Safety and Health Requirements Manual. September.

U.S. Department of Defense (DoD), 2010. DoD Manual 6055.09-M, DoD Ammunition and Explosives Safety Standards. February.

DoD Explosives Safety Board, 2004. Technical Paper 18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel. December.

U.S. Department of Transportation (DOT), 49 CFR §§ 100 through 199.

ATTACHMENTS

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ATTACHMENT 1

SOP ACKNOWLEDGEMENT SHEET

SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the activities described in this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure that all persons assigned to this process are qualified, have read and understand the requirements of this SOP, and have signed the worker's statement for this purpose. I will ensure that the SOP contains current procedures. If a change to the SOP is necessary, I will ensure that the process is stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards are found, I will make sure the process is stopped until the hazards have been eliminated.

____________________________________ ________________
Senior UXO Supervisor Date

WORKER'S STATEMENT

I have read this SOP and I have received adequate training to perform the procedures addressed in the SOP. If I identify a hazard not addressed in the SOP, or encounter an operation I cannot perform IAW the SOP, I will stop the process and notify my immediate supervisor.

Worker's Name	Date	Supervisor's Name

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ATTACHMENT 2

U.S. Department of Justice
Bureau of Alcohol, Tobacco, Firearms and Explosives

Federal Explosives License/Permit
(18 U.S.C. Chapter 40)

In accordance with the provisions of Title XI, Organized Crime Control Act of 1970, and the regulations issued thereunder (27 CFR Part 555), you may engage in the activity specified in this license or permit within the limitations of Chapter 40, Title 18, United States Code and the regulations issued thereunder, until the expiration date shown. **THIS LICENSE IS NOT TRANSFERABLE UNDER 27 CFR 555.53.** See "WARNINGS" and "NOTICES" on reverse.

Direct ATF Correspondence To: ATF - Chief, FELC, 244 Needy Road, Martinsburg, WV 25405-9431

License/Permit Number: **1-AL-089-20-7F-00632**

Chief, Federal Explosives Licensing Center (FELC)
Christopher R. Reeves

Expiration Date: **June 1, 2017**

Name
HYDROGEOLOGIC, INC MUNITIONS RESPONSE TEAM

Premises Address (Changes? Notify the FELC at least 10 days before the move.)
5030 BRADFORD DRIVE BLDG 1, SUITE 230
HUNTSVILLE, AL 35805-

Type of License or Permit
20-MANUFACTURER OF EXPLOSIVES

Purchasing Certification Statement

The licensee or permittee named above shall use a copy of this license or permit to assist a transferor of explosives to verify the identity and the licensed status of the licensee or permittee as provided by 27 CFR Part 555. The signature on each copy must be an original signature. A faxed, scanned or e-mailed copy of the license or permit with a signature intended to be an original signature is acceptable. The signature must be that of the Federal Explosives Licensee (FEL) or a responsible person of the FEL. I certify that this is a true copy of a license or permit issued to the licensee or permittee named above to engage in the business or operations specified above under "Type of License or Permit."

NWF

Licensee/Permittee Responsible Person Signature

UXO OPS MANAGER

Position/Title

NEIL W. FEIST

Printed Name

05/15/2014

Date

Mailing Address (Changes? Notify the FELC of any changes.)

HYDROGEOLOGIC, INC
HYDROGEOLOGIC, INC MUNITIONS RESPONSE TEAM
5030 BRADFORD DRIVE BLDG 1, SUITE 230
HUNTSVILLE, AL 35805-

Previous Edition is Obsolete

ATF Form 5400.14/5400.15 Part I
Revised October 2011

Federal Explosives License (FEL) Customer Service Information

Federal Explosives Licensing Center (FELC)
244 Needy Road
Martinsburg, WV 25405-9431

Toll-free Telephone Number: (877) 283-3352
Fax Number: (304) 616-4401
E-mail: FELC@atf.gov

ATF Homepage: www.atf.gov

Change of Address *(27 CFR 555.54(a)(1))*. Licensees or permittees may during the term of their current license or permit remove their business or operations to a new location at which they intend regularly to carry on such business or operations. The licensee or permittee is required to give notification of the new location of the business or operations not less than 10 days prior to such removal with the Chief, Federal Explosives Licensing Center. The license or permit will be valid for the remainder of the term of the original license or permit. **(The Chief, FELC, shall, if the licensee or permittee is not qualified, refer the request for amended license or permit to the Director of Industry Operations for denial in accordance with § 555.54.)**

Right of Succession *(27 CFR 555.59)*. (a) Certain persons other than the licensee or permittee may secure the right to carry on the same explosive materials business or operations at the same address shown on, and for the remainder of the term of, a current license or permit. Such persons are: (1) The surviving spouse or child, or executor, administrator, or other legal representative of a deceased licensee or permittee; and (2) A receiver or trustee in bankruptcy, or an assignee for benefit of creditors. (b) In order to secure the right provided by this section, the person or persons continuing the business or operations shall furnish the license or permit for for that business or operations for endorsement of such succession to the Chief, FELC, within 30 days from the date on which the successor begins to carry on the business or operations.

(Continued on reverse side)

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ATTACHMENT 3

Manufacturer of Explosives Record of Acquisition

Site Name/Location:	HGL License Number: 1-AL-089-20-7F-00632
Project Site Activity:	**Supervisor's Name/Position:**

Date of Manufacture or other Acquisition	Lot Number or Manufacturer's Marks of Identification	Brand Name, Nomenclature or Description and Size-(when mixing binary materials)	Quantity Acquired	Name, Address and License or Permit Number of Distributor

HGL MR Form 15.02 (Revised Feb 2014)

Page __________ of __________.

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ATTACHMENT 4

HGL HydroGeoLogic, Inc.

Daily Summary of Magazine Transactions (Magazine Data Card)

Nomenclature/Brand Name of Manufacturer:	Lot Number/Manufacturer Mark:	Hazard Class/Division:
Site Location/Name:	GPS Coordinate:	HGL License Number: 1-AL-089-20-7F-00632

Date	Quantity In	Quantity Out	Current Balance	Action/Purpose (Receipt/Issue/Inventory)	Printed Name

HGL MR Form 15.03 (Revised January 2014)

Page ________ of ________.

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ATTACHMENT 5

Explosive Material Disposition Record – Bill of Lading

Date:	Site Name/Location:	Grid #/Area or GPS coordinate:	Distributee Explosive License #: 1-AL-089-20-7F-00632

This form will be used as a Bill of Lading anytime explosives are transported in a HGL vehicle under DOT regulations and kept with the explosive driver in the vehicle until the explosives are issued, expended or returned to storage.

SECTION I. Explosive Material Issued for Demilitarization/Demolition Operations:

Lot Number/Manufacturer's Marks of Identification	Brand Name, Nomenclature or Description	Quantity	Hazard/ Class	Receipt Initials

Print Explosive Driver Name:	Explosive Driver Signature:

SECTION II. Explosive Material Expended by Detonation:

Lot Number/Manufacturer's Marks of Identification	Brand Name, Nomenclature or Description	Quantity	Hazard/ Class	Receipt Initials

SECTION III. Explosive Material Returned to Storage:

Lot Number/Manufacturer's Marks of Identification	Brand Name, Nomenclature or Description	Quantity	Hazard/ Class	Receipt Initials

Demolition Supervisor Signature:	SUXOS Signature:

HGL MR Form 15.05 (Revised Feb 2014)

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ATTACHMENT 6

HGL HydroGeoLogic, Inc

Munitions and Explosives of Concern Demilitarization/ Disposal by Detonation Accountability Record

Site Name:	Site Location:	Contract Number:	Delivery/Task Order No:

Anomaly No.	Grid or GPS Coordinates Location	Depth Detected (feet)	Identification/Nomenclature (include DMM, MC, MEC or UXO)	Date Located	Date of Demil/ Disposal	Method of Demil/Disposal	Comments

SUXOS review and acceptance (print name):	SUXOS signature:	Date:

HGL MR Form 15.05 (Apr 2012)

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ATTACHMENT 7

HGL HydroGeoLogic, Inc. MUNITIONS RESPONSE TEAM

Motor Vehicle Inspection–Hazardous Materials

Section 1 – Documentation and Instructions

1. This form applies to all vehicles which must be marked and placarded in accordance with DOT Title 49 CFR and will be retained in the cab of the vehicle with the driver operator.
2. This form will be completed in conjunction with the Vehicle Inspection Checklist and Bill of Lading forms.
3. Upon completion of explosive transportation operations this form will be retained in the project files and will be submitted to the HGL Huntsville office, attention UXO Operations Manager at the completion of field activities.

Company:	
Date of inspection:	
Time of inspection:	
Location of inspection:	
Operator's name:	
Operator's license number:	

Medical examination current: ☐ Yes ☐ No

Valid CDL with Hazardous Materials endorsement: ☐ Yes ☐ No

Route plan and map: ☐ Yes ☐ No

Hazardous Materials Compliance Handbook in vehicle: ☐ Yes ☐ No

Vehicle Inspection Checklist HGL MR Form 15.23 completed and retained in vehicle: ☐ Yes ☐ No

Bill of Lading HGL MR Form 15.05 completed and retained in vehicle: ☐ Yes ☐ No

Section 2 – Mechanical Inspection *(place "X" in the applicable box, if rejected, explain in block 3*:

	Satisfactory	Unsatisfactory		Satisfactory	Unsatisfactory
Horn operative	☐	☐	Tires, wheels and rims	☐	☐
Steering system	☐	☐	Wheel chocks set	☐	☐
Windshield/wipers	☐	☐	Tailgate and doors	☐	☐
Mirrors	☐	☐	Cargo space clear	☐	☐
Warning signals	☐	☐	Non-sparking bed liner	☐	☐
Spare fuses	☐	☐	Tarpaulin and straps	☐	☐
Electrical wiring	☐	☐	Two 10-lb fire extinguishers	☐	☐
Lights and reflectors	☐	☐	Properly placarded on all sides	☐	☐
Fuel system	☐	☐	Detonator box	☐	☐
Exhaust system	☐	☐	Type 3 day box (IME 122)	☐	☐
Brake system	☐	☐	Explosives properly segregated	☐	☐
Suspension	☐	☐	Other (explain in Block A.)	☐	☐

Inspection result *(If rejected provide reason in block 3)*: **ACCEPTED** ☐ **REJECTED** ☐

A. Remarks:

B. Inspector signature (origin):	**C.** Driver signature (origin):
D. Inspector signature (destination):	**E.** Driver signature (destination):

HGL MR Form 15.06 Jan 2014)

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ATTACHMENT 8

U.S. Department of Justice
Bureau of Alcohol, Tobacco, Firearms and Explosives

Report of Theft or Loss-Explosive Materials

For ATF Use Only

Date Received	Date Faxed to JSOC & Field Division	Unique Identifier
		Case Number

To Be Completed By Person Making Report

Upon discovery of any theft or loss of any of your explosive materials:
- First, contact ATF toll free at 1-800-461-8841 between 8:00 a.m. - 5:00 p.m. EST or after hours and weekends contact ATF at 1-800-800-3855 to report the theft or loss;
- Second, contact your local law enforcement office to report the theft or loss to obtain a police report; and
- Third, complete this form and attach any additional reports, sheets or invoices necessary to provide the required information, and fax the form with additional material(s) to the ATF U.S. Bomb Data Center (USBDC) at 866-927-4570 or email to USBDC@atf.gov.

1. Date

2. Type of Report *(Check one)*: ☐ Theft ☐ Loss ☐ Attempted Theft/Suspicious Activity ☐ Supplement

3. Full Name of Person Making the Report *(Last, First, Middle)*

4a. Licensee or Permittee Name

4b. Federal Explosives License or Permit Number

5a. Office Address *(Street Address, City, State, and Zip Code)*

5b. Telephone Number

5c. E-mail Address

6. Actual Location of Theft or Loss *(If different from item 5a)*

7. Theft or Loss	Date	Time
a. Discovered		
b. When Was the Magazine Last Checked		
c. Occurred *(Show approximate if exact not known)*		
d. Reported to ATF by Telephone		
e. Reported to Local Authorities		

8. Name of Local Law Enforcement Officer to Whom Reported

9. Name and Address of Local Authority to Whom Reported

10. Telephone Number

11. Police Report Number

12. Explosive Materials Lost or Stolen *(Attach invoices or additional sheets, if necessary)*

a. Manufacturer and/or Importer	b. Brand Name	c. Date Shift Code	d. Size *(Length & Diameter)*	e. Quantity *(Pounds of Explosives, Number of Dets)*	f. Type and Description *(Dynamite, Blasting Agents, Detonators, etc. Include for each type, size, MS delay or length of legwire, as applicable)*

ATF Form 5400.5
Revised July 2012

ATTACHMENT 8 (continued)

13. Theft or Loss Occurred from *(Check applicable box on each row)*

a. Magazine Type:

☐ 1 ☐ 2 ☐ 2 Det. Box ☐ 3 Day Box ☐ 4 ☐ 5

☐ Outdoor ☐ Indoor

☐ Permanent ☐ Portable ☐ Mobile Truck ☐ Mobile Trailer

☐ Overnight Storage ☐ Day Storage

b. Types of Locks *(Check all that apply)*:

☐ Padlock ☐ Mortise ☐ 3-Point ☐ Puck Lock ☐ Other *(Explain)* ______

c. Location Description/Type:

☐ Licensed/Permitted Premises ☐ Remote Storage ☐ Work Site ☐ In Transit ☐ During Operations

14. Method of Entry:

☐ Door

Was a Key Used? ☐ Yes ☐ No

Suspected Employee-Involved Theft? ☐ Yes ☐ No

☐ Wall(s) ☐ Roof ☐ Floor/Bottom

Lock(s) Defeated? *(If yes, check additional appropriate boxes)* ☐ Yes ☐ No

☐ Lock Shackle Cut *(How?)* ______

☐ Lock Left Unlocked

☐ Keyway Drilled Out

☐ Other *(Explain)* ______

☐ Lock Pried, Twisted or Levered

☐ Lock Picked or Shimmed

☐ Lock Body Drilled Out or Cut

Manufacturer and Model of Lock:	Location of Magazine Keys: ☐ Office ☐ Employee ☐ Other *(Address)* ______	Are All Keys Accounted For? ☐ Yes ☐ No

15. Hood Defeated? *(If yes, check all applicable)* ☐ Yes ☐ No

☐ Hood Cut

☐ Other *(Explain)* ______

☐ Hood Removed

☐ Hood Broken

Hood Width *(Inches)* ______ Hood Length (Inches) ______

Hood Depth *(Inches)* ______ Hood Thickness (Inches) ______

16. Other Information Pertinent to the Theft, Loss or Suspicious Activity *(Any details you can provide)*

16a. Was Theft or Loss Disclosed During an ATF Inspection or Being Reported as a Result of Inspection? ☐ Yes ☐ No

16b. Additional Security Measures in Place?

☐ Alarm ☐ Security System/Service ☐ Fencing ☐ Lighting ☐ Other *(Explain)* ______

17. Signature and Title of Person Making Report	18. Date

ATF Form 5400.5
Revised July 2012

ATTACHMENT 9

EXPLOSIVE RECORD MAINTENANCE AND USE INSTRUCTIONS

<table>
<tr><th>RECORD</th><th>USE</th><th>ELECTRONIC RECORD</th><th>ORIGINAL RECORD</th></tr>
<tr><td>Explosive material delivery invoice – Form 15.02</td><td>Verify actual invoice receipt for accuracy and legibility.</td><td rowspan="4">All explosive acquisitions or transactions occurring during a workweek will be submitted via email to the Huntsville office on the last work day of the week to the UXO Operations Manager, email:

nfeist@hgl.com

and

nmcmillan@hgl.com</td><td rowspan="4">1. Retain original record on file during field activities.

2. On completion of field activities submit to Huntsville office</td></tr>
<tr><td>Manufacturer of Explosives Record of Acquisition – Form 15.03</td><td>1. Record all on-call delivery acquisitions.
2. Record all to on-site storage delivery acquisitions.
3. Verify each item recorded on this form matches each item listed on the delivery invoice.</td></tr>
<tr><td>Daily Summary of Magazine Transaction (Magazine Data Card) – Form 15.03</td><td>1. Record all explosive material acquisitions, receipts, issues, and turn-ins on the day of occurrence.
2. Record all explosive material inventory activities.</td></tr>
<tr><td>Explosive Material Disposition Record/ Bill of Lading – Form 15.04</td><td>Record upon occurrence all explosive materials:
1. Issued for demil/demolition operations.
2. Expended by detonation.
3. Turned-in for return to storage.</td></tr>
<tr><td>MEC Demilitarization/Disposal by Detonation Accountability Log – Form 15.05</td><td></td><td>Not required</td><td>Upon completion of field activities</td></tr>
</table>

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HGL HydroGeoLogic, Inc Exceeding Expectations	**STANDARD OPERATING PROCEDURE**

Explosive Demolition Operations	**SOP No.: 502.01.1** **SOP Category: MMRP and Geophysics** **Revision No.: 1**
	Revision Date: January 2016 **Review Date: January 2017**

Approved By:

Jan Kool Digitally signed by Jan Kool Date: 2016.01.14 20:37:09 -05'00'

1/14/2016

Jan Kool, Ph.D. Date
Corporate QA Manager

Digitally signed by Neil Feist
DN: cn=Neil Feist, o, ou=HGL, email=nfeist@hgl.com, c=US
Date: 2016.01.14 20:35:03 -06'00'

Neil Feist Date
MMRP Operations Manager

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LIST OF ATTACHMENTS

Explosive Demolition Operations	SOP No.: 502.01.1
	SOP Category: MMRP and Geophysics
	Revision No.: 1
	Revision Date: January 2016
	Review Date: January 2017

1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) establishes the overall safe practices and procedures for conducting explosive demolition operations on HydroGeoLogic, Inc. (HGL) Military Munitions Response Program (MMRP) projects sites.

2.0 SUMMARY OF METHOD

This SOP applies to all HGL employees assigned to perform explosive demolition operations on HGL project sites. All employees tasked with performing munitions and explosives of concern (MEC)-related activities will be qualified in accordance with (IAW) Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 18 and the requirements specified by HGL SOP 501.01.1, *Explosive Materials Accountability and Management*, Section 5.0.

This SOP also applies to all instances where public safety may be affected by site conditions. Use this SOP in conjunction with approved project plans and the HGL SOPs cited in Section 8.0 of this SOP.

3.0 GENERAL REQUIREMENTS

Perform all work in a manner consistent with Occupational Safety and Health Administration-established standards and requirements. Refer to the site- or project-specific health and safety plan for relevant health and safety requirements.

- Conduct all explosive activities in conformance with the Work Plan, Explosives Safety Submission (ESS)/Explosives Site Plan (ESP), Site Safety and Health Plan (SSHP) and HGL SOP 501.01.1.
- Procedures for packaging and disposing of all material potentially presenting an explosive hazard (MPPEH) generated during field activities will be described in the project-specific work plan and processed IAW HGL SOP 504.01.1, *MPPEH Inspection and Management*.

Personnel who use this procedure must complete the SOP acknowledgement form (see Attachment 1) and submit it to the Site Manager/Senior Unexploded Ordnance (UXO) Supervisor (SUXOS) and the Unexploded Ordnance Quality Control Specialist (UXOQCS) as evidence that they have read and understand this procedure. Site management will retain the SOP acknowledgement form in the project file.

Justify any deviations from the procedures specified in this SOP to the HGL Senior UXO Operations Manager and UXO Safety Manager for approval and inclusion in the project work plan before implementing. Do not compromise federal law in deviations. Thoroughly describe both deviations from requirements and the newly modified process in the justification documentation.

4.0 DEFINITIONS

APP	Accident Prevention Plan
BIP	blow-in-place
CCBC	counter-charge bottom centerline
CPR	cardiopulmonary resuscitation
DDESB	Department of Defense Explosives Safety Board
DoD	U.S. Department of Defense
DS	Demolition Supervisor
ESP	Explosives Site Plan
ESS	Explosives Safety Submission
EZ	exclusion zone
HE	high explosives
HFD-H	hazardous fragment distance-horizontal
HGL	HydroGeoLogic, Inc.
MDAS	material documented as safe
MDEH	material documented as an explosive hazard
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MR	munitions response
MSD	minimum safe distance
PPE	personal protective equipment
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
TP	technical paper
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	UXO Safety Officer

5.0 PROCEDURES

This section describes the administration, training, and logistics necessary for conducting explosives demolition operations on HGL MMRP project sites.

5.1 DEMOLITION TEAM PERSONNEL

All employees are required to meet the minimum requirements listed in this procedure, but may request a variance if these procedures are unsafe or not compatible with contract or site-specific requirements. Obtain permission to vary from this procedure from the Project Manager and the HGL UXO Safety Manager. All employees are encouraged to submit comments and recommendations to improve this procedure.

All personnel engaged in demolition operations must be thoroughly trained in explosive safety and demolition procedures, and must be capable of recognizing hazardous situations and taking prompt corrective action. All UXO demolition team personnel must meet the minimum requirements specified by DDESB TP 18 and HGL SOP 501.01.1, Section 4.3, to perform tasks covered by this SOP.

Do not conduct demolition operations without client authorization, approved plans/SOPs, qualified and trained UXO technicians, and proper demolition and safety equipment.

5.2 DEMOLITION TEAM ASSIGNMENTS AND RESPONSIBILITIES

HGL demolition operations require specific organizational roles and personnel assignments as follows:

- **Senior Unexploded Ordnance Supervisor (SUXOS) (Demolition Supervisor)**
    - Serves as the Demolition Supervisor (DS), but may delegate this responsibility to a UXO Technician III level qualified individual;
    - Plans, directs, and executes all demolition operations;
    - When employing the services of a “certified blaster” from a licensed explosive dealer, allows only UXO technicians to place donor charges next to MEC/UXO;
    - Maintains explosive accountability for and security of all explosive materials issued for use during execution of demolition operations;
    - Maintains positive communications at all times with the Demolition Team and the UXO Safety Officer (UXOSO); and
    - Inspects the detonation site after each explosive detonation or any misfire and allows no one within the minimum safe distance (MSD) from the detonation site until the area is declared safe, but may delegate this responsibility to a qualified UXO Technician III.

- **UXOSO**
  - Ensures that all demolition operations are performed safely and IAW the approved site-specific plans and this SOP;
  - Establishes reliable primary and secondary communications before demolition operations begin;
  - Collaborates with the SUXOS before initiating any explosive charges to secure all roadways and access points to the MSD area and evacuate all personnel;
  - Verifies that the detonation site is inspected after each explosive detonation or misfire; and
  - Allows no one within the MSD until the area is declared safe.
- **Demolition Team** consisting of a minimum of three personnel or as required by the approved work plan. The minimum qualifications for demolition team members includes the following:
  - UXO Technician III or above performing the duties of DS,
  - A UXO Technician II or above to assist the DS during demolition operations, and
  - A UXO Technician I or above.

5.3 REFERENCE DOCUMENTS

Before beginning demolition operations, the SUXOS and UXOSO read and acquire a good working knowledge of the following approved documents and publications, and make them available on site during all demolition operations:

- U.S. Army Technical Manual 60A-1-1-31, *General Information on Explosive Ordnance Disposal Procedure*
- DDESB-approved ESP or ESS (if applicable)
- Work Plan or Technical Management Plan
- Accident Prevention Plan (APP)/SSHP

5.4 COORDINATION AND NOTIFICATIONS

The SUXOS conducts a coordination meeting to establish roles and responsibilities before demolition operations begin, and to address specific elements of planning and organizational responsibilities including but not limited to the following:

- Individual(s) assigned with ultimate responsibility for demolition operations,
- Demolition team assignments and responsibilities,
- Primary and secondary communications,
- Verification of reliable communications on remote sites,

- Explosive handling, storage, and transportation,
- Required support services, fire, medical, security, etc.,
- Emergency procedures,
- Notification process,
- Maintenance and control of exclusion zones (EZ):
  - Safety guard positions
  - Road barricades
  - EZ clearance prior initiation of demolition shot
  - Demolition team rally point
  - Posting of operation “all clear” procedures
- Community impact.

5.4.1 Public Meeting

In coordination with the client, HGL’s Project Manager, Site Manager, or SUXOS may be required to hold a public meeting before beginning demolition operations when demolition operations potentially impact the local civilian community. Topics could include the following:

- Daily hours of operation,
- Requirements for evacuation of occupied residences and road closures,
- EZs/MSD boundaries, and
- Community impact.

5.4.2 Notifications

The SUXOS notifies emergency response agencies as far in advance as possible that disposal activities will take place. The notifications include information on scheduling, evacuations, road closures, EZs, and any other required support. The following agencies are typically notified, as applicable:

- Public utility companies (electric, gas and water),
- Paramedic/emergency medical technician squad,
- Local fire department,
- Local law enforcement/police department,
- Security agency, and
- Local airport (Federal Aviation Administration, etc.).

5.4.3 Public Utility Services

The SUXOS notifies the appropriate utility company officials when demolition operations could potentially impact public utilities. When situations mandate the demolition of a MEC hazard near public utilities, take precautions to prevent damaging or disrupting these services, with either protective measures (engineering controls) or with relocation of the MEC hazard to a safe distance when the SUXOS and UXOSO have jointly determined that the MEC hazard is acceptable to move.

5.5 EXCLUSION ZONES, EVACUATIONS, AND ROAD CLOSURES

Base the EZ for all demolition operations on the munition with the greatest fragmentation distance as identified in the project work plan and/or ESP/ESS. Before initiating explosive demolition operations to demilitarize, destroy, or dispose of MEC hazards, evacuate all personnel to a safe location beyond the MSD as determined by DDESB TP 16 calculation methodologies.

When conducting explosive demolition of MEC items, observe the greater of the following: hazardous fragment distance-horizontal (HFD-H), unless reduced by DDESB-approved engineering controls, or the calculated K328 distance using the formula $D=328W^{1/3}$. The following procedures should also be implemented:

- Post the necessary warnings and safety controls before beginning explosive operations. Posters or flyers may be suitable in some cases. Identify the location of operations, the times operations begin and end, and the contact person for verifying safe passage through an area.
- Maintain positive site control at all times during any explosive operation.
- Establish the highest degree of public safety by placing barricades at access points on residential streets and roads and by posting an appropriate number of safety guards at key locations to prevent access to the EZ before conducting explosive operations.

Once demolition operations are in progress, do not allow the public and other nonessential personnel into the EZ under any circumstances. Grant re-entry into the EZ only under the following conditions:

- The SUXOS has granted essential personnel an "all-clear."
- The UXOSO has completed a post-detonation assessment of the EZ and determined the area safe to access.

5.6 TWO-PERSON RULE

The two-person rule is a safety concept that requires two knowledgeable individuals to perform potentially hazardous operations. These individuals must be trained and be capable of recognizing safety hazards and improper procedures. The two-person rule applies whenever explosives are handled or transported during demolition operations. No one should handle or assemble explosives alone.

5.7 DEMOLITION OPERATIONS BRIEF

Before beginning any explosive operations, hold a demolition operation briefing for all personnel assigned to or working with disposal teams to review MEC explosive demolition and emergency response procedures. Use applicable SOP attachments to cover topics including, but not limited to, the following:

- APP/SSHP,
- This SOP,
- Demolition firing systems and components,
- Disposal charge placement,
- Explosives transportation,
- Site munitions brief,
- Type and condition of MEC,
- Emergency response equipment,
- Emergency procedures,
- Two-person rule, and
- Team assignments.

5.8 EQUIPMENT, MATERIAL, AND VEHICLE REQUIREMENTS

The DS ensures that all required equipment and materials are available. Use the checklists in the attachments to this procedure to verify and document equipment and material availability. At minimum, verify the following are available before beginning each disposal operation:

- Demolition equipment (Attachment 3),
- Safety Equipment (Attachment 4),
- Explosive vehicles (HGL SOP 503.01.1),
- Safety vehicle(s), and
- Designated personnel accountability and assembly location/rally point.

5.9 COMMUNICATIONS

Use field handheld portable radios for primary communications. Post contact information for emergency services, including telephone numbers for the project personnel, in the APP/SSHP.

Use cellular telephones for secondary communication. Post telephone numbers for the HGL key personnel in the APP.

– W A R N I N G –

Maintain radio communication between the demolition team and SUXOS at all times.

5.10 EXPLOSIVE VEHICLE TRANSPORTATION

Use vehicles that comply with the regulations specified by the Department of Transportation, 49 Code of Federal Regulations §§ 171, 173, and 177, and HGL SOP 501.01.1, Section 4.7, to transport explosive materials.

5.11 WEATHER AND ENVIRONMENTAL CONSIDERATIONS

The UXOSO will obtain a local weather report before beginning demolition operations. Do not conduct demolition operations when electrical storms are within 10 miles of site operations, when visibility restricts positive control of the EZ, or when weather conditions impact safety.

5.12 EMERGENCY MEDICAL SUPPORT

Ensure that the telephone number of the responding medical facility is posted in the APP/SSHP or is otherwise available to site personnel. If required, notify emergency medical personnel of the location and duration of demolition operations each day. At least two on-site UXO personnel will be first aid and cardiopulmonary resuscitation (CPR) qualified.

5.13 FIRE PREVENTION PLAN

Ensure that the telephone number of the responding fire department is posted in the APP/SSHP or is otherwise available to site personnel. If required, notify the fire department of the location and duration of demolition operations each day. Keep fire extinguishers and shovels on site to fight small fires. Evacuate personnel from the area if the fire approaches munitions or explosives. Do not fight grass fires in areas where there may be munitions or kickouts.

5.14 PERSONAL PROTECTIVE EQUIPMENT

Conduct demolition operations in Level D personal protective equipment (PPE) consisting of cotton, GORE-TEX®, or other nonstatic producing clothing and foul weather gear; gloves; safety glasses; and composite or steel-toed boots. The UXOSO verifies that the proper PPE is procured, issued, and used by project personnel and that daily checks are performed to ensure continued PPE availability and use.

5.15 EXPLOSIVE OPERATIONS PROCEDURES

Allow only HGL UXO-qualified personnel to conduct demolition operations on HGL munitions response project sites. Follow these general safety guidelines at all times during all demolition operations:

- Blow-in-place (BIP) MEC items found requiring demolition that the SUXOS and UXOSO consider unacceptable to move.
- The SUXOS and UXOSO jointly declare when MEC items are acceptable to move.

- Move MEC items deemed acceptable to move by the SUXOS and UXOSO to a single item location within the munitions response site for destruction when approved in project plans.
- Vent MPPEH or material documented as an explosive hazard (MDEH) items to facilitate 100 percent inspection of all surfaces.
- Do not conduct demolition operations without proper authorization.
- When required, use engineering controls (for example, sandbag mitigation) to reduce blast and fragment hazards.

5.15.1 Engineering Controls

Employ engineering controls IAW the project plans and DDESB guidance.

5.15.2 Initiation Sequence

The SUXOS or DS ensures that the following steps are taken before initiating any demolition shot:

1. All required notifications have been completed.
2. The EZ has been established and guards have been posted at access points.
3. The EZ and surrounding area have been visually inspected for unauthorized personnel.
4. The following demolition warnings announcements have been issued on the handheld/mobile radio before the demolition shot(s):
    a. **Five-minute warning:** The DS announces a warning 5 minutes before the shot(s).
    b. **One-minute warning:** The DS announces a warning 1 minute before the shot(s).

After these steps have been completed, the SUXOS/DS shouts three loud “Fire in the Hole!” warnings and then gives the “fire” command on the radio.

After the demolition shot has been cleared, the SUXOS/DS announces over the radio an “all clear.” The SUXOS/DS then announces on the radio that demolition operations have ceased.

5.15.3 Initiation Systems

The following applies to the initiation systems used in explosives operations:

- The primary firing system: remote firing device with Nonel®.
- The alternate primary firing system: remote firing device with electric blasting caps.

- The secondary system: blasting machines or initiators capable of electric or Nonel® initiation.
- In areas of high electromagnetic radiation, or a high fire index, use a Nonel® system.

5.15.4 Blow-in-Place Operations

Verify the following before a MEC item is BIP:

- An appropriate EZ for the MEC encountered has been established and evacuation of the area has been confirmed.
- When applicable, the appropriate engineering controls are in place for the reduction of the fragmentation hazard.
- The following emergency support services have been notified and are standing by in position:
  - Emergency services (when required)'
  - Fire department, and
  - Law enforcement.
- Make every effort to establish the firing point in a location where the SUXOS and the UXOSO can visually observe the entire EZ.

Fire all BIP operations by positive control methods. Use Nonel® or direct command remote control firing device initiation to maintain positive control up to the point of detonation.

5.15.5 Phosphorus-Filled Munitions

When munitions containing plasticized white phosphorus, red phosphorus, or white phosphorus fillers are encountered, adhere to the following procedures:

- Wear protective clothing, including helmets with full-face shields, a welder's apron, and gloves when handling suspected phosphorus-filled munitions.
- Instruct medical support personnel that they are supporting phosphorus-filled munitions demolition operations and have first aid treatment materials on hand.
- If an accident occurs in the field, irrigate phosphorus wounds with water, and apply a saline-soaked dressing. Keep the dressing wet until medical personnel arrive.
- Keep an ample supply of water and sand readily available when handling suspected phosphorus-filled munitions.
- If safe to do so, counter-charge bottom centerline (CCBC) phosphorus-filled munitions to disperse the phosphorus in the air for complete combustion.

- Verify that all phosphorus has been consumed when returning to the disposal site after detonation of phosphorus-filled munitions.
- Do not approach the area until all smoke has cleared and the SUXOS has declared the area safe.

5.15.6 MPPEH

Consider all potential munitions-related items to be MPPEH until they have undergone a 100 percent inspection by a UXO Technician II and a 100 percent re-inspection by a UXO Technician III. Designate MPPEH items that cannot be 100 percent visually inspected as MDEH IAW U.S. Department of Defense (DoD) Instruction 4140.62.

Treat MDEH as Hazards Class/Division 1.1 material until it has undergone the proper treatment process specified by the work plan and/or the DDESB-approved ESP/ESS. **Do not** co-mingle MDEH with any other material until it has (1) undergone the required treatment process, (2) undergone a second 100 percent inspection by a UXO Technician II, (3) undergone a 100 percent re-inspection by a UXO Technician III, and (4) met the designation requirement of material documented as safe (MDAS).

Upon completion of the venting and/or demolition shot, UXO technicians conduct a thorough inspection of the surrounding area. The resulting MPPEH will be inspected before final disposition to determine its designation as either MDEH or MDAS IAW project plans and HGL SOP 504.01.1.

6.0 SAFETY

The SUXOS and UXOSO ensure that all demolition operations on HGL munitions response (MR) project sites are conducted in the safest possible manner for protection of project personnel, the public, and project equipment assets. The SUXOS and the UXOSO brief all demolition team members on and verify that they understand Attachments 2, 4, and 5 of this SOP before the execution of any explosive operation.

7.0 DATA AND RECORDS MANAGEMENT

The SUXOS, DS, and UXOQCS use the forms and checklists identified by this SOP and HGL SOP 501.01.1, *Explosive Materials Accountability and Management*, for all HGL demolition operations. The following checklists are used to verify that all demolition operations personnel assignments and functions, and explosive expenditures are properly documented and recorded:

- Disposal Operations Checklist (Attachment 2)
- Post-Demolition Operations Checklist (Attachment 8)
- Three Phase Quality Control Checklist (Attachment 9)

The following documents must be on site during disposal operations in conjunction with this SOP:

- Approved work plan,
- Approved SSHP,
- Approved ESP or ESS (when applicable),
- Range certification (when applicable),
- HGL SOP 501.01.1, *Explosive Materials Accountability and Management*,
- HGL SOP 503.01.1, *Explosives Storage Inspection and Security*, and
- HGL SOP 504.01.1, *Material Potentially Presenting and Explosive Hazard Inspection and Management*.

8.0 REFERENCES

Bureau of Alcohol, Tobacco, Firearms and Explosives, 2012. Publication 5400.7, Federal Explosives Laws and Regulations (27 CFR § 555). April.

Code of Federal Regulations, Title 49, Parts 171, 173 and 177 (U.S. Department of Transportation and Other Regulations Relating to Transportation).

HydroGeoLogic, Inc. (HGL), 2015. Standard Operating Procedure (SOP) 501.01.1, Explosive Materials Accountability and Management. December.

HGL, 2015. SOP 503.01.1, Explosives Storage Inspection and Security. December.

HGL, 2015. SOP 504.01.1, Material Potentially Presenting an Explosive Hazard Inspection and Management. December.

U.S. Army, 2008. Technical Manual 60A-1-1-31, General Information on Explosive Ordnance Disposal Procedure. October.

U.S. Army Corps of Engineers, 2008. Engineer Manual 385-1-97, Explosives Safety and Health Requirements Manual. September.

U.S. Department of Defense (DoD), 2008. Explosives Safety Board Technical Paper 18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel, December.

DoD, 2010. Manual 6055.9-M, DoD Ammunition and Explosives Safety Standards. February.

DoD, 2008. Instruction 4140.62, DoD Ammunition and Explosives Safety Standards. November.

ATTACHMENTS

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ATTACHMENT 1

SOP ACKNOWLEDGEMENT SHEET

SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the activities described in this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure that all persons assigned to this process are qualified, have read and understand the requirements of this SOP, and have signed the worker's statement for this purpose. I will ensure that the SOP contains current procedures. If a change to the SOP is necessary, I will ensure that the process is stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards are found, I will make sure the process is stopped until the hazards have been eliminated.

____ ____________________

Senior UXO Supervisor Date

WORKER'S STATEMENT

I have read this SOP and I have received adequate training to perform the procedures addressed in the SOP. If I identify a hazard not addressed in the SOP, or encounter an operation I cannot perform IAW the SOP, I will stop the process and notify my immediate supervisor.

Worker's Name	Date	Supervisor's Name

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ATTACHMENT 2

<table>
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ATTACHMENT 2

DEMOLITION OPERATIONS CHECKLIST

</td></tr>
<tr><th>FUNCTION CHECK</th><th>DATE/TIME</th><th>INITIALS</th></tr>
<tr><td colspan="3">1.0 SENIOR UXO SUPERVISOR:</td></tr>
<tr><td>

1. Assign Demolition Team:

a. SUXOS: ______________________________
b. Demolition Supervisor: ______________________________
c. Demo Team Assistant: ______________________________
d. Demo Team Member: ______________________________
e. Demo Team Member: ______________________________
f. UXOSO: ______________________________
1) Safety Position #1: ______________________________
2) Safety Position #2: ______________________________
3) Safety Position #3: ______________________________
4) Safety Position #4: ______________________________
g. Other: ______________________________

2. Communications:

a. Radio call signs / cellular numbers:

1) SUXOS: _________________ /____________________
2) DS: _________________ /____________________
3) UXOSO: _________________ /____________________
4) Safety Position-1: ______________ /________________
5) Safety Position-2: ______________ /________________
6) Safety Position-3: ______________ /________________
7) Safety Position-4: ______________ /________________

3. Brief Demolition Team:

a. Review emergency procedures.
b. Discuss MEC/MC/UXO to be disposed.
c. Describe Disposal procedures.

</td><td></td><td></td></tr>
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HGL HydroGeoLogic, Inc	ATTACHMENT 2 DEMOLITION OPERATIONS CHECKLIST	
FUNCTION CHECK	**DATE/TIME**	**INITIALS**
4. Inspect Range/Exclusion zone upon completion of operations.		
2.0 DEMOLITION SUPERVISOR		
1. Verify roads are closed.		
2. Verify exclusion zone boundaries in place.		
3. Complete health and safety and equipment checklists.		
4. Ensure command center has completed the verification checklist: a. Responsible activity. b. Medical Facility. c. Fire Department. d. Security/Police Department.		
5. Disposal Supervisor tailgate safety brief: a. Designate emergency vehicles. b. Designate emergency evacuation route. c. Review emergency response procedures.		
6. Verify daily equipment inspection.		
7. Verify detonators are separated from explosives.		
8. Verify area has been evacuated.		
9. Notify command center operations are commencing.		
10. Start disposal activities.		
11. UXOSO ensures detonation site inspected after designated wait time.		
12. Collect all metal fragments for later disposal.		
13. QC check performed.		
14. Stop disposal activities.		

HGL HydroGeoLogic, Inc MUNITIONS RESPONSE TEAM	ATTACHMENT 2 DEMOLITION OPERATIONS CHECKLIST	
FUNCTION CHECK	**DATE/TIME**	**INITIALS**
15. QA check (if required). 16. HGL notification upon completion of demolition operations: a. Notify Client: ____________________ b. Responsible Activity: ____________________ c. Medical Facility: ____________________ d. Fire Department: ____________________ e. Local Police/Security: ____________________ f. Public Utility Company: ____________________ 17. Complete HGL Form MEC/UXO Accountability Log. 18. Complete Post Demolition Operation Checklist, Attachment 8.		
Demolition Supervisor Signature:	**Date:**	

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ATTACHMENT 3

DEMOLITION EQUIPMENT CHECKLIST

Equipment	Quantity	Comments
Explosive Vehicle(s)		
Personnel Vehicle(s)		
Handheld Radios		
Camera		
Day Boxes		
Wheel Chocks		
Placards		
Fire Extinguishers, 1A 10BC		
Sand Bags		
Tie Downs		
Locks		
Demolition Kit		
Cutter, NONEL		
Knife		
Duct tape		
Electrical tape		
Galvanometer		
Firing Device / Blast Machine		
Shovel		
Firing Wire		
Measuring tape, 50- or 100-meter		
Toolbox, general hand tools		
Magnetometer / Detector		

Checklist Verification

Disposal Supervisor Signature:	**Date:**

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ATTACHMENT 4

SAFETY EQUIPMENT CHECKLIST

1.0 EQUIPMENT	QUANTITY	COMMENTS
Burn Blanket		
Emergency Eye Wash		
Fire Blanket		
Fire Extinguishers, 1A 10BC		
First Aid Kit		
Leather gloves		
Goggles		
Face Shield(s)		
Welder's Gloves		
Welder's Apron(s)		
Safety Vest(s)		
Stretcher		
Water, 5-gal		
Water, drinking		
Other:		
Other:		

2.0 CHECKLIST VERIFICATION

Disposal Supervisor Signature:	Date:

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ATTACHMENT 5

GENERAL SAFETY PRECAUTIONS

1. Carry blasting caps in approved containers and keep them out of direct sun. Keep the caps located at least 25 feet from other explosives until they are needed for priming.

2. Do not work with electric blasting caps or other electro-explosive devices while wearing clothing prone to producing static electricity such as nylon, silk, synthetic hair, etc.

3. Do not use explosives or accessory equipment that is obviously deteriorated or damaged. They may cause premature detonation or fail completely.

4. Always point the explosive end of blasting caps, detonators, and explosive devices away from the body during handling.

5. Use only standard blasting caps of at least the equivalent of a commercial No. 8 blasting cap.

6. Use electric blasting caps of the same manufacturer for each demolition shot involving more than one cap.

7. Do not use improvised methods for initiating blasting caps.

8. Do not bury blasting caps. Use detonating cord to transmit the explosive wave from the blasting caps, on the surface, to a buried/tamped explosive charge. Buried blasting caps are subject to unobserved pressures and movement, which could lead to premature firing or misfires.

9. Test electric-blasting caps for continuity at least 50 feet from any other explosives prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be shunted by twisting the bare ends of the wires together. The wires will remain shunted until ready to be connected to the firing circuit.

10. In the event of a misfire when disposing of explosives by detonation, do not approach the disposal site for at least 60 minutes after the expected detonation time, when firing electrically. When conducting non-electric procedures, the wait time will be at least one hour from the expected time of detonation.

11. Items with lugs, strong backs, tail-booms, base plates, etc., should be oriented away from personnel locations.

12. Consideration should be given to tamping the UXO to control fragments, if the situation warrants. Fragments will be minimized not only to protect personnel but also property, such as buildings, trees, etc.

13. Avoid inhaling the smoke, dust, or fumes of burning pyrotechnic or incendiary materials. The smoke, dust and fumes from many of these materials are irritating and/or toxic if inhaled.

14. Do not use water on incendiary fires. Water may induce a violent reaction or be completely ineffective, depending on the mixture.

15. Anticipate a high order detonation when burning pyrotechnic or incendiary-loaded MEC. Safety

measures for personnel and property must be based upon this possibility.

16. Inert munitions will not be disposed of, or sold for scrap, until the internal fillers have been exposed and unconfined. Heat generated during a reclamation operation can cause the inert filler, moisture, or air to expand and burst the sealed casings. Venting or exposure may be accomplished in any way necessary to preclude rupture due to pressure from being confined. All requirements of the UXO Procedure for the Management and Disposition of Material Potentially Presenting an Explosive Hazard (MPPEH) will be met prior to releasing any inert munitions material.

17. Maintain minimum safe distances between electromagnetic-radiating sources and electro-explosive devices (IAW EODB/TM-TO 60A-1-1-12).

18. Do not conduct blasting or Demolition operations during an electrical, dust, sand, or snowstorm severe enough to produce atmospheric static electrical charges, or when such a storm is nearby (within 10 miles). Under such conditions, all operations will be suspended or terminated, cap and lead wires shunted, and personnel removed from the demolition area. Demolition operations will also be terminated if visibility becomes less than 600 feet.

19. Loose initiating explosives: lead azide, mercury fulminate, lead styphnate, and tetracene. These explosives manifest extreme sensitivity to friction, heat, and impact. Extra precautions are required when handling these types of explosives. Keep initiating explosives in a water-wet condition at all times until ready for final preparation for detonation. Sensitivity of these explosives is greatly increased when dry.

20. Exercise extreme care when handling and preparing high explosives for detonation. They are subject to detonation by heat, shock, or friction.

21. Do not pack bomb fuze wells with explosives unless it can be positively confirmed that the fuze well does not contain any fuze components.

22. Photo flash bombs must be handled with the same care as black powder-filled munitions.

23. MEC containing phosphorus will not be detonated into the ground. Phosphorus-filled munitions will be counter-charged on the bottom centerline (CCBC) when possible.

24. A search of the detonation site, after the demolition operation, will be conducted to assure complete disposal was accomplished.

25. Do not abandon any explosives.

26. Do not leave explosives, empty cartridges, boxes, liners or other materials used in the packing of explosives lying around where children, unauthorized persons or livestock can get at them.

27. Do not allow any wood, paper or other materials used in packing explosives to be burned in a stove, fireplace, or other confined space, or be re-used for any other purpose. Such materials will be destroyed by burning at an isolated location out of doors, with no one allowed within 100 feet of the burning operation.

28. Do not fight fires involving explosive material. Evacuate all personnel to a safe location and secure the area.

29. Know and observe federal, state, and local laws/regulations that apply to the transportation, storage,

and use of explosives.

30. Do not permit metal, except approved metal truck bodies, to contact explosive containers.

31. Do not transport metal, flammable, or corrosive substances with explosives.

32. Do not allow smoking, or the presence of unauthorized personnel, in vehicles transporting explosives.

33. Carefully load and unload explosives from vehicles. Never throw or drop explosives from the vehicle.

34. Assure the load is blocked and braced to prevent it from movement and displacement.

35. Do not drive vehicles containing explosives over public highways until all permits and certifications have been obtained from the state enforcement agencies.

36. All routes must be approved in writing prior to transporting explosive materials over public highways.

37. Licensed commercial carriers will conduct the shipment of explosive materials over public highways unless HGL UXO personnel have been specifically licensed and certified to make the shipment.

38. Never leave a vehicle that is loaded with explosives unattended.

39. Do not store blasting caps, detonators, or other items containing initiating explosives in the same box, container, or magazine with other explosives.

40. Store explosive materials in military or BATF-approved magazines only. Ensure the magazines used for the storage comply with quantity distance requirements, for the class of explosive material they contain. Reference documents include: Explosives Law and Regulation, BATF P 5400.7, and 49 CFR.

41. Do not store spark-producing metal/tools in an explosive magazine.

42. Do not permit smoking, matches, or any source of fire or flame within 100 feet of an explosive magazine.

43. Do not allow leaves, grass, brush, or debris to accumulate within 50 feet of an explosive magazine.

44. Do not permit the discharge of firearms within 300 feet of an explosive magazine.

45. Do not use any alkaline material such as lye, washing soda, or soap to remove TNT exudate. Alkaline materials will react with TNT to render it more sensitive.

46. Do not permit smoking, matches, or other sources of fire or flame within 100 feet of an area in which explosives are being handled.

47. Do not expose explosives or devices containing explosive to prolonged exposure to direct sun light. Such exposure can increase sensitivity and deterioration.

48. Ensure all unused explosives are returned to their proper containers and the container closed after use.

49. Do not carry explosives or explosive components in pockets or on the body.

50. Do not insert anything but time fuse or detonating cord into the open end of a blasting cap.

51. Do not strike, tamper with, or attempt to remove or investigate the contents of an electric/non-electric blasting cap, detonator, or other explosive initiating device. A detonation may occur.

52. Do not pull on the electrical lead wires of electric blasting caps, detonators, or their electro-explosive devices. A detonation may occur.

53. Do not attempt to remove an unfired or misfired primer or blasting cap from a base coupling. There is a high risk of an explosion.

54. Do not allow unauthorized or unnecessary personnel to be present when explosives are being handled.

55. Always point the explosive end of blasting caps, detonators, and other explosive devices away from the body.

56. Do not use pull rings or safety pins to lift or handle explosive devices.

HGL HydroGeoLogic, Inc MUNITIONS RESPONSE TEAM	**ATTACHMENT 6** **EXPLOSIVE SYSTEMS CONFIGURATION**

1.0 REMOTE FIRING DEVICE

1. The following guidance refers to the Rothenbuhler remote firing device. If alternative firing devices are used, follow the applicable manufacturer's guidance.
2. Perform system pre-operational test and set up using the Rothenbuhler Operator's Manual. Remove key from controller unit until ready to fire.
3. Place the remote near the detonation site with the antenna in the vertical position. If using electric caps the remote should be within 100 feet of the shot. Use the unit blast shield, sandbags, or natural cover to protect the remote.
4. Ensure the remote indicates a READY condition for the selected initiation method (green READY LED on steady, red ARMED LED off).
5. If using Nonel®/shocktube, connect the shock tube to the igniter tip. The tube should be wrapped around through holes in the tip's molded casing to keep it from falling out. Prime the shot and return to the safe area.
6. If using electric caps, cut off a length of firing wire that will reach between the remote and the charges (100 feet or less).
7. Conduct a continuity check of the firing wire with a galvanometer. Shunt the free ends of the wire to prevent an electric charge from building up in the firing wire.
8. Test each electric blasting cap 50 feet downwind of other explosives with a galvanometer.
9. Place blasting caps in a hole, behind a barricade, or under a sandbag before removing the shunt and testing for continuity.
10. Fully extend the leg wires and ensure the cap is pointing away from the person conducting the continuity test.
11. Secure the leg wires to prevent the cap from moving during the test.
12. Use only a special silver-chloride dry cell battery in the testing galvanometer. Other type batteries may provide sufficient voltage to fire the blasting cap.
13. Upon completion of testing, re-shunt the leg wires. The wires will remain shunted until ready to connect to the firing circuit.
14. For dual priming connect blasting caps in a parallel circuit to the extension wires.
15. Test the circuit with the galvanometer, and then connect extension wires to the remote.
16. Retrieve caps from barricade, prime shot, and return to safe area.

17. Retrieve caps from barricade, prime shot, and return to safe area.

2.0 FIRING THE REMOTE FIRING DEVICE

1. The SUXOS will verify that the exclusion zone is clear and barricades are in place.
2. The SUXOS will give a "five-minute warning" over the radio.
3. The SUXOS will give a "one-minute warning" over the radio.
4. Install the key and engage the "POWER" switch on the controller to the right until the BATTERY LED illuminates.
5. Momentarily depress the controller STATUS button. The yellow TRANSMIT LED will flash for approximately one second. At the end of this time a green READY LED will come on steady, indicating that the remote is on and in the standby mode. The steady green LED also indicates the remote is within range of the controller.
6. Push the ARM/DISARM switch to the left and hold for one second. The red ARMED LED will flash for approximately 18 seconds and then come on steady. The remote is now armed.
7. UXO Demolition Supervisor gives three loud "Fire-in-the-Hole" warnings.
8. SUXOS gives fire command on the radio.
9. SUXOS gives permission to fire the shot.
10. Lift the safety cover on the FIRE switch and push the FIRE switch forward.

3.0 PREPARATION OF THE SCORPION ELECTRONIC BLASTING MACHINE

1. The following guidance refers to the Scorpion Electronic Blasting Machine. If alternative blasting machines are used, follow the applicable manufacturer's guidance.
2. Perform pre-operational check as per instructions on blasting machine.
3. Lay out firing wire or Nonel®/shocktube.
4. Conduct a continuity check of the firing wire with a galvanometer. Shunt the free ends of the wire to prevent an electric charge from building up in the firing wire.
5. Test each blasting cap with a galvanometer 50 feet away from other explosives.
6. Place blasting caps in a hole, behind a barricade, or under a sandbag before removing the shunt and testing for continuity.
7. Fully extend the leg wires and ensure the cap is pointing away from the person conducting the continuity test.
8. Secure the leg wires to prevent the cap from moving during the test.
9. Use only a special silver-chloride dry cell battery in the testing galvanometer. Other type

batteries may provide sufficient voltage to fire the blasting cap.

10. Upon completion of testing, re-shunt the leg wires. The wires will remain shunted until ready to connect to the firing circuit.
11. For dual priming, connect blasting caps in a parallel circuit to the firing wire.
12. Retrieve caps from barricade, prime shot, and return to safe area.

4.0 FIRING THE SCORPION ELECTRONIC BLASTING MACHINE

1. The SUXOS will verify that the exclusion zone is clear and barricades are in place.
2. The SUXOS will give a "five-minute warning" over the radio.
3. The SUXOS will give a "one-minute warning" over the radio.
4. If firing electric check firing wire with a galvanometer.
5. Connect the firing leads to the terminal posts of the blasting machine.
6. For Nonel®/shocktube, plug in the shock tube adapter and attach Nonel®/shocktube.
7. UXO Demolition Supervisor gives three loud "Fire-in-the-Hole!" warnings.
8. SUXOS gives fire command on the radio.
9. SUXOS gives permission to fire the shot.
10. Degrees and hold CHARGE button (keep depressed throughout sequence).
11. Press DETONATE button when green ready light comes on. For non-electric shots, hold DETONATE button down for one second and release.

5.0 MISFIRE PROCEDURES FOR THE REMOTE FIRING DEVICE

1. Make three successive attempts to fire.
2. Turn off the controller and remove the key.
3. Wait 60 minutes from the last initiation attempt.
4. After the wait time has elapsed, the Demolition Supervisor and a safety observer will proceed down range to inspect the firing system.
5. If Nonel®/shocktube was used, do not remove the caps from the charge. Disconnect Nonel®/shocktube from the igniter tip on the remote. Place a new, primed explosive charge next to the misfired charge.
6. If electric caps were used, remove the old blasting caps from charge and disconnect from extension wires. Shunt cap leg wires.
7. If detonating cord was used, cut detonating cord between cap and charge, and disconnect cap

from extension wires. Shunt cap leg wires.

8. Set up new firing system.

6.0 MISFIRE PROCEDURES FOR THE SCORPION ELECTRONIC BLASTING MACHINE

1. Make three successive attempts to fire.
2. If using firing wire and still unsuccessful, disconnect wires and check continuity.
3. If continuity is good, reconnect to blasting machine and make three more attempts to fire.
4. If still unsuccessful, check connections of firing wires to terminals and make three more attempts to fire.
5. Change blasting machine after third unsuccessful attempt.
6. If unsuccessful with new blasting machine, disconnect and shunt firing leads.
7. If using Nonel®/shocktube, disconnect from blasting machine.
8. Wait 60 minutes from the last initiation attempt.
9. After the wait time has elapsed, the Demolition Supervisor and a safety observer will proceed down range to inspect the firing system.
10. If electric caps were used, remove old blasting caps from charge and disconnect from firing wire. Shunt cap leg wires.
11. If detonating cord was used, cut detonating cord between cap and charge and disconnect cap from fire wire. Shunt cap leg wires.
12. If Nonel®/shocktube was used, do not remove the caps from the charge. Place a new, primed explosive charge next to the misfired charge (FM-5-250).
13. Set up new firing system.

7.0 SHOCK TUBE FIRING SYSTEMS

Shock tube is a thin plastic tube of extruded polymer with a layer of special explosive dust deposited on its interior surface. The special explosive dust propagates a detonation wave, which is normally contained within the plastic tubing. Shock tube offers the instantaneous action of electric initiation without the risk of accidental initiation of the blasting cap by radio transmitters in the area or by static electricity discharge. The shock tube medium is extremely reliable.

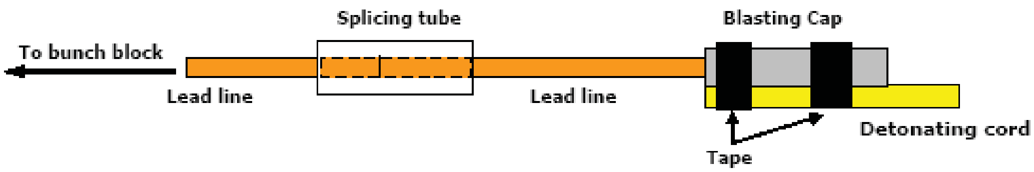
The high reliability of shock tube blasting is due to the fact that all of the components are sealed and, unlike standard non-electric priming components, cannot be easily degraded by moisture. Cutting the shock tube makes the open end vulnerable to moisture. Care should be taken to keep moisture from the cut end of the shock tube. Use the following procedures to cut and splice shock tube.

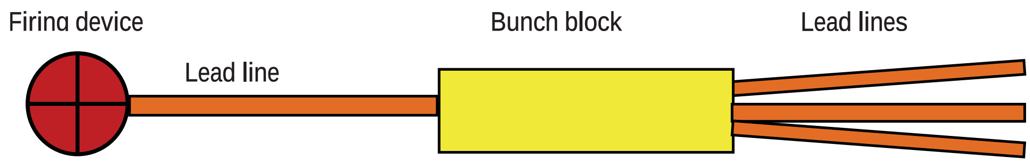
1. Use a sharp knife or razor blade to squarely cut (90-degree angle) approximately 18 inches from a new roll or the cut-off end of a partial roll.
2. Loosely tie the two shock tube ends to be spliced together in a SQUARE KNOT. Leave at least 2 inches free at the end of each shock tube beyond the knot.
3. Pull the shock tube lightly to tighten the knot, but not so tight as to significantly deform the shock tube in the knot.
4. Use only the splicing tubes provided to make splices. Taping the two cut ends of shock tube together does not make a reliable splice.
5. Push one of the free shock tubes, to be spliced, firmly into one of the pre-cut splicing tubes at last 1/4 inch.
6. Push the other shock tube end firmly into the other end of the splicing tube at least 1/4 inch. Attempt to push the two ends up against each other or get as close as possible.
7. Secure splice with electrician's tape.
8. Each additional splice in shock tube reduces the reliability of the priming system. Minimize the number of splices in a shock tube line to as few as possible.
9. Spool out the desired length of shock tube and cut off squarely with a sharp knife or razor blade.
10. Secure the shock tube remaining on the spool by tying a tight overhand knot in the loose end.
11. Protect the open end of the shock tube by sealing it with the end caps provided or with electrician's tape.
12. Attach an initiator to the free end of the shock tube that is spliced into the blasting cap. If a separate blasting cap or detonating cord is used to actuate the shock tube, tie a tight overhand knot in this end

8.0 SHOCK TUBE SET-UP

1. Lay out required length of shock tube (trunk line) from demo area back to the firing point.
2. Attach an EZTL 30 bunch block (or equivalent) using the supplied splicing tube to the lead line at demo site. Secure the bunch block or immobilize with sandbags. Run additional lead line(s) from bunch block to OE (See Figure 1).
3. Attach only a maximum of six additional leads per bunch block. Use additional bunch blocks, if necessary.

FIGURE 1 – SHOCK TUBE SETUPS





9.0 DONOR EXPLOSIVES

The primary donor explosives used for MEC disposal will be the boosters, plastic explosives, jet perforators, or binary explosives.

9.1 BOOSTER

1. Insert appropriate grain detonating cord into the detonator well. Insert all the way through and back through other hole and tie an overhand knot to secure it.

2. When using more than one booster, insert detonating cord through each of the boosters' detonator wells and secure to keep them from sliding along the detonating cord.

9.2 Plastic Explosives

Set up with blasting cap(s) or detonating cord lead(s) as per EODB 60A-1-1-31.

9.3 Jet Perforator

1. Use the detonating cord clip provided or tape to secure detonating cord to the Jet Perforator.
2. If safe, place the Jet Perforator on the MEC item using tape or other suitable methods to prevent it from moving.
3. For tamped shots, use a box or other suitable material to provide soil from getting between the perforator and MEC item.

9.4 Binary Explosives

Binary explosives are two-part explosives that are not classified as an explosive until mixed. These can be procured in various configurations to include plastic tube containers and pliable packs in varying sizes depending on the required application. The binary should not be mixed until ready for use. After mixing it can be primed as a cap sensitive explosive using Nonel®/shocktube, detonating cord, or electric or non-electric blasting caps. Use as any high explosive with a velocity of detonation around 20,000 feet per second.

9.5 Post-Demolition Procedures

1. Wait the designated wait times specified by the SOP. A minimum 5 minutes after single

shots or after a series of shot that can be counted. A minimum of 60 minutes after multiple shots that could not be counted.

2. The Demolition Supervisor and one other UXO technician will return to the detonation site and check the results of the shot. If the procedure was successful, the Demolition Supervisor will call in additional personnel to clean up the site. UXO personnel will conduct a visual sweep of the detonation site and the immediate area to gather fragments and explosive residue, if present.
3. Explosive residue will be collected and detonated.
4. MPPEH will be examined to ensure complete consumption of explosive material.
5. Intact MEC items that failed to detonate will be disposed of.
6. After area is swept and cleared the Demolition Supervisor will notify the SUXOS and the “all clear’ will be given.

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ATTACHMENT 7

ROTHENBUHLER ENGINEERING 1670 REMOTE FIRING DEVICE (RFD) PROCEDURES

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SAFETY WARNINGS

1) Always follow your local safety regulations. This manual and its procedures are secondary to governmental regulations, local regulations or company safety regulations and procedures. The operation procedures in this manual are only suggestions and should be checked against the above safety regulations and procedures. Company training should include the proper use of this machine and only trained personnel should use it.

2) Never rely on this equipment or any equipment totally for your safety. All mechanical and electronic equipment can fail. Always have a safety procedure that will protect you and minimize hazards of such failure.

3) High power radio transmissions can cause electric blasting caps to detonate. Keep the high powered Controller 25 or more feet (8 meters) from electric detonators.

4) The Shock Tube Initiator on the Remote Unit can develop up to 3,000 Volts. Do not touch this tip or tip jacks while arming or firing the unit.

5) Do not connect electric detonator wires or shock tube to the Remote Unit unless the green READY light is on, the red ARMED light is off, and the battery light is on steady.

6) Do not use the system if any of the units show damage to the point that failure is suspected. Thoroughly test the system prior to use.

7) Never approach the Remote Unit if it is attached to live explosives unless you have a confirmed READY status back to the Controller AND you have waited at least 2 minutes for the automatic disarm AND you have followed proper safety wait times.

8) It is MANDATORY that the Protective Cover is installed on the Charge Connector of the Remote unit at all times unless charging. There is the potential presence of voltage on some of the pins of the Charge Connector. For models produced after March 2009 (Serial Numbers 371+), the maximum current available from any pin is limited to 14.3 milliamperes.

3. PREOPERATIONAL PROCEDURES

3.1. PHYSICAL INSPECTION

3.1.1. Inspect all components for physical damage.

3.1.2. Remove the antenna dust caps and ensure the antenna jacks on the Controller Unit and Remote Unit are not damaged. Ensure they are clean and dry. Replace the antenna dust caps.

3.1.3. Ensure that the Remote and Controller Unit antennas are clean and free of damage. Ensure the electrical contacts are clean and dry.

3.1.4. Examine the shock tube igniter jacks on the left sides of the Remote Units. The jacks should be clean and dry.

3.1.5. Examine the Remote Unit's shock tube igniter tips. They should be clean and dry. If more than 200 shots have accumulated on either tip, replacement is recommended to ensure reliable shot initiation.

3.1.6. Press the two electric detonator binding posts located on the left sides of the Remote Units. Ensure they compress and return to their normal position (Dual Output Model only).

3.1.7. Ensure the key receptacles on the Controller Unit and Remote Units are clean and dry. Ensure they operate smoothly and show no signs of physical damage.

3.2. CHARGING THE BATTERIES

3.2.1. Ensure all units are turned off (The Remote Unit will not charge unless deactivated).

3.2.2. Ensure the ambient air temperature is between 32 and 86 °F (0 to 30 °C). When the ambient temperature is above 80 °F (27 °C), best results are obtained when the Remote lids are opened and air is allowed to circulate over the Remote display panels.

3.2.3. Remove the protective covers on the charge connectors. Line the key on the charger adapter plugs with the slot on the top of charge connectors mounted on each unit. Insert the plugs and turn clockwise until locked in place.

WARNING It is MANDATORY that the Protective Cover is installed on the Charge Connector of the Remote unit at all times unless charging. There is the potential presence of voltage on some of the pins of the Charge Connector. For models produced after March 2009 (Serial Numbers 371+), the maximum current available from any pin is limited to 14.3 milliamperes.

3.2.4. Insert the supplied charger adapters into suitable power outlets (100-240 VAC, 50/60 Hz).

3.2.5. As the units begin charging, the green SLOW lights will come on briefly, then the red FAST lights will blink for about 5 seconds and come on steady. The red FAST lights indicate the units are fast charging. Table 3-1 shows the charge indicator modes.

3.2.6. When charging is complete, the FAST lights will turn off, and the green SLOW lights will come on steady. Typical recharge time is 3-4 hours. For maximum battery life, avoid leaving the charger connected for more than 24 hours when possible.

Light	Blink Mode	Indicates
FAST	On steady	Fast Charging
FAST	Blinks at startup	Pre-testing
FAST	Blinks continuous	Battery Error
SLOW	On steady	Charge Complete
SLOW	Blinks continuous	Pack Temperature Range Exceeded

Table 3-1 RFD Charge Indicator Modes

3.2.7. When charging is complete, disconnect the charge adapters and reinstall the covers on the charge connectors.

WARNING It is MANDATORY that the Protective Cover is installed on the Charge Connector of the Remote unit at all times unless charging. There is the potential presence of voltage on some of the pins of the Charge Connector. For models produced after March 2009 (Serial Numbers 371+), the maximum current available from any pin is limited to 14.3 milliamperes.

3.3. BATTERY USAGE AND TESTING

3.3.1. To check the Controller's battery level, activate the unit by pressing the ON switch. The battery level will be shown as a percentage of full charge.

Figure 3-1 Controller Battery Level

Figure 3-2 Remote Battery Voltage

3.3.2. To test the Remote's battery voltage, turn the unit on and the hold the PRESS TO TEST switch for 10 seconds. A fully charged battery will stabilize with a reading of 13.5 V or more. The Remote Unit should be charged when the battery is less than 12.0 V. At 11.7 V, the yellow POWER light will flash to show the battery is too low.

3.3.3. When freshly charged, the Remote Units will run for up to 16 hours at an ambient temperature of 68 °F or 20 °C. Allow for reduced run times for hot or cold temperatures, or when the Safety Poll® mode of operation is used (Safety Poll® mode is explained in Section 5.1). Each unit can be fired approximately 100 times before recharging is required. Allow 15 minutes less run time, for each firing event.

3.3.4. When freshly charged, the Controller Unit will run in standby for up to 12 hours at an ambient temperature of 68 °F or 20°C. Allow for reduced run times for hot or cold temperatures, or when the Safety Poll® mode of operation is used (Safety Poll® mode is explained in Section 5.1).

3.3.5. The batteries will self-discharge at a rate of approximately 1% per day. This rate will increase as the temperature increases.

3.3.6. The RFD battery cells are reasonably resistant to developing a memory. For best results, allow the RFD to become mostly discharged before recharging, and allow the unit to fully charge without interruption.

3.3.7. The RFD's internal battery packs can be recharged up to 500 times before replacement is required. A decrease in run time may be noticed at the end of the battery pack's life cycle.

Return the RFD to an authorized service shop for replacement when required, or change your packs during the recommended 2-year servicing. Do not attempt field replacement.

3.3.8. Always turn the units off when not in use to conserve the battery charge.

3.3.9. The battery meter test switch can be pushed to check the battery level even if the power switch is in the off position. If the accessories bag in the lid gets excessively stuffed with tips or other items the possibility exists that the battery test button could be held down and consequently drain the battery.

3.4. TESTING THE RFD

3.4.1. This test procedure must be conducted in an area that is at least 100 feet from the nearest electric detonators or wires connected to electric detonators.

3.4.2. All RFD system components are described in detail in Section 2.

3.4.3. Ensure all units are sufficiently charged according to procedures 3.2 and 3.3.

3.4.4. Position the Controller and Remote Units at least 5 feet (1.5 meters) apart, in a position where all units can be observed while testing.

3.4.5. Install the antennas on the Remote and Controller Units.

3.4.6. On the Remotes, insert the enable keys and turn the POWER switches to the ON positions. Observe that the READY, ARMED, and POWER lights blink briefly on power up. The yellow light next to the ENABLE KEY should blink continuously to show the key is installed. The POWER light should remain on steady.

3.4.7. On the Remote Units, place the SELECT switch to the SHOCK TUBE position (Dual Output Model only). Observe the green SHOCK TUBE READY lights are on, and the red ARMED lights are out. Install a shock tube tip into the jacks located on the side of each Remote Unit.

3.4.8. On the Controller Unit, insert the Controller's key and press the ON switch. Observe the yellow POWER and KEY lights are on steady.

3.4.9. On the Controller, press the STATUS switch. After a short time the green READY lights for the Remote Units that were previously prepared for use, will come on steady to show they are disarmed and communicating two-way. The select lights will automatically be turned on for Remote Units that answered back to the Status request if the Auto Select option is enabled.

3.4.10. If Auto Select option is not enabled, on the Controller, press the SELECT switches to select the Remote Units to be tested. The yellow SELECT lights for the selected units will turn on.

3.4.11. On the Controller, press the ARM switch. The ARMED lights for the selected Remote Units will blink for up to 15 seconds and come on steady.

3.4.12. On the Remote Units, the red ARMED lights will come on steady. The system is armed.

3.4.13. On the Controller, before 2 minutes have elapsed, press the DISARM switch. All Remotes will disarm within 3 seconds.

3.4.14. Re-arm the Controller Unit and wait 2 minutes. After the 2 minutes, all Remotes will return to the disarmed state. The red ARMED lights will go out, and the green READY lights will come on steady.

3.4.15. Re-arm the Controller Unit, and before the two minutes have expired, press both FIRE switches together and hold for ½ second. You should notice that all Remote Units developed sparks at the shock tube tip electrodes. All units subsequently return to the disarmed state.

Note: 3.4.16 through 3.4.19 applies to the Dual Output Model only.

3.4.16. On the Remote Units, place the SELECT switches to the ELECTRIC DETONATOR position and observe the green ELECTRIC DETONATOR READY lights are on, and the ARMED lights are out.

3.4.17. On the Remotes, depress the two spring loaded binding posts and insert the leads of the test lamps.

3.4.18. Repeat procedures 3.4.11 through 3.4.14. The test lamps should remain extinguished through out this portion of the procedure.

3.4.19. Re-arm the Controller Unit, and before the two minutes have expired, press both FIRE switches together and hold for ½ second. You should notice that all test lamps light briefly. All units subsequently return to the disarmed state.

3.4.20. If any units did not work as described in this section, return to a service shop for repair. Never use a unit that is damaged or suspected of being damaged.

3.4.21. Turn off all units. Restore antennas, tips, and test lamps as required. The system is now operationally ready for use.

4. RFD OPERATIONAL PROCEDURES

4.1. SETTING UP THE RFD

WARNING It is MANDATORY that the Protective Cover is installed on the Charge Connector of the Remote unit at all times unless charging. There is the potential presence of voltage on some of the pins of the Charge Connector. For models produced after March 2009 (Serial Numbers 371+), the maximum current available from any pin is limited to 14.3 milliamperes."

4.1.1. Select the number of Remotes required for the operation. Ensure all units are sufficiently charged and tested according to Chapter 3.

Figure 4-1 Installing the Controller Antenna

4.1.2. Ensure the Controller Unit key is removed. Position the Controller Unit at the intended firing position and install the antenna.

4.1.3. To place the RFD in Safety Poll® mode, press and hold the STATUS switch while also pressing the ON switch (Details of Safety Poll® mode in Section 5.1).

4.1.4. Select a position for the first Remote Unit close to the blast area, but far enough to ensure the Remote is safe from direct air blasts and falling rocks.

Figure 4-2 Remote Antenna Installation

4.1.5. Install the antenna on the Remote Unit. Ensure the antenna is free of obstruction.

Figure 4-3 Activating the Remote Unit

4.1.6. Turn the POWER switch to the ON position. Observe the yellow POWER light is on and not flashing. Ensure the battery voltage is above 12.0V.

4.1.7. For underground operation, ensure the green RECEIVE light is on steady to indicate the Remote is in receiving range of the leaky feeder radio signal.

4.1.8. For surface operation, the green RECEIVE light suggests there may be an interfering radio signal or noise present. The RECEIVE light is similar to breaking squelch on a handheld radio and does not necessarily indicate operation is degraded.

Figure 4-4 Select the Initiator

4.1.9. Place the SELECT switch to the desired initiation method (Dual Output Model only). Verify the green READY light is on, while the red ARMED light remains off.

4.1.10. If using non-electric shock tube, install the tube into the RFD Tip, and install the tip into the jacks on the left side of the Remote as described in Section 2.8.

4.1.11. If using electric detonators, install the two-wire firing cable into the spring loaded binding posts located on the left side of the Remote Unit (Dual Output Model only).

4.1.12. Install the enable key into the Remote Unit and observe the yellow light next to the ENABLE KEY begins flashing. If the Controller is in Safety Poll® mode, this light will turn on steady within 15 seconds to show that full 2-way communications are working.

4.1.13. Close the lid on the Remote for protection. Repeat Sections 4.1.4 to 4.1.13 for the remaining Remote Units to be used in the operation.

4.2. FIRING THE RFD

Figure 4-5 Activating the Controller Unit

4.2.1. Activate the Controller Unit on pressing the ON switch. Observe the yellow POWER light is on. The Controller should be recharged when the BATTERY indicator reads 20% or less.

Figure 4-6 Inserting the Controller KEY

4.2.2. When the area is clear and all shots are prepared, insert the key into the Controller Unit as shown in Figure 4-6. The yellow KEY light will turn on.

Figure 4-7 Select the Remote Units

4.2.3. Press the SELECT switches to select the Remote Units to be fired. The yellow SELECT lights will illuminate as the corresponding Remotes are selected.

Figure 4-8 Perform a STATUS check

4.2.4. Press the STATUS switch and observe the green READY lights will light for each selected Remote Unit that is operational and within range.

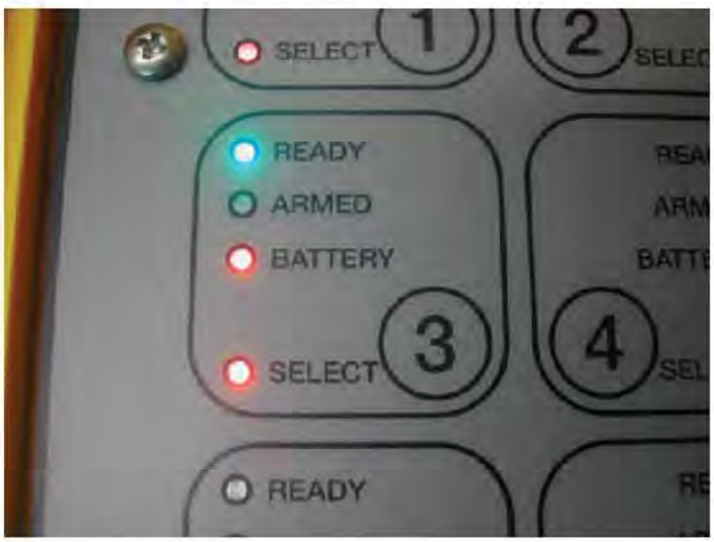

Figure 4-9 Observing the STATUS check results

4.2.5. Shown in Figure 4-9 are the results of our STATUS check for Unit #3. The steady green READY light indicates Unit #3 is disarmed. The steady yellow BATTERY light indicates Unit #3's battery is not low.

Figure 4-10 Arm the SELECTED Remote Units

4.2.6. Wait for the appropriate warning sirens. About 30 seconds from firing, press and hold the ARM switch for ½ second. The red ARMED lights will blink for up to 15 seconds and come on steady.

4.2.7. For systems configured in 1-way mode: If any of the ARMED lights continue to blink, those units are not within 2-way range and confirmation cannot be received. The Remote(s) may or may not fire depending on range, local interference, and the Controller radio's power setting.

4.2.8. For systems configured for 2-way only mode, units that are not within 2-way range will not be armed.

Figure 4-11 Firing the ARMED and SELECTED Remote Units

4.2.9. When ready to fire, press the two FIRE switches together at the same time and hold for ½ Second as shown in Figure 4-11. Shot initiation should be detected.

Figure 4-12 Verify the green READY Lights are on steady

4.2.10. After a short time, the green READY lights should be on steady to show that each Remote Unit has fired and is now disarmed as shown in Figure 4-12. Any lights that continue to blink indicate the Controller did not receive a confirming message and a manual STATUS check is required to ensure all units are disarmed.

Figure 4-13 Manually checking STATUS

4.2.11. To manually check status, press the STATUS switch at any time. The updated status of the SELECTED Remotes will be reported on the faceplate enunciator panel. You may alternately press DISARM and STATUS until all Remotes have reported they are confirmed READY.

Figure 4-14 Turn the Controller Unit OFF

4.2.12. With all deployed Remote Units having reported steady READY status, deactivate the Controller by pressing the OFF switch.

Figure 4-15 Remove the Controller's Key

4.2.13. Remove the Controller Unit's key.

4.2.14. Wait an additional 2 minutes, and following standard safety procedures, you may approach and retrieve the Remote Units.

4.2.15. Turn OFF the Remote Units. Remove and store the enable keys, antennas, and shock tube tips.

4.2.16. Inspect all units for physical damage. Close the lids and restore dust caps.

ATTACHMENT 8

POST-DEMOLITON OPERATIONS CHECKLIST

I. Project Information

Site Name: ____________________ Date: __________

Site Location: ____________________ Grid Number: __________

Demolition Team Leader: ____________________

II. Explosive and MEC/UXO Accountability (Donor explosives)

		Yes	No
(a)	All unused explosive materials returned to magazine and properly stored?		
(b)	Explosive Usage Record (HGL Form 15.05) completed and submitted to SUXOS?		
(c)	All destroyed/demiled MPPEH, MEC and UXO accounted for and verified by SUXOS?		
(d)	MEC/UXO Accountability Record (HGL Form 15.04) completed and filed?		
(e)	Magazine Data Card–Daily Summary of Magazine Transaction (HGL Form 15.02) completed?		
(f)	Magazine locked and secured (two-locks)?		
(g)	Detonator box locked and secured (two-locks)?		
(h)	Magazine fence gate locked and secured?		
(i)	Magazine keys returned and properly secured?		

III. Remarks

IV. Approval (signature)

Demolition Supervisor:	Senior UXO Supervisor:

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ATTACHMENT 9
Three-Phase Quality Control Checklist
Explosive Demolition Operations

Team:	**Location:**	**Date:**
Personnel Present:		
Phase of Inspection (Circle): *PREPARATORY (P); INITIAL (I); FOLLOW-UP (F)*		

CHECKLIST

Item	Reference	Inspection Point	Yes	No	N/A	Comments
1.	DDESB TP 18	All demolition team members meet the UXO-qualified personnel requirements				(*P)*
2.	Work Plans, ESP or ESS	Have all demolition team members reviewed the current work plan, ESP or ESS? *Check Dates/Record of training.*				(*P)*
3.	SOP 502.01.1	Do the provisions of SOP 502.01.1 meet procedural and safety requirements for performing demolition operations for all personnel selected to participate in the procedures meet the requirements specified?				*(P), (I), (F)*
4.	SOP 502.01.1	Was the **Safety Briefing** held prior to commencing Demolition operations?				*(P)*
5.	SOP 502.01.1	Was a **Public Meeting** held prior to commencing Demolition operations? (if applicable)				*(P)*
6.	SOP 502.01.1	Has the SUXOS completed the mandatory notifications in advance of the conduct of Demolition operations (i.e. *Medical, Fire, Security)*				*(P),(I),(F)*
7.	SOP 502.01.1	Has the Explosive Safety Quantity Distance arc for the largest munition that will be detonated been used to calculate the EZ prior to the conduct of Demolition operations?				*(P),(I),(F)*
8.	SOP 502.01.1	Are proper visitor access and control procedures known and followed?				*(P),(I),(F)*
9.	SOP 502.01.1	Does the integrity of the EZ remain intact until Demolition operations are complete?				*(P), (I), (F)*
10.	SOP 502.01.1	Are appropriate personnel requirements met/achieved for the proper conduct of Demolition operations?				*(P), (I), (F)*
11.	SOP 502.01.1	Is the two-man rule concept religiously followed whenever explosives are transported or handled during explosive operations?				*(P), (I), (F)*
12.	SOP 502.01.1	Does a demolition procedures review occur prior to the conduct of Demolition operations in accordance with the requirements of SOP 502.01.1?				*(P), (I), (F)*
13.	SOP 502.01.1	Have sufficient communications been established to enable team/field personnel to communicate with the Site Field Office and emergency response agencies prior to the conduct of operations?				*(P), (I), (F)*
14.	SOP 502.01.1	Are there sufficient range vehicles available, with appropriate safety devices installed, to transport and support Explosive Demolition Operation Personnel?				*(P), (I), (F)*
15.	SOP 502.01.1	Are all vehicle safety requirements of SOP 502.01.1 known and strictly observed?				*(P), (I), (F)*
16.	SOP 502.01.1	Does the SUXOS obtain a weather report prior to the conduct of Demolition operations?				*(P), (I), (F)*

17.	SOP 502.01.1	Are Demolition operations denied or cancelled when electrical storms are within 5 miles of the disposal site or when other severe weather conditions exist that would have a negative impact on safety?				*(P), (I), (F)*
18.	SOP 502.01.1	Are emergency medical support administrative, notification, training, and equipment requirements observed for Demolition operations in accordance with SOP 502.01.1?				*(P), (I), (F)*
19.	SOP 502.01.1	Are fire support administrative, notification, training, and equipment requirements observed for Demolition operations in accordance with SOP 502.01.1?				*(P), (I), (F)*
20.	SOP 502.01.1	Are the PPE items required for Demolition operations present and serviceable in accordance with SOP 502.01.1?				*(P), (I), (F)*
21.	SOP 502.01.1	Are engineering control specifications available and employed when it becomes necessary to reduce detonation effects? (if applicable)				*(P), (I), (F)*
22.	SOP 502.01.1	Does the SUXOS or Demolition Supervisor take the appropriate actions as specified in SOP 502.01.1 prior to initiating a demolition shot?				*(I), (F)*
23.	SOP 502.01.1	Are explosive initiation systems chosen in accordance with SOP 502.01.1 provisions?				*(I), (F)*
24.	SOPs 501.01.1 and 502.01.1	Are Disposal Operations Checklists and Explosive Disposal Logs prepared and completed in accordance with this SOP 501.01.1 and SOP 502.01.1?				*(I), (F)*

PUNCH LIST ITEMS

No.	

Conducted by: ________________________ Acknowledged by: __________________________

HydroGeoLogic, Inc — Exceeding Expectations	STANDARD OPERATING PROCEDURE
Explosives Storage Inspections and Security	**SOP No.: 503.01.1** **SOP Category: MMRP and Geophysics** **Revision No.: 1** **Revision Date: January 2016** **Review Date: January 2017**

Approved By:

Jan Kool Digitally signed by Jan Kool
Date: 2016.01.14 20:38:47
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1/14/2016

Jan Kool, Ph.D. Date
Corporate QA Manager

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Neil Feist Date
MMRP Operations Manager

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LIST OF ATTACHMENTS

Explosives Storage Inspections and Security	SOP No.: 503.01.1
	SOP Category: MMRP and Geophysics
	Revision No.: 1
	Revision Date: January 2016
	Review Date: January 2017

1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) describes the basic guidelines and procedures for performing explosive storage inspections and for providing security for magazines sited during Military Munitions Response Program (MMRP) projects. HydroGeoLogic, Inc. (HGL) employees should use this SOP in conjunction with HGL SOP 501.01.1, *Explosive Materials Accountability and Management*.

2.0 SCOPE AND APPLICATION

This procedure applies to all HGL employees who have been granted "Responsible Person" and "Employee Possessor" status by the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) under HGL's Type 20 - Manufacturer of Explosives license and are tasked with performing explosive storage inspections and operations and with providing security for magazines located on HGL project sites. These procedures apply to the inspection and security of all HGL explosive storage magazines during mobilization and demobilization, active site operations, and periods when site operations are inactive but explosives are still stored on the premises.

3.0 GENERAL REQUIREMENTS

Perform all work in a manner consistent with Occupational Safety and Health Administration standards and requirements. Refer to the site- or project-specific health and safety plan for relevant health and safety requirements. Conduct all activities in conformance with the approved Explosives Safety Submission (ESS) or the Explosives Site Plan (ESP), and Site Safety and Health Plan (SSHP). Describe procedures for packaging and disposing of waste generated during field activities in the project-specific work plan.

Personnel who use this procedure must complete the SOP Acknowledgement Form (see Attachment 1) and submit it to the Senior Unexploded Ordnance Supervisor (SUXOS) and Unexploded Ordnance Quality Control Specialist (UXOQCS) as evidence that they have read and understand this procedure. Project leaders retain this documentation in the project file.

Justify deviations from specified requirements to the Project Manager and/or the relevant Program Manager for approval, authorization, and inclusion in the approved project plans. Do not compromise federal law in deviations. Thoroughly describe both the deviations and the newly modified process in the justification documentation.

4.0 DEFINITIONS

4.1 DEFINITIONS

Constructive Possessor: Any person who has access to explosive materials but does not physically handle them. For example, a Demolition Supervisor who keeps keys for storage magazines in which explosives are stored for use in construction activities, or an individual who directs the use of explosive materials by other employees.

Employee Possessor: Any employee under HGL's explosive license who has or will have actual physical possession (direct access) of explosive materials or who has or will have constructive possession of explosive materials. This includes HGL employees assigned to unexploded ordnance (UXO) positions who directly handle explosive materials as part of the production process, employees who handle explosive materials to ship or transport them, and employees who actually use explosive materials, such as blasters and their helpers.

Responsible Person: An employee under HGL's explosive license who has the authority to direct the management of and policies pertaining to explosive materials.

4.2 ABBREVIATIONS/ACRONYMS

AR	Army Regulation
ATF	Bureau of Alcohol, Tobacco, Firearms and Explosives
ATFP	ATF Publication
CERCLA	Comprehensive Environmental Response, Cleanup, and Liability Act
CDL	commercial driver's license
CFR	Code of Federal Regulations
CMV	commercial motor vehicle
DDESB	DoD Explosives Safety Board
DOT	U.S. Department of Transportation
DoD	U.S. Department of Defense
ESP	Explosives Site Plan
ESS	Explosives Safety Submission
HGL	HydroGeoLogic, Inc.
IAW	in accordance with
MMRP	Military Munitions Response Program
MRS	Munitions Response Site

NEW	net explosive weight
NFPA	National Fire Protection Association
OE	ordnance and explosives
PES	potential explosive site
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
USACE	U.S. Army Corps of Engineering
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer

5.0 PROCEDURAL STEPS

Only HGL employees who are cleared by the ATF as either a Responsible Person or an Employee Possessor and are listed on the HGL Explosives License - Notice of Clearance are authorized to have access to explosive materials and storage magazines.

- The SUXOS and the UXOQCS are responsible for inspecting and securing explosive storage magazines.
- If a UXOQCS is not assigned or available, the UXO Safety Officer (UXOSO) may serve as the responsible party.

5.1 INSPECTIONS AND TESTING

5.1.1 Project Startup Inspections

Before establishing an explosive storage magazine and receiving explosive materials at a project site, the SUXOS and the UXOQCS conduct a joint explosive security survey inspection using the checklist provided as Attachment 2. The SUXOS documents the result of this survey using Attachment 2 and submits the results in the daily report.

5.1.2 Grounding Inspection and Testing

Identify a qualified electrician during pre-operational planning. Contract with a qualified electrician to install the grounding installation system in accordance with (IAW) the National Fire Protection Association (NFPA) 780. When more than one magazine is used, separate them by a minimum of 6.5 feet and ground them separately. If the 6.5-foot distance is not feasible, bind the magazines to a common grounding system.

5.1.2.1 Electrical Test

The contracted electrician will perform electrical grounding and bonding (resistance) tests in accordance with U.S. Department of Defense (DoD) Manual 6055.09-M, V2.E4.3.2. The electrical test will be conducted before placing explosive magazines in service and every 2 years.

5.1.2.2 Visual Inspection

Visually inspect the explosive storage magazines, including their grounding, every 12 months in accordance with DoD Manual 6055.09-M, V2.E4.3.1.

5.1.3 Weekly Inspections of Storage Areas

Begin weekly (not to exceed 7 days) inspections of the explosive magazines immediately after explosive materials arrive on the project site.

The weekly inspection (not to exceed 7 days) is necessary to determine if unauthorized entry into the magazine(s) or unauthorized removal of the magazine contents has been attempted. Use the Explosive Storage Magazine Inspection Checklist in Attachment 3 to document inspections of regular explosive storage.

The individual conducting the inspection signs the checklist after the inspection has been completed. The SUXOS reviews and signs the inspection checklist and maintains this report with the project site files.

The weekly inspection includes, but is not limited to, the following:

- Explosive storage magazine(s) grounding systems,
- Placards and signage,
- Fire hazards,
- Posting of fire/chemical hazards and safety information,
- Explosive compatibility,
- Net explosive weight limits,
- Explosive material container labeling and packing,
- Housekeeping,
- Explosive storage magazine integrity,
- Fencing security,
- Evidence of forced entry, sabotage, tampering, or vandalism,
- Vegetation,

- Magazine lock and key accountability,
- Abnormal odors and temperatures, and
- Emergency point of contact information displayed.

5.1.4 Explosive Materials Inventories

The SUXOS and UXOQCS will ensure that magazines containing explosive materials are inventoried every 30 days. Document the inspection in accordance with HGL SOP 501.01.1, *Explosive Materials Accountability and Management*.

Conduct the inventory as follows:

- Confirm that the project field office is maintaining current manufacture of explosives record of acquisition forms.
- Confirm that the "Magazine Data Card - Daily Summary of Transactions" is being maintained with the explosive materials and that the project field office is maintaining a duplicate copy.
- Ensure that inventory, issue, and receipt transactions are accurately annotated and reflect the most recent transactions.
- Account for explosives received and stored in the magazine from the date of receipt to the date of destruction or to the date of transfer.

5.2 EXPLOSIVE STORAGE MAGAZINES

Store and secure explosive magazines in appropriate numbers and locations as required by all applicable DoD Explosives Safety Board (DDESB); ATF; and other federal, state, and local laws and regulations.

- Store all high-explosive materials appropriately IAW the following:
  - DoD Manual 6055.09-M, *DoD Ammunition and Explosives Safety Standards*, Volumes 2 and 3;
  - ATF Publication (ATFP) 5400.7, *ATF Federal Explosives Law and Regulations*; and,
  - U.S. Army Corps of Engineers (USACE) Engineer Manual 385-1-97.
- Properly secure all high-explosive materials in approved ATF Type 2 outdoor portable explosive storage magazines.
- Comply with the explosive quantity distances per the site-specific DDESB-approved ESS or ESP.

5.3 SECURITY LOCKS

Use high-security padlocks to secure explosive materials in accordance with Code of Federal Regulations (CFR) § 555.208. The SUXOS and UXOQCS must maintain control of all magazine keys. Use the HGL Key Control Register and Inventory Log (Attachment 4) to record persons accountable for explosive magazine storage keys.

5.4 PLACARDS AND SIGNAGE

Place placards and signs on the doors of the magazines that indicate the U.S. Department of Transportation (DOT) hazardous materials class and division for the explosive materials stored in each magazine.

- Place an "*EMPTY*" sign on the magazine when it contains no explosive materials and is not in use.
- Prominently display a sign in an accessible location at the explosive storage area showing contact information for the HGL emergency point of contact.

5.5 NOTIFICATIONS

Immediately after explosive storage magazines on HGL project sites are established, notify appropriate parties as required by HGL SOP 501.01.1, *Explosive Materials Accountability*.

5.6 FENCING PROTECTION

Install appropriate fencing (physical security) on all sites IAW ATFP 5400.7 and Army Regulation (AR) 190-11, paragraph 5-3:

- Use a chain link fence made of galvanized, aluminized, or plastic coated woven steel with a 2-inch-square mesh and 9-gauge-diameter wire, including coating.
- Locate posts, bracing, and other structure members on the inside of the fence. Use galvanized steel or aluminized wire-ties equal in gauge to the fencing to secure the fence to the posts or other structural members.
- Use a fence with minimum height of 6 feet without an outrigger.
- Extend the bottom of the fence to within 2 inches of firm ground.
    - Stabilize surfaces in areas where loose sand, shifting soils, or surface waters may cause erosion and thereby assist an intruder in penetrating the fenced area.
    - Install concrete curbs, sills, or other suitable-type anchoring devices, extending them below ground level where surface stability is not possible or practicable.

- Install the fewest number of vehicular and pedestrian gates in the barrier required for operations.
  - Use gates that are structurally comparable to the adjacent fence.
  - Install approved lock and hinge pins on gates; weld or otherwise modify hardware to prevent easy removal.

Fences installed around magazines must be at least 6.5 feet from the magazine. If the 6.5-foot distance is not feasible, bind the fencing into the grounding system.

6.0 TRANSPORTATION REQUIREMENTS

Comply with all federal, state, and local regulations when transporting ordnance and explosives (OE).

For on-site OE transportation: Permits are not required under the Comprehensive Environmental Response, Cleanup, and Liability Act (CERCLA) for on-site transportation within the MRS.

For off-site OE transportation:

- Do not transport OE off site without first coordinating with and receiving approval from the USACE Contracting Officer.
- Use commercial carriers approved to transport ammunition and explosives to ship OE off site.
- Package OE in accordance with 49 CFR Parts 172 and 173, if possible. If not possible, package and transport the OE so that it does not move or touch other OE items.
- Provide drivers with emergency response information.
- Inspect vehicles using the Explosives Vehicle Inspection Form; properly placard the vehicles if applicable.
- Observe compatibility requirements.
- Brace the load well; cover with a fire-resistant tarpaulin except when in an enclosed vehicle or day box.

6.1 GENERAL HIGHWAY TRANSPORTATION

In most instances, the data in the following sections meets the requirements for explosive transport.

6.1.1 Commercial Motor Vehicle Requirements (49 CFR Part 383.5)

Commercial motor vehicle (CMV) means a motor vehicle, or a combination of motor vehicles (towed units, etc.), used in commerce to transport passengers or property, if the motor vehicle

- Has a gross combination weight rating of 11,794 or more kilograms (26,001 pounds or more), inclusive with a towed unit with a gross vehicle weight rating of more than 4,536 kilograms (10,000 pounds); or
- Has a gross combination weight rating of 11,794 or more kilograms (26,001 pounds or more), inclusive with a towed unit with a gross vehicle weight rating of more than 4,536 kilograms (10,000 pounds); or
- Has a gross vehicle weight rating of 11,794 or more kilograms (266,001 pounds or more); or
- Has a gross vehicle weight rating of 11,794 or more kilograms (266,001 pounds or more); or is designed to transport 16 or more passengers, including the driver; or
- Is designed to transport 16 or more passengers, including the driver; or
- Is of any size and is used in the transportation of materials found to be hazardous for the purposes of the Hazardous Materials Transportation Act, and which require the motor vehicle to be placarded under the *Hazardous Materials Regulations* (49 CFR Part 172, subpart E).

6.1.2 CDL Requirements

If a commercial driver's license (CDL) is required, the Project Manager or UXOSO ensures that vehicle operators obtain the necessary license/permits. The operator of the vehicle need not have a CDL if site personnel are not performing the following:

- Transporting explosives on DOT public roadways (for example, within an MRS and off a public road), or
- Transporting any materials that must be placarded under the DOT Hazardous Materials Regulations (for example, they are only transporting 1.4 explosives in quantities less than 1,000 pounds).

Comply with DOT 49 CFR Parts 172, 173, 387, and 397 when transporting 1,000 pounds or less of Compatibility Group 1.4B and 1.4S. Comply with DOT 49 CFR Parts 172, 173, 387, and 397 when transporting 99 pounds or less of detonating cord Compatibility Group 1.4D, if the explosive content does not exceed 100 grains per linear foot. Under these circumstances a CDL, vehicle placarding, and written travel route are not required.

6.1.3 Federal Installations/On-Site

Comply with the following requirements during transportation of explosives and OE on-site and on federal installations:

- Inspect and properly placard vehicles.
- Transport explosives in closed vehicles whenever possible.
- When loading or unloading explosives, turn off the vehicle engine and set wheel chocks and brakes.
- Equip vehicle beds with a plastic bed liner, dunnage, or sandbags to protect the explosives from contact with the metal bed and fittings.
- Equip vehicles transporting explosives with a first aid kit, two 10-BC fire extinguishers, and communications capabilities.
- Separate initiating explosives, such as detonators, from other high explosives during loading, unloading, and while on vehicles.
- Observe compatibility requirements.
- Verify that operators transporting explosives have a valid driver's license.
- Instruct drivers concerning speed limits. Ensure that they know to do the following:
  - Comply with posted speed limits, but not exceed a safe and reasonable speed for conditions regardless of posted limits; and
  - Not exceed 25 mph in when transporting explosives off-road.

6.2 OFF-SITE TRANSPORTATION OF EXPLOSIVES OVER PUBLIC HIGHWAY

DOT certificates of registration for individuals involved in the transportation of demolition materials are not required as long as only 1.4 explosives, or less than 55 net explosive weight (NEW) of 1.1, 1.2, or 1.3 explosives are being transported.

Explosives of compatibility Group S may be packed with explosives of all other explosive compatibility groups except A and L. To determine the compatibility of the material typically transported by site personnel, refer to the appropriate Material Data Safety Sheets.

6.2.1 General Placarding Requirements

Sites that require placards must adhere to requirements in 49 CFR 172.504. The placard requirements listed below apply to explosives transportation, if applicable:

"(a) Except as otherwise provided, each bulk packaging, freight container, unit load device, transport vehicle or rail car containing any quantity of a hazardous material must be placarded on each side and each end with the type of placards specified in Tables 4 and 5, in accordance with other requirements and exceptions."

A CDL, vehicle placarding, and written travel route are not required for the following:

- When transporting 1,000 pounds or less of Compatibility Group 1.4B and 1.4S, and
- When transporting 99 pounds or less of detonating cord Compatibility Group 1.4D, if the explosive content does not exceed 100 grains per linear foot.

6.2.2 Documentation

When explosives are being transported, place completed copies of forms described below in the vehicle. Coordinate deviations from the planned route with the UXOSO.

Instructions for Motor Vehicle owners (Emergency Response Information):

- Enter into the form only the items being transported. Complete columns for applicable quantity unit and weight.
- It is imperative that the NEW limitation of 55 lbs. not be exceeded.
- Enter all required data on the front of the form; check Guide 50 block on the back of the form.

Explosives Purchase/Receipt/Authorization List (required as part of the transport paperwork):

- Verify that pertinent data for transporting explosives is included.
- Use only the route shown unless an emergency arises or the designated route is blocked.

Explosives Vehicle Inspection Form:

- Complete before placing explosives in the vehicle.
- Include the form with each shipment.

ATF Permit/License: Make a copy of the current ATF license readily available in the vehicle.

7.0 QUALITY CONTROL

- The HGL MMRP Operations Manager annually reviews this SOP for completeness and accuracy, and ensures that appropriate safety measures are addressed.
- The HGL UXO Safety Manager maintains, manages, and annually reviews this SOP for procedural, quality control and safety issues.
- The UXO Safety Manager receives all questions, comments, and recommendations regarding this SOP.
- Project managers and supervisors ensure that site personnel read, understand, and follow this SOP.
- Discrepancies found with procedural steps or safety issues pertaining to this SOP should be referred to the responsible supervisor for corrective action.

The SUXOS or their designee trains all personnel responsible for explosive storage magazine and security on the requirements of this SOP, and documents the training with the HGL Training Attendance Log and in the SUXOS daily report.

8.0 SAFETY

Notify the SUXOS, the UXOSO, and the project manager immediately if an explosive safety situation is encountered during any phase of work. Follow these explosive safety precautions and protocols:

- Never open a metal container inside or within 50 feet of the explosive storage magazine or explosives.
- Open all containers of explosives with non-sparking tools, except metal slitters, which may be used on fiberboard containers.
- Do not permit matches, lighters or any other spark-producing devices inside or in the proximity of an explosive storage area, explosive storage magazine or potential explosive site (PES).
- Do not smoke within 50 feet of the explosive storage area or a PES.
- Keep magazines clean, dry and free of trash at all times. Sweep magazine floors regularly; use only nonsparking cleaning gear to maintain cleanliness.
- Clean floors stained with leakage from explosive materials according to the explosive manufactures instructions.
- Keep the area within 25 feet in all directions surrounding the explosive storage magazines clear of rubbish, brush, high grass and trees. Live trees greater than 10 feet tall need not be moved.

- Do not allow flammable and volatile materials within 50 feet from the explosive storage area.
- Observe the two-person rule at all times during inventory, issue, turn-in and transportation of explosives.

9.0 RECORDS

9.1 GROUNDING INSPECTIONS

The contracted electrician who installed the explosive magazine grounding system will submit documentation of the certification to the HGL Site Manager/SUXOS upon completion of the test.

- Include a statement that the explosive storage magazine(s) complies with the requirements of NFPA 780 before storing explosive materials in the magazine(s).
- The SUXOS maintains the original inspection report in the project files.
- The UXOQCS sends an electronic copy to the HGL MMRP office, Huntsville, Alabama, UXO Safety Manager.

9.2 SECURITY INSPECTIONS

The SUXOS maintains original copies of all inspection records on site, and makes them available for inspection by authorized HGL designees and agencies. The UXOQCS submits an electronic copy of this inspection to the UXO Operations Manager.

Upon completion of project field operations, send all original inspection and explosive transaction records to the HGL MMRP office in Huntsville, Alabama, to the attention of the UXO Operations Manager, for archiving throughout the life of HGL's explosive license.

9.3 DOCUMENTATION

Collect and maintain documentation generated as a result of this procedure using the following forms attached to this SOP:

- Attachment 1: SOP Acknowledgement Form
- Attachment 2: Explosive Storage and Security Survey Checklist
- Attachment 3: Explosive Storage Magazine Inspection Checklist
- Attachment 4: Key Control Register and Inventory Log

If a nonconformance is identified during an inspection, provide a detailed description of the nonconformance with recommendations for addressing the nonconformance. Record all inspections using the Explosive Storage Area Inspection Checklist, Attachment 3.

10.0 REFERENCES

Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), 2008. Publication 5400.15, ATF Safety and Security Information for Federal Explosives Licensees and Permittees. March.

ATF, 2011. Publication 5400.18, Daily Summary of Magazine Transactions. October.

ATF, 2011. Publication 5400.19, Recordkeeping Requirements for Explosive Material Manufacturers. October.

ATF, 2012. Publication 5400.7, Federal Explosives Laws and Regulations (27 CFR § 555). April.

HydroGeoLogic, Inc. (HGL), 2016. SOP 503.01.1, Explosives Storage Inspections and Security, January.

National Fire Protection Association (NFPA) 780, 2014, Standards for the Installation of Lightning Protective Systems.

U.S. Army, 2013. Army Regulation (AR) 190-11, Physical Security of Arms, Ammunition, and Explosives, September.

U.S. Army Corps of Engineers (USACE), Engineer Manual 385-1-97, 2008, Explosives Safety and Health Requirements Manual, September.

U.S. Department of Defense (DoD) Manual 6055.9-M, 2010, DoD Ammunition and Explosives Safety Standards, February.

U.S. Department of Transportation (DOT), 49 CFR Parts 100-199, 383.

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ATTACHMENTS

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ATTACHMENT 1

STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT

I have read, understand and agree to abide by the provisions as detailed in this standard operating procedure (SOP) prepared by HGL. By signing below, I certify that I have had the opportunity to read and ask questions about this SOP, and that I understand the procedures, equipment and restrictions, and agree to abide by them. Failure to comply with this SOP may lead to disciplinary action and/or my dismissal from the work site and termination of employment.

Prior to the commencement of any work task associated with this SOP, the SUXSO or UXOQCS assigned to the project will discuss additional procedures to be implemented, or any other site-specific conditions that may arise. All on-site personnel of HydroGeoLogic, Inc., must sign this Acknowledgment Form before performing the task covered by these SOPs.

Print Name	Signature	Date

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ATTACHMENT 2

Explosive Storage and Security Survey Checklist

Project Site (name, city and state):		
Inspection conducted by/position:	Signature	Date
UXOQCS or UXOSO:	Signature	Date
Reviewed by SUXOS:	Signature	Date

	YES	NO	NA	COMMENTS
1. **Publications**	YES	NO	NA	COMMENTS
a. ATF Federal Explosive Law & Regulations, ATF P 5400.7,	☐	☐	☐	
b. HGL SOP 15.00 Explosive Accountability & Management	☐	☐	☐	
c. HGL SOP 15.02 Explosive Storage, Inspection & Security	☐	☐	☐	
2. **Explosive Storage**	YES	NO	NA	COMMENTS
a. Proper explosive storage magazines, Type 2 conforming to BATF standard	☐	☐	☐	
b. Placards. Each magazine properly placarded with DOT Haz Class/Division symbol	☐	☐	☐	
c. Explosive compatibility groups. Separated into the appropriate Haz Class/Division	☐	☐	☐	
d. Physical Security survey conducted and documented	☐	☐	☐	
e. Locks met BATF standards	☐	☐	☐	
f. Key control system established and functional	☐	☐	☐	
g. Lightening Protection.	☐	☐	☐	
1) Magazine constructed of minimum 3/16 inch metal	☐	☐	☐	
2) Magazine grounded	☐	☐	☐	
3) Magazine located 6 feet from nearest fence	☐	☐	☐	
4) Installation/Client/Property Owner standards met	☐	☐	☐	
h. Fire Protection. Minimum size/type fire extinguisher located within 30 feet of storage magazine	☐	☐	☐	
1) Proper fire division symbol at entrance to storage site	☐	☐	☐	
5) Fire fighting control plan established in APP/SSHP	☐	☐	☐	
6) Area surrounding magazine free of rubbish, brush, dry grass, trees for a minimum of 25 foot.	☐	☐	☐	
i. Magazine location site meets IBD/PTR distances	☐	☐	☐	
j. Commercial explosives being stored in DoD facilities require DoD HC/SCG approval	☐	☐	☐	
k. Adequate earth cover used to meet IBD & PTR distances	☐	☐	☐	

MR Form 15.31 (June 2011)

1 of 2

ATTACHMENT 2 (continued)

HGL HydroGeoLogic, Inc.

Explosive Storage and Security Survey Checklist

3. Explosive Accountability & Management	YES	NO	NA	COMMENTS
a. Explosive accountability and management responsibilities and organization established	☐	☐	☐	
b. Explosive material purchase/receipt signature authority on-hand	☐	☐	☐	
c. Accountability records & tracking established	☐	☐	☐	
d. MEC final disposition accountability tracking records established	☐	☐	☐	
e. Lost, missing and stolen procedures in place	☐	☐	☐	
f. Disaster preparedness plan in place	☐	☐	☐	
g. Receipt procedures accounting for each item of explosives properly documented on-site	☐	☐	☐	
h. Individuals authorized to receive issue and transport Identified and granted explosive access by the BATF FELC.	☐	☐	☐	

4. Explosive Transportation	YES	NO	NA	COMMENTS
a. Hazardous waste manifest on-hand and maintained	☐	☐	☐	
b. Explosive Transport Vehicle	☐	☐	☐	
1) Vehicle inspection checklist on hand	☐	☐	☐	
2) Proper DOT placards, lettering, and/numbering on hand	☐	☐	☐	
3) Operators licensed (CDL/HazMat endorsement)	☐	☐	☐	
4) First aid kit on board vehicle	☐	☐	☐	
5) Communication protocols established	☐	☐	☐	
6) Day boxes on hand	☐	☐	☐	

MR Form 15.31 (June 2011)

ATTACHMENT 3

HGL

Explosive Storage Magazine Inspection Checklist

Project Site (name, city and state):		
Inspection by:	**Signature:**	**Date:**
Reviewed by Senior UXO Supervisor:	**Signature:**	**Date:**

A. EXTERIOR OF MAGAZINE	**YES**	**NO**
1. Are explosive storage magazines grounding systems in place, and properly grounded and bonded?	☐	☐
2. Are the proper hazard class/division and fire symbols placards posted and in good condition?	☐	☐
3. Are any fire hazards (flammable/volatile materials) visible within 50 feet of the magazine?	☐	☐
4. Is the area around the magazine cleared of vegetation not less than 25 feet in all directions?	☐	☐
5. Are all no-smoking signs posted?	☐	☐
6. Are magazines and fence gates in good repair, locked and secured?	☐	☐
7. Are there any indications of vandalism/tampering with the magazines, fence or locks?	☐	☐
8. Is the emergency point of contact information prominently displayed in an accessible location?	☐	☐
9. Are fire extinguishers required and present?	☐	☐
B. INTERIOR OF MAGAZINE	**YES**	**NO**
1. Are there any unusual odors or stain present?	☐	☐
2. Are detonators segregated from high explosives and stored properly?	☐	☐
3. Are ventilation ports clear?	☐	☐
4. Are all magazines floors clean, dry and good housekeeping being maintained?	☐	☐
5. Are explosive material containers properly packed, stacked, marked and stowed?	☐	☐
6. Are the any damaged or leaking containers?	☐	☐
7. Are containers properly stowed away from the magazine walls?	☐	☐
C. MAGAZINE OPERATIONS	**YES**	**NO**
1. Are Net Explosive Weigh limits exceeded?	☐	☐
2. Are personnel training on security, fire protection and emergency procedures?	☐	☐
3. Are magazines locks and keys accounted for and properly logged in and out?	☐	☐
4. Upon completion of this inspection send an electronic copy of this report to the HGL Huntsville Office.	☐	☐

D. REMARKS

Note any departures from authorized procedures and list any discrepancies noted below.

HGL MR Form 15.09 (Sep 2012)

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ATTACHMENT 4

HGL
HydroGeoLogic, Inc.

Key Control Register and Inventory Log

SITE NAME/LOCATION:	PERIOD COVERED: FROM: TO:

KEY CONTROL NUMBER(S)
(Enter serial number or other identifying number from key)

1.	13.	25.	37.
2.	14.	26.	38.
3.	15.	27.	39.
4.	16.	28.	40.
5.	17.	29.	41.
6.	18.	30.	42.
7.	19.	31.	43.
8.	20.	32.	44.
9.	21.	33.	45.
10.	22.	34.	46.
11.	23.	35.	47.
12.	24.	36.	48.

KEY ISSUE AND TURN IN

KEY NUMBER	ISSUED (Date/Time)	ISSUE BY (Printed Name/Signature)	ISSUED TO (Printed Name/Signature)	TURNED IN (Date/Time)	RECEIVED BY (Printed Name/Signature)

HGL MR Form 15.26 (Sep 10)

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HydroGeoLogic, Inc Exceeding Expectations	STANDARD OPERATING PROCEDURE	
MPPEH Inspection and Management		**SOP No.: 504.01.1**
		SOP Category: MMRP and Geophysics
		Revision No.: 1
		Revision Date: January 2016
		Review Date: January 2017

Approved by:

Jan Kool Digitally signed by Jan Kool
Date: 2016.01.14 20:40:15
-05'00'

1/14/2016

Jan Kool, Ph.D. Date
Corporate QA Manager

Digitally signed by Neil Feist
DN: cn=Neil Feist, o, ou=HGL, email=nfeist@hgl.com, c=US
Date: 2016.01.14 20:36:15 -06'00'

Neil Feist Date
MMRP Operations Manager

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TABLE OF CONTENTS

LIST OF ATTACHMENTS

MPPEH Inspection and Management	SOP No.: 504.01.1
	SOP Category: MMRP and Geophysics
	Revision No.: 1
	Revision Date: January 2016
	Review Date: January 2017

1.0 PURPOSE

This standard operating procedure (SOP) describes procedures for handling material potentially presenting an explosive hazard (MPPEH), including inspection, management, safety, security, and chain of custody (CoC) certification during munitions response activities.

2.0 SCOPE AND APPLICATION

This SOP applies to all HydroGeoLogic, Inc. (HGL) employees involved in inspection and management processes for certifying MPPEH as either material documented as safe (MDAS) or as material documented as an explosive hazard (MDEH) before transfer within or release from U.S. Department of Defense (DoD) control. HGL employees tasked with performing these procedures must be qualified in accordance with DoD Safety Board (DDESB) Technical Paper 18 and DoD Instruction (DoDI) 4140.62.

3.0 GENERAL REQUIREMENTS

All work must be performed in a manner consistent with Occupational Safety and Health Administration-established standards and requirements. Refer to the site- or project-specific health and safety plan for relevant health and safety requirements. Conduct all activities in conformance with the Explosive Safety Submission/Explosives Site Plan and the Site Safety and Health Plan (SSHP). Describe procedures for the packaging and disposal of all waste generated during field activities in the project-specific work plan.

Personnel who use this procedure must complete the SOP Acknowledgment Form (see Attachment 1) and submit the form to the Senior Unexploded Ordnance (UXO) Supervisor and Unexploded Ordnance Quality Control Specialist (UXOQCS) as evidence that they have read and understand this procedure. The UXOQCS retains this document in the project file.

Justify deviations from specified requirements to the project manager (PM) and/or the relevant program manager for authorization and discussion in the approved project plans. Do not compromise federal law in deviations. Fully describe both deviations from requirements and the newly modified process in the justification documentation.

4.0 DEFINITIONS AND ABBREVIATIONS/ACRONYMS

4.1 DEFINITIONS

*Exclusion Zone (EZ)***:** A safety zone established around a work area that contains or potentially contains munitions and explosives of concern (MEC). Only project personnel and authorized escorted visitors are allowed within the EZ. Examples of EZs include safety zones around MEC intrusive activities and safety zones where MEC is intentionally detonated.

Fuze: Devices that initiate the detonation sequence in munitions, such as (1) a device with explosive components designed to initiate a train of fire or detonation in a munition, and (2) a nonexplosive device designed to initiate an explosion in a munition.

Fuzes are typically associated with munitions (for example, mortars, and bombs), but are occasionally found separately. They may contain a charge large enough to cause injury or death.

Material Documented as an Explosive Hazard (MDEH) (formerly referred to as MDAH, material documented as hazardous): MPPEH that cannot be documented as MDAS, that has been assessed and documented as to the maximum explosive hazards the material is known or suspected to present, and for which the CoC has been established and maintained. This material is no longer considered to be MPPEH. The MDEH characterization only addresses the explosives safety status of the material.

Material Documented as Safe (MDAS): MPPEH that has been assessed and documented as not presenting an explosive hazard and for which the CoC has been established and maintained. This material is no longer considered MPPEH.

Material Potentially Presenting an Explosive Hazard (MPPEH): Material owned or controlled by the DoD that, prior to determination of its explosives safety status, potentially contains explosives or munitions (for example, munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris) or potentially contains a high enough concentration of explosives that the material presents an explosive hazard (for example, equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization, or disposal operations).

Excluded from MPPEH are munitions within the DoD-established munitions management system, nonmunitions-related material (for example, horseshoes, rebar, other solid objects), munitions-related solid metal fragments that do not realistically present an explosive hazard, and other items that may present explosion hazards (for example, gasoline cans, compressed gas cylinders) that are not munitions and are not intended for use as munitions.

Military Munitions: All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of DoD, the Coast Guard, Department of Energy, and National Guard.

Military Munitions includes confined gaseous, liquid, and solid propellants; explosives; pyrotechnics; chemical and riot control agents; smokes; and incendiaries, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof. The term also includes non-nuclear components of nuclear devices managed under the nuclear weapons program of the Department of Energy after all required sanitization operations under the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.) have been completed (10 U.S.C. 2710(e)(3)(A)).

Military Munitions does not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, except as noted above.

Military Munitions Response Program (MMRP): A relatively new (2002) element of the Secretary of Defense's Defense Environmental Restoration Program that addresses the following:

- Potential explosives safety, health, and environmental issues caused by past DoD munitions related activities; and
- Potential explosives safety hazards presented by MEC, which includes UXO, discarded military munitions (DMM), and munitions constituent concentrations high enough to pose an explosive hazard and potential environmental contamination.

Minimum Separation Distance (MSD): MSD is the distance at which personnel in the open must be from an intentional or unintentional detonation.

Munitions and Explosives of Concern (MEC): Specific categories of military munitions that may pose unique explosives safety risks, including the following:

- UXO, as defined in 10 U.S.C. 101(e)(5)(A) through (C);
- DMM, as defined in 10 U.S.C. 2710(e)(2); or
- Munitions constituents (such as TNT and RDX), as defined in 10 U.S.C. 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

Munitions Debris (MD): Remnants of munitions (such as fragments, penetrators, projectiles, shell casings, links, and fins) remaining after munitions use, demilitarization, or disposal. Inert munitions-related material recovered during an MEC removal.

Range-Related Debris (RRD): Debris, other than munitions debris, collected from operational ranges or from former ranges (for example, targets such as tanks, vehicles or other man-made structures).

Transferred Within or Released from DoD Control: A situation where a receiver has taken physical custody of MDEH or MDAS from DoD and has received signed documentation that acknowledges the MDEH or MDAS material (DD Form 1348−1A, Issue Release/Receipt Document, or an equivalent document).

Unexploded Ordnance (UXO): Military munitions that meet one of the following criteria:

- Have been primed, fuzed, armed, or otherwise prepared for action;
- Have been fired, dropped, launched, or projected;
- Have been placed in such a manner as to constitute a hazard to operations, installation, personnel, or material; and
- Remain unexploded whether by malfunction, design, or any other cause.

A more detailed description of the term UXO is provided in Public Law (P.L.) 106-65, section 3031 (c)(5)(A).

UXO-Qualified Personnel: Individuals who meet the training requirements for UXO Technician and Personnel and have performed successfully in military Explosive Ordnance Disposal (EOD) positions or are qualified to perform in the following service contractor positions: UXO Technician II, UXO Technician III, and UXO Safety Officer (UXOSO), UXO Quality Control Specialist (UXOQCS), and Senior UXO Supervisor (SUXOS).

4.2 ABBREVIATIONS/ACRONYMS

CoC	chain of custody
DDESB	DoD Explosives Safety Board
DMM	discarded military munitions
DoD	U.S. Department of Defense
DoDI	U.S. Department of Defense Instruction
DQCR	Daily Quality Control Report
EM	Engineer Manual
EOD	Explosives Ordnance Disposal
EZ	exclusion zone
HGL	HydroGeoLogic, Inc.
HTRW	hazardous, toxic, or radiological waste
MD	munitions debris
MDAS	material documented as safe
MDEH	material documented as an explosive hazard
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MSD	minimum separation distance

OESS	Ordnance and Explosive Safety Specialist
P.L.	Public Law
PM	Project Manager
QC	quality control
RRD	range-related debris
SOP	standard operating procedure
SSHP	site safety and health plan
SUXOS	Senior Unexploded Ordnance Supervisor
USACE	U.S. Army Corps of Engineering
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
UXOSP	Unexploded Ordnance Sweep Personnel

5.0 RESPONSIBILITIES

5.1 MANAGERS AND SUPERVISORS

The PMs and field supervisors ensure that all site personnel read, understand, and follow this SOP. Immediately refer any discrepancies with procedural steps or safety issues pertaining to this SOP to the responsible supervisor for corrective action.

The SUXOS or senior UXO-qualified individual assigned ensures that all MPPEH activities are conducted in accordance with the following:

- DoD 6055.09-M, Volume 7, DoD Ammunition and Explosives Safety Standards: Criteria for Unexploded Ordnance, Munitions Response, Waste Military Munitions, and Material Potentially Presenting an Explosive Hazard;
- DoDI 4140.62, Material Potentially Presenting and Explosive Hazard;
- EM 385-1-97, Explosives Safety and Health Requirements Manual; and
- All other references shown in Section 8.0 of this SOP.

HGL employees assigned by the field level UXO Technicians must comply with these procedures for processing MPPEH for final disposition. Only UXO-qualified personnel are authorized to perform MPPEH processing.

5.2 UXO TECHNICIANS

Follow these procedures to safely conduct inspections of the exterior and interior surfaces of all recovered MPPEH and to ensure these items do not present an explosive hazard.

1. Unexploded Ordnance Sweep Personnel (UXOSP):
   - Marks suspected items only; may not assess a suspect item to determine its status.
2. UXO Technician I:
   - Tentatively identifies a located item as MPPEH with confirmation by a UXO Technician II or III.
3. UXO Technician II:
   - Performs a 100 percent inspection of each item as it is recovered and determines the following:
     - Is the item a UXO, a DMM, munitions debris, or RRD?
     - Does the item contain explosives hazards or other dangerous fillers?
     - Does the item require detonation?
     - Does the item require demilitarization or venting to expose dangerous fillers?
     - Does the item require removal of batteries, mercury seals, or switches; draining of engine fluids; or removal of illuminating dials and other visible liquid HTRW materials?
   - Segregates material items requiring demilitarization or venting procedures from items ready for certification.
   - Processes any items found to contain explosive hazards or other dangerous fillers in accordance with applicable procedures.
4. UXO Technician III:
   - Performs a 100 percent reinspection of all recovered items to determine if it free of explosives hazards or other dangerous fillers and engine fluids, illuminating dials, and other visible liquid HTRW materials.
   - Supervises detonation of items containing explosive hazards or other dangerous fillers and venting/demil procedures.
   - Supervises the consolidation of MPPEH to be containerized and sealed, ensuring that MD and RRD are segregated.
5. UXOQCS:
   - Conducts daily audits of the procedures used by UXO teams and individuals for processing MPPEH.

- Performs and documents random sampling by pieces, volume, or area of all MPPEH collected from the various teams. Ensures that no sampled items with explosive hazards, engine fluids, illuminating dials, or other visible liquid HTRW materials are identified as MD or RRD as required for completion of DD Form 1348-1A, Issue Release/Receipt Document (see Attachment 3).

6. UXOSO:
    - Ensures the specific procedures and responsibilities for processing MPPEH for certification as MD or RRD specified in the work plan are being followed.
    - Ensures all procedures for processing MPPEH are being performed safely and consistent with applicable regulations.
7. SUXOS:
    - Ensures that work and quality control (QC) plans specify the procedures and responsibilities for processing MPPEH for final disposition as MD or RRD.
    - Completes a Requisition and Turn-in Document, DD Form 1348-1A, for all MD and RRD to be transferred for final disposition.
    - Performs or witnesses the initial 100 percent inspection or DDESB-approved processing of the material to verify that the MD and RRD is free of explosive hazards necessary to complete the DD Form 1348-1A.
    - Certifies all MD and RRD as free of explosive hazards, engine fluids, illuminating dials, and other visible liquid HTRW materials.
    - Ensures that inspected debris is secured in a closed, labeled, and sealed container, and document as follows:
        - The container will be closed and clearly labeled on the outside with the following information: U.S. Army Corps of Engineering (USACE) or applicable DoD component/installation name/HGL/0001/seal's unique identification. Subsequent containers will be numbered 0002, 0003, and so on.
        - The container will be closed in such a manner that a seal must be broken in order to open the container. The container will be clearly marked with the seal's identification number.
        - A document describing each container will be created with the following information: container contents, weight of container, location where MD or RRD was obtained, HGL named as contractor, names of certifying and verifying individuals, unique container identification, and seal identification. Include these documents in a separate section of the final report.
    - Establishes a secure location for collecting, processing, and storing MPPEH, MD and RRD until transferred off site.

- Uses the MPPEH, Munitions Debris and Range Debris Processing and Storage Area Inspection Checklist (see Attachment 2) to verify the following:
  - Exclusion zones are maintained during MPPEH inspection and processing activities.
  - Adequate warning signs and boundary markers are in place during MPPEH inspection and processing activities.
  - Storage containers, drums, pallets, and tarpaulins are in good repair.
  - Storage containers and drums are properly labeled and legible.
  - Uninspected material is properly segregated from inspected material to prevent co-mingling.
  - Storage containers or drums in active use are locked to prevent uninspected material from being co-mingled with inspected material until seals are installed.
  - Demilitarized items are secured.

5.3 MPPEH CERTIFICATION AND VERIFICATION PROCEDURES

Assess all MPPEH to determine and document its explosive safety status before transferring the material within DoD facilities or releasing it from DoD control. Authorized and technically qualified personnel must certify the MPPEH as MDAS before it can be released to the public. MPPEH procedures must comply with DoDI 4140.62 and Engineer Manual (EM) 385-1-97.

Adhere to the following certification and verification procedures for material suspected or determined to be MPPEH before transporting it within or out of DoD control:

1. Obtain certification and verification that a 100 percent inspection and an independent 100 percent reinspection has been completed and that the material has been determined to be free of explosives before certifying it as MDAS.
2. The SUXOS certifies that the debris is free of explosives hazards and can be classified as MDAS.
3. The USACE Ordnance and Explosive Safety Specialist (OESS) or similarly trained individual verifies that the debris is free of explosive hazards. When an OESS is not assigned, a similarly trained UXO-qualified person performs the verification.
4. Use DD Form 1348-1A, Issue Release/Receipt Document, as the certification/verification document. The DD Form 1348-1A must clearly show the names of the SUXOS and the OESS or similarly trained UXO-qualified individual and contain the following information (refer to example shown in Enclosure 3):
   - <u>Block 5</u>: Document date
   - <u>Block 17</u>: Basic material content (type of metal, such as steel or mixed)

- Block 20: Total weight
- Blocks 24, 25, 26, and 27:
  - SUXOS and OESS names, or UXOQCS name if OESS is not present;
  - Company name;
  - SUXOS and OESS signatures, or the UXOQCS signature if OESS is not present;
  - HGL Huntsville office addresses and telephone number;
  - HGL unique identification number for each container;
  - Container seal number; and
  - Site name, city, and state of where MD or RRD was obtained.

5. Enter the following certification/verification on each DD Form 1348-1A (refer to Attachment 3) for MD or RRD transferred within or released from DoD control. The SUXOS and the OESS, if present, must sign the form. If the OESS is not on site or one has not been assigned, a similarly trained UXO-qualified individual signs. Use this statement on any ranges where RRD is processed along with MD:

   "This certifies that the material listed has undergone a 100 percent inspection and an independent 100 percent reinspection, and to the best of our knowledge and belief, is free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials."

6. Enter the following certification/verification on each DD Form 1348-1A (refer to example, Attachment 3) for turnover of MD. The SUXOS and the OESS, if present, must sign the form if present. If the OESS is not on site or one has not been assigned, a similarly trained UXO-qualified individual signs. Use this statement on properties where only munitions debris is being processed:

   "This certifies and verifies that the material listed has undergone a 100 percent inspection and an independent 100 percent reinspection, and to the best of our knowledge and belief, is inert and/or free of explosives or related materials."

7. Upon receipt of the material identified on the DD Form 1348-1A, the PM and the SUXOS ensure that the following blocks are completed by the qualified recycler:
   - Block 10: Quantity of material received
   - Block 22: Signature
   - Block 23: Date

5.4 MAINTAINING CHAIN OF CUSTODY AND FINAL DISPOSITION

Coordinate with the USACE or the appropriate DoD agency to arrange for maintaining the CoC and for final disposition of the certified and verified materials. Release the certified and verified material only to an organization that will perform the following:

1. Provide certification on company letterhead stating the following:

   "Upon receiving the unopened labeled containers each with its unique identified and unbroken seal ensuring a continued chain of custody, and after reviewing and concurring with all the provided supporting documentation, sign for having received and agreed with the provided documentation that the sealed containers contained no explosive hazards when received. The contents of these sealed containers will not be sold, traded or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content."

2. Send notification and supporting documentation to HGL documenting that the sealed containers have been smelted and are now only identifiable by their basic content.

The following steps should then be taken:

1. Incorporate this supporting documentation into the final report as supporting documentation for the final disposition of munitions debris and range-related debris.
2. If the CoC is broken, the affected MPPEH must undergo a second 100 percent inspection, then 100 percent reinspection, and be documented again to verify its explosives safety status (identified as either munitions debris or range-related debris). Refer to Section 7 of this SOP.
3. MDAS is no longer considered MPPEH as long as the CoC remains intact. A legible copy of inspection, reinspection, and documentation must accompany the material through final disposition and be maintained for a period of 3 years thereafter. Maintain this documentation as directed in Section 7.0 of this SOP.
4. Document MDAS being transferred within or released from DoD control on the CoC form, which is presented as Attachment 5.
5. The PM contacts the receiving agent/recycler to obtain MDAS final demilitarization certification documentation.

5.5 MDAS MANAGEMENT

Dispose of all MDAS with a recycler that smelts MDAS prior to resale or release in accordance with EM 385-1-97. If it is discovered during the material transfer and shipping process that a seal has been broken and the CoC of the material cannot be verified, the material in question will be subject to reinspection following the established MPPEH processes described in Sections 5.3 and 5.4 of this SOP.

The MDAS recycler subcontractor prepares the documentation verifying the demilitarization and final disposition of the material and provides copies of all MDAS certification and CoC documentation to HGL. Refer to examples in Attachments 3, 4 and 5.

5.6 MDEH MANAGEMENT

Complete the following procedures before releasing MDEH:

1. Ensure that MDEH is transferred or released only to a qualified receiver that meets the following requirements:
   - Has the licenses and permits required to receive, manage, or process the materials;
   - Has technical experts about the known or suspected explosive hazards associated with the MDEH;
   - Is qualified to receive, manage, and process MDEH in accordance with DoDI 4140.62; and
   - Has personnel who are
     - Experienced in managing and processing hazardous materials equivalent to the MDEH, and
     - Trained and experienced in the identifying and safe handling of used and unused military and/or any potential explosive hazards that may be associated with the specific MPPEH.
2. Advise the receiver of all of the potential hazards associated with the MPPEH. The receiver must agree to receive and process the material in accordance with DoD Instruction 4140.62.
3. Choose public transportation routes that comply with DoD hazardous material transportation regulations for all MPPEH shipments.
4. Maintain CoC and accountability records through final disposition of the MPPEH. A legible copy of inspection, reinspection, and other documentation as discussed in Sections 5.3 and 5.4 must accompany MPPEH through final disposition and be maintained for a period of 3 years thereafter and in accordance with Section 7.0 of this SOP.

5.7 INSPECTIONS

5.7.1 Project Startup Inspection

Before establishing the MPPEH processing and MD and RRD storage areas, the UXOQCS and UXOSO conduct a joint inspection of the storage areas and document the results of the inspection, identify any discrepancies, and note their disposition in the project Daily Quality Control Report (DQCR).

5.7.2 Routine Weekly Inspection

The UXOQCS inspects the MPPEH processing and MD/RRD storage area containers every week after they arrive and are collected at the site, using the MPPEH Processing and Munitions Debris and Range Debris Storage Area Inspection Checklist (Attachment 2) for conducting and documenting weekly storage area inspections.

The weekly inspection is necessary to determine if unauthorized entry into the containers has been attempted, or if unauthorized removal of the contents has occurred.

– N O T E –

It is paramount that these inspections enforce all safeguarding and security control measures required for preventing potential co-mingling of processed material and ensuring the integrity of this process is properly maintained.

The UXOQCS weekly inspection addresses the following questions:

1. Are exclusion zones properly maintained?
2. Are adequate hazard warning signs and boundary markers in place?
3. Are storage containers and drum pallet in fair condition?
4. Are containers properly labeled and labels intact?
5. Are containers sealed and locked?
6. Are uninspected items segregated from inspected items?
7. Are demilitarized items secured?
8. Are any materials missing, or is there evidence of tampering or unauthorized entry?

The UXOQCS signs the inspection checklist upon completion of this inspection; the SUXOS reviews and signs the inspection checklist. The checklist is maintained with the project site office files and is annotated in the weekly production report and the DQCR.

The SUXOS periodically spot-checks the MPPEH processing and MD/RRD storage area containers to ensure that security, integrity, and good housekeeping of the storage area is maintained.

6.0 QUALITY CONTROL

- The HGL Corporate QA Manager and MMRP Operations Manager ensure that this SOP is reviewed annually for completeness, accuracy, and safety.

- The HGL UXO Safety Manager maintains, manages, and annually reviews this SOP for procedural, QC, and safety issues. All questions, comments, or recommendations regarding this SOP should be directed to the UXO Safety Manager.
- PMs and supervisors ensure that all site personnel read, understand, and follow this SOP.
- Refer any discrepancies found with procedural steps or safety issues pertaining to this SOP to the responsible supervisor for corrective action.

All personnel involved in the MPPEH inspection process and management must carefully follow all safeguards and security control measures to prevent co-mingling of processed material. If suspicion arises that co-mingling has occurred, notify the SUXOS and the UXOQCS immediately. Reinspect and process the suspect material in accordance with this SOP.

Train all UXO-qualified personnel in the recognition and safe handling of used and unused military munitions and specific types of MPPEH in accordance with DoDI 4140.62, Material Potentially Presenting an Explosive Hazard; qualify all UXO-qualified personnel in accordance with DDESB Technical Paper 18.

7.0 RECORDS

All project personnel are responsible for documenting in detail all reports, logs, and certification and inspection forms based on their assigned level of technical responsibility. Use the forms listed below and found in the attachments to this SOP in the order shown for documenting the MPPEH inspection, certification, storage, and transfer and release of material process.

Before the transfer within DoD or release from DoD, document all verified and certified materials as follows:

1. The SUXOS prepares two original copies of the following:
   - DD Form 1348-1A, Issue Release/Receipt Document; refer to the two examples provided as Attachment 3.
   - CoC form.
   - Obtain signatures from the SUXOS, OESS (or UXOQCS), and MDAS recycler in all appropriate blocks on all documents as shown in Attachments 3, 4, and 5.
2. Distribute copies of the DD Form 1348-1A, Issue Release/Receipt Document, and CoC form as follows:
   - Copy 1:
     - Issued to the receiver (for example, transporter, demilitarization facility, or recycler).
   - Copy 2:

- o Mail the original to the HGL Huntsville office repository, to the attention of the UXO Safety Manager, for retention.
- o Scan Copy 2 as a PDF file and submit it electronically to the subcontracted recycler manager and the HGL UXO Safety Manager.

3. The PM and SUXOS coordinate the following:
   - Notifying the receiver agent/qualified recycler in advance of any pickups and shipments to its facility,
   - Forwarding advanced electronic copies of all completed CoC and DD Form 1348-1A documents to the receiving agent/recycler,
   - Following up with the receiving agent/recycler to obtain final (signed) destruction certification documents, and
   - Ensuring that either hard or electronic copies of the final demilitarization certification documents are forwarded to the HGL Huntsville office, to the attention of the UXO Safety Manager.

– N O T E –

It is the responsibility of the project manager to coordinate with the UXO Safety Manager to ensure final closeout of all material demilitarization/destruction certification records.

8.0 REFERENCES

U.S. Army Corps of Engineers (USACE), 2008. Engineer Manual 385-1-97 Explosives Safety and Health Requirements, September.

U.S. Code of Federal Regulations (CFR), Title 27, Part 55, Commerce in Explosives.

CFR, Title 29, Part 1910, Occupational Safety and Health Standards.

CFR, Title 29, Part 1926, Occupational Safety and Health Standards.

CFR, Title 40, Parts 260-299, Protection of the Environment.

CFR, Title 49, Parts 100-199, Transportation.

U.S. Department of Defense (DoD) 4145.26-M, 2008. Contractor's Safety Requirements for Ammunition and Explosives, March.

DoD Explosives Safety Board Technical Paper 18, 2004. Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel, December.

DoD Manual 6055.09-M, Volume 7, 2010. DoD Ammunition and Explosives Safety Standards: Criteria for Unexploded Ordnance, Munitions Response, Waste Military Munitions, and Material Potentially Presenting an Explosive Hazard, August.

DoD Manual 4160.28-M-1, 2011 Defense Demilitarization Manual, June.

DoD Instruction (DoDI) 4140.62, 2008. Material Potentially Presenting an Explosive Hazard, November.

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ATTACHMENTS

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ATTACHMENT 1

STANDARD OPERATING PROCEDURE ACKNOWLEDGMENT

SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the activities described in this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure that all persons assigned to this process are qualified, have read and understand the requirements of this SOP, and have signed the worker's statement for this purpose. I will ensure that the SOP contains current procedures. If a change to the SOP is necessary, I will ensure that the process is stopped until the SOP is revised and approved. Changes will require the submission of a Field Change Request (FCR) or Design Change Notice (DCN) by the HGL project team and receipt of RPM approval before implementation. If unexpected safety, health, or environmental hazards are found, I will make sure the process is stopped until the hazards have been eliminated.

______________________________ __________________________

Senior UXO Supervisor Date

WORKER'S STATEMENT

I have read this SOP and I have received adequate training to perform the procedures addressed in the SOP. If I identify a hazard not addressed in the SOP, or encounter an operation I cannot perform in accordance with the SOP, I will stop the process and notify my immediate supervisor.

Printed Name	**Company**	**Signature**	**Date**

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ATTACHMENT 2

Material Potentially Presenting an Explosive Hazard, Munitions and Range Debris Processing and Storage Area Inspection Checklist

Site (name, city and state):		
Inspection conducted by:	**Signature:**	**Date:**
Reviewed by Senior UXO Supervisor:	**Signature:**	**Date:**

I. INSPECTION ITEM

A. MPPEH and MD Storage Areas	YES	NO	Explain Discrepancies
1. Are exclusion zones maintained during processing?	☐	☐	
2. Are adequate warning signs and boundary markers in place?	☐	☐	
3. Are containers/drums in fair condition?	☐	☐	
4. Are drum pallets in fair condition?	☐	☐	
5. Are containers properly labeled and labels intact?	☐	☐	
6. Are un-inspected items segregated from inspected items to prevent comingling?	☐	☐	
7. Are containers sealed or locked?	☐	☐	
8. Are MDEH items properly segregated and secure?	☐	☐	
9. Are demilitarization items secure?	☐	☐	
10. Is the plastic tarpaulin intact?	☐	☐	
B. RD Storage Area	**YES**	**NO**	**Explain Discrepancies**
1. Are there any pieces or parts of targets missing?	☐	☐	
2. Is there evidence of any disturbance to the pile?	☐	☐	

HGL MR Form 15.28 (Dec 2010)

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ATTACHMENT 3

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

PREVIOUS EDITION MAY BE USED

1 2 3	4 5 6	7	23 24	25 26 27 28 29	45–50	51	52	53–54	55–56	57–59	60–61	62–64	65–66	67–69	70	71	72–73	74–80
DOC IDENT	RI FROM	M & S	UNIT / UI	QUANTITY	SER / SUPPLEMENTARY ADDRESS	SIG	FUND	DISTRIBUTION	PROJECT	PRI	REQD DEL DATE	ADV	RI	O/P	COND	MGT	UNIT PRICE (DOLLARS / CTS)	

1. TOTAL PRICE — DOLLARS / CTS

2. SHIP FROM

3. SHIP TO

4. MARK FOR

5. DOC DATE | 6. NMFC | 7. FRT RATE | 8. TYPE CARGO | 9. PS

10. QTY. REC'D | 11. UP | 12. UNIT WEIGHT | 13. UNIT CUBE | 14. UFC | 15. SL

16. FREIGHT CLASSIFICATION NOMENCLATURE

17. ITEM NOMENCLATURE

Munitions Debris - Steel, Brass and Copper,

18. TY CONT | 19. NO CONT | 20. TOTAL WEIGHT | 21. TOTAL CUBE

22. RECEIVED BY | 23. DATE RECEIVED

Sign and date here

24. DOCUMENT NUMBER & SUFFIX (30-44)

25. NATIONAL STOCK NO. & ADD (8-22)

26. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) UP (74-80)

27. ADDITIONAL DATA

NOTICE: This form will used when Munitions Debris (MD) and range debris (RD) are processed together.

"This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, are free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials."

DoD Contractor Title: Senior UXO Supervisor (SUXOS)

Print Name ______________________________

Sign here

Signature: ______________________________

Company: HydroGeoLogic, Inc., Munitions Response Team

Address: 8202 Louisiana Blvd NE, Albuquerque, NM 87113

Telephone #:(505) 341-2010

Container No. HGL-00______________________

Seal No: ______________________

DoD Agency Representative or USACE Ordnance and Explosive Safety Specialist

Print Name: ______________________________

Origin of the Material: (Site Name/City/State:

____

____

Sign here

Signature: ______________________________

Address: ______________________________

Telephone: ______________________________

PerFORM (DLA)

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

PREVIOUS EDITION MAY BE USED

1 2 3 4 5 6 7 23 24 25 26 27 28 29 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

DOC IDENT | RI FROM | M&S | UNIT | UI SS | QUANTITY | SER | SUPPLEMENTARY ADDRESS | SIG | FUND | DISTRIBUTION | PROJECT | PRI | REQD DEL | DATE | ADV | RI | O/P | COND | MGT

UNIT PRICE: DOLLARS | CTS

1. TOTAL PRICE: DOLLARS | CTS

2. SHIP FROM

3. SHIP TO

4. MARK FOR

5. DOC DATE | 6. NMFC | 7. FRT RATE | 8. TYPE CARGO | 9. PS

10. QTY. REC'D | 11.UP | 12. UNIT WEIGHT | 13. UNIT CUBE | 14. UFC | 15. SL

16. FREIGHT CLASSIFICATION NOMENCLATURE

17. ITEM NOMENCLATURE

Munitions Debris - Steel, Brass and Copper,

18. TY CONT | 19. NO CONT | 20. TOTAL WEIGHT | 21. TOTAL CUBE

22. RECEIVED BY | 23. DATE RECEIVED

Sign and date here

24. DOCUMENT NUMBER & SUFFIX (30-44)

25. NATIONAL STOCK NO. & ADD (8-22)

26. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) UP (74-80)

27. ADDITIONAL DATA

NOTICE: This form will be used for the release of munition debris (MD) ONLY.

"This material does not present an explosive hazard and is consequently safe for release. This certifies and verifies that the material listed has been 100 percent inspected and to the best of my knowledge and belief is inert and/or free of explosives related materials."

DoD Contractor Position Title: Senior UXO Supervisor

Print Name: ______________________________

Sign here

Signature: ______________________________
Company: HydroGeoLogic, Inc., Munitions Response Team
Address: 8202 Louisiana Blvd NE, Albuquerque, NM 87113

Telephone #: (505) 341-2010

DoD Contractor Position Title: UXO Safety Officer

Print Name: ______________________________

Sign here

Signature: ______________________________
Company: HydroGeoLogic, Inc., Munitions Response Team
Address: 8202 Louisiana Blvd NE, Albuquerque, NM 87113

Telephone #: (505) 341-2010

Container No. HGL-00______________________

Seal No: ______________________

Origin of the Material: (Site Name/City/State:

____

____

PerFORM (DLA)

ATTACHMENT 4

SAMPLE

CERTIFICATE OF DESTRUCTION

To: Mr./Mrs. ____________________,
Project Manager,
HydroGeoLogic, Inc.
(Applicable HGL office address)

From: Mr./Mrs. Debris,
President/Owner
American EOD Services, Inc.
1206 East Park Avenue
Anaconda, MT 59711-0878

Re: Demilitarization and Recycling of Material Documented as Safe (MDAS) for the Remedial Investigation at Munitions Response Site ANAD-001-R-01, Recoiless Rifle Range, Anniston Army Depot, AL, U.S. Army Corp of Engineer Contract Number W912DY-10-D-0023, Delivery Order Number 002

Upon receiving the unopened labeled containers each with its unique identified and unbroken seal ensuring a continued chained of custody, and after reviewing and concurring with all the provided supporting documentation, sign for having received and agreeing with the provided documentation that the sealed containers contained no explosive hazards when received. The contents of these sealed containers will not be sold, traded or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content.

I hereby certify that the material received/shipped from Anniston Army Depot, AL was demilitarized by means of shredding and smelting by the Bonetti Explosives, LLC, Columbus, TX and were only identifiable by their basic contents; furthermore, recycling was accomplished by smelting. The material was recycled by smelting into new steel products by at Lone Star Foundries, Inc., Austin, TX an are only identifiable by their basic content.

This certifcation is made in accordance with and subject to penalties of law under the United States Code, Title 18, Section 1001, Crimes and Criminal Procedures.

SIGN HERE

SIGNATURE: ________________________________

NAME: ________________________

DATE: ________________________

TITLE: President/Owner

AGENCY: American EOD Services, Inc.

SAMPLE

BLANKET END USE CERTIFICATION

ANNISTON ARMY DEPOT, AL
REMEDIAL INVESTIGATION AT MUNITIONS RESPONSE SITE ANAD-001-R-01,
RECOILESS RIFLE RANGE,
U.S. ARMY CORP OF ENGINEER CONTRACT NUMBER W912DY-10-D-0023,
DELIVERY ORDER NUMBER 002

It is hereby certify that Bonetti Explosives, LLC, Columbus, TX will comply with all applicable federal, state and local ordinances, and regulations with respect to the care, handling, storage, shipment, resale, export, and other use of the material hereby purchased or received, and that he/she as a user in said materials is capable of complying with all appplicable federal, state and local laws. It is further certified that the material will be recycled into new steel and products by means of smelting within the continental United States of America and that the material will only be identifiable by its basic content. This certification is made in accordance with and subject to the penalties of the United States Code, Title 18, Section 1001, Crimes and Criminal Procedures.

SIGN HERE

SIGNATURE: ______________________________

NAME: ______________________________

DATE: ____________________

TITLE: ____________________

AGENCY: American EOD Services, Inc.

ATTACHMENT 5

Section I – Generator Release (continued on page 3)

Certification Chain of Custody (CoC) for Non-Hazardous Munitions and Range-related Debris (Inert, Demilitarization/Destruction)	**1a.** Project location and contract number:
1b. Generator name and mailing address: **HydroGeoLogic, Inc. Munitions Response Team** **5030 Bradford Drive, Bld 1 Suite 230, Huntsville, AL 35805**	Telephone number: **(256) 970-2103 or (256) 970-2106**
1c. Project site name and location:	Telephone number:

1d. Container Number:	**1e.** Unique Seal Identification Number:	**1f.** Gross weight (lbs):	**1g.** Net weight (lbs):	**1h.** Tare weight (lbs):

1i. Material description:	**1j.** Material type:	**1k.** Units (weight/volume):

1l. Inert certification:

"I certify and verify that the ammunition, explosives and other dangerous article (AEDA) residue, range residue and/or explosive contaminated property listed have been 100 percent inspected and to the best of my knowledge and belief is free of AEDA and other dangerous articles."

1m. Generator Inspector/Certifier—Unexploded Ordnance Quality Control Specialist:

Print or type name:	Signature:	Month/Day/Year:

1n. Generator Inspector/Certifier—Site Senior Unexploded Ordnance Supervisor:

Print or type name:	Signature:	Month/Day/Year:

1o. Generator Release—I am the Project Site Manager and acknowledge release of this material:

Print or type name:	Signature:	Month/Day/Year:

Section II –Transporter

2a. Transporter company name and mailing address:	Telephone Number:	Dispatcher Name:

2b. Transporter Receipt—I acknowledge receipt of this material and have verified that each container is sealed and intact:

Print or type name:	Signature:	Month/Day/Year:

2c. Transporter Release— I acknowledge release of this material:

Print or type name:	Signature:	Month/Day/Year:

HGL MR Form 15.07 (Revised Jun 2012)

Page 1 of 3

Section III – Qualified Receiver

3b. Qualified Receiver Storage Manager Receipt Acknowledgement:

I acknowledge receipt of the unopened labeled container(s) listed herein each with its unique identified and unbroken seal ensuring a continued chained of custody, and after reviewing and agreeing with all the provided supporting documentation, I sign for having received the provided documentation that the sealed containers contained no explosive hazards when received.

Print or type name:	Signature:	Month/Day/Year:

3c. Demilitarization/Destruction Processor Acknowledgement:

I acknowledge receipt of this material and certify and verify that each item or items listed herein were demilitarized and/or destroyed so as to no longer resemble AEDA beyond the requirement listed in DoD 4160.21-M-1 and is only identifiable by its basic content.

Print or type name:	Signature:	Month/Day/Year:

3e. Qualified Receiver Manager Demilitarization/Destruction Certification:

I acknowledge this material has undergone demilitarization/destruction in accordance with DoD 4160.21-M-1and Engineer Manual 1110-1-4009 and that the contents of these sealed containers will not be sold, traded or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content.

Print or type name:	Signature	Month/Day/Year:

4a. Special Instructions:

1. The SUXOS will produce the required number of the original CoC certification copies for distribution in accordance with HGL MMRP SOP 15.03.
2. The *Transporter* will be provided *1 original CoC certification copy* and complete Section II, blocks 2a. through 2.c.with signature.
3. The *Transporter* will turn over *this CoC certification copy* to the Qualified Recycler Manager upon delivery.
4. The *Qualified Recycler Manager* upon receipt of the material will verify and certify the CoC certification document information is complete and accurate by completing Section III. 3a.through 3e. with signatures.
5. The *Qualified Recycler Manager* after completing the demilitarization/destruction of the material listed on this CoC certification document will provide the Generator with a signed company letterhead stating:

   "Upon receiving the unopened labeled containers each with its unique identified and unbroken seal ensuring a continued chained of custody, and after reviewing and concurring with all the provided supporting documentation, sign for having received and agreeing with the provided documentation that the sealed containers contained no explosive hazards when received. The contents of these sealed containers will not be sold, traded or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content".
6. The *Qualified Recycler Manager* will complete the attached DD FORM 1348–Issue Release/Transfer Document, blocks 22 and 23 and return this form along with this CoC certification document and Certificate of Destruction letter to the Generator address shown in block 1b.

4b. Discrepancies.

HGL MR Form 15.07 (Revised Jun 2012)

Page 2 of 3

ATTACHMENT 5 (continued)

Section I – Generator Release (Continued)

1.d. Container Numbers:		**1.e.** Unique Seal Identification No:	**1.f.** Gross weight (lbs):	**1.g.** Net weight (lbs):	**1.h.** Tare weight (lbs):
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
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24.					
25.					
26.					
27.					

HGL MR Form 15.07 (Revised Jun 2012)

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HydroGeoLogic, Inc MUNITIONS RESPONSE TEAM	STANDARD OPERATING PROCEDURE	
	Approved by:	Corporate QA Manager Technical Lead

Analog MEC Clearance Operations	**SOP No.: 505.01.1**
	SOP Category: MMRP
	Revision No.: 3
	Revision Date: May 2016
	Review Date:

Approved By:

______________________________ ____________

Jan Kool, Ph.D. Date
Corporate QA Manager

______________________________ ____________

Neil Feist Date
MMRP Operations Manager

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TABLE OF CONTENTS (continued)

Analog MEC Clearance Operations	SOP No.: 505.01.1
	SOP Category: MMRP
	Revision No.: 3
	Revision Date: May 2016
	Review Date:

1.0 PURPOSE

This standard operating procedure (SOP) establishes standard safe practices for analog detection and anomaly removal during munitions response (MR) projects conducted by HydroGeoLogic, Inc. (HGL) personnel. These procedures are typically referred to as "mag-and-dig" or "mag-and-flag" operations.

2.0 SCOPE AND APPLICATION

This SOP applies to all HGL employees involved in analog operations while conducting munitions and explosives of concern (MEC) surface and subsurface anomaly detection, investigation and removal. All HGL employees tasked with performing these procedures will be qualified in accordance with the U.S. Department of Defense Safety Board (DDESB) Technical Paper 18.

3.0 GENERAL REQUIREMENTS

- Perform all work in a manner consistent with Occupational Safety and Health Administration established standards and requirements.
- Conduct all activities in conformance with the project-specific Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP).
- Justify any deviations from specified requirements to the project manager and the Military Munitions Response Program Manager for approval and inclusion in the approved project plans. Do not compromise applicable laws and regulations when implementing deviations. Thoroughly describe both deviations from requirements and the newly modified process in the justification documentation.

4.0 DEFINITIONS AND ABBREVIATIONS/ACRONYMS

4.1 DEFINITIONS

Essential Personnel: U.S. Department of Defense and contractor personnel necessary for the safe and efficient completion of field operations conducted in an exclusion zone (EZ). Multi-discipline and multiple MEC teams project teams performing tasks required to execute the project may be in the EZ while MEC procedures are being performed as long as team separation distances (TSDs) are maintained.

Exclusion Zone (EZ): A safety zone established around MEC operations work area. Only essential personnel and authorized/escorted visitors are allowed within the EZ.

- Examples of EZs include safety zones around MEC intrusive activities and safety zones where MEC is intentionally detonated.
- For chemical warfare material projects sites, the EZ is the area within the No Significant Effects (NOSE) zone.

MEC Operations: Defined as MEC identification; access procedures such as excavation, either by hand or using heavy equipment; handling of UXO, explosives or explosive items; or disposal, including movement, transportation, and final disposal of MEC.

Minimum Separation Distance (MSD): The distance at which personnel in the open must be from an intentional or unintentional detonation.

Munitions and Explosives of Concern (MEC): Specific categories of military munitions that may pose unique explosive risks, including:

- UXO, as defined in 10 U.S.C. §101(e)(5);
- Discarded military munitions (DMM), as defined in 10 U.S.C. §2710(e)(2); or
- Munitions constituents (for example, TNT, RDX), as defined in 10 U.S.C. §2710(e)(3), present in high enough concentrations to pose an explosive hazard.

Team Separation Distance (TSD): The distance that teams of essential personnel must be separated by during the conduct of MEC activities on an MMRP site. Normally this the K40 distance of the net explosive weight of the munition with the greatest fragmentation distance (MGFD) for the site.

Unexploded Ordnance (UXO): As defined by 10 U.S.C. §101(e)(5)(A) through (C), UXO includes military munitions that:

- Have been primed, fuzed, armed, or otherwise prepared for action;
- Have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and
- Remain unexploded whether by malfunction, design, or any other cause.

4.2 ABBREVIATIONS/ACRONYMS

APP	Accident Prevention Plan
DDESB	U.S. Department of Defense Explosives Safety Board
DMM	discarded military munitions

EMM	Earthmoving equipment
EZ	exclusion zone
GPS	Global Positioning System
HGL	HydroGeoLogic, Inc.
MEC	munitions and explosives of concern
MGFD	munition with the greatest fragmentation distance
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MR	munitions response
MSD	minimum separation distance
NOSE	No Significant Effects
PPE	personal protective equipment
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
TNT	2,4,6-Trinitrotoluene
TSD	team separation distance
USACE	U.S. Army Corps of Engineers
USC	United States Code
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	UXO Safety Officer

5.0 PROCEDURE FOR ANALOG DETECTION AND MEC CLEARANCE

5.1 ANALOG DETECTION AND MEC CLEARANCE REQUIREMENTS

On sites where mag-and-dig or mag-and-flag operations are in progress, all non-UXO-qualified personnel will be under the direct supervision of UXO-qualified personnel. Only essential personnel are allowed in the EZ during intrusive MEC operations. If non-essential personnel require access, stop all intrusive operations while they are in the EZ.

During analog MEC clearance operations, HGL personnel must adhere to the APP/SSHP and the following general safety practices:

- Conduct operations only during daylight hours.
- Allow only qualified UXO Technicians to handle MEC.
- Do not conduct MEC operations until all applicable plans for the site in question are prepared and approved.
- Conduct operations on the concept of limiting exposure to the minimum number of personnel, for the minimum amount of time, to the minimum amount of MEC consistent with safe and efficient operations.
- Prior to any action taken on a MEC item, definitively identify all fuzing, including fuze type by function and the physical state/condition (armed or unarmed) of the fuze, i.e., burned, broken, parts exposed/ sheared, etc.
- All personnel must attend the Daily Safety Briefing before entering the operating area.
- Anyone can stop operations if they observe an unsafe act or situation.
- Immediately report safety violations and/or unsafe acts/practices to the UXOSO.

5.2 ANALOG CAPABILITIES

Analog operations are particularly effective in areas where vegetation and terrain limit the use of digital systems, or when it is ineffective or cost prohibitive to use digital equipment because the MEC items and other metallic fragments and debris at the site are too similar to be distinguished.

5.2.1 Analog Advantages

Advantages of analog geophysical surveys include the following:

- Geophysical operators can use real-time field observations.
- Surveys provide a precise anomaly location.
- Anomalies can be excavated immediately following the survey.
- Surveys can be conducted with fewer vegetation and topographic constraints.

5.2.2 Analog Disadvantages

Limitations for analog surveys include the following:

- Detection is generally not as deep as digital instruments.
- Survey quality depends on operator training and demonstrated performance and is also affected by human factors, such as attentiveness/distraction and hearing ability.
- It is more challenging to develop rigorous QC measures capable of assessing the consistency of each operator's effectiveness and performance for the duration of the survey and the measures are less precise than for digital geophysical methods.
- A higher percentage of smaller (below failure criteria) are typically detected during analog surveys. This results in a higher number of intrusive investigations versus digital geophysical surveys.
- Electronic data cannot be further evaluated.
- Resulting electronic records are not permanent.
- Geophysical instruments have depth of detection capabilities related to the size of the coils and transmitter power. Handheld analog instruments typically have smaller coils and less transmitter power than their digital counterparts and, therefore, typically have more shallow maximum depths of detection than their digital counterparts.

5.3 ANALOG MEC CLEARANCE PROCEDURES

5.3.1 Establish Site Layout and Investigation Boundaries

Establish site layout and clearance boundaries in accordance with project requirements (for example, Global Positioning System [GPS], licensed surveyor, or compass and measuring tape). An UXO Technician II or higher:

- Escorts survey crews in the field, if applicable.
- Checks the intended boundary point locations with a geophysical instrument before driving stakes into the ground to prevent driving stakes into buried MEC hazards.

5.3.2 Analog Clearance Procedures

Teams will implement the MEC clearance by establishing lanes and sweeping the lanes using analog geophysical instruments. Teams will establish lanes by laying lines (ropes) or other suitable means such as marking lanes with pin flags. Unless otherwise noted, lanes will be established at a maximum of 5-foot intervals to ensure 100 percent coverage of the clearance footprint. The SUXOS typically determines which techniques will be used to mark and sweep boundaries based on site conditions.

During analog MEC clearance activities, the UXO technicians will:

- Operate the geophysical instrument at a pace that ensures the entire lane is searched and that the instrument is able to appropriately respond to subsurface anomalies.
- Use geophysical instruments to locate and pinpoint the anomaly.
- Carefully remove the earth overburden to expose the source of the subsurface metallic anomaly and positively identify the source of the anomaly.
- Ensure anomalies are resolved in accordance with the project planning documents.

The UXO Team Leader will periodically perform QC checks behind the UXO team to ensure that the MEC clearance objectives detailed in the project planning documents are achieved.

5.4 MEC AND MPPEH PROCEDURES

Upon encountering a MEC item, a minimum of one UXO Technician II and one UXO Technician III will identify and mark the item for future disposition in accordance with the approved project planning documents. Only the SUXOS and UXOSO, jointly, will determine if a MEC item is acceptable to move.

5.4.1 MEC Disposal

Conduct all MEC disposal procedures in accordance with the project specific planning documents and HGL SOP 502.01.1 *Explosive Demolition Operations*.

5.4.2 MPPEH Processing

Process all MPPEH in accordance with the project specific planning documents and HGL SOP 504.01.01 *MPPEH Inspection, Management and Processing*.

6.0 EQUIPMENT PROCEDURES

Upon arrival at the site, verify the condition and functionality of the equipment as follows:

- Inspect all instruments and equipment that require maintenance and/or calibration upon arrival, regardless of source, and periodically as required in the manufacturers' equipment manual.
- Check instrument and equipment functionality to ensure operational readiness.
- Tag equipment found to be damaged or defective as "unserviceable" and return it to the source for repair or replacement.
- Inspect equipment required for daily use in accordance with project plans.

- Remove or replace equipment from service if a functionality check indicates it is not operating correctly and it cannot be field repaired immediately.
  - Remove from service until it can be repaired, or
  - Replace with a like model or an approved substitute. Meet the same specifications for accuracy and precision in the replacement equipment as for the equipment removed from service.

6.1 EARTHMOVING EQUIPMENT PROCEDURES

6.1.1 For Removing Soil Overburden

Earthmoving equipment (EMM) may be used to excavate overburden from suspected MEC. Do not use EMM to excavate within 12 inches of a suspected MEC. Once the EMM is within 12 inches of the suspected MEC, complete the excavation by hand excavation methods. Personnel who are not UXO qualified may operate the EMM only when supervised by a UXO Technician III or higher.

- If more than one EMM is to be used onsite, the same minimum separation distances for multiple work teams applies.
- There is no need to harden/shield the EMM to protect its operator when EMM is used to remove soil overburden to within 12 inches from the anomaly.

6.1.2 For Intentional Excavation of MEC

If the intent of the mechanized MEC procedures are to intentionally dig up anomalies that could be MEC, without practicing anomaly avoidance techniques, the equipment must be hardened/armored appropriately. The operator must also be afforded protection for blast overpressure to the K24 factor, if hearing protection is used the K18 factor can be used.

If mechanized MEC procedures are being performed, the MSD for unintentional detonations for non-essential personnel will be the maximum fragmentation range-horizontal.

6.2 GEOPHYSICAL INVESTIGATION EQUIPMENT REQUIREMENTS

For analog MEC clearances, the following geophysical investigation equipment are typically used:

- Flux-gate magnetometers:
  - Schonstedt GA 52-CX
  - Schonstedt GA 72-CD

- Forester FEREX 4.032
- Ebinger MAGEX 120 LW
- Vallon EL 1302D1 or 1303D
- Chicago Steel Tape (magna-trak 102)

- Frequency-Domain Electromagnetic Induction Metal Detectors:
  - White's All Metals Detector
  - Fisher 1266X
  - Garrett
  - Geophex GEM3
  - Foerster Minex
  - Minelabs Explorer II

6.3 EQUIPMENT FUNCTION CHECKS

Check equipment function daily on all geophysical instruments by using the instrument in a designated test plot (function check area) to verify response to known target anomalies. Determine instrument settings based on the response results from the test plot. After completing the function check, record the geophysical instrument type, serial number and results on the Equipment/Instrument Calibration/Maintenance Log IAW project plans.

7.0 SAFETY

Before conducting intrusive MEC operations, the UXO Team Leader must conduct a daily tailgate safety meeting covering emergency procedures, operations, MEC, and all other hazards associated with the work site. Use the Tailgate Safety Meeting Log to record the meeting.

7.1 MEC SAFETY PROTOCOLS

Death or injury can occur from MEC and explosive related accidents. The age or condition of a MEC hazard does not necessarily decrease the effectiveness. MEC that exposed to the elements for an extended time can become more sensitive to shock, movement, and friction because the stabilizing agent in the explosives may be degraded The general MEC safety precautions and protocols are:

- Remain alert at all times for MEC and related scrap or MPPEH hazards.
- Observe the cardinal principle of limiting the exposure to a minimum number of personnel, for the minimum amount of time, to a minimum amount of hazardous material consistent with a safe and efficient operation during construction activities involving ordnance, explosives, ammunition, severe fire hazards, or toxic materials.

- Always assume MEC hazards contain a live charge until determined otherwise.
- Clearly mark the location of any ordnance item found so it can be easily located and avoided.
- Follow the procedures of the approved project planning documents.
- Upon locating any MEC hazards, immediately notify the UXO Technician to take appropriate measures.
- Consider MEC that has been exposed to fire as extremely hazardous. Chemical and physical changes to the contents may have occurred that render it more sensitive than its original state.DO NOT touch, move or jar any ordnance items regardless of the markings or apparent condition. Under no circumstances handle any MEC during avoidance activities or move in an attempt to make a positive identification.
- DO NOT touch, pickup up, kick, or move anything unfamiliar or unknown.
- DO NOT roll an unknown item over or scrape the item to identify markings.
- DO NOT approach or enter a munitions site if an electrical storm is occurring or approaching. If a storm approaches during site operations, leave the site immediately and seek shelter.
- DO NOT transmit by radio or cellular phone in the vicinity of suspect MEC hazards.
- DO NOT walk across an area where the ground surface cannot be seen and that has not been cleared of MEC hazards by the UXO Technician.
- DO NOT rely on color codes for positive identification of ordnance items or their contents.
- DO NOT drive vehicles into a suspected MEC area; use clearly marked lanes.
- DO NOT carry matches, cigarettes, lighters or other flame-producing devices into a MEC site.
- DO NOT be misled by markings on the MEC item stating “practice bomb,” “dummy,” or “inert.” Practice ordnance can have explosive charges used to mark and/or spot the point of impact; or the item could be marked incorrectly.

– W A R N I N G –

Removing or taking any munitions, explosive or unexploded ordnance or munitions related debris from the site by any employee is strictly prohibited.

7.2 OTHER HAZARDS

Hazards that may be present during the anomaly and MEC subsurface clearance operations may include sharp metal, industrial chemicals, and other hazards as described below:

- *Metal Debris*: Metal debris, to include munitions debris and cultural debris (nails, banding, barbed wire, etc.), are typically encountered during intrusive operations. Wear the appropriate personal protective equipment (PPE) to protect personnel from hazards caused by sharp objects.
- *Chemicals*: Locating industrial-type chemicals is a possibility during intrusive MEC activities. If sealed drums, contaminated soils, or other suspect conditions that indicate a potential health or safety hazard are encountered:
  - Stop work and follow proper notification procedures identified in project planning documents.
  - The SUXOS notifies the Project Manager using established notification procedures.
  - Do not continue work in the area where the hazard was discovered until the SUXOS and UXOSO evaluate the situation and confer with the Project Manager and HGL's Corporate Health and Safety Director, and all agree it is safe to proceed.

7.3 EXCLUSION ZONES AND MINIMUM SEPARATION DISTANCES

7.3.1 Exclusion Zones

During intrusive MEC operations, only essential project personnel may be within the EZ.

- The UXOSO and UXO Team Leaders monitor and keep the EZ intact until intrusive operations are complete.
- If a MEC larger than the identified MGFD is encountered, notify the appropriate authority and use an EZ appropriate for the found munition.

7.3.1.1 Essential Personnel and Authorized Visitors

Only project personnel necessary for the safe and efficient completion of the field operations are allowed in an EZ. Multi-discipline and multiple MEC teams project teams performing tasks required to execute the project may be in the EZ while MEC procedures are being performed as long as TSDs are maintained. Team locations must be closely coordinated with the SUXOS and UXOSO. Authorized visitors are allowed within the EZ under the restrictions and requirements of EM 385-1-97.

Personnel are not allowed to work in the EZ without the following:

- Briefing on the use of the buddy system
- PPE in accordance with the APP/SSHP
- Applicable training and certifications
- Understanding of the APP/SSHP
- Approval of SUXOS

7.3.2 Minimum Separation Distance

7.3.2.1 Unintentional Detonations

Evacuate all non-essential personnel from within the EZ/MSD during intrusive operations in areas with known or suspected MEC.

7.3.2.2 Intentional Detonations

Evacuate all personnel from within the MSD during intentional detonation of MEC items.

8.0 RESPONSIBILITIES

HGL employees performing the activities addressed by this SOP are responsible for meeting the requirements detailed herein. HGL employees conducting technical review of task performance are also responsible for following appropriate portions of this SOP.

8.1 PERSONNEL

8.1.1 Senior UXO Supervisor

The SUXOS is ultimately responsible for ensuring all MEC operations are performed in accordance with this SOP and the project planning documents.

8.1.2 UXO Safety Officer

Communicates directly with the Corporate Health and Safety Director on all matters concerning safety. Ensures all explosive safety procedures are performed in accordance with project planning documents.

8.1.3 UXO Quality Control Specialist

Communicates directly with the Corporate Quality Assurance Officer on all matters concerning quality control. Oversees quality control of all site explosive operations and procedures, ensuring compliance with project planning documents.

8.1.4 UXO Team Leader

The UXO Team Leader directs all intrusive MEC teams during field operations.

9.0 QUALITY CONTROL

Refer any discrepancies found with procedural steps or safety issues pertaining to this SOP to the responsible supervisor for corrective action.

- The HGL Senior UXO Operation Manager annually reviews this SOP for completeness, accuracy, and safety.
- The HGL UXO Safety Manager maintains, manages, and annually reviews this SOP for procedural, quality control and safety issues.
- The UXO Safety and Quality Manager receive all questions, comments, or recommendations regarding this SOP.
- Project Managers and supervisors ensure that all site personnel read, understand, and follow this SOP.

10.0 RECORDS

Project participants are responsible for providing objective documentation in sufficient detail showing that they have met the requirements of this SOP. Collect, retain, and maintain the documentation resulting from this SOP with the project record files IAW project planning documents.

11.0 REFERENCES

HydroGeoLogic, Inc. (HGL), Standard Operating Procedure (SOP) 502.01.1, Explosive Demolition Operations.

HGL, SOP, 504.01.1 Material Potentially Presenting an Explosive Hazard Inspection, Management and Processing.

U.S. Army Corps of Engineers (USACE), Engineer Manual (EM) 385-1-97.

USACE, EM 200-1-15.

U.S. Department of Defense Explosives Safety Board (DDESB) Technical Paper 18.

DoD Manual 6055-09-M.

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	STANDARD OPERATING PROCEDURE	
HGL HydroGeoLogic, Inc MUNITIONS RESPONSE TEAM	Approved by:	Corporate QA Manager Technical Lead
Digital MEC Clearance Operations	**SOP No.: 506.01.1**	
	SOP Category: MMRP	
	Revision No.: 2	
	Revision Date: June 2016	
	Review Date:	

Approved By:

____________________________________ ________________

Jan Kool, Ph.D. Date
Corporate QA Manager

____________________________________ ________________

Neil Feist Date
MMRP Operations Manager

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	Review Date:

1.0 PURPOSE

This standard operating procedure (SOP) establishes standard safe practices for performing digital munitions and explosives of concern (MEC) clearance operations during munitions response projects conducted by HydroGeoLogic, Inc. (HGL) unexploded ordnance (UXO)-qualified personnel.

2.0 SCOPE AND APPLICATIONS

This SOP applies to all HGL employees involved in anomaly and MEC subsurface clearance operations. All HGL employees tasked with performing MEC-related activities must qualify in accordance with the Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 18. Perform all work in a manner consistent with Occupational Safety and Health Administration established standards and requirements. Conduct all activities in conformance with the project-specific Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP).

Justify any deviations from specified requirements to the project manager and the Military Munitions Response Program Manager for approval and inclusion in the approved project plans. Do not compromise applicable laws and regulations when implementing deviations. Thoroughly describe both deviations from requirements and the newly modified process in the justification documentation.

3.0 DEFINITIONS AND ABBREVIATIONS/ACRONYMS

3.1 DEFINITIONS

Essential Personnel: U.S. Department of Defense and contractor personnel necessary for the safe and efficient completion of field operations conducted in an exclusion zone (EZ). Multi-discipline and multiple MEC teams project teams performing tasks required to execute the project may be in the EZ while MEC procedures are being performed as long as team separation distances (TSDs) are maintained. Examples of essential personnel include:

- Contractor work team members including the UXO Safety Officer (UXOSO), UXOQCS, SUXOS;
- U.S. Army Corps of Engineers (USACE) Ordnance and Explosives Safety Specialist; and
- Geophysical equipment operator.

Exclusion Zone (EZ): A safety zone established around MEC operations work area. Only essential personnel and authorized/escorted visitors are allowed within the EZ.

- Examples of EZs include safety zones around MEC intrusive activities and safety zones where MEC is intentionally detonated.
- For chemical warfare material projects sites, the EZ is the area within the No Significant Effects (NOSE) zone.

Munitions and Explosives of Concern (MEC): Specific categories of military munitions that may pose unique explosive risks, including:

- UXO, as defined in 10 U.S.C. §101(e)(5);
- Discarded military munitions (DMM), as defined in 10 U.S.C. §2710(e)(2); or
- Munitions constituents (for example, TNT, RDX), as defined in 10 U.S.C. §2710(e)(3), present in high enough concentrations to pose an explosive hazard.

MEC Operations: Defined as MEC identification; access procedures such as excavation, either by hand or using heavy equipment; handling of UXO, explosives or explosive items; or disposal, including movement, transportation, and final disposal of MEC.

Minimum Separation Distance (MSD): The distance at which personnel in the open must be from an intentional or unintentional detonation.

Team Separation Distance (TSD): The distance that essential personnel must be separated by during the conduct of MEC activities on an MMRP site. Normally this the K40 distance of the munition with the greatest fragmentation distance (MGFD) for the site.

Unexploded Ordnance (UXO): As defined by 10 U.S.C. §101(e)(5)(A) through (C), UXO includes military munitions that:

- Have been primed, fuzed, armed, or otherwise prepared for action;
- Have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and
- Remain unexploded whether by malfunction, design, or any other cause.
- A more detailed description of the term UXO is provided in Public Law (P.L.) 106-65, section 3031 (c)(5)(A)

3.2 ABBREVIATIONS/ACRONYMS

APP	Accident Prevention Plan
BIP	blow-in-place

CD	cultural debris
DDESB	U.S. Department of Defense Explosives Safety Board
DGM	digital geophysical mapping
DMM	discarded military munitions
EMM	Earth Moving Machinery
EZ	exclusion zone
GPO	Geophysical Prove-out
GPS	global positioning system
GSV	geophysical system verification
HGL	HydroGeoLogic, Inc.
IVS	Instrument Verification Strip
MD	munitions debris
MEC	munitions and explosives of concern
MGFD	munitions with the greatest fragmentation distance
MPPEH	material potentially presenting an explosive hazard
MSD	minimum separation distance
NEW	net explosive weight
NOSE	no significant effects
P.L.	Public Law
PPE	personal protective equipment
RCWM	recovered chemical warfare materiel
RRD	range-related debris
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
SUXOS	senior unexploded ordnance supervisor
TP	Technical Paper
TSD	team separation distance
USACE	U.S. Army Corps of Engineers

UXO	unexploded ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer

4.0 GENERAL REQUIREMENTS

On sites where digital MEC clearance operations are in progress, all non-UXO-qualified personnel will be under the direct supervision of UXO-qualified personnel. Only essential personnel are allowed in the EZ during intrusive MEC operations. If non-essential personnel require access, stop all intrusive operations while they are in the EZ.

During MEC clearance operations, HGL personnel must adhere to the APP/SSHP and the following general safety practices:

- Conduct operations only during daylight hours.
- Allow only qualified UXO Technicians to handle MEC.
- Do not conduct MEC operations until all applicable plans for the site in question are prepared and approved.
- Conduct operations on the concept of limiting exposure to the minimum number of personnel, for the minimum amount of time, to the minimum amount of MEC consistent with safe and efficient operations.
- Prior to any action taken on an ordnance item, definitively identify all fuzing, including fuze type by function and the physical state/condition (armed or unarmed) of the fuze, i.e., burned, broken, parts exposed/ sheared, etc.
- All personnel must attend the Daily Safety Briefing before entering the operating area.
- Anyone can stop operations if they observe an unsafe act or situation.
- Immediately report safety violations and/or unsafe acts/practices to the UXOSO.

4.1 DIGITAL MEC CLEARANCE REQUIREMENTS

4.2 DIGITAL CAPABILITIES

Digital geophysical tools are capable of recording and geo-referencing geophysical measurements. Most digital instruments have the capability to output a digital signal that can be co-registered with global positioning system (GPS) information to develop a two-dimensional map of the anomalies detected.

4.2.1 Digital Advantages

Digital instruments typically have higher sensitivity than analog instruments, are capable of noise reduction techniques, and advanced data analysis techniques. Advantages of digital geophysical surveys include the following:

- Uniform process for data collection and analysis.
- Geo-referenced location of data and anomalies.
- No operator subjectivity (to investigate an anomaly or not).
- Ability to further evaluate electronic data.
- A permanent electronic record.
- Ability to define rigorous QC measures capable of detecting all/most possible failure modes for the geophysical survey.

4.2.2 Digital Disadvantages

Challenges for performing digital geophysical mapping include the following:

- Decreased effectiveness in high clutter areas.
- Vegetation and topographic constraints.
- Quality dependent on operator training and demonstrated performance.
- Ability to define anomaly selection criteria that meet the project team's needs in terms of identifying all targeted anomalies while not selecting large numbers of non-targeted anomalies.

5.0 EQUIPMENT REQUIREMENTS

Upon arrival at the site, verify the condition and functionality of the equipment as follows:

- Inspect all instruments and equipment that require maintenance and/or calibration upon arrival, regardless of source, and periodically as required in the manufacturers' equipment manual.
- Check instrument and equipment functionality to ensure operational readiness.
- Tag equipment found to be damaged or defective as "unserviceable" and return it to the source for repair or replacement.
- Inspect equipment required for daily use in accordance with project plans.
- Remove or replace equipment from service if a functionality check indicates it is not operating correctly and it cannot be field repaired immediately.
    - Remove from service until it can be repaired, or

- Replace with a like model or an approved substitute. Meet the same specifications for accuracy and precision in the replacement equipment as for the equipment removed from service.

5.1 EARTHMOVING EQUIPMENT REQUIREMENTS AND PROCEDURES

5.1.1 For Removing Soil Overburden

Earth Moving Machinery (EMM) may be used to excavate overburden from suspected MEC. EMM will not be used to excavate within 12 inches of a suspected MEC. Once the EMM is within 12 inches of the suspected MEC, the excavation will be completed by hand excavation methods. Personnel who are not UXO qualified may operate the EMM only when supervised by a UXO Technician III or higher.

- If more than one EMM is to be used onsite, the same minimum separation distances for multiple work teams applies.
- There is no need to harden/shield the EMM to protect its operator when EMM is used to remove soil overburden to within 12 inches from the anomaly.

5.1.2 For Intentional Excavation of MEC

If the intent of the mechanized MEC procedure is to intentionally dig up anomalies that could be MEC without practicing anomaly avoidance techniques, the equipment must be hardened/armored appropriately. The operator must also be afforded protection for blast overpressure to the K24 factor, if hearing protection is used the K18 factor can be used.

If mechanized MEC procedures are being performed, the MSD for unintentional detonations for non-essential personnel will be the maximum fragmentation range-horizontal.

5.2 GEOPHYSICAL INVESTIGATION EQUIPMENT REQUIREMENTS

For digital MEC clearances, the following geophysical investigation equipment are typically used:

- Flux-gate magnetometers:
  - Schonstedt GA 52-CX
  - Schonstedt GA 72-CD
  - Forester FEREX 4.032
  - Ebinger MAGEX 120 LW
  - Vallon EL 1302D1 or 1303D
  - Chicago Steel Tape (magna-trak 102)

- Frequency-Domain Electromagnetic Induction Metal Detectors:
  - White's All Metals Detector
  - Fisher 1266X
  - Garrett
  - Geophex GEM3
  - Foerster Minex
  - Minelabs Explorer II
- Production - Time Domain Electromagnetic Induction Metal Detectors
  - Geonics EM61
  - Geonics EM61-MK2
  - Schiebel AN PSS-12
  - Vallon VMH3
- Advanced - Time Domain Electromagnetic Induction Metal Detectors
  - ALLTEM
  - BUD
  - Handheld BUD
  - MetalMapper
  - MPF EMI
  - TEMTADS
  - TEMTADS MP 2x2 Cart

5.3 EQUIPMENT FUNCTION CHECKS

5.3.1 Handheld Instrument Function Checks

Check equipment function daily on all handheld geophysical instruments by using the instrument in a designated test plot (function check area) to verify response to known target anomalies. Instrument settings will be determined based on the response results from the test plot. After completing the function check, record the geophysical instrument type, serial number and results on the Equipment/Instrument Calibration/Maintenance Log IAW project planning documents.

5.3.2 Digital Instrument Function Checks

The geophysical system verification (GSV) is the preferred method for verification of digital geophysical systems on munitions projects. The GSV process consists of an Instrument Verification Strip (IVS) and a blind seeding program within the production site. A Geophysical Prove-out (GPO) may be required if the selected DGM instrument sensor response can't be predicted or the geophysicist cannot determine how to select anomalies for a particular sensor. If the geophysicist selects such an instrument, then the instrument should be evaluated at a

GPO to estimate the detection depth capabilities of the instrument prior to beginning the MEC fieldwork.

The purpose of the IVS is to ensure the DGM instrument functionality prior to collecting data within a production area. The IVS also may be used to determine the background noise at the site to aid in anomaly selection. In addition, the IVS is used to quantify the expected errors in recorded response due to variations (instrument bounce, anomaly orientation, etc.).

Digital instruments should be functioned checked in accordance with project planning documents. After completing the function check, record the geophysical instrument type, serial number and results on the Equipment/Instrument Calibration/Maintenance Log.

6.0 PROCEDURES

6.1 DIGITAL MEC CLEARANCE PROCEDURES

The digital geophysical mapping (DGM), processing of geophysical data, anomaly selection, and generation of dig lists aspects of the digital survey process are not included in this SOP. This SOP covers the anomaly resolution aspects of digital geophysical surveys. There are three key aspects to anomaly resolution: anomaly reacquisition, anomaly excavation (including reporting dig results), and post-dig verification sampling.

6.1.1 Anomaly Reacquisition

Anomaly reacquisition is a critical element of DGM systems because this task must physically match anomalies on dig lists with their sources. In order to resolve all anomalies on the dig list and pass project specific QC standards, the UXO intrusive team must clear the entire footprint of the DGM anomaly. The UXO intrusive team typically performs the following reacquisition process:

- Using a method to navigate to the selected location. Typically accomplished with GPS or using measuring tapes.
- Reproducing a signal at that location with the geophysical instrument selected and referenced in the project planning documents.
- Placing a plastic pin flag and/or painting the ground surface near the reacquired source.

6.1.2 Anomaly Excavation

The disposition and final location details of each anomaly excavated are normally recorded on the final dig sheets. The reported dig results should be reviewed by the interpreting geophysicist, who must have authority to require additional reacquisition and/or excavation activities be performed for anomalies having characteristics that are not explained by the reported dig results. The UXO intrusive team typically conducts anomaly excavation as follows:

1. Excavate each anomaly from the side of anomaly location and carefully remove overburden to expose anomaly features for evaluation.
2. If suspect MEC is encountered, the UXO Technician II and UXO Technician III (team leader) will determine the items condition. If determined to be MEC, notify the SUXOS and follow the MEC disposition guidance in the project planning documents.
3. Record the anomaly characteristics required on the dig sheets. Typical information required on the dig sheets includes:
   - Team number
   - Date investigated
   - Reacquisition instrument reading, typically millivolts
   - Reacquisition offset distance and direction
   - Anomaly type (for example, UXO, munitions debris [MD], cultural debris [CD], Seed, Other)
   - Anomaly orientation, depth, length, and weight
   - Anomaly quantity
   - Anomaly description
   - Post-dig instrument reading, typically millivolts
4. Collect, process, and dispose of the anomaly item(s). Adhere to the following procedure for anomaly removal:
   - If a recovered anomaly is classified as MEC, the SUXOS and UXOSO determines whether the item is acceptable to move.
   - If the item ***can*** be safely moved, remove and relocate the item pending further disposition, depending on project planning document guidance.
     - Inspect under the removed item to ensure additional anomalies are removed from the anomaly footprint.
   - If the item ***cannot*** be safely moved, designate it blow-in-place (BIP) and execute the BIP procedure. Do not move MEC designated as BIP for any reason. If needed, use engineering controls to decrease the possibility of damage to personnel or property.

    - Upon disposition, inspect the anomaly location to ensure anomalies are removed from the anomaly footprint.
  - Collect anomalies classified as material potentially presenting an explosive hazard (MPPEH) for further inspection.
5. Dispose of all MEC and MPPEH in accordance with the approved procedures in the project planning documents.
6. Photographs of investigated anomalies may be required. Typically, at minimum, photographing MEC items is required.
7. After removing the anomaly (anomalies), the UXO team will ensure the entire anomaly footprint free of anomalies in accordance with project planning documents.
8. If required, the UXO intrusive team will collect post-dig instrument readings to ensure the selected anomaly has been resolved and the digital instrument reading is now below the project threshold.

6.1.3 Post-dig Anomaly Resolution

Post-dig anomaly resolution sampling is conducted after intrusive investigations to verify that the source of the anomaly has been removed during the intrusive investigation. The original geophysical instrument used to identify anomalies, or one that performs better than the original, should be used to verify that the anomalies have been resolved.

The project QC and quality assurance plans should detail the number of anomalies that required post-dig verification sampling. The UXOQCS will implement the post-dig anomaly resolution process in accordance with project planning documents.

6.2 MEC AND MPPEH PROCEDURES

Upon encountering a MEC item, a minimum of one UXO Technician II and one UXO Technician III will identify and mark the item for future disposition in accordance with the approved project planning documents. Only the SUXOS and UXOSO, jointly, will determine if a MEC item is acceptable to move.

6.2.1 MEC Disposal

Conduct all MEC disposal procedures in accordance with the project specific planning documents and HGL SOP 15.01 Explosive Demolition Operations.

6.2.2 MPPEH Processing

Process all MPPEH in accordance with the project specific planning documents and HGL SOP 15.03 MPPEH Inspection, Management and Processing.

7.0 RESPONSIBILITIES

HGL employees performing MEC subsurface clearance operations are responsible for meeting the requirements detailed in this SOP. HGL employees conducting technical review of task performance are responsible for following appropriate portions of this SOP.

7.1 PERSONNEL REQUIREMENTS

7.1.1 Senior UXO Supervisor

The SUXOS is ultimately responsible for ensuring all MEC operations are performed in accordance with this SOP and the project planning documents.

7.1.2 UXO Safety Officer

Communicates directly with the Corporate Health and Safety Director on all matters concerning safety. Ensures all explosive safety procedures are performed in accordance with project planning documents.

7.1.3 UXO Quality Control Specialist

Communicates directly with the Corporate Quality Assurance / Quality Control (QC) Officer on all matters concerning QC. Oversees QC of all site explosive operations and procedures, ensuring compliance with project planning documents.

7.1.4 UXO Team Leader

The UXO Team Leader directs all intrusive MEC teams during field operations.

8.0 SAFETY

Before conducting intrusive MEC operations, the UXO Team Leader must conduct a daily tailgate safety meeting covering emergency procedures, operations, MEC, and all other hazards associated with the work site. Use the Tailgate Safety Meeting Log to record the meeting.

8.1 MEC SAFETY PROTOCOLS

Death or injury can occur from MEC and explosive related accidents. The age or condition of a MEC hazard does not necessarily decrease the effectiveness. MEC that exposed to the elements for an extended time can become more sensitive to shock, movement, and friction because the stabilizing agent in the explosives may be degraded. The general MEC safety precautions and protocols are:

- Remain alert at all times for MEC and related scrap or MPPEH hazards.
- Observe the cardinal principle of limiting the exposure to a minimum number of personnel, for the minimum amount of time, to a minimum amount of hazardous material consistent with a safe and efficient operation during construction activities involving ordnance, explosives, ammunition, severe fire hazards, or toxic materials.
- Always assume MEC hazards contain a live charge until determined otherwise.
- Clearly mark the location of any ordnance item found so it can be easily located and avoided.
- Follow the procedures of the approved project planning documents.
- Upon locating any MEC hazards, immediately notify the UXO Technician to take appropriate measures.
- Consider MEC that has been exposed to fire as extremely hazardous. Chemical and physical changes to the contents may have occurred that render it more sensitive than its original state. DO NOT touch, move or jar any ordnance items regardless of the markings or apparent condition. Under no circumstances handle any MEC during avoidance activities or move in an attempt to make a positive identification.
- DO NOT touch, pickup up, kick, or move anything unfamiliar or unknown.
- DO NOT roll an unknown item over or scrape the item to identify markings.
- DO NOT approach or enter a munitions site if an electrical storm is occurring or approaching. If a storm approaches during site operations, leave the site immediately and seek shelter.
- DO NOT transmit by radio or cellular phone in the vicinity of suspect MEC hazards.
- DO NOT walk across an area where the ground surface cannot be seen and that has not been cleared of MEC hazards by the UXO Technician.
- DO NOT rely on color codes for positive identification of ordnance items or their contents.

- DO NOT drive vehicles into a suspected MEC area; use clearly marked lanes.
- DO NOT carry matches, cigarettes, lighters or other flame-producing devices into a MEC site.
- DO NOT be misled by markings on the MEC item stating "practice bomb," "dummy," or "inert." Practice ordnance can have explosive charges used to mark and/or spot the point of impact; or the item could be marked incorrectly.

– W A R N I N G –

Removing or taking any munitions, explosive or unexploded ordnance or munitions related debris from the site by any employee is strictly prohibited.

8.2 OTHER HAZARDS

Hazards that may be present during the anomaly and MEC subsurface clearance operations may include sharp metal, industrial chemicals, and other hazards as described below:

- *Metal Debris*: Metal debris, to include munitions debris and cultural debris (nails, banding, barbed wire, etc.), are typically encountered during intrusive operations. Wear the appropriate personal protective equipment (PPE) to protect personnel from hazards caused by sharp objects.
- *Chemicals*: Locating industrial-type chemicals is a possibility during intrusive MEC activities. If sealed drums, contaminated soils, or other suspect conditions that indicate a potential health or safety hazard are encountered, do the following:
  - Stop work and follow proper notification procedures.
  - The SUXOS notifies the Project Manager using established notification procedures.
  - Do not continue work in the area where the hazard was discovered until the SUXOS and UXOSO evaluate the situation and confer with the Project Manager and HGL's Corporate Health and Safety Director, and all agree it is safe to proceed.

8.3 EXCLUSION ZONES AND MINIMUM SEPARATION DISTANCES

8.3.1 Exclusion Zones

During intrusive MEC operations, only essential project personnel may be within the EZ.

- The UXOSO and UXO Team Leaders monitor and keep the EZ intact until intrusive operations are complete.
- If a MEC larger than the identified MGFD is encountered, notify the appropriate authority and use an EZ appropriate for the found munition.

8.3.1.1 Essential Personnel and Authorized Visitors

Only project personnel necessary for the safe and efficient completion of the field operations are allowed in an EZ. Multi-discipline and multiple MEC teams project teams performing tasks required to execute the project may be in the EZ while MEC procedures are being performed as long as TSDs are maintained. Team locations must be closely coordinated with the SUXOS and UXOSO. Authorized visitors are allowed within the EZ under the restrictions and requirements of EM 385-1-97.

Personnel are not allowed to work in the EZ without the following:

- Briefing on the use of the buddy system
- PPE requirements in accordance with the APP/SSHP
- Applicable training and certifications
- Understanding of the APP/SSHP
- Approval of SUXOS

8.3.2 Minimum Separation Distance

8.3.2.1 Unintentional Detonations

Evacuate all non-essential personnel from within the EZ/MSD during intrusive operations in areas with known or suspected MEC.

8.3.2.2 Intentional Detonations

Evacuate all personnel from within the MSD during intentional detonation of MEC items.

9.0 QUALITY CONTROL

Refer any discrepancies found with procedural steps or safety issues pertaining to this SOP to the responsible supervisor for corrective action.

- The HGL Senior UXO Operation Manager annually reviews this SOP for completeness, accuracy, and safety.
- The HGL UXO Safety Manager maintains, manages, and annually reviews this SOP for procedural, QC and safety issues.

- The UXO Safety and Quality Manager receive all questions, comments, or recommendations regarding this SOP.
- Project Managers and supervisors ensure that all site personnel read, understand, and follow this SOP.

10.0 RECORDS

Project participants are responsible for providing objective documentation in sufficient detail showing that they have met the requirements of this SOP. Collect, retain, and maintain the documentation resulting from this SOP with the project record files IAW project planning documents.

11.0 REFERENCES

HydroGeoLogic, Inc. (HGL), Standard Operating Procedure 502.01.1, Explosive Demolition Operations.

HGL, Standard Operating Procedure, 504.01.1 Material Potentially Presenting an Explosive Hazard Inspection, Management and Processing.

U.S. Army Corps of Engineers (USACE), Engineer Manual 385-1-97.

USACE, Engineer Manual 200-1-15.

U.S. Department of Defense Explosives Safety Board (DDESB), Technical Paper 16.

DDESB Technical Paper 18.

DoD Manual 6055-09-M.

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Approved By:

______________________________ ______________

Jan Kool, Ph.D. Date
Corporate QA Manager

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Neil Feist Date
MMRP Operations Manager

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1.0 PURPOSE

This standard operating procedure (SOP) describes the procedures for all HydroGeoLogic, Inc. (HGL) and subcontractor personnel performing munitions and explosives of concern (MEC) anomaly avoidance support during field operations where there is a potential for encountering MEC hazards.

2.0 SCOPE AND APPLICATIONS

This MEC SOP discusses surface and subsurface anomaly avoidance procedures and techniques to be used while conducting munitions, hazardous, toxic, radioactive waste (HTRW)-related activities during investigative, design, and remedial actions. These procedures were developed using the following:

- U.S. Department of Defense (DoD) Manual 6055.09-M DoD.
- DoD Explosives Safety Board (DDESB) Technical Paper 18.
- U.S. Army Corps of Engineers (USACE) Engineering Manual (EM) 385-1-97.

Intrusive anomaly investigation and/or MEC removal is not authorized unless stated in the Performance Work Statement (PWS) or Scope of Work (SOW) and addressed in project work and safety plans. Anomaly avoidance techniques must be employed on properties known or suspected to contain MEC or chemical agent to avoid surface explosive hazards, chemical hazards, and, subsurface anomalies. Anomaly avoidance techniques are implemented for activities that include, but are not limited to:

- Surveying and mapping
- Environmental and natural resource assessments
- Surface and subsurface sampling
- Boring and drilling
- Groundwater monitoring
- Installation of signs and fences

3.0 GENERAL REQUIREMENTS

Perform all work in a manner consistent with Occupational Safety and Health Administration established standards and requirements. Conduct all activities in conformance with the Accident Prevention Plan (APP)/Site Safety and Health Plan (SSHP). Justify any deviations from specified requirements to the project manager and/or the relevant program manager. Thoroughly describe both deviations from requirements and the newly modified process in the justification documentation.

4.0 DEFINITIONS AND ABBREVIATIONS/ACRONYMS

4.1 DEFINITIONS

Anomaly Avoidance: Techniques employed on property known or suspected to contain MEC or chemical agent, regardless of configuration, to avoid contact with potential surface or subsurface hazards, to allow entry into the area for the performance of required operations.

Hazardous, Toxic, and Radioactive Waste Activities (HTRW): Activities undertaken for:

- The U.S. Environmental Protection Agency's (EPA) Superfund program,
- The Defense Environmental Restoration Program (DERP), including Formerly Used Defense Sites (FUDS),
- Installation Restoration Program (IRP) sites at active DoD facilities,
- HTRW actions associated with Civil Works projects, and
- Any other mission or non-mission work performed for others at HTRW sites.

HTRW actions during the investigative/design phase of a HTRW project on a site with known UXO or unknown fillers require anomaly avoidance procedures for MEC support. HTRW activities during the remedial action phase (construction) of a HTRW project on a site with known or UXO with unknown fillers may require either standby support or subsurface removal.

Military Munitions: All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DoD, the Coast Guard, the Department of Energy, and the National Guard.

Includes: confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof.

Does not include: wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, except as noted above.

Munitions and Explosives of Concern (MEC): Specific categories of military munitions that may pose unique explosives safety risks, including:

- UXO, as defined in 10 U.S.C. 101(e)(5)(A) through (C);
- Discarded military munitions (DMM), as defined in 10 U.S.C. 2710(e)(2); or

- Munitions constituents (such as, TNT or RDX), as defined in 10 U.S.C. 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

Munitions Constituents (MC): Any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 U.S.C. 2710).

Munitions Debris: Remnants of munitions remaining after munitions use, demilitarization, or final disposition. Examples of munitions remnants include fragments, penetrators, projectiles, shell casings, links, and fins. Also includes inert munitions-related material recovered during an MEC removal.

Recovered Chemical Warfare Materiel (RCWM): Non-stockpile chemical warfare materiel (CWM) that was previously discarded, buried, or fired and discovered either unexpectedly or during planned environmental restoration operations that DoD has either secured in place or placed under DoD control pending final disposition. CWM is normally secured in a DDESB-approved storage location or interim holding facility, pending final disposition.

Unexploded Ordnance (UXO): As defined by 10 U.S.C. §101(e)(5)(A) through (C), military munitions that:

- Have been primed, fuzed, armed, or otherwise prepared for action;
- Have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material; and
- Remain unexploded whether by malfunction, design, or any other cause.

UXO-Qualified Personnel: Personnel who:

- Meet the training requirements for UXO Technician and Personnel and have performed successfully in military explosive ordnance disposal (EOD) positions; or
- Are qualified to perform in the following service contract act contractor positions: UXO Technician II, UXO Technician III, and UXO Safety Officer (UXOSO), UXO Quality Control Specialist (UXOQCS), and SUXOS.

Refer to DDESB Technical Paper (TP) 18 for detailed information for approved contract titles and qualifications.

4.2 ABBREVIATIONS/ACRONYMS

bgs	below ground surface
CWM	chemical warfare materiel
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DMM	discharged military munitions
DoD	U.S. Department of Defense
DPT	direct push technology
EM	Engineering Manual
EOD	explosive ordnance disposal
EPA	U.S. Environmental Protection Agency
ER	Engineering Regulation
FUDS	Formerly Used Defense Site
GPS	global positioning system
HGL	HydroGeoLogic, Inc.
HTRW	hazardous, toxic and radiological waste
IAW	in accordance with
IDW	investigated derived waste
IRP	Installation Restoration Program
MC	munitions constituents
MEC	Munitions and Explosives of Concern
P.L.	Public Law
PA/SI	Preliminary Assessment/Site Inspection
PWS	Performance Work Statement
RCWM	Recovered Chemical Warfare Materiel
SSHP	Site Safety and Health Plan
SOP	standard operating procedure
SOW	Scope of Work
SUXOS	Senior Unexploded Ordnance Supervisor

TP	Technical paper/pamphlet
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
WP	Work Plan

5.0 PROCEDURES

5.1 UXO TEAM

For anomaly avoidance on a site with potential MEC, HGL provides an UXO Team consisting of a minimum of two personnel, one of whom must be a UXO Technician II or above (see exception in following paragraph). The senior UXO-qualified person serves as the UXO Team Leader and has ultimate responsibility for ensuring all MEC anomaly avoidance support activities are performed in accordance with this SOP, the work plan, and/or the SSHP. The UXO Team Leader directs all MEC anomaly avoidance support during field operations.

UXO Tech I may escort personnel who are not directly involved in MEC-related activities (e.g., sweep personnel, support workers, visitors to cultural sites) on property known or suspected to contain MEC, but have an operational requirement and authorization to access such property. Although escort by a UXO Tech I is typically performed under the supervision of UXO Qualified Personnel, the responsible commander or authority may approve UXO Tech I personnel to perform escort duties without supervision. Such approval must be, based on an approved risk assessment and implementation of methods to
mitigate potential exposures.

5.1.1 UXO Qualified Personnel

- Provide MEC recognition, location, and explosive safety functions.
- Conduct explosive safety briefing for all site personnel and visitors.
- Conduct a surface access survey to locate all surface and near-surface anomalies.
- Work closely with the USACE/client personnel on all MEC-related matters.
- Coordinate and report MEC discoveries in accordance with project planning documents.

5.1.2 Non UXO-Qualified Personnel

- Obtain training in recognizing the potential hazards associated with MEC.

- Remain with the UXO Technician all times unless otherwise cleared to work without a UXO escort. Personnel must be escorted by UXO qualified personnel until the UXO escort has completed the access survey and the anomaly free areas have been marked.
- Follow the instructions given by the UXO Technician if an accident occurs.
- Exercise caution when walking on site; follow UXO Technician directions.
- Non UXO-qualified personnel will follow behind the UXO escort.

5.2 ANOMALY AVOIDANCE PROCEDURES

Conduct anomaly avoidance procedures during field investigation activities whenever there is a potential for encountering MEC. The purpose of the procedures is to avoid any potential surface and subsurface MEC hazards during these activities. Anomaly avoidance procedures are outlined in the following subsections including, but not limited to:

- Establishing site access routes and site boundaries, and conducting MEC avoidance survey;
- Clearing and grubbing;
- Land surveying and mapping;
- Conducting Preliminary Assessments/Site Inspections (PA/SI) on FUDS and Base Realignment and Closure Sites;
- Geophysical surveying; and
- Assessing environmental and natural resources:
    - surface soil sampling
    - subsurface soil sampling
    - boring and drilling
    - ground water monitoring
    - test pits and trenches excavations

5.2.1 Access Survey and MEC Avoidance Procedures

The UXO escort must conduct a surface access survey and a subsurface surface survey for anomalies before any type of activities commence, including foot and vehicular traffic. The UXO escort is responsible for conducting the access survey using the following steps:

- Conduct an access survey of the footpath and/or vehicular lanes approaching and leaving work areas with known or suspected MEC. Typically, the access route will be twice as wide as the widest vehicle that will use the route.

- Conduct an access survey around the proposed work site that is large enough to support all planned operations. The size of the area will take into account the maneuverability of the equipment, parking of support vehicles, and any supporting equipment.
- Use geophysical instrumentation capable of detecting the smallest known or anticipated MEC to locate anomalies just below the ground surface that may be encountered because of erosion from rain, or because of continual foot or vehicular traffic. If the emplacement depth is greater than the detection capabilities, then the escort must complete the geophysical survey in intervals until the required depth is reached (for example, every 6 inches, 1 foot, 2 feet, etc.).
- Clearly mark the route(s) for future entry control.
- If anomalies or surface MEC are encountered, they will be marked, and the work area will be relocated to an anomaly free area to avoid contact.
- No personnel will be allowed outside surveyed areas.

5.2.2 Clearing and Grubbing

Initial clearing and grubbing operations may be required before field activities. The objective of clearing and grubbing is to create unhindered access for the field teams. In areas with potential MEC hazards, the UXO Team must:

1. **Hazard identification and clearing and grubbing.**
    - Survey the proposed clearing and grubbing area with a geophysical instrument. Mark hazards with survey flagging or pin flags.
    - Begin clearing and grubbing within the area established by the survey.
    - Qualified UXO Technicians must escort grubbing teams at all times.
    - Exercise caution when using mechanical grubbing equipment.
    - Keep the lowest part of the cutting deck of the grubbing equipment at least 6 inches above ground level to avoid potential contact with any MEC hazards remaining after the initial survey.
2. **MEC Hazards.**
    - Stop all operations if MEC hazard is encountered during clearing and grubbing.
    - Take no further action until the UXO Technician has notified all applicable parties and the appropriate safety concerns are resolved in accordance with the WP or SSHP.

5.2.3 Land Surveying and Mapping Procedures to Locate Anomalies

Land surveying teams in areas with potential MEC must have a minimum of one UXO Technician II or above assigned to perform MEC anomaly avoidance.

The UXO Technician:

- Conducts an access survey of the routes to and from the proposed survey site and an area around the site.
- Visually inspects the surface of each proposed survey point for any indication of MEC or MEC-related contamination.
- Uses a handheld geophysical instrument to assess the presence or absence of subsurface anomalies at the locations where survey points/stakes installation is planned. If responses indicate an anomaly, the UXO Technician disallows survey point/stake installation at that specific location, and selects an alternate location.

5.2.4 Sampling and Drilling Procedures

5.2.4.1 <u>Surface Soil Sampling (Zero to 6 Inches)</u>

The following paragraphs describe anomaly avoidance procedures for surface soil sampling between 0 and 6 inches below ground surface (bgs) in areas with potential MEC.

- Conduct a surface access survey of the routes to and from the proposed investigation site as well as a support area around the investigation site.
- Visually inspect the surface of each proposed surface soil sampling site for any indication of MEC or MEC-related contamination.
- Survey the proposed sample locations using hand-held geophysical instruments.
- Select an alternate location to collect surface soil samples if anomalies are detected at a proposed sampling location or too many anomalies are detected in a general area of interest.

5.2.4.2 <u>Subsurface Soil Sampling (below 6 Inches) and Monitoring Well Installation</u>

The following paragraphs describe anomaly avoidance procedures for subsurface soil sampling and monitoring well installations in an area with potential MEC. Subsurface soil sampling is defined as the collection of samples below a nominal depth of approximately 6 inches with a split-spoon, Shelby tube, direct push sampler, or bucket auger (hand auger) soil sampler using drilling techniques. Drilling techniques are also used to install groundwater monitoring wells for HTRW investigations. The UXO Team adheres to the following procedures:

- Conduct a surface access survey of the routes to and from the proposed investigation site as well as an area around the investigation site.
- Conduct a subsurface survey of the proposed drill hole location(s) with a hand-held, geophysical instrument to detect subsurface MEC anomalies.
- Prominently mark location of any anomalies detected with survey flagging or non-metallic pin flags for avoidance.
- Select a new sampling or borehole location if an anomaly is detected.
- Incrementally complete the down-hole geophysical survey to undisturbed soil depth if the subsurface sampling depth is greater than the geophysical detection capabilities.

5.2.4.3 Incremental Geophysical Survey for Conventional MEC Avoidance

For intrusive sampling (subsurface sampling and well drilling) in areas with suspected MEC, the team completes follows this procedure:

1. **Begin the installation.**
   - Complete the access survey of the area.
   - Complete the geophysical survey and install a pilot hole at the sample or drill location if no anomalies detected.
   - As long as no anomalies are detected, the pilot hole will be advanced to the maximum reach of the auger or to the maximum depth of the proposed drill hole.
   - Inspect the pilot hole upon reaching the final depth. Provide a total clearance depth equal to the pilot hole depth plus 2 feet.
   - During installation, inspect for anomalies every 2 feet using a geophysical instrument configured for down-hole use, unless otherwise specified by the WP or SSHP.
   - When working in impact areas, the UXO team may discontinue incremental screening once a depth of 30 feet bgs is reached or the depth of MEC penetration has been exceeded, whichever is less.
   - For all other areas, incremental screening will be determined based on an assessment of the sites characteristics and history.

2. **If anomalies are detected:**

   Stop installation immediately and backfill the pilot hole in accordance with project-specific procedures.

   HTRW sampling personnel select a new location.

   Prominently mark any anomalies detected with survey flagging or pin flags.

5.2.4.4 Test Pits and Trench Excavations

Test pits and trench excavations are used to identify and characterize large subsurface HTRW areas of concern. Adhere to the following procedure:

- Conduct an access survey of the routes to and from the proposed excavation locations.
- If an anomaly is detected, select a new excavation location
- If the proposed excavation depth is greater than the geophysical instrument detection capabilities, the UXO team must:
  - Identify underground utilities and obtain a dig permit in accordance with (IAW) the WP or SSHP.
  - HTRW personnel may begin excavation in 1-foot increments.
  - At the end of each 1-foot increment, the UXO team will screen for anomalies. If an anomaly is detected, the HTRW team must modify the excavation to avoid the anomaly.
  - If MEC is encountered, all operations will cease. The UXO team will access the item and follow MEC procedures detailed in the WP or SSHP.
  - Once the MEC hazard is removed from the excavation, excavation using anomaly avoidance may continue.
- In the event potentially hazardous waste, debris, or drums are encountered during test pit or trenching operations, stop all excavation activities. The HTRW Site Safety Officer adheres to the following procedure:
  - Assess the situation and direct a change to the personal protective equipment for site workers, if necessary.
  - Notify the appropriate personnel in accordance with the WP or SSHP.
  - Handle wastes in accordance with the Investigation-Derived Waste (IDW) Management, Transportation, and Disposal Plan (IDW Plan).

5.2.4.5 Soil Sampling with Direct Push Technology

The following paragraphs describe anomaly avoidance procedures for soil sampling and use of direct-push technology (DPT) in areas with potential MEC. Soil sampling with DPT typically involves manual or mechanical penetration at the desired location, followed by withdrawal and collection of a soil sample. The UXO Team adheres to the following procedure:

- Conduct a surface access survey of the routes to and from the proposed investigation site as well as an area around the investigation site.
- Follow the same anomaly-avoidance procedures as described previously for subsurface soil sampling and monitoring well installations for soil sampling and DPT installations as follows:
- Incremental down-hole geophysical survey for metallic anomalies.
- Conduct actual sampling and geophysical instrument screening through the DPT bore hole.
- Backfill the sampling location in accordance with project-specific procedures after collection of the soil samples.

5.2.5 Groundwater Monitoring

Groundwater monitoring activities include measuring groundwater elevations, measuring free product thickness, and collecting analytical samples. Unless a path is clearly marked, HTRW sampling personnel must be escorted by UXO-qualified personnel when conducting groundwater monitoring/aquifer characterization activities in areas with potential MEC.

5.2.6 Preliminary Assessment and Site Inspection

On sites were MEC hazards may be present, UXO-qualified personnel conduct anomaly avoidance measures to prevent non-UXO-qualified personnel who are conducting PA/SI work on the site from contacting MEC hazards.

5.3 MUNITIONS AND EXPLOSIVES OF CONCERN

5.3.1 MEC ENCOUNTERED

If MEC/UXO is encountered, the UXO Technician:

- Stops the team, draws attention to the hazard, and marks the hazard with a high-visibility pin flag, paint, or surveyors tape.

- If safe to do so, attempts to identify the MEC hazard via markings and other external features such as shape, size, and external fittings.
- Records the MEC hazard item(s) location, record global positioning system (GPS) coordinates if possible.
- Photographs the hazard.
- Makes notifications required in the project planning documents.

The team continues activities after these steps are completed.

5.3.2 MEC DISPOSITION

The UXO escort is not authorized or equipped to perform MEC disposition. MEC discoveries will be reported to the designated personnel/agencies identified in project planning documents. In the event that MEC is encountered that cannot be avoided or, based on its fuzing or current condition, presents an imminent hazard, the UXO escort will immediately notify the personnel/agencies designated in project planning documents.

6.0 QUALITY CONTROL

The HGL Senior UXO Operation Manager ensures this SOP is reviewed annually for completeness, accuracy, and safety.

The HGL UXO Safety Manager maintains, manages, and annually reviews this SOP for procedural, quality control, and safety issues. Direct all questions, comments, or recommendations regarding this SOP to HGL's UXO Safety Manager. Project Managers and supervisors ensure that all site personnel read, understand, and follow this SOP. Bring any discrepancies with procedural steps or safety issues pertaining to this SOP to the attention of the responsible supervisor for corrective action.

6.1 AUTHORITY

The senior UXO-qualified person on site has final on-site authority on all munitions and MEC procedures and safety issues. This individual has direct reporting and communications responsibility with all responsible authorities as directed by the HGL Project Manager.

6.2 CERTIFICATIONS

HGL provides UXO-qualified personnel who meet the certification levels specified by DDESB Technical Paper 18 and USACE EM 385-1-97.

6.3 EQUIPMENT

- Perform a daily equipment function check on all geophysical instruments and GPS equipment. Describe the performance results of the equipment check in the logbook or in an instrument maintenance and calibration log following each functionality test.
  - o If an equipment function check indicates that any piece of equipment is not operating correctly and it cannot be field repaired immediately, remove the equipment from service until it can be repaired.
  - o Alternately, the equipment may be replaced with a like model or an approved substitute. Replacement equipment must meet the same specifications for accuracy and precision as the equipment removed from service.
- Inspect and function-check all equipment, regardless of source, to ensure completeness and operational readiness. Return for replacement or repair any equipment found damaged or defective.
- Inspect all instruments and equipment that require routine maintenance and/or calibration upon arrival and periodically as required in the manufacturer’s equipment manual.

6.3.1 Geophysical and Support Equipment

The type of geophysical equipment depends on site conditions and the intended work to be conducted. For the purpose of anomaly avoidance, the following geophysical equipment are typically used:

- Magnetometers
- All-metals detectors
- Downhole monitors

Additional equipment items that may be required for marking hazards are as follows:

- Pin flags (as required)
- Brightly colored surveyors tape (as required)
- High visibility, biodegradable spray paint (as required)
- GPS.

7.0 SAFETY

If MEC is encountered during any phase of work, follow the procedures in the project planning documents. In general, adhere to the following MEC safety precautions and protocols:

- Observe this cardinal principle when work may involve ordnance, explosives, ammunition, severe fire hazards, or toxic materials: limit the exposure to a minimum number of personnel, for the minimum amount of time, to a minimum amount of hazardous material consistent with a safe and efficient operation.
- Always assume MEC hazards contain a live charge until determined otherwise.
- Understand that the age or condition of a MEC hazard does not decrease the effectiveness. MEC that has been exposed to the elements for an extended period of time becomes more sensitive to shock, movement, and friction because the stabilizing agent in the explosives may be degraded.
- DO NOT touch, move or jar any ordnance items regardless of the markings or apparent condition. Under no circumstances handle any MEC during avoidance activities or moved in an attempt to make a positive identification.
- DO NOT touch, pick up, kick, or move anything that is unfamiliar or unknown.
- DO NOT roll the item over or scrape the item to identify markings.
- DO NOT approach or enter a munitions site if an electrical storm is occurring or approaching. If a storm approaches during site operations, leave the site immediately and seek shelter.
- DO NOT transmit radios or cellular phones in the vicinity of suspect MEC hazards.
- DO NOT walk across an area where the ground surface cannot be seen or that has not been cleared of MEC hazards by the UXO Technician.
- DO NOT rely on color codes for positive identification of ordnance items nor their contents.
- DO NOT drive vehicles into a suspected MEC area until anomaly avoidance techniques have been implemented.
- DO NOT be misled by markings on the MEC item stating “practice” or “dummy.” Practice ordnance can have explosive charges used to mark and/or spot the point of impact, or the item could be marked incorrectly.
- Clearly mark the location of any ordnance item found during anomaly avoidance activities so it can be easily located and avoided.

— WARNING —
REMOVING OR TAKING ANY MUNITIONS, EXPLOSIVE OR UNEXPLODED ORNANCE OR MUNITIONS-RELATED DEBRIS FROM THE SITE BY ANY EMPLOYEE IS STRICTLY PROHIBITED.

7.1 DAILY TAILGATE SAFETY MEETING

Before entering an area requiring MEC anomaly avoidance, the UXO Team Leader must conduct a safety brief covering emergency procedures, operations, MEC hazards, and anomaly avoidance procedures.

8.0 REFERENCES

U.S. Army Corps of Engineers (USACE). Engineer Manual (EM) 385-1-97.

U.S. Department of Defense (DoD) Explosives Safety Board (DDESB) Technical Paper (TP) 18.

DoD Manual 6055-09-M.

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FINAL

Supplemental Standard Operating Procedures for Endangered Species Conservation and their Critical Habitat

DERP-FUDS Property No. I02PR0068
Culebra, Puerto Rico

US Army Corps
of Engineers
Jacksonville District

February 2014
(Addendum 1 February 2015)

ADDENDUM 1

SUPPLEMENTAL STANDARD OPERATING PROCEDURES
ENDANGERED SPECIES CONSERVATION AND HABITAT PROTECTION
DERP-FUDS PROJECT NO. I02PR0068, CULEBRA, PUERTO RICO

1.0 PURPOSE AND NEED

The purpose of this document is to 1) supplement, not replace, the *February 2014 Supplemental Standard Operating Procedures (SOPs) for Underwater Investigations for Defense Environmental Restoration Program for Formerly Used Defense Site (DERP-FUDS) Project No. I02PR006802, Culebra, Puerto Rico*, 2) serve as guidance for USACE and its Contractors in order to avoid or minimize impacts to listed species and their designated critical habitat and species proposed for Endangered Species Act (ESA) listing during geophysical surveys, intrusive investigations/MC environmental sampling, and controlled detonation activities, 3) satisfy the substantive requirements of the ESA, 4) incorporate newly listed species, and 5) update the POC list for coordination and reporting.

2.0 LISTED OR PROPOSED FOR LISTING SPECIES

A description of threatened or endangered species and their habitat as well as species proposed for listing that are known to occur or have the potential to occur in the waters around Culebra Island and adjacent cays have been discussed in the previously developed and coordinated SOPs listed below.

a. SOPs for Endangered Species Conservation and their Habitat – July 2008

b. Addendum to the July 2008 SOPs – April 2011

c. SOPs for Endangered Species Conservation and their Critical Habitat during Underwater Investigations – April 2012

d. Supplemental SOPs for Endangered Species Conservation and their Critical Habitat during Underwater Investigations – February 2014

Subsequent to the February 2014 supplement, ESA listing decisions became final and additional species have been proposed for listing as threatened or endangered under the ESA. The species for which ESA listing decisions are now final and additional species now proposed for ESA-listing are discussed below:

a. On September 10, 2014, the National Marine Fisheries Service (NMFS) published a final rule in the Federal Register (79 FR 53851) to list 20 coral species as threatened under the ESA (effective date October 10, 2014). Five of these species are known to occur in Puerto Rico including: Pillar Coral (*Dendrogyra cylindrus*), Rough Cactus Coral (*Mycetophyllia ferox*), Lobed Star Coral (*Orbicella annularis*), Mountainous Star Coral (*Orbicella faveolata*), and Boulder Star Coral (*Orbicella franksi*)(genus *Orbicella* formerly known as *Montastraea*). In addition, the determination to maintain the status of Elkhorn Coral (*Acropora palmata*) and Staghorn Coral (*Acropora cervicornis*) as threatened rather than changing their listing to endangered was included in this final rule. <u>Please note</u>: the listed species common names above were taken from the final rule (79 FR 53851) and supersede those in 2012 SOPs for Endangered Species Conservation and their Critical Habitat during Underwater Investigations – April 2012, Page 21 Section 3.13 Species of Corals Proposed for Listing under the ESA, Page 23: Section 3.13.2.1, and Page 24 Section 3.13.2.3.

b. On September 2, 2014, NMFS published a final rule in the Federal Register (79 FR 38213) to list the Central and Southwest (SW) Atlantic Distinct Population Segment (DPS) of Scalloped Hammerhead Shark (*Sphyrna lewini*) as a threatened species under the ESA. NMFS is also considering critical habitat for the Central & SW Atlantic DPSs. These DPSs include the U.S. Caribbean. NMFS does not currently have any explosive guidelines specific to sharks. For the scalloped hammerhead a conservative estimate is application of the predictive equations and example calculations for fish from 2014 SOPs, Appendix E, Section 4.2. However, this species isn't expected to be common in the work area given the shallow depths and overfishing. Because this is an underwater species that doesn't need to surface to respire, perhaps the highest potential for observation would be through diver survey prior to any intrusive work. However, sharks could still swim into the area and not be seen. Sharks should be far more resilient to pressure wave injury than air bladdered fish, turtles, and marine mammals because they have no swim bladder (or air containing organs). External injury (eyes, gills, scale loss, contusions) or auditory damage could occur if the shark is fairly close to the blast. However, mortal injury or death is unlikely. Therefore, the acoustic impact calculations for fish from the 2014 SOPs will be used to establish zones of influence for sharks during in-water detonation/blow-in-place activities.

c. On September 2, 2014, NMFS issued a proposed rule and request for comments (79 FR 51929) and announced a 12-month finding and listing determination on a petition to list the Nassau Grouper (*Epinephelus striatus*) as threatened or endangered under the ESA. The 105 day document comment period ends on December 31, 2014.

d. On November 5, 2014, NMFS announced a 12-month finding (79 FR 65628) and listing determination on a petition to list the Queen Conch (*Strombus gigas*) as threatened or endangered under the ESA. NMFS completed the status review and determined that there was not enough evidence to warrant listing at this time.

3.0 MEASURES TO AVOID OR MINIMIZE POTENTIAL IMPACTS

The measures in the SOPs listed in Section 2.0 above will be implemented to minimize the risk of unintended impacts to these newly listed species, species proposed for ESA-listing, and all other threatened or endangered species and their habitat during RI/FS underwater investigation. Activities that may pose potential impacts to listed species include, but are not limited to running aground, accidental collision or vessel strike, personnel during snorkeling and diving operations, equipment [e.g. multi-beam, side scan sonar, remotely operated vehicle (ROV), hand-held magnetometers, electromagnetic (EM) platforms, and video cameras], intrusive investigations requiring excavation of the marine bottom, removal and transport of anomalies from underwater locations to terrestrial collection points, and accidental detonation.

By implementation of these measures, adverse impacts to listed species or their habitats are expected to be avoided or minimized. It should be noted that the Contractor will be required to implement these SOPs during any underwater work.

The POC list for coordination and reporting from the February 2014 Supplemental SOP has been updated and is presented below.

4.0 POINTS OF CONTACT FOR SOPs COORDINATION AND REPORTING

Name	Organization	Telephone/Email
Wilberto Cubero Project Manager	USACE, Jacksonville	Office: 904-232-1426 Wilberto.Cubero-delToro@usace.army.mil
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Julio F. Vazquez Remedial Project Manager	EPA Region II	Office: 212-657-4323 Vazquez.Julio@epa.gov
Nilda Jimenez Marrero Marine Resource Division	DNER	Office: 787-772-2022 njimenez@drna.gobierno.pr
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US Army Corps of Engineers
Jacksonville District

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LIST OF ACRONYMS

DERP	Defense Environmental Restoration Program
DM	Decision Matrix
DNER	Department of Natural and Environmental Resources
EBS	Environmental Baseline Survey
EQB	Environmental Quality Board
EM	Electromagnetic
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESP	Explosives Site Plan
FS	Feasibility Study
FUDS	Formerly Used Defense Sites
FWS	U.S. Fish and Wildlife Service
GPS	Global Positioning System
MC	Munitions Constituent
MD	Munitions Debris
MDAS	Material Documented as Safe
MEC	Munitions and Explosives of Concern
MPPEH	Material Potentially Presenting an Explosive Hazard
MRA	Munitions Response Area
MRS	Munitions Response Sites
Navy	Department of Navy
NMFS	National Marine Fisheries Service
QC	Quality Control
RI	Remedial Investigation
ROV	Remote Operated Vehicle
SCUBA	Self Contained Underwater Breathing Apparatus
SLRA	Screening Level Risk Assessment
SOPs	Standard Operating Procedures
TPP	Technical Project Planning
UIT	Underwater Investigation Team
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
UXO	Unexploded Ordnance
WP	Work Plan

SUPPLEMENTAL STANDARD OPERATING PROCEDURES
ENDANGERED SPECIES CONSERVATION AND HABITAT PROTECTION
DERP-FUDS PROJECT NO. I02PR0068, CULEBRA, PUERTO RICO

1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) is conducting Environmental Baseline Surveys (EBS) on Culebra Island Munition Response Sites (MRSs) underwater portions. The EBS is the first of three (3) phases of the Remedial Investigation (RI) being conducted within these areas. The RI is comprised of the following phases:

a. Phase I – Hydrographic Survey and Underwater Visual Surveys.

b. Phase II - Geophysical Surveys to detect metallic anomalies.

c. Phase III - Intrusive Investigations/Munitions Constituents (MC) Environmental Sampling.

The overall objective of the RI/Feasibility Study (FS) is to determine the nature and extent of any contamination related to munitions and explosives of concern (MEC) and/or MC within the underwater portions of these MRSs. The main objectives of the underwater investigations are to a) characterize and map benthic habitats within investigation areas, b) determine, identify and map endangered or threatened species, in particular coral colonies, c) gather the necessary information to determine potential effects (e.g. location of species versus location of suspected MEC) on endangered or threatened species during remedial investigations and cleanup activities, d) determine presence or absence of MC and MEC, e) characterize the nature and extend of MC and MEC presence, and f) determine if the MC or MEC pose an unacceptable risk to human health and the environment, which would require further considerations or a response action.

2.0 PURPOSE AND NEED

The purpose of this document is to 1) supplement, not replace, the *April 2012 Standard Operating Procedures (SOPs) for Underwater Investigations for Defense Environmental Restoration Program for Formerly Used Defense Site (DERP-FUDS) Project No. I02PR006802, Culebra, Puerto Rico* 2) serve as guidance for USACE and its Contractors in order to avoid or minimize impacts to listed, or proposed for listing, species and their designated critical habitat during geophysical surveys, intrusive investigations/MC environmental sampling, and controlled detonation activities, and 3) satisfy the substantive requirements of the Endangered Species Act (ESA).

3.0 LISTED OR PROPOSED FOR LISTING SPECIES

A description of threatened or endangered species and their habitat as well as species proposed for listing that are known to occur or have the potential to occur in the waters around Culebra Island and adjacent cays have been discussed in previously developed and coordinated SOPs. The following SOPs are being incorporated by reference into this document and they can be found in **Appendix A**:

a. SOPs for Endangered Species Conservation and their Habitat – July 2008

b. Addendum to the July 2008 SOPs – April 2011

c. SOPs for Endangered Species Conservation and their Critical Habitat during Underwater Investigations – April 2012

4.0 MEASURES TO AVOID OR MINIMIZE POTENTIAL IMPACTS

The following measures will be implemented to minimize the risk of unintended impacts to threatened or endangered species and their habitat during RI/FS underwater investigation. Activities that may pose potential impacts to listed species are, but not limited to running aground, accidental collision or vessel strike, personnel, snorkeling and diving operations, equipment (e.g. multi-beam, side scan sonar, remotely operated vehicle (ROV), hand-held magnetometers, electromagnetic (EM) platforms, and video camera), intrusive investigations requiring excavation of the marine bottom, removal and transport of anomalies from underwater locations to terrestrial collection points and accidental detonation.

By implementation of these measures, adverse impacts to listed species or their habitats are expected to be avoided or minimized. It should be noted that the Contractor will be required to implement these SOPs during any underwater work as well as the previously coordinated SOPs included in Appendices A.

4.1 General Conservation Measures

4.1.1 Date of Commencement: The Contractor will provide USACE with a written notification of the date of commencement of underwater investigation work and a detailed description of the work to be implemented based on the Work Plan (WP) that will be coordinated and reviewed by Technical Project Planning (TPP) Team. USACE will provide the date of commencement to the TPP Team at least 10 days prior to initiating fieldwork.

4.1.2 Training/Briefing: Prior to initiating work all personnel shall receive training or briefings regarding the importance of endangered species, their characteristics, how they can be identified, potential and critical habitats, types of material in which they may hide, actions to take if are sighted, and avoidance measures to be followed as detailed in the SOPs. For additional information refer to **Appendix A**. This training or briefing shall be prepared and offered by qualified personnel (e.g. biologist, marine biologist, environmental scientist, among others). The Contractor shall submit their qualifications to the USACE for review and approval. The training or briefing will also include safety and emergency procedures.

4.1.3 Civil and Criminal Penalties: The Contractor shall instruct all personnel associated with the project of the potential presence of threatened or endangered species. All personnel shall be advised that there are civil and criminal penalties for harming, harassing, killing or otherwise altering the natural behavior or condition of threatened or endangered species protected under the ESA, the Puerto Rico Wildlife Law, the Puerto Rico Coral Reef Conservation Law and the Regulation to Govern the Endangered and Threatened Species of the Commonwealth of Puerto Rico. ESA gives both the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) responsibility for enforcing its provisions. The Commonwealth regulations to protect endangered and threatened species are enforced by the Puerto Rico Department of Natural and Environmental Resources (DNER).

4.1.4 Qualified Personnel: Each team performing underwater investigation work shall be accompanied on the boat, but not necessarily in the water, by qualified and experienced personnel (e.g. biologist, marine biologist, environmental scientist, among others) in order to identify the presence or absence of threatened or endangered species. The Contractor shall submit their qualifications to the USACE. The self contained underwater breathing apparatus (SCUBA) divers or snorkelers can request that the designated and qualified personnel on the boat to enter the water to identify and determine if a suspected threatened or endangered species is present in the study area.

4.1.5 Reports: The Contractor shall maintain a log detailing endangered or threatened species sightings in terrestrial and marine habitats. The log shall include, but not be limited to, the following information: date and time, location coordinates using a Global Positioning System (GPS) unit, species, one or more photographs, if possible, and any actions taken (e.g. species identification and distance from working area, reasons to cease operation, reasons to determine that operation may be resumed, among others) during the work period. All data shall be provided to USACE to be shared with the TPP. **Appendix B** includes a guide with the minimum information required for the Daily Observer Log Sheet.

4.2 Non-Intrusive Geophysical Underwater Investigation Conservation Measures

The following supplements but does not replace conservation measures established in the SOPs listed in Section 3.0 above.

4.2.1 All transect sections with scattered coral, reef, or colonized hard bottom will be surveyed with a method which results in no contact with the sea floor or with coral heads that extend close to the water surface. Detailed information on the appropriate equipment selection process will be provided in the WP and coordinated with the TPP Team. The equipment/system used in any underwater MRS portion will depend primarily on personnel safety, depth of water, and type of habitat present.

4.2.2 While several systems and EM platforms may be used during geophysical surveys, it is possible that in areas with varying amounts of submerged aquatic vegetation (e.g. seagrass) a system that is designed to come in contact with the sea floor may be used. For Quality Control (QC) purposes, prior to conducting the survey, a single transect across an area of submerged aquatic vegetation coverage will be surveyed using the proposed system. Qualified personnel will perform an assessment of the test area to determine if any adjustment is necessary to minimize disturbance to sand, macro algae and seagrass. After work is complete, the surveyed area will be inspected to ensure no impact to submerged aquatic vegetation has occurred.

4.2.3 In shallow water areas (1 to 4 feet) where contact with the bottom is not desired, the EM coil will be floated or will be suspended beneath a floating platform.

4.2.4 In areas with coral that are too deep for the floated system, or in areas containing coral heads with high relief, an ROV platform may be used to propel the EM coil along the transect while ensuring contact with the coral head is avoided. If the ROV EM platform is not suitable for selected transect segments these segments will be surveyed by divers or snorkelers as an instrument aided visual transect.

4.2.5 Divers/snorkelers will use handheld magnetometers to identify metallic anomalies, which may represent MEC or MPPEH. All equipment shall be used in a manner to avoid physical contact with corals.

4.2.6 QC will be established at all times to ensure appropriate pre-selected equipment is used throughout underwater investigation work as coordinated with TPP Team.

4.2.7 Anomalies along transects may be investigated upon discovery. Intrusive investigation will be conducted following measures listed in the next section (4.3).

4.3 Intrusive Underwater Investigation and Material Potentially Presenting an Explosive Hazard (MPPEH) Relocation Conservation Measures

Certified unexploded ordnance (UXO) divers/snorkelers will conduct the anomaly intrusive investigations. If the anomaly is at the surface, the investigation will be completed without disturbing the area or item, and if the anomaly is buried in sediments it will be uncovered by excavating down to the anomaly using hand tools, then the investigation will be performed to determine the vertical extent and boundaries of contamination and possible remedial actions.

Following are the measures to be implemented to protect listed species and their habitat during intrusive investigation. It should be noted that during all intrusive investigation phases qualified observers shall be present to scan the work area for sea turtles and marine mammals and take necessary measures to protect the species.

4.3.1 Excavations will be conducted in unconsolidated sediments and seagrass areas only. If the anomaly is located within coral or hardbottom areas the anomaly will be investigated visually only. However, if the anomaly is not encrusted in hardbottom or coral and can be easily removed by hand and has no coral colonization by listed or proposed corals, it can be removed and relocated to the designated processing area.

4.3.2 Divers will film and take pictures of the area around the anomaly to be investigated. If the anomaly is located in corals or hardbottom areas, divers will investigate an area with a three (3) meter radius, the center of which is the anomaly. Within that area, divers will determine the distance to and location of all listed and proposed coral. The pictures shall include measurements of distance between anomalies and listed or proposed corals and size of item. Care will be taken to avoid damaging corals or seagrass, if present.

4.3.3 If the anomaly is suspected to be MPPEH, a visual device will be placed temporarily next to the munition to provide a reference point for later investigation. This device shall have enough weight to remain in place without skipping along the bottom to avoid impact to corals until the investigation is complete. Once the investigation is complete, it will be removed.

4.3.4 UXO divers/snorkelers investigating anomalies within seagrass areas will be careful to maintain root systems as much as possible. Pre and post pictures shall be taken and shall include a measurement of the area investigated. Should intact plugs of seagrass be removed they will be replanted following the removal of the anomaly. As a possible method, the seagrass can be cut on three sides and rolled up. After work is complete, the excavated area will be filled with sand, if necessary, then the seagrass will be rolled back into place and staked with biodegradable stakes to enable the grass to reestablish quickly.

4.3.5 Each MPPEH item will be evaluated as a separate scenario. A Decision Matrix (DM) will be developed to provide timely decisions and methods of relocation and disposal. The DM will be included in the RI Phase III WP.

4.3.6 When feasible, if the anomaly is not munition related, the anomaly is not cemented in hard substrate, and ESA-listed or proposed corals are not attached to it, it will be brought to the surface and relocated to the designated terrestrial processing area for appropriate disposal. If non listed corals are attached, as feasible and as detailed in **Appendix C**, the recommended Coral Relocation and Reattachment Protocol will be followed.

4.3.7 No intrusive investigation, MEC/MPPEH removal, or MEC/MPPEH handling in MRSs adjacent to beaches will be conducted during the 48-hour period following the emergence of sea turtle hatchlings.

4.3.8 Anomalies or MPPEH Acceptable to Move: Anomalies that are 1) exposed or only shallowly buried in soft sediments, 2) are acceptable to move, and 3) its removal will not cause damage to listed species (e.g. listed corals are not attached) or their designated critical habitat will be relocated to the designated terrestrial processing site for disposal (see Section 4.4 for more information). Prior to removal, the UXO team must agree that the MEC/MPPEH is acceptable to move.

4.3.8.1 Prior to the anomaly/MEC/MPPEH removal effort, qualified personnel will verify the locations of listed and proposed corals, designated critical habitat and seagrass within the immediate vicinity. Listed and proposed coral species location will be identified with temporary underwater buoys or visual devices as a visual aid for the UXO team while setting up equipment for the removal. All removal actions shall be documented. Pre and post pictures of the area shall be taken with a scale measure next to the anomaly/MEC/MPPEH.

4.3.8.2 For soft sediment and seagrass areas, once an anomaly is reacquired, the MEC/MPPEH UXO investigation team will expose and recover the anomaly source using hand tools (such as spades, trowels, shovels). For coral and hardbottom areas, if the anomaly is not encrusted in hardbottom or coral and can be easily removed by hand and has no coral colonization by listed or proposed corals, it can be removed and relocated to the designated processing area. If non listed corals are attached, as feasible and as detailed in **Appendix C**, the recommended Coral Relocation and Reattachment Protocol will be followed. The MEC/MPPEH UXO investigation team will transfer recovered MEC/MPPEH to the shore or designated terrestrial location for processing and disposal.

4.3.8.3 Removal may occur by hand or by using lifting equipment (e.g. remotely with a lifting balloon). MEC that are acceptable to move but will cause an unacceptable risk to diver due size and weight of MEC will be moved remotely. Care will be taken to avoid damaging corals or seagrass during removal. However, corals that are not listed or proposed for listing, although it is not desired, may be damaged during MEC removal or disposal as a necessity. This may happen if corals are attached or in contact with the MEC item. As feasible and as detailed in **Appendix C**, the recommended Coral Relocation and Reattachment Protocol will be followed.

4.3.8.4 The terrestrial processing site will be located within the boundaries of the Munition Response Area (MRA). Its potential location will be provided in WP to the TPP. MPPEH items will not be transported out of the MRA.

4.3.9 Anomalies or MPPEH Not Acceptable to Move: Anomalies or MPPEH that are deeply buried or that are located in areas where removal of the item could result in damage to listed or proposed coral species or destruction or adverse modification of designated critical habitat will be accurately mapped by GPS and left in place.

4.3.9.1 These items will be marked by the placement of a solid clump next to it to provide a reference point for later investigation/action. For the purposes of these SOPs, a clump is defined as a heavy weight (such as a 7 pound mushroom anchor) that is placed 12-inches north of the item. The clump is not attached to a line or buoy but provides the divers with a visual reference for future identification. The clump location and placement shall not impact listed or proposed coral species. If the placement of a solid clump is not feasible (e.g. presence of listed species), the item will be accurately mapped by GPS.

4.3.9.2 The areas surrounding the anomaly or MPPEH will be filmed paying particular attention to corals and biology in the immediate vicinity. If the anomaly is located in corals or hardbottom areas, divers will investigate an area with a three (3) meter radius, the center of which is the anomaly. Within that area divers will determine the distance to and location of all listed and proposed coral. The pictures shall include measurements of distance between anomalies and listed or proposed corals and size of item. These films will be used later when identifying a suitable method for disposal. If it is determined that BIP is required and it is estimated that the potential blast impact radius is greater than 3 meters, additional investigation may be required.

4.3.10 Environmental Sampling: Samples will be taken at locations where Munition Debris (MD) or suspected MPPEH items are observed. Detailed information on the environmental sampling will be provided in the WP to the TPP Team. Any sampling work shall avoid impacts to protected species.

4.4 MEC/MPPEH Disposal/Detonation Site Conservation Measures

4.4.1 Prior to removal of MEC/MPPEH from underwater locations, the Contractor in coordination with USACE will establish a designated terrestrial MEC/MPPEH disposal/detonation site. All recovered underwater MEC/MPPEH will be transferred to this site for processing and inspection to determine disposal method. Following appropriate inspection procedures, items that do not pose a risk will be designated or reclassified to Material Documented as Safe (MDAS) and transported off of Culebra for final disposal.

4.4.2 The MEC/MPPEH processing and disposal/detonation site will be established on a beach to provide convenient access by UXO removal teams working in the offshore waters and to minimize disturbance of vegetation and protected species on Culebra. The site will not be located in lagoon areas.

4.4.3 Qualified and experienced personnel will inspect the beach that would be used for MEC/MPPEH processing and detonation for the presence of sea turtles, sea turtle nests, and signs of recent sea turtle activity. An area not recently used by sea turtles and at least 100 meters from any place of active sea turtle use would be selected as the detonation site to the maximum extent practicable. Daily beach surveys will be conducted by qualified personnel to determine whether sea turtles are using beaches within the MRS. It should be noted that the contactor shall follow additional conservation measures provided in the July 2008 (pages 6-9) and April 2012 (Section 4.2) SOPs.

4.4.4 During MEC/MPPEH transfer and processing, qualified observer would continue to survey the beaches for signs of sea turtle activity. No human activity would occur until beaches are clear of sea turtles. Any active sea turtle nests will be marked and a 100-meter protection zone will be created around each nest to prevent incidental damage during detonation. It should be noted that the contactor shall follow additional conservation measures provided in the July 2008 (pages 6-9) and April 2012 (Section 4.2) SOPs.

4.4.5 All MEC/MPPEH detonation/processing will be performed during daylight hours to minimize the possibility that hatchlings would emerge from the nests during working hours. Detonation will be delayed until 48 hours have passed from the time of hatchling observation on the beach.

4.4.6 There are listed and migratory seabird species that have the potential to occur in the project area. The Roseate Tern (*Sterna dougallii*) is listed as threatened and the Brown Pelican (*Pelecanus occidentalis*) was delisted due to recovery but is being monitored. A complete list of seabirds that occur in the project area is included in **Appendix D**. Prior to detonation, a qualified observer will check the beach and adjacent waters for the presence of protected and listed seabird species by scanning the area with 10 X 50 binoculars. The qualified observer will also survey the beaches for signs of bird nesting. If bird nests are found within the detonation site and/or blast impact area, no detonation will be conducted in that area. If any protected bird species are within 200 meters of the detonation site, MEC detonation will be delayed until after the animal(s) leave the area. In addition, if blast impacts will extend into nearshore waters, a qualified observer for sea turtles and marine mammals shall be required. If these species are observed the detonation shall be postponed until the animal has left the impact zone or more than 30 minutes have elapsed since it was last sighted.

4.4.7 Immediately prior to detonation, a qualified observer will scan the overhead sky for the presence of any birds. If birds are in flight within 100 meters of the detonation site, the detonation will be delayed until no birds are within 100 meters of the detonation site.

4.4.8 The MEC/MPPEH will be demolished and/or demilitarized by controlled detonation using explosives to be provided by local vendors on as-needed basis. When feasible, all demolition events will be covered with sandbags to mitigate the blast effects and to reduce the risk of shrapnel being ejected. Additional measures may be implemented based on the calculations to adjust and establish exclusion areas. Munition debris (MD) will be recovered after detonation for appropriate disposal.

4.5 In-Water Detonation/Blow-in-Place (BIP) Conservation Measures

In-water detonations of MEC/MPPEH, including BIP, may occur during this project. All BIPs shall be closely coordinated with TPP Team. In-water detonations present unique challenges to the avoidance of unintended adverse impacts on protected marine species. As such, in addition to the measures listed above and established in previous SOPs, special conservation measures are described in this section to reduce the potential for adverse impacts should underwater detonations occur. Additional measures will be provided in the WP and/or Explosive Site Plan (ESP) to the TPP Team.

4.5.1 When possible, the MEC/MPPEH will be relocated to the designated terrestrial processing site for disposal as long as it is acceptable to move and it can be physically moved. The Senior UXO Supervisor and UXO Safety Officer must agree that the item is acceptable to move.

4.5.2 Appropriate sand substrate areas will be chosen during all phases of the investigation as potential MEC disposal sites based on safety considerations and minimizing impacts to resources of concern to the maximum extent practicable. These areas will be used only if MEC/MPPEH are unstable or represent a safety concern.

4.5.3 Prior to any detonation (24 hours minimum), the Contractor, in coordination with USACE staff, shall contact NMFS, FWS, the Environmental Protection Agency (EPA), the Puerto Rico Environmental Quality Board (EQB), the Puerto Rico Department of Natural and Environmental Resources (DNER) and the U.S. Coast Guard (USCG) to inform them of a planned underwater detonation.

4.5.4 Detonations will be done during daylight hours only, and under conditions of good visibility that ensure the exclusion zone is clear of marine mammals and sea turtles.

4.5.5 No detonation shall occur when protected marine species (marine mammals, sea turtles and corals) are known or suspected within the exclusion zone. The exclusion zone delineation will also consider the potential level of acoustic impacts following the Young's (1991) equation in **Appendix E**. It should be noted that the excerpts from NMFS's explosive guidance provided in Appendix E are in draft form and a complete review and approval process is still pending. The guidance is provided to assist with determinations of the potential extent of acoustic impacts to sea turtles and marine mammals so that decisions can be made as to which items cannot be detonated without further coordination with the TPP Team. The water surface within the entire exclusion zone will undergo a visual search for protected marine species a minimum of 30 minutes prior to detonation. Should a protected marine mammal or sea turtle species be observed, the detonation shall be postponed until the animal has been observed outside of the exclusion zone, or more than 30 minutes have elapsed since it was last sighted.

4.5.4 Constant vigilance over the exclusion zone will be maintained for a minimum of 30 minutes following a detonation, and a thorough water surface inspection of the zone shall be completed immediately following a detonation to search for injured or dead protected marine species and surrounding coral and hardbottom habitat impacts. Impacts to coral and hardbottom habitat will be documented using pictures and measures and the information provided to the TPP Team. Should an injured or dead protected species be observed, immediately contact the appropriate response hotline (Marine Mammals: (877) 433-8299; Sea Turtles: (727) 824-5312; and DNER (787) 645-5593). Emergency handling procedures for an injured sea turtle or mammal will be provided by NOAA.

4.5.5 All observed stranding of protected marine species should be reported to the appropriate hotline, regardless of whether or not the stranding is the result of a detonation or other component of the project.

4.5.6 Constant vigilance for the presence of protected marine species during all aspects of the project, particularly in-water activities, is required.

4.5.7 Visual surveys within the vicinity of the work areas for that day shall be made prior to the start of work each day, and prior to resumption of work following any break of more than one half hour.

4.5.8 To the extent practicable and depending the ordnance type, appropriate techniques will be implemented to avoid and minimize damage to marine habitat. Detailed information will be provided in the ESP to the TPP Team.

4.5.9 All in–water work shall be conducted following the marine mammals and sea turtles avoidance measures established above and in previously coordinated SOPs.

5.0 POINTS OF CONTACT FOR SOPs COORDINATION AND REPORTING

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APPENDIX A

SOPs for Endangered Species Conservation and their Critical Habitat during Underwater Investigations – April 2012

FINAL

Standard Operating Procedures for Endangered Species Conservation and their Critical Habitat during Underwater Investigations

DERP-FUDS Property No. I02PR0068

Culebra, Puerto Rico

US Army Corps of Engineers
Jacksonville District

April 2012

US Army Corps of Engineers
Jacksonville District

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LIST OF ACRONYMS

DERP	Defense Environmental Restoration Program
DNER	Department of Natural and Environmental Resources
EBS	Environmental Baseline Survey
EQB	Environmental Quality Board
ESA	Endangered Species Act
FUDS	Formerly Used Defense Sites
FWS	U.S. Fish and Wildlife Service
MC	Munitions Constituent
MEC	Munitions and Explosives of Concern
MRS	Munitions Response Sites
Navy	Department of Navy
NMFS	National Marine Fisheries Service
SOPs	Standard Operating Procedures
TPP	Technical Project Planning
UIT	Underwater Investigation Team
USACE	U.S. Army Corps of Engineers

STANDARD OPERATING PROCEDURES FOR ENDANGERED SPECIES CONSERVATION AND THEIR CRITICAL HABITAT DURING UNDERWATER INVESTIGATIONS AT DERP-FUDS PROPERTY No. I02PR0068, CULEBRA ISLAND, PUERTO RICO

1.0 INTRODUCTION

Culebra Island is located approximately 17 miles east of the island of Puerto Rico and is approximately 9 miles from the Island of Vieques (**Figure 1**).

Figure 1. Location Map of Culebra.

In 1901, Culebra's public land was placed under the Department of Navy (Navy) control. The Island and adjacent cays were used as impact areas and firing ranges for aerial bombs and rockets, missiles, mortars, small arms, artillery rounds, and naval projectiles by the Navy and U.S. Marine Corps from 1903 until 1975. In 1978, part of the public land was transferred to the Commonwealth of Puerto Rico and the rest to the U.S. Fish and Wildlife Service (FWS).

Lands were transferred to the Commonwealth through a Quitclaim Deed and a Cooperative Management Agreement signed by the Government of Puerto Rico and the Department of the Interior in 1982.

The Finding and Determination of Eligibility, dated December 24, 1991, qualified 2,660 acres of Culebra Island and adjacent cays as eligible for consideration under the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS). However, upon subsequent review of historical material from the National Archives, it was determined that all of Culebra Island and the adjacent cays should be considered a FUDS, except the Northwest Peninsula which is not eligible under the 1982 Quitclaim Deed and Public Law 93-166, and the tract that was controlled by the Navy after 1986. The revised area covered by the DERP-FUDS projects for Culebra Island and adjacent cays consists of approximately 8,430 acres. **Figure 2** shows the DERP-FUDS project for Culebra.

Figure 2. DERP-FUDS Projects for Culebra.

The objectives of all the DERP-FUDS projects are to reduce risk to human health and the environment and reduce the hazards to public safety presented by military munitions through implementation of effective, legally compliant, and cost-effective response actions. In order to gather additional information that would help to determine the nature and extent of munitions constituent (MC) or munitions and explosive of concern (MEC) contamination on Culebra Island Munitions Response Sites (MRS), it was agreed by the Technical Project Planning Team (TPP Team) comprised of Federal and Commonwealth of Puerto Rico agencies to conduct underwater investigations and to prepare an Environmental Baseline Survey (EBS). The main objectives of the underwater investigations are: a) characterize and map benthic habitats within investigation areas, b) determine, identify and map endangered or threatened species, in particular coral colonies, c) gather the necessary information to determine potential effects (e.g. location of species versus location of suspected MEC) on endangered or threatened species during remedial investigations and cleanup activities, d) determine presence or absence of MC and MEC, e) characterize the nature and extend of MC and MEC presence, and f) determine if the MC or MEC pose an unacceptable risk to human health and the environment, which would require further considerations or a response action.

2.0 PURPOSE AND NEED

The purpose of this document is to develop a series of Standard Operating Procedures (SOPs) to avoid or minimize impacts to threatened and endangered species listed, pursuant to the Endangered Species Act (ESA), and their critical habitats during the DERP-FUDS underwater investigations on Culebra Island and adjacent cays. Also, serve as a guide for the underwater investigation team (UIT) providing them a general description of the listed species known to be found in the waters around Culebra and for which the surrounding waters and marine substrate were designated as critical habitat.

For the purpose of this document underwater investigation activities consist of visual observations, boating and diving operations, and remote sensing surveys. No intrusive investigation will be conducted. Based on the EBS results, additional SOPs or other measures would be developed and coordinated with the TPP for further investigation phases.

The information used to describe the listed species and their habitat was obtained from state/federal agencies fact sheets, recovery and management plans, petitions, the Federal Register and internet search, among other sources.

3.0 LISTED THREATENED OR ENDANGERED SPECIES

The purpose of this section is to provide a general description of threatened and endangered species that are known to occur or have the potential to occur in the waters around Culebra Island and adjacent cays. Species include the Loggerhead (*Caretta caretta*), Green (*Chelonia* *mydas*), Leatherback (*Dermochelys coriacea*) and Hawksbill (*Eretmochelys imbricata*) sea turtles, West Indian manatee (*Trichechus manatus manatus*), Humpback (*Megaptera novaeangliae*), Finback (*Balaenoptera physalus*), Sei (*Balaenoptera borealis*), Sperm (*Physeter macrocephalus*) and Blue (*Balaenoptera musculus*) whales and Elkhorn (*Acropora palmata*) and Staghorn (*Acropora cervicornis*) corals.

3.1 Loggerhead Sea Turtle (*Caretta caretta*)

Description: The loggerhead is characterized by a large head with blunt jaws. The carapace and flippers are a reddish-brown color; the plastron is yellow. The carapace has five pairs of costal scutes with the first touching the nuchal scute. There are three large inframarginal scutes on each of the bridges between the plastron and carapace. Adults grow to an average weight of about 200 pounds (**Figure 3**). This species was listed as threatened on July 28, 1978.

Figure 3. Loggerhead Sea Turtle
Source: http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.htm

Nesting Season and Development: Nesting season extends from about May through August with nesting occurring primarily at night and it is infrequent in Puerto Rico. Loggerheads are known to nest from one to seven times within a nesting season (mean is about 4.1 nests per season) at intervals of approximately 14 days. Mean clutch size varies from about 100 to 126 along the southeastern U.S. coast. Incubation ranges from about 45 to 95 days, depending on incubation temperatures, but averages 55 to 60 days for most clutches in Florida. Hatchlings generally emerge at night. Remigration intervals of 2 to 3 years are most common in nesting loggerheads, but remigration can vary from 1 to 7 years. Age at sexual maturity is believed to be about 20 to 30 years. The species feeds on mollusks, crustaceans, fish, and other marine animals.

Distribution/Habitat: The loggerhead sea turtle can be found throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. It may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Coral reefs, rocky places, and ship wrecks are often used as feeding areas. Loggerheads nest on ocean beaches and occasionally on estuarine shorelines with suitable sand. Nests are typically made between the high tide line and the dune front. Most loggerhead hatchlings originating from U.S. beaches are believed to lead a pelagic existence in the North Atlantic gyre for an extended period of time, perhaps as long as 10 to 12 years, and are best known from the eastern Atlantic near the Azores and Madeira. Post-hatchlings have been found floating at sea in association with *Sargassum* rafts. Once they reach a certain size, these juvenile loggerheads begin recruiting to coastal areas in the western Atlantic where they become benthic feeders in lagoons, estuaries, bays, river mouths, and shallow coastal waters. These juveniles occupy coastal feeding grounds for a decade or more before maturing and making their first reproductive migration, the females returning to their natal beach to nest.

3.2 Green Sea Turtle (*Chelonia mydas*)

Description: The green sea turtle grows to a maximum size of about 4 feet and a weight of 440 pounds. It has a heart-shaped shell, small head, and single-clawed flippers. Color is variable. Hatchlings generally have a black carapace, white plastron, and white margins on the shell and limbs. The adult carapace is smooth, keelless, and light to dark brown with dark mottling; the plastron is whitish to light yellow. Adult heads are light brown with yellow markings. Identifying characteristics include four pairs of costal scutes, none of which borders the nuchal scute, and only one pair of prefrontal scales between the eyes (**Figure 4**). This species was listed under the ESA on July 28, 1978. The breeding populations in Florida and the Pacific coast of Mexico are listed as endangered; elsewhere the species is listed as threatened.

Figure 4. Green Sea Turtle
Photo: Andy Bruckner, NOAA
Source: http://www.nmfs.noaa.gov/pr/species/turtles/green.htm

Nesting Season and Development: The nesting season varies with the locality. In Puerto Rico, it is roughly June through October. Nesting occurs nocturnally at 2, 3, or 4-year intervals. Only occasionally do females produce clutches in successive years. A female may lay as a many as nine clutches within a nesting season (overall average is about 3.3 nests per season) at about 13-day intervals. Clutch size varies from 75 to 200 eggs, with an average clutch size of 136 eggs reported for Florida. Incubation ranges from about 45 to 75 days, depending on incubation temperatures. Hatchlings generally emerge at night. Age at sexual maturity is believed to be 20 to 50 years.

Distribution/Habitat: The green turtle is globally distributed and generally found in tropical and subtropical waters along continental coasts and islands between 30° North and 30° South. In U.S. Atlantic and Gulf of Mexico waters, green turtles are found in inshore and nearshore (reefs and seagrass beds) waters from Texas to Massachusetts, the U.S. Virgin Islands, and Puerto Rico.

Critical habitat was designated in 1998 for green turtles in coastal waters around Culebra (**Figure 5**).

Figure 5. Green Sea Turtle Critical Habitat.

3.3 Leatherback Sea Turtle (*Dermochelys coriacea*)

Figure 6. Leatherback Sea Turtle
Source: http://en.wikipedia.org/wiki/Leatherback_sea_turtle

Description: The leatherback is the largest, deepest diving, and most migratory and wide ranging of all sea turtles. The adult leatherback can reach 4 to 8 feet in length and 500 to 2000 pounds in weight. Its shell is composed of a mosaic of small bones covered by firm, rubbery skin with seven longitudinal ridges or keels. The skin is predominantly black with varying degrees of pale spotting; including a notable pink spot on the dorsal surface of the head in adults. A toothlike cusp is located on each side of the gray upper jaw; the lower jaw is hooked anteriorly. The paddle-like clawless limbs are black with white margins and pale spotting (**Figure 6**). Hatchlings are predominantly black with white flipper margins and keels on the carapace. Jellyfish are the main staple of its diet, but it is also known to feed on sea urchins, squid, crustaceans, tunicates, fish, blue-green algae, and floating seaweed. The leatherback turtle was listed under the ESA as endangered in 1970.

Breeding Season and Development: On Culebra nesting occurs from about February to August with the peak occurring around April to May. Female leatherbacks nest an average of 5 to 7 times within a nesting season, with an observed maximum of 11 nests. The average interesting interval is about 9 to 10 days. The nests are constructed at night in clutches of about 70 to 80 yolked eggs. The white spherical eggs are approximately 2 inches in diameter. Typically incubation takes from 55 to 75 days, and emergence of the hatchlings occurs at night. Most leatherbacks return to their nesting beaches at 2 to 3-year intervals. Leatherbacks are believed to reach sexual maturity in 6 to 10 years.

In the U.S., small nesting populations occur on the Florida east coast (35 females/year), Sandy Point, U.S. Virgin Islands (50 to 100 females/year), and Puerto Rico (30 to 90 females/year). The leatherback is the most pelagic of the sea turtles. Adult females require sandy nesting beaches backed with vegetation and sloped sufficiently so the crawl to dry sand is not too far. The preferred beaches have proximity to deep water and generally rough seas. Culebra beaches most used by the species are Flamenco, Brava, Resaca and Soni Beach.

Distribution/Habitat: The leatherback turtle is distributed worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans. It is also found in small numbers as far north as British Columbia, Newfoundland, and the British Isles, and as far south as Australia, Cape of Good Hope, and Argentina.

3.4 Hawksbill Sea Turtle (*Eretmochelys imbricata*)

Description: The Hawksbill Turtle (*Eretmochelys imbricate*) is small to medium-sized compared to other sea turtle species. Adults weigh 100 to 150 lbs (45 to 68 kg) on average, but can grow as large as 200 lbs (91 kg). Hatchlings weigh about 0.5 oz (14 g). The carapace (top shell) of an adult ranges from 25 to 35 inches (63 to 90 cm) in length and has a "tortoiseshell" coloring, ranging from dark to golden brown, with streaks of orange, red, and/or black. The shells of hatchlings are 1-2 inches (about 42 mm) long and are mostly brown and somewhat heart-shaped. The plastron (bottom shell) is clear yellow. The rear edge of the carapace is almost always serrated, except in older adults, and has overlapping "scutes". The hawksbill turtle's head is elongated and tapers to a point, with a beak-like mouth that gives the species its name. Hawksbill turtles are unique among sea turtles in that they have two pairs of prefrontal scales on the top of the head and each of the flippers usually has two claws (**Figure 7**). This species was listed under the ESA as endangered in 1970.

Figure 7. Hawksbill Sea Turtle
Photo: Caroline Rogers, USGS
Source: http://www.nmfs.noaa.gov/pr/species/turtles/hawksbill.htm

Nesting Season and Development: The nesting season varies with locality, nesting occurs all year long. Hawksbills nest at night and, on average, about 4.5 times per season at intervals of approximately 14 days. In Florida and the U.S. Caribbean, clutch size is approximately 140 eggs, although several records exist of over 200 eggs per nest. They nest under the vegetation on the high beach and nests have been observed having the last eggs of the clutch as close as 3 inches from the sand's surface. Remigration intervals of 2 to 3 years predominate. The incubation period averages 60 days. Hawksbills recruit into the reef environment at about 35 cm in length and are believed to begin breeding about 30 years later. However, the time required to reach 35 cm in length is unknown and growth rates vary geographically. As a result, actual age at sexual maturity is not known.

Distribution/Habitat: Hawksbill turtles use different habitats at different stages of their life cycle, but are most commonly associated with healthy coral reefs. The ledges and caves of coral reefs provide shelter for resting hawksbills both during the day and at night. Hawksbills are known to inhabit the same resting spot night after night. Hawksbills are also found around rocky outcrops and high energy shoals. These areas are optimum sites for sponge growth, which certain species are the preferred food of hawksbills. They are also known to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent.

3.5 Antillean Manatee (*Trichechus manatus manatus*)

Figure 8. Antillean Manatee
Source: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A007

Description: Manatees are marine mammals found in marine, estuarine, and freshwater environments. The West Indian manatee, *Trichechus manatus*, includes two distinct subspecies, the Florida manatee (*Trichechus manatus latirostris*) and the Antillean manatee (*Trichechus manatus manatus*). While morphologically distinctive, both subspecies have many common features. Manatees have large, seal-shaped bodies with paired flippers and a round, paddle-shaped tail. They are typically grey in color (color can range from black to light brown) and occasionally spotted with barnacles or colored by patches of green or red algae. The muzzle is heavily whiskered and coarse, single hairs are sparsely distributed throughout the body. Adult manatees, on average, are about nine feet long (3 meters) and weigh about 1,000 pounds (200 kilograms). At birth, calves are between three and four feet long (1 meter) and weigh between 40 and 60 pounds (30 kilograms) (**Figure 8**). This species was listed under the ESA as endangered in 1967.

Behavior, Development and Diet: The manatee maneuvers through the water moving its paddle-like tail up and down and steering with its flippers. It often rests suspended just below the water's surface with only the snout above water. It feeds underwater, but must surface periodically to breathe. Although the manatee can remain underwater for as long as 12 minutes, the average time is 4-1/2 minutes.

Manatees reach breeding maturity between 3 and 10 years of age. The gestation period is approximately 13 months. Calves may be born at any time during the year. Usually a single calf is born, but twins do occur. An adult manatee will usually give birth to a calf every 2 to 5 years. The low reproductive rate makes the species less capable of rebounding from threats to its survival. They nurse underwater for about three minutes at a time from a nipple located behind their mother's forelimb. Born with teeth, calves begin eating plants within a few weeks but remain with their mother for up to 2 years. Manatees may live for several decades.

Manatees are herbivores that feed opportunistically on a wide variety of marine, estuarine, and freshwater plants, including submerged, floating, and emergent vegetation. Common forage plants include and are not limited to: cord grass, alga, turtle grass, shoal grass, manatee grass, eel grass, and other plant types. Manatees also require sources of freshwater, obtained from both natural and anthropogenic sources.

Distribution/Habitat: All of the studies suggest that manatees in Puerto Rico are more commonly observed in coastal areas from San Juan, eastward to the east coast, (and including Culebra and Vieques Islands) and then south and west, past Jobos Bay, to the west coast, and then about as far to the northwest as Rincon. Manatees are concentrated in several "hot spots" including Ceiba, Vieques Island, Jobos Bay and Boquerón Bay, and are less abundant along the north coast, between Rincón and Dorado.

3.6 Humpback Whale (*Megaptera novaeangliae*)

Description: Humpback whales are well known for their long "pectoral" fins, which can be up to 15 feet (4.6 m) in length. Their scientific name, *Megaptera novaeangliae,* means "big-winged New Englander" as the New England population was the one best known to Europeans. These long fins give them increased maneuverability; they can be used to slow down or even go backwards.

Figure 9. Humpback Whale
Source: http://www.nmfs.noaa.gov/pr/images/cetaceans/humpbackwhale_noaa_large.jpg

Similar to all baleen whales, adult females are larger than adult males, reaching lengths of up to 60 feet (18 m). Their body coloration is primarily dark grey, but individuals have a variable amount of white on their pectoral fins and belly. This variation is so distinctive that the pigmentation pattern on the undersides of their "flukes" is used to identify individual whales, similar to a humans fingerprint (**Figure 9**).

In June 1970, humpback whales were designated as "endangered" under the Endangered Species Conservation Act (ESCA). In 1973, the ESA replaced the ESCA, and continued to list humpbacks as endangered.

Behavior, Development and Diet: Humpback whales travel great distances during their seasonal migration, the farthest migration of any mammal. The longest recorded migration was 5,160 miles (8,300 km). This trek from Costa Rica to Antarctica was completed by seven animals, including a calf. One of the more closely studied routes is between Alaska and Hawaii, where humpbacks have been observed making the 3,000 mile (4,830 km) trip in as few as 36 days.

During the summer months, humpbacks spend the majority of their time feeding and building up fat stores (blubber) that they will live off of during the winter. Humpbacks filter feed on tiny crustaceans (mostly krill), plankton, and small fish and can consume up to 3,000 pounds (1360 kg) of food per day. Several hunting methods involve using air bubbles to herd, corral, or disorient fish. One highly complex variant, called "bubble netting," is unique to humpbacks. This technique is often performed in groups with defined roles for distracting, scaring, and herding before whales lunge at prey corralled near the surface.

In their wintering grounds, humpback whales congregate and engage in mating activities. Humpbacks are generally "polygynous" with males exhibiting competitive behavior on wintering grounds. Aggressive and antagonistic behaviors include chasing, vocal and bubble displays, horizontal tail thrashing, and rear body thrashing. Males within these groups also make physical contact; striking or surfacing on top of one another. These bouts can cause injuries ranging from bloody scrapes to, in one recorded instance, death. Also on wintering grounds, males sing complex songs that can last up to 20 minutes and be heard 20 miles (30 km) away. A male may sing for hours, repeating the song several times. All males in a population sing the same song, but that song continually evolves over time.

Gestation lasts for about 11 months. Newborns are 13 to 16 ft (4 to 5 m) long and grow quickly from the highly nutritious milk of their mothers. Weaning occurs between 6 and 10 months after birth. Mothers are protective and affectionate towards their calves, swimming close and frequently touching them with their flippers. Males do not provide parental support for calves. Breeding usually occurs once every two years, but sometimes occurs twice in three years.

Distribution/Habitat: Humpback whales live in all major oceans from the equator to sub-polar latitudes. In the western North Atlantic ocean, humpback whales feed during spring, summer, and fall over a range that encompasses the eastern coast of the U.S. (including the Gulf of Maine), the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland. In winter, whales from the Gulf of Maine mate and calve primarily in the West Indies. Not all whales migrate to the West Indies every winter, and significant numbers of animals are found in mid- and high-latitude regions at this time.

During migration, humpbacks stay near the surface of the ocean. While feeding and calving, humpbacks prefer shallow waters. During calving, humpbacks are usually found in the warmest waters available at that latitude. Calving grounds are commonly near offshore reef systems, islands, or continental shores. Humpback feeding grounds are in cold, productive coastal waters (**Figure 14**).

3.7 Fin or Finback Whale (*Balaenoptera physalus*)

Description: Fin or finback whales are the second-largest species of whale, with a maximum length of about 75 ft (22 m) in the Northern Hemisphere, and 85 ft (26 m) in the Southern Hemisphere. Fin whales show mild sexual "dimorphism", with females measuring longer than males by 5-10%. Adults can weigh between 80,000-160,000 lbs (40-80 tons).

Figure 10. Fin or Finback Whale
Source: http://www.cetaceanalliance.org/cetaceans/Bp_home.htm
Photos © Tethys Research Institute.

Fin whales have a sleek, streamlined body with a V-shaped head. They have a tall, "falcate" dorsal fin, located about two-thirds of the way back on the body, that rises at a shallow angle from the animal's back. The species has a distinctive coloration pattern: the back and sides of the body are black or dark brownish-gray, and the ventral surface is white. The unique, asymmetrical head color is dark on the left side of the lower jaw, and white on the right side. Many individuals have several light-gray, V-shaped "chevrons" behind their head, and the underside of the tail flukes is white with a gray border (**Figure 10**).

Within the U.S., the fin whale is listed as endangered throughout its range under the ESA and is listed as "depleted" throughout its range under the Marine Mammal Protection Act of 1972.

Behavior, Development and Diet: Fin whales can be found in social groups of 2-7 whales and in the North Atlantic are often seen feeding in large groups that include humpback whales, minke whales, and Atlantic white-sided dolphins. Fin whales are large, fast swimmers and the killer whale (*Orcinus orca*) is their only non-human predator.

During the summer, fin whales feed on krill, small schooling fish (e.g., herring, capelin, and sand lance), and squid by lunging into schools of prey with their mouth open, using their 50-100 accordion-like throat pleats to gulp large amounts of food and water. They then filter the food particles from the water using the 260-480 "baleen" plates on each side of the mouth. Fin whales fast in the winter while they migrate to warmer waters.

Little is known about the social and mating systems of fin whales. Similar to other baleen whales, long-term bonds between individuals are rare. Males become sexually mature at 6-10 years of age; females at 7-12 years of age. Physical maturity is attained at approximately 25 years for both sexes. After 11-12 months of gestation, females give birth to a single calf in tropical and subtropical areas during midwinter. Newborn calves are approximately 18 ft (6 m) long, and weigh 4,000-6,000 lb (2 tons). Fin whales can live 80-90 years.

Distribution/Habitat: Fin whales are found in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes, and less commonly in the tropics. They occur year-round in a wide range of latitudes and longitudes, but the density of individuals in any one area changes seasonally (**Figure 14**).

3.8 Sei Whale (*Balaenoptera borealis*)

Description: Sei whales are members of the baleen whale family and are considered one of the "great whales" or rorquals. Two subspecies of sei whales are recognized, *B. b. borealis* in the Northern Hemisphere and *B. B. schlegellii* in the Southern Hemisphere.

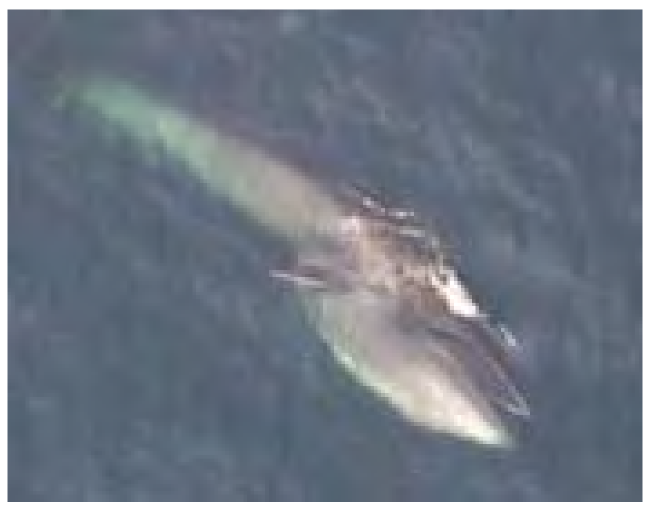

Figure 11. Sei Whale
Source: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/seiwhale.htm#more

These large animals can reach lengths of about 40-60 ft (12-18 m) and weigh 100,000 lbs (45,000 kg). Females may be slightly longer than males. Sei whales have a long, sleek body that is dark bluish-gray to black in color and pale underneath. The body is often covered in oval-shaped scars (probably caused from cookie-cutter shark and lamprey bites) and sometimes has subtle "mottling". This species has an erect "falcate", "dorsal" fin located far down (about two-thirds) the animals back. They often look similar in appearance to Bryde's whales, but can be distinguished by the presence of a single ridge located on the animal's "rostrum". Bryde's whales, unlike other rorquals, have three distinct prominent longitudinal ridges on their rostrum. They have 219-410 baleen plates that are dark in color with gray/white fine inner fringes in their enormous mouths. They also have 30-65 relatively short ventral pleats that extend from below the mouth to the naval area. The number of throat grooves and baleen plates may differ depending on geographic population (**Figure 11**).

When at the water's surface, sei whales can be sighted by a columnar or bushy blow that is about 10-13 feet (3-4 m) in height. The dorsal fin usually appears at the same time as the blowhole, when the animal surfaces to breathe. This species usually does not arch its back or raise its flukes when diving.

This species was listed under the ESA as endangered in 1970.

Behavior, Development and Diet: They are usually observed singly or in small groups of 2-5 animals, but are occasionally found in larger (30-50) loose aggregations. Sei whales are capable of diving 5-20 minutes to opportunistically feed on plankton (e.g., copepods and krill), small schooling fish, and cephalopods (e.g., squid) by both gulping and skimming. They prefer to feed at dawn and may exhibit unpredictable behavior while foraging and feeding on prey. Sometimes seabirds are associated with the feeding frenzies of these and other large whales.

Sei whales become sexually mature at 6-12 years of age when they reach about 45 ft (13 m) in length, and generally mate and give birth during the winter in lower latitudes. Females breed every 2-3 years, with a gestation period of 11-13 months. Females give birth to a single calf that is about 15 ft (4.6 m) long and weighs about 1,500 lbs (680 kg). Calves are usually nursed for 6-9 months before being weaned on the preferred feeding grounds. Sei whales have an estimated lifespan of 50-70 years.

Distribution/Habitat: Sei whales have a cosmopolitan distribution and occur in subtropical, temperate, and subpolar waters around the world. They prefer temperate waters in the mid-latitudes, and can be found in the Atlantic, Indian, and Pacific Oceans. During the summer, they are commonly found in the Gulf of Maine, and on Georges Bank and Stellwagen Bank in the western North Atlantic. The entire distribution and movement patterns of this species is not well known. This species may unpredictably and randomly occur in a specific area, sometimes in large numbers. These events may occur suddenly and then not occur again for long periods of time. Populations of sei whales, like other rorquals, may seasonally migrate toward the lower latitudes during the winter and higher latitudes during the summer. They prefer subtropical to subpolar waters on the continental shelf edge and slope worldwide and they are usually observed in deeper waters of oceanic areas far from the coastline (**Figure 14**).

3.9 Sperm Whale (*Physeter macrocephalus*)

Figure 12. Sperm Whale
Source: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/spermwhale.htm

Description: Sperm whales are the largest of the odontocetes (toothed whales) and the most sexually dimorphic cetaceans, with males considerably larger than females. Adult females may grow to lengths of 36 feet (11 m) and weigh 15 tons (13607 kg). Adult males, however, reach about 52 feet (16 m) and may weigh as much as 45 tons (40823 kg). It is distinguished by its extremely large head, which takes up to 25 to 35% of its total body length. It is the only living cetacean that has a single blowhole asymmetrically situated on the left side of the head near the tip. Sperm whales have the largest brain of any animal (on average 17 pounds (7.8 kg) in mature males), however, compared to their large body size, the brain is not exceptional in size.

There are between 20-26 large conical teeth in each side of the lower jaw. The teeth in the upper jaw rarely erupt and are often considered to be vestigial. It appears that teeth may not be necessary for feeding, since they do not break through the gums until puberty, if at all, and healthy sperm whales have been caught that have no teeth.

Sperm whales are mostly dark gray, but oftentimes the interior of the mouth is bright white, and some whales have white patches on the belly. Their flippers are paddle-shaped and small compared to the size of the body, and their flukes are very triangular in shape. They have small dorsal fins that are low, thick, and usually rounded (**Figure 12**).

This species was listed under the ESA as endangered in 1970.

Behavior, Development and Diet: Because sperm whales spend most of their time in deep waters, their diet consists of many larger organisms that also occupy deep waters of the ocean. Their principle prey are large squid weighing between 3.5 ounces and 22 pounds (0.1 kg and 10 kg), but they will also eat large demersal and mesopelagic sharks, skates, and fishes. The average dive lasts about 35 minutes and is usually down 1,312 feet (400 m), however dives may last over an hour and reach depths over 3280 feet (1000 m).

Female sperm whales reach sexual maturity around 9 years of age when they are roughly 29 feet (9 m) long. At this point, growth slows and they produce a calf approximately once every five years. After a 14-16 month gestation period, a single calf about 13 feet (4 m) long is born. Although calves will eat solid food before one year of age, they continue to suckle for several years. Females are physically mature around 30 years and 35 feet (10.6 m) long, at which time they stop growing. For about the first 10 years of life, males are only slightly larger than females, but males continue to exhibit substantial growth until they are well into their 30s. Males reach physical maturity around 50 years and when they are 52 feet (16 m) long. Unlike females, puberty in males is prolonged, and may last between ages 10 to 20 years old. Even though males are sexually mature at this time, they often do not actively participate in breeding until their late twenties.

Most females will form lasting bonds with other females of their family, and on average 12 females and their young will form a family unit. While females generally stay with the same unit all their lives in and around tropical waters, young males will leave when they are between 4 and 21 years old and can be found in "bachelor schools", comprising of other males that are about the same age and size. As males get older and larger, they begin to migrate to higher latitudes (toward the poles) and slowly bachelor schools become smaller, until the largest males end up alone. Large, sexually mature males that are in their late 20s or older, will occasionally return to the tropical breeding areas to mate.

Distribution/Habitat: They inhabit all oceans of the world. They can be seen close to the edge of pack ice in both hemispheres and are also common along the equator, especially in the Pacific. Sperm whales are found throughout the world's oceans in deep waters between about 60° N and 60° S latitudes. Their distribution is dependent on their food source and suitable conditions for breeding, and varies with the sex and age composition of the group. It migrations are not as predictable or well understood as migrations of most baleen whales. In some mid-latitudes, there seems to be a general trend to migrate north and south depending on the seasons (whales move poleward in the summer). However, in tropical and temperate areas, there appears to be no obvious seasonal migration.

Sperm whales tend to inhabit areas with a water depth of 1968 feet (600 m) or more, and are uncommon in waters less than 984 feet (300 m) deep. Female sperm whales are generally found in deep waters (at least 3280 feet, or 1000 m) of low latitudes (less than 40°, except in the North Pacific where they are found as high as 50°). These conditions generally correspond to sea surface temperatures greater than 15°C, and while female sperm whales are sometimes seen near oceanic islands, they are typically far from land (**Figure 14**).

Immature males will stay with female sperm whales in tropical and subtropical waters until they begin to slowly migrate towards the poles, anywhere between ages 4 and 21 years old. Older, larger males are generally found near the edge of pack ice in both hemispheres. On occasion, however, these males will return to the warm water breeding area. No critical habitat has been designated for this species.

3.10 Blue Whale (*Balaenoptera musculus*)

Description: The blue whale is a cosmopolitan species of baleen whale. In the Northern Hemisphere, they are generally smaller than those in the Southern Ocean. Maximum body length in the North Atlantic was about 88.5 feet (27 m) and the largest blue whale reported from the North Pacific was about 88 feet (26.8 m). Adults in the Antarctic can reach a maximum body length of about 108 feet (33 m) and can weigh more than 330,000 pounds (150,000 kg). As is true of other baleen whale species, female blue whales are somewhat larger than males. Blue whales are identified by the following characteristics: a long-body and comparatively slender shape; a broad, flat "rostrum" when viewed from above; a proportionately smaller dorsal fin than other baleen whales; and a mottled gray color pattern that appears light blue when seen through the water (**Figure 13**).

Figure 13. Blue Whale

Source: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/bluewhale.htm

This species was listed under the ESA as endangered in 1970.

Behavior, Development and Diet: Scientists have yet to discern many details regarding the life history of the blue whale. The best available science suggests the gestation period is approximately 10-12 months and that blue whale calves are nursed for about 6-7 months. Most reproductive activity, including births and mating, takes place during the winter. Weaning probably occurs on, or en route to, summer feeding areas. The average calving interval is probably two to three years. The age of sexual maturity is thought to be 5-15 years. There are no known differences in the reproductive biology of blue whales in the North Pacific and North Atlantic oceans.

The primary and preferred diet of blue whales is krill (euphausiids). In the North Atlantic, blue whales feed on two main euphausiid species: *Thysanoëssa inermis*and and *Meganyctiphanes norvegica*. In addition, *T. raschii*and and *M. norvegica* have been recorded as important food sources of blue whales in the Gulf of St. Lawrence. In the North Pacific, blue whales prey mainly on *Euphausia pacifica*and secondarily on *T. spinifera*. While other prey species, including fish and copepods, have been mentioned in the scientific literature, these are not likely to contribute significantly to the diet of blue whales.

Distribution/Habitat: They are found in oceans worldwide and are separated into populations by ocean basin in the North Atlantic, North Pacific, and Southern Hemisphere. They follow a seasonal migration pattern between summering and wintering areas, but some evidence suggests that individuals remain in certain areas year-round. The extent of knowledge concerning distribution and movement varies with area and migratory routes are not well known but, in general, distribution is driven largely by food requirements.

Blue whales inhabit sub-polar to sub-tropical latitudes. Poleward movements in spring allow the whales to take advantage of high zooplankton production in summer. Movement towards the subtropics in the fall allows blue whales to reduce their energy expenditure while fasting, avoid ice entrapment in some areas, and engage in reproductive activities in warmer waters of lower latitudes. Although the species is often found in coastal waters, blue whales are thought to occur generally more offshore than humpback whales, for example (**Figure 14**).

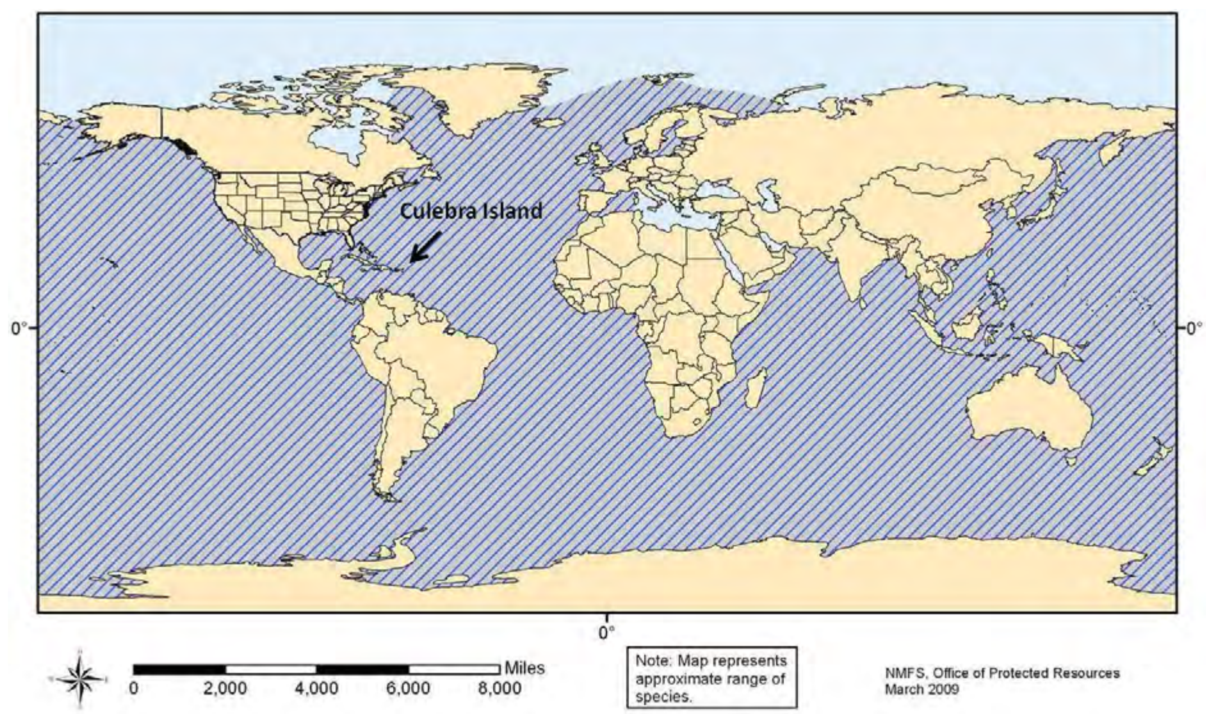

Figure 14. Approximate range map for Humpback, Sei, Sperm and Blue whales.

3.11 Elkhorn coral (*Acropora palmata*)

Description: It is a large, branching coral with thick and sturdy antler-like branches (**Figure 15**) and is found in shallow reefs, typically in water depths from 0-35 feet, as these corals prefer areas where wave action causes constant water movement. Colonies are fast growing: branches increase in length by 2-4 inches (5-10 cm) per year, with colonies reaching their maximum size in approximately 10-12 years. Over the last 10,000 years, elkhorn coral has been one of the three most important Caribbean corals contributing to reef growth and development and providing essential fish habitat. This species was listed under the ESA as endangered on May 4, 2006.

Figure 15. Elkhorn Coral
Source: http://www.nmfs.noaa.gov/pr/species/invertebrates/elkhorncoral.htm

Color: Living colonies are yellow, brown or golden with light rims.

Habitat: Elkhorn coral was formerly the dominant species in shallow water (3 ft-16 ft [1-5 m] deep) throughout the Caribbean and on the Florida Reef Tract, forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 feet (6 m), although isolated corals may occur to 65 feet (20 m).

Distribution/Reproduction: Elkhorn coral is found on coral reefs in southern Florida, the Bahamas, and throughout the Caribbean.

The dominant mode of reproduction for elkhorn coral is asexual, with new colonies forming when branches break off of a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female (simultaneous hermaphrodites) and will typically release millions of "gametes". The coral larvae (planula) live in the plankton for several days until finding a suitable area to settle, but very few larvae survive to settle and metamorphose into new colonies. The preponderance of asexual reproduction in this species raises the possibility that genetic diversity may be very low in the remnant populations.

3.12 Staghorn coral (*Acropora cervicornis*)

Figure 16. Staghorn Coral
Source: http://www.nmfs.noaa.gov/pr/species/invertebrates/staghorncoral.htm

Description: It is a branching coral with cylindrical branches ranging from a few centimeters to over 6.5 feet (2 m) in length (**Figure 16**). This coral exhibits the fastest growth of all known western Atlantic corals, with branches increasing in length by 4-8 inches (10-20 cm) per year. This species was listed under the ESA as endangered on May 4, 2006.

Color: Living colonies are light, grayish to yellowish-brown.

Habitat: Staghorn coral occur in back reef and fore reef environments from 0-100 feet (0 to 30 m) deep. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Fore reef zones at intermediate depths of 15-80 feet (5-25 m) were formerly dominated by extensive single species stands of staghorn coral until the mid 1980s.

Distribution/Reproduction: Staghorn coral is found in the Atlantic Ocean, Caribbean Sea, and western Gulf of Mexico. Specifically, staghorn coral is found throughout the Florida Keys, the Bahamas, the Caribbean islands, and Venezuela. The northern limit of staghorn coral is around Boca Raton, FL.

The dominant mode of reproduction for staghorn coral is asexual fragmentation, with new colonies forming when branches break off a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female (simultaneous hermaphrodites) and will release millions of "gametes". The coral larvae (planula) live in the plankton for several days until finding a suitable area to settle, but very few larvae survive to settle and metamorphose into new colonies. The preponderance of asexual reproduction in this species raises the possibility that genetic diversity is very low in the remnant populations

The NMFS has designated critical habitat for elkhorn and staghorn corals in four areas: Florida, Puerto Rico, St. John/St. Thomas, and St. Croix. **Figure 17** shows the designated areas for Puerto Rico. In addition, a 4(d) rule (50 CFR Part 223) establishing “take” prohibitions for elkhorn and staghorn corals went into effect on November 28, 2008. Take includes collect, bother, harm, harassment, damage to, death, or other actions that affect health and survival of listed species.

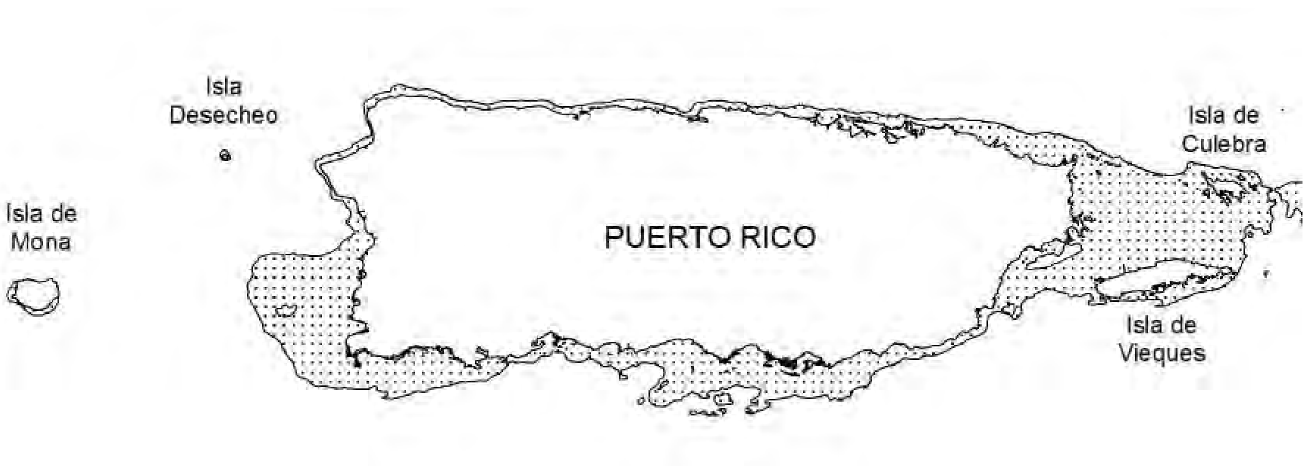

Figure 17. Elkhorn and Staghorn Corals Critical Habitat.

3.13 Species of Corals Proposed for Listing under the ESA

On 20 October 2009, the National Marine Fisheries Service (NMFS) received a petition from the Center for Biological Diversity to list 83 species of corals as threatened or endangered under the Endangered Species Act (ESA) and to designate critical habitat for these corals. NMFS reviewed the petition and determined that the requested listing actions may be warranted for 82 of the 83 coral species. All of the Atlantic coral species have the potential to be found in waters around Culebra. These species are: Lamarck's Sheet Coral (*Agaricia lamarcki*), Boulder Star Coral (*Montastraea annularis*), Mountainous Star Coral (*Montastrae faveolata*), *Montastraea franksi*, Pillar Coral (*Dendrogyra cylindrus*), Elliptical Star Coral or Pineapple Coral (*Dichocoenia stokesii*) and Rough Cactus Coral (*Mycetophyllia ferox*). As of the day of this document, no final decision on whether to list these species has been made by NMFS. **Figure 18** shows a range map for the seven species of coral proposed for listing under ESA.

Figure 18. Range map for the seven species of coral proposed for listing under ESA.

3.13.1 Lamarck's Sheet Coral (*Agaricia lamarcki*)

Description: Colonies form large, mostly thick plates, broad, rounded or acute, often overlapping each other. The upper surface bears concentric rows of ridges with relatively wide, straight or reticulate, valleys. The white, star-like, polyps are in the valleys' center. The septa alternate in height and thickness. Generally, the taller and thicker primary septa extend close to the columella before dropping sharply into the corallite pit, while the thinner secondary septa appear shorter, because they slope

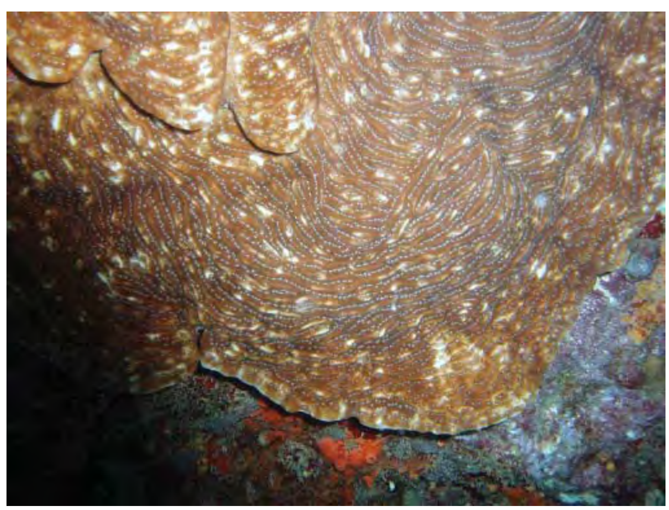

Figure 19. Lamarck's Sheet Coral
Source: http://coralpedia.bio.warwick.ac.uk/en/corals/agaricia_lamarcki.html

gradually into the corallite pit. The underside of the colony is smooth, without polyps (**Figure 19**).

Color: Yellow-brown to golden-brown to brown, sometimes with bluish or grayish tints, with contrasting white polyps (**Figure 19**).

Habitat: On sloping reefs and along walls, between 16-165 feet (5-50 m), but most common between 65-115 feet (20 and 35 m).

Distribution: Occasional in Florida and the Bahamas, common in the Caribbean (**Figure 18**).

3.13.2 *Montastraea* Complex

3.13.2.1 Boulder Star Coral (*Montastraea annularis*)

Description: The colonies grow in several morphotypes that were originally described as separate species. The species occurs as long, thick columns with enlarged, dome-like tops; large, massive mounds; sheets with skirt-like edges; irregularly bumpy mounds and plates or as smooth plates. Colonies up to 10 feet (3 m) in diameter. The surface is covered with distinctive, often somewhat raised, corallites (**Figure 20**).

Color: Shades of green to brown, yellow-brown and gray.

Figure 20. Boulder Star Coral
Source: http://coralpedia.bio.warwick.ac.uk/images/Montastraea%20annularis01.JPG

Habitat: Inhabit most reef environments and the species is often the predominant coral between 22-82 feet (7-25 m). The flattened plates are most common at deeper reefs, down to 165 feet (50 m).

Distribution: Common to abundant Florida, Bahamas and Caribbean (**Figure 18**).

3.13.2.2 Mountainous Star Coral (*Montastraea faveolata*)

Description: This species has been called the “dominant reef-building coral of the Atlantic”. *Montastraea faveolata* buds extratentacularly to form head or sheet colonies with corallites that are uniformly distributed and closely packed, but sometimes unevenly exsert. Septa are highly exsert, with septocostae arranged in a variably conspicuous fan system, and the skeleton is generally far less dense than those of its sibling species. Active growth is typically found at the edges of colonies, forming a smooth outline with many small polyps (**Figure 21**).

Figure 21. Mountainous Star Coral
Source: http://coralpedia.bio.warwick.ac.uk/images/Montastraea%20faveolata01.JPG

Color: It is usually pale brown but may be bright, fluorescent green over the dark brown.

Habitat: *M. faveolata* is found from 3-100 feet (1-30 m) in backreef and fore-reef habitats, and is often the most abundant coral between 30-65 feet (10-20 m) in fore-reef environments.

Distribution: This species occurs in the Caribbean, the Gulf of Mexico, Florida, and the Bahamas. May also be present in Bermuda, but this requires confirmation (**Figure 18**).

3.13.2.3 *Montastraea franksi*

Description: This species builds massive, encrusting plate or subcolumnar colonies via extratentacular budding. The characteristically bumpy appearance of this species is caused by relatively large, unevenly exsert, and irregularly distributed corallites. *M. franksi* is distinguished from its sibling *Montastraea* species by this irregular or bumpy appearance; a relatively dense, heavy, and hard skeleton (corallum); thicker septo-costae with a conspicuous septocostal midline row of lacerate teeth; and a greater degree of interspecies aggression (**Figure 22**).

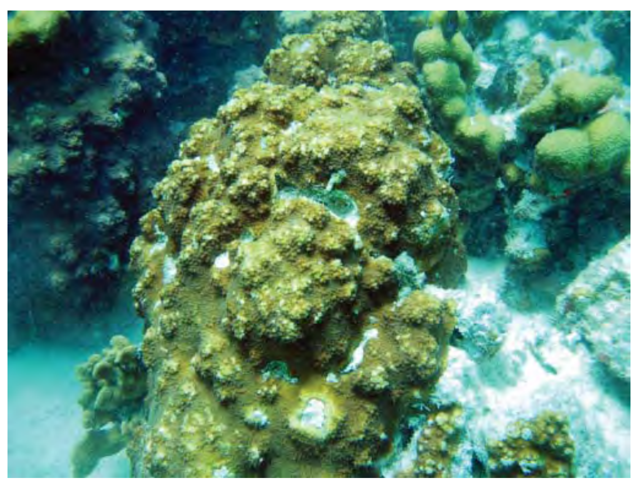

Figure 22. *Monstastraea franki*
Source: http://coralpedia.bio.warwick.ac.uk/images/Montastraea%20franksi01.JPG

Color: It is basically orange-brown with many pale patches on the lumpy surface, but may be grey or greenish-brown (**Figure 22**).

Habitat: This species mostly grows in the open like other species of this genus but smaller, encrusting colonies are common in shaded overhangs. It is uncommon in very shallow water, but becomes common deeper.

Distribution: This species occurs in the Caribbean, the Gulf of Mexico, Florida, and the Bahamas (**Figure 18**).

3.13.3 Pillar Coral (*Dendrogyra cylindrus*)

Description: Colonies form numerous, heavy, cylindrical spires, that grow upwards from an encrusting base mass. The colonies can attain a height of 10 feet (3 m), with a pillar diameter of more than 4 inches (10 cm). Polyps are normally extended during the day, giving the colony a fuzzy appearance and obscuring the long, meandroid, corallite series (**Figure 23**).

Figure 23. Pillar Coral
Source: http://coralpedia.bio.warwick.ac.uk/en/corals/dendrogyra_cylindrus.html

Color: Light tan to golden brown and chocolate brown.

Habitat: Colonies are typically found on flat gently sloping back reef and fore reef environment in depths of 3-82 feet (1-25 m). The species does not occur in extremely exposed locations.

Distribution: This species occurs in the Caribbean, the southern Gulf of Mexico, Florida, and the Bahamas (**Figure 18)**.

3.13.4 Elliptical Star Coral or Pineapple Coral (*Dichocoenia stokesii*)

Description: Colonies form rounded heads, domes or flattened plates. The distinctive character of this species is the oval corallites which protrude conspicuously above the surface between the corallites (coenesteum). Corallites are markedly oval and become elongated, almost meandroid, before dividing. Corallites are well separated from each other, and the surface between them is granular (**Figure 24**).

Color: Though sometimes green, they are usually orange-brown with white septo-costae.

Habitat: It is uncommon but has been found in most reef environments within its range, including both back and fore reef environments, rocky reefs, lagoons, spur and groove formations, channels, and occasionally at the base of reefs. This species occurs in depths from 6-236 feet (2-72 m); when found in exposed reefs at depths less than 65 feet (20 m), its hemispherical heads are more abundant than usual.

Figure 24. Elliptical/Pineapple Coral
Source: http://coralpedia.bio.warwick.ac.uk/en/corals/dichocoenia_stokesii.html

Distribution: This species occurs in the Caribbean, the Gulf of Mexico, Florida (including the Florida Middle Grounds), the Bahamas, and Bermuda (**Figure 18**).

3.13.5 Rough Cactus Coral (*Mycetophyllia ferox*)

Description: Colonies consist of flat plates with radiating valleys. It is a widely recognized valid species with colonies comprised of thin, weakly attached plates with interconnecting, slightly sinuous, narrow valleys. Tentacles are generally absent and corallite centers tend to form single rows. The walls of the valleys commonly join to form closed valleys, a feature not seen in other members of *Mycetophyllia*. The ridges are usually small and square, with a groove on top. The ridges, or walls between valleys, are commonly quite thin, and are irregular, and valleys are narrower (**Figure 25**).

Figure 25. Rough Cactus Coral
Source: http://coralpedia.bio.warwick.ac.uk/en/corals/mycetophyllia_ferox.html

Color: Valleys and walls are contrasting shades of grays and browns.

Habitat: This species is most common in fore reef environments from 5-30 meters (but is more abundant from 10-20 meters), but also occurs at low abundance in certain deeper back reef habitats and deep lagoons.

Distribution: This species occurs in the Caribbean, southern Gulf of Mexico, Florida, and the Bahamas (**Figure 18**).

4.0 MEASURES TO AVOID OR MINIMIZE POSSIBLE IMPACTS

The following measures will be implemented to avoid or minimize impacts to threatened or endangered species and their habitat during underwater investigation activities. Because the proposed action consists of data collection, no intrusive work will be performed and munitions disposal are not considered. Adverse impacts to protected species or their habitats are not expected.

The Contractor will be required to implement these SOPs, as well as the previously developed SOPs included in the attached Appendices A and B as part of any underwater work.

4.1 General Conservation Measures

4.1.1 Date of Commencement: The Contractor will provide to the U.S. Army Corps of Engineers (USACE) with a written notification of the date of commencement of underwater investigation work and a detailed description of the work to be implemented based on the Work Plan (WP) that will be coordinated and reviewed by TPP Team. USACE will provide the date of commencement to the TPP Team at least 10 days prior to initiating fieldwork.

4.1.2 Training/Briefing: Prior to initiating work all personnel shall receive training or briefings regarding the importance of endangered species, their characteristics, how they can be identified, potential and critical habitats, types of material in which they may hide, actions to take if are sighted, and avoidance measures to be followed as detailed in these SOPs. This training or briefing shall be prepared and offered by qualified personnel (e.g. biologist, marine biologist, environmental scientist, among others). The Contractor shall submit their qualifications to the USACE for review and approval. The training or briefing will also include safety and emergency procedures.

4.1.3 Civil and Criminal Penalties: The Contractor shall instruct all personnel associated with the project of the potential presence of threatened or endangered species. All personnel shall be advised that there are civil and criminal penalties for harming, harassing, killing or otherwise altering the natural behavior or condition of threatened or endangered species protected under the ESA, the Puerto Rico Wildlife Law, and the Regulation to Govern the Endangered and Threatened Species of the Commonwealth of Puerto Rico. ESA gives both the FWS and NMFS responsibility for enforcing its provisions. The Commonwealth regulations to protect endangered and threatened species are enforced by the Puerto Rico Department of Natural and Environmental Resources (DNER).

4.1.4 Qualified Personnel: Each team performing underwater investigation work shall be accompanied on the boat, but not necessarily in the water, by qualified and experienced personnel (e.g. biologist, marine biologist, environmental scientist, among others) in order to identify the presence or absence of threatened or endangered species. The Contractor shall submit their qualifications to the USACE. The divers can request to the designated and qualified personnel on the boat to enter in the water to identify and determine if a suspected threatened or endangered species is present in the study area.

4.1.5 Coordination: All related work will be coordinated with the TPP Team prior to initiation as described in Part 4.1.1. The Contractor will provide a preliminary schedule and the areas (including the proposed transects and grids) where investigation will be performed and all the equipment to be used. Changes to the schedule and working areas will be provided to the TPP Team. The Contractor will make any required project notifications to the appropriate USACE personnel, who will in turn notify the regulators and resource agencies.

4.1.6 Reports: The Contractor shall maintain a log detailing endangered or threatened species sightings in terrestrial and marine habitats. The log shall include, but not limited to, the following information: date and time, location coordinates using a Global Positioning System (GPS) unit, species, one or more photographs, if possible, and any actions taken (e.g. species identification and distance from working area, reasons to cease operation, reasons to determine that operation may be resumed, among others) during the work period. All data shall be provided to USACE to be shared with the TPP.

4.1.7 Detonation Activities: Because the proposed action consists of data collection and characterization of benthic habitats, intrusive investigation or munitions detonations will not be conducted under this phase. If MECs are indentified during underwater work, they will be left in place and GPS coordinates of the MEC's location will be obtained for further investigations. MEC location will be shared with the TPP as "Privilege and Confidential." Due to public safety concerns, the MEC location shall not be released to the public. Based on the EBS results, additional SOPs or other conservation measures will be closely developed and coordinated with the TPP for further investigation phases and disposal activities.

4.1.8 If the UIT determines that weather conditions are unsafe (e.g. heavy rain, strong wind and rough seas), underwater investigation will not be conducted in order to minimize the potential for accidental groundings.

4.1.9 Underwater investigation activities will be conducted during day time hours (7:00am-5:00pm) only.

4.1.10 If during underwater activities the Contractor observes items that may have historic or archeological value, the Contractor will obtain GPS coordinates of the items' locations and notify the USACE of the observation. In consultation with the State Historic Preservation Officer, the USACE will use this information to assess the significance of the items in compliance with the National Historic Preservation Act.

4.2 Staging Area and Sea Turtle Nesting Monitoring

4.2.1 Contractor shall identify any onshore staging areas needed for execution of these investigations so that sea turtle nest monitoring can be conducted prior to initiating mobilization to ensure no impacts occur to this species.

4.2.2 The sea turtle nests monitoring will be limited to the areas used by the Contractor personnel. The beach monitoring efforts will consist of nests sighting and identification. The Contractor will avoid any sea turtle nests that are encountered. Any nest encountered shall be clearly marked (e.g. using flagging). The Contractor personnel shall stay at least 26 feet (8 meters) away from the marked area to avoid impacts to the nest(s). All nest sightings and actions taken shall be documented as described in Part 4.1.6. Additional conservation measures are provided in Appendices A and B.

4.2.3 Staging areas shall not require any removal of coastal vegetation. These areas shall consist of temporary tents or similar structures that can be easily removed.

4.2.4 Any areas proposed for use as staging area that form part of the Culebra National Wildlife Refuge shall be closely coordinated with the refuge manager. Points of contact are provided in Part 5.0.

4.2.5 The smaller offshore cays should not be used as staging areas; only cays that can be safely accessed by boats should be identified for use. Temporary mooring buoys should be employed to access staging areas to avoid repeated anchoring and impacts to marine bottom as per previous SOPs (refer to Parts 4.3 - 4.4 and Appendix A for more information).

4.2.6 Monitoring shall be conducted daily by qualified personnel (e.g. biologist, marine biologist, environmental scientist, among others) to identify the potential presence of new nests or sea turtle tracks during the activity period (refer to Appendix A for detailed information).

4.2.7 If sea turtle nests are found, the Contractor personnel will notify USACE, who will notify the FWS Boquerón Endangered Species Specialist, NMFS Boquerón Office and DNER

POC. If agreed the nest locations will be clearly marked and the staging area will be relocated. This information shall be documented as described in Part 4.1.6.

4.3 Coral and Seagrass Avoidance Measures

4.3.1 Prior to initiation of field activities the UIT shall receive a boating safety briefing and information regarding location and identification of coral reefs, colonized hardbottom and seagrass (refer to Part 4.1.2 for more information). Also, the information contained in these SOPs and its Appendices, and the types of actions that constitute a violation to the 4(d) rule (50 CFR Part 223) shall be discussed.

4.3.2 Vessel operator shall carry and consult appropriate NOAA nautical charts, NOAA benthic habitat maps and aerial photographs to locate potential coral reefs, colonized hardbottom and seagrass areas. Combining information from aerial photographs with hydrographic data will help to ensure that nautical charts are accurate.

4.3.3 Real-time data (e.g. GPS with nautical chart and depth finder on boat) will be continuously observed to verify water depths and vessel location. For additional information, please refer to Parts 4.3.5 and 4.4.3.

4.3.4 Vessel operator and UIT shall maintain a vigilant watch for coral reefs, colonized hardbottom and seagrass areas to avoid running aground or striking protected species. As part of the WP for conducting the underwater investigations and EBS, the Contractor shall provide and specify the type of equipment to be used and their recommended safety depths to avoid impacts to endangered and threatened species.

4.3.5 From the water's surface, some coral areas appear golden-brown. These areas should be avoided to keep from running aground. The operator shall stay at a minimum of 4 feet from the bottom of the vessel to the top of coral areas.

4.3.6 If no moorings are available, the vessel will be anchor in unvegetated sandy areas away from corals and seagrasses, so the anchor, chain and line do not contact or damage coral or seagrass areas.

4.3.7 Vessels shall be maintained away from areas with corals and seagrasses (see Part 4.3.5). Operations shall be conducted in such manner that bottom scour or prop dredging will be avoided when corals or seagrasses are present.

4.3.8 The following actions are prohibited:

a. Walk on, sit on or stand on coral
b. Collect coral (dead or alive)
c. Anchoring on coral/seagrass
d. Touch coral with hands or equipment
e. Discharge any pollutant or contaminant
f. Dump trash

4.3.9 If during the underwater investigation work any coral is injured, whatever activity causing the damage will be stopped, the injured coral will be left in place and the U.S. Coast Guard (USCG), NMFS Boquerón Office and DNER should be immediately notified. If listed corals are injured, the Contractor shall also contract the NOAA Office of Law Enforcement at 1-800-853-1964. The following information must be provided:

a. The time, date, and location (latitude/longitude) of the incident.
b. The name and type of the vessel involved.
c. The vessel's speed during the incident.
d. A description of the incident.
e. Water depth.
f. Environmental conditions (e.g. wind speed and direction, sea state, cloud cover, and visibility).
g. The type of coral or description, if possible.
h. A description of the damage caused to any coral, if possible.

4.3.10 If the vessel runs aground, the operator shall perform the following:

a. Turn of the engine.
b. Do not try to use the engine to power off the reef, hardbottom or seagrass.
c. Raise the propeller, and allow the boat to drift free.
d. Radio the Coast Guard, Marine Patrol or VHF Channel 16 for assistance.
e. If any coral or seagrass is injured the Contractor shall follow the procedures described in Part 4.3.9.

4.4 Marine Mammals and Sea Turtles Avoidance Measures

4.4.1 Vessel strike avoidance measures were also provided in Appendix A, page 12, items 1-6. These measures have been updated and for the purpose of underwater investigation activities, the Contractor shall follow and implement the avoidance measures provided under this section.

4.4.2 The Contractor shall instruct all personnel associated with the underwater investigation work of the potential presence of marine mammals (e.g. manatees and whales) and sea turtles and the need to avoid collisions with these species. The Contractor shall be held responsible for any marine mammal and sea turtle harmed, harassed, or killed as a result of underwater activities (including vessel operations supporting these activities) and general boating activities needed to go to and from the study areas. All appropriate precautions shall be followed and the operator will avoid excessive speed as described in Parts 4.4.7 and 4.4.8.

4.4.3 All vessels associated with the underwater investigations shall operate at "no wake/idle" speeds at all times while in waters where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes whenever possible. Boats used to transport personnel shall be shallow-draft vessels, preferably of the light-displacement category, where navigational safety permits.

4.4.4 Mooring bumpers shall be placed on all vessels wherever and whenever there is a potential for marine mammal or sea turtle to be crushed between two moored vessels. The bumpers shall provide a minimum stand-off distance of four feet.

4.4.5 Vessel operator and UIT should maintain a vigilant watch for marine mammals and sea turtles to avoid striking sighted protected species.

4.4.6 If a marine mammal or sea turtle is sighted within 300 feet (100 yards) of the project area, all appropriate precautions shall be implemented by the Contractor to ensure protection of these species. These precautions shall include the operation of all moving equipment no closer than 150 feet (50 yards) of a marine mammal or sea turtle. If a marine mammal or sea turtle is closer than 150 feet (50 yards) to moving equipment or the study area, the equipment shall be shut down and all activities shall cease to ensure protection of the species. Underwater activities shall not resume until the marine mammal(s) or sea turtle(s) have left the study area naturally. Animals must not be herded away or harassed into leaving.

4.4.7 When marine mammals or sea turtles are sighted while a vessels is underway, the operator will remain parallel to the animal's course. Vessel operator will avoid excessive speed or abrupt changes in direction until the animal has left the area.

4.4.8 Vessel operator will reduce vessel speed to 10 knots or less when mother/calf pairs, groups, or large assemblages of marine mammals are observed near an underway vessel, when safety permits. A single marine mammal at the surface may indicate the presence of submerged animals in the vicinity; therefore, prudent precautionary measures will be exercised. The vessel should attempt to route around the animals, maintaining a minimum distance of 300 feet whenever possible.

4.4.9 Marine mammals and sea turtles may surface in unpredictable locations or approach slowly moving vessels. When an animal is sighted in the vessel's path or in close proximity to a moving vessel and when safety permits, the vessel operator will reduce speed and shift the engine to neutral. Vessel operator will not engage the engines until the animals are clear of the area.

4.4.10 Monitoring: The UIT shall monitor for the presence of marine mammals and sea turtles.

4.4.11 All sightings and actions taken shall be reported as described in Part 4.1.6.

4.4.12 Injured or Dead Protected Species Reporting: Any collisions or sighting of any injured or incapacitated marine mammals or sea turtles shall be reported immediately to the USACE, FWS, NMFS, and DNER and information listed in Part 4.3.9 must be provided. For additional contact information, please refer to Section 5.0.

- Report stranded marine mammals to Southeast U.S. Stranding Hotline: (305) 862-2850
- Report stranded sea turtles to the NMFS Southeast Regional Office: (727) 824-5312
- NMFS Boquerón Office: (787) 851-3700
- FWS Boquerón Office: (787) 851-7297
- FWS Culebra NWR Office: (787) 742-0115
- DNER: (787) 645-5593

4.5 Diving Operations and Equipment

4.5.1 All underwater investigation work will be conducted by qualified and trained divers and will be planned in a manner that avoids direct impacts to threatened or endangered species and sensitive habitats within the project area. Anchoring practices described in Part 4.3 shall be implemented.

4.5.2 Prior to initiation of daily operations the UIT will check the weather conditions, inspect the vessel and verify that all the required equipment is available, in good condition, working correctly, and calibrated. The Contractor will maintain a log detailing equipment inspections.

4.5.3 The UIT will make sure that underwater conditions (e.g. visibility, current speeds) and weather are suitable for diving to ensure safety for divers and for sensitive underwater habitats.

4.5.4 Based on dive site conditions, the amount of divers in the water will be determined by the Contractor.

4.5.5 The following general “best diving practices” will be followed:

a. The point of entry and exit will be carefully selected to avoid coral or underwater sensitive areas.
b. Divers will make sure that all equipment is well secured before entering in the water.
c. Divers will make sure that they are neutrally buoyant at all times.
d. Safe distance from coral areas to be provided in the WP shall be maintained.
e. Good finning practice and body control will be followed to avoid accidental contact with coral or stirring up the sediment.
f. Divers will stay off the bottom and will never stand or rest on corals or other sessile benthic invertebrates.

4.5.6 To support or supplement the underwater investigation activities the following equipment, but not limited to, will be used: remotely operated vehicle (ROV), side scan sonar towfish, underwater metal detectors, benthic/diver sleds, towing cables and lifting lines, underwater cameras, marking buoys and floats, and GPS. The Contractor shall provide and specify the type of equipment to be used and their recommended safety depths to avoid impacts to endangered and threatened species (see Parts 4.1.1 and 4.1.5).

4.5.7 All equipment will be used in a manner to avoid physical contact or harassment of any protected species and it shall not interfere with diving operations. Hand-held equipment that would be carried by divers shall not contact corals or disturb the bottom or seagrasses in the area.

4.5.8 Site conditions, marine structures present, real-time information and existing water depth will be constantly monitored by trained operators to determine the appropriate use of equipment needed to minimize the risk of physical contact with protected species and sensitive habitats.

4.5.9 Any unintentional injury to protected species during diving operations will be reported immediately as described in Parts 4.3.9 and 4.4.12.

4.6 Supplemental Information

The July 2008 SOPs developed for Culebra DERP-FUDS and its April 2011 Addendum remain in effect. Copies of these documents are included in the attached Appendices A and B. The SOPs in the current document are meant to supplement, not replace, previous SOPs and are directed toward underwater investigation activities. The SOPs in the current document also provide the most up-to-date information regarding listed corals.

5.0 POINTS OF CONTACT FOR SOPs COORDINATION AND REPORTING

Name	Organization	Telephone/Email
Tom Freeman Project Manager	USACE, Jacksonville	Desk: 904-232-1040 Thomas.R.Freeman.III@usace.army.mil
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Lisamarie Carrubba Director, Caribbean Field Office	NMFS	Desk: 787-851-3700 Lisamarie.Carrubba@noaa.gov
José Rivera Habitat Conservation Division	NMFS	Desk: 787-405-3605 Jose.A.Rivera@noaa.gov
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Damaris Delgado Bureau of Coast, Reserves and Refuges	DNER	Desk: 787-999-2200 ext. 2107 ddelgado@drna.gobierno.pr
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LIST OF APPENDICES

A. SOPs for Endangered Species Conservation and their Habitat (July 2008)

B. Addendum to the 2008 SOPs (April 2011)

APPENDIX A

SOPs for Endangered Species Conservation and their Habitat (July 2008)

Standard Operating Procedures For Endangered Species Conservation And their Habitat on DERP-FUDS Project No. I02PR006802. Culebra, Puerto Rico

US Army Corps
of Engineers
Jacksonville District

Standard Operating Procedures
For Endangered Species Conservation and their Habitat on
DERP-FUDS Project No. I02PR006802. Culebra, Puerto Rico

PURPOSE

The intent of this document is to develop a series of standard operating procedures (SOPs) to avoid or minimize impacts to threatened and endangered species listed pursuant to the Endangered Species Act (ESA) during the DERP-FUDS work at locations designated for cleanup on Culebra and adjacent cays and in surrounding waters that serve as habitat for these species. Species include the endangered hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*) sea turtles, the threatened green sea turtle (*Chelonia mydas*) and its designated critical habitat 3 nautical miles around Culebra and its surrounding islands and cays, the threatened elkhorn (*Acropora palmata*) and staghorn corals (*Acropora cervicornis*), the West Indian manatee (*Trichechus manatus*), and avian species. These SOPs are in accordance with on-going communication with staff from the U.S. Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS) and the Puerto Rico Department of Natural and Environmental Resources (DNER), as well as pursuant to the Interim Guidelines provided by FWS to work on lands of Culebra National Wildlife Refuge, with the U.S. Army Corps of Engineers (USACE) Regulations and Environmental Operating Principles. These SOPs were prepared to supplement existing and future USACE contracts for work on Culebra and surrounding islands and cays under the DERP/FUDS Program and to satisfy the substantive requirements of Section 7 of the Endangered Species Act. These SOPs do not address requirements related to access approvals from FWS on lands that are within the Culebra National Wildlife Refuge.

SEA TURTLES

Culebra has some of the most important sea turtle nesting beaches in the US Caribbean. Three species of sea turtles utilize these beaches throughout the year. The endangered leatherback and hawksbill sea turtles are the most common nesters, and the threatened green sea turtle also nests on beaches in the project area. The beaches on Culebrita, Cayo Norte, and Playa Larga, Brava and Resaca on Culebra were designated as critical habitat under the Endangered Species Act by FWS in recognition of their vital importance to the future of these species (50 CFR 17.95). Similarly, waters surrounding the island of Culebra (50 CFR 226.208) from the mean high water line seaward to 3 nautical miles (5.6 km) are designated as critical habitat for the green sea turtle. These waters include Culebra’s outlying Keys including Cayo Norte, Cayo Ballena, Cayos Geniquí, Isla

Culebrita, Arrecife Culebrita, Cayo de Luis Peña, Las Hermanas, El Mono, Cayo Lobo, Cayo Lobito, Cayo Botijuela, Alcarraza, Los Gemelos, and Piedra Steven where cleanup efforts are anticipated. Sea grass beds within these waters are foraging habitat for the species. In addition, the benthic habitat, including seagrass beds, coral reefs, and colonized hardbottom, around Culebra and its surrounding islands and cays provides foraging and refuge habitat for sea turtles.

Nesting Seasons

The following nesting season information was obtained from the USFWS sea turtle fact sheets and local agencies.

Green Sea Turtle: The nesting season varies with the locality. In Puerto Rico, it is roughly June through October. Nesting occurs nocturnally at 2, 3, or 4-year intervals. Only occasionally do females produce clutches in successive years. A female may lay as a many as nine clutches within a nesting season (overall average is about 3.3 nests per season) at about 13-day intervals. Clutch size varies from 75 to 200 eggs, with an average clutch size of 136 eggs reported for Florida. Incubation ranges from about 45 to 75 days, depending on incubation temperatures. Hatchlings generally emerge at night. Age at sexual maturity is believed to be 20 to 50 years. Nesting data for Puerto Rico, specifically for Culebra beaches shall be obtained from the FWS. However, the DNER indicated that nesting of green turtles in Culebra beaches is infrequent and not as common as the other species.

Green Sea Turtle

Hawksbill Turtle: The nesting season varies with locality, in Culebra, as per DNER, nesting occurs all year long with the peak between August to November. Hawksbills nest at night and, on average, about 4.5 times per season at intervals of approximately 14 days. In Florida and the U.S. Caribbean, clutch size is approximately 140 eggs, although several records exist of over 200 eggs per nest. They nest under the vegetation on the high beach and nests have been observed having the last eggs of the clutch as close as 3 inches from the sand's surface. Remigration intervals of 2 to 3 years predominate. The incubation period averages 60 days. Hawksbills recruit into the reef environment at about 35 cm in length and are believed to begin breeding about 30 years later. However, the time required to reach 35 cm in length is unknown and growth rates vary geographically. As a result, actual age at sexual maturity is not known.

Hawksbill Sea Turtle

Leatherback Turtle: On Culebra nesting occurs from about February to August with the peak occurring around April to May. Female leatherbacks nest an average of 5 to 7 times within a nesting season, with an observed maximum of 11 nests. The average internesting interval is about 9 to 10 days. The nests are constructed at night in clutches of about 70 to 80 yolked eggs. The white spherical eggs are approximately 2 inches in diameter. Typically incubation takes from 55 to 75 days, and emergence of the hatchlings occurs at night. Most leatherbacks return to their nesting beaches at 2 to 3-year intervals. Leatherbacks are believed to reach sexual maturity in 6 to 10 years. Culebra beaches most used by the species are Flamenco, Brava and Resaca.

Leatherback Sea Turtle

Acroporid Corals

Since the preparation of some of the Culebra Project work plans, two coral species have been listed as threatened by the National Marine Fisheries Service effective May 8, 2006. Elkhorn coral (*Acropora palmata*) and staghorn coral (*Acropora cervicornis*) belong to the most abundant group of corals in the world and once represented the most dominant reef building species throughout Florida and the Caribbean. Elkhorn corals are found in shallow reefs, typically in water depths from 0-35 feet, as these corals prefer areas where wave action causes constant water movement. Staghorn corals are found in water depths ranging from 1-160 feet, although they are most common in depths from 10-60 feet. In addition to growing on reefs, staghorn corals often form colonies on bare sand. Acroporid corals have relatively high growth rates (5-6 inches per year) for corals and exhibit branching morphologies that provide important habitat for other reef organisms. The abundance of these corals has been declining for several decades due in part to hurricane damage and disease.

Acropora cervicornis

Acropora palmata

Measures to Avoid or Minimize Possible Impacts Resulting from Munitions Clearance and Detonation Activities

Vegetation Removal:

A standard 70 meter setback (from mean high water) is usually designated to avoid impacts to hawksbill sea turtle nesting habitat during nesting season. Based on the characteristics of the nesting habitat in Culebra and the surrounding cays, an appropriate setback will have to be established for beaches that are part of the cleanup project. For instance, hawksbill sea turtle nesting habitat might be designated from the line of woody vegetation instead of from the high water line. Measuring and flagging the setback on project beaches might be easier if measured landward from the edge of the existing woody vegetation since the high water line may change daily.

Beach Monitoring

To the maximum extent practicable detonation activities shall be realized when it is not sea turtle nesting season and when hatchlings are not present on beaches. To the maximum extent practicable, ground intrusive activities, including detonation, will not occur during the peak nesting seasons from March to November.

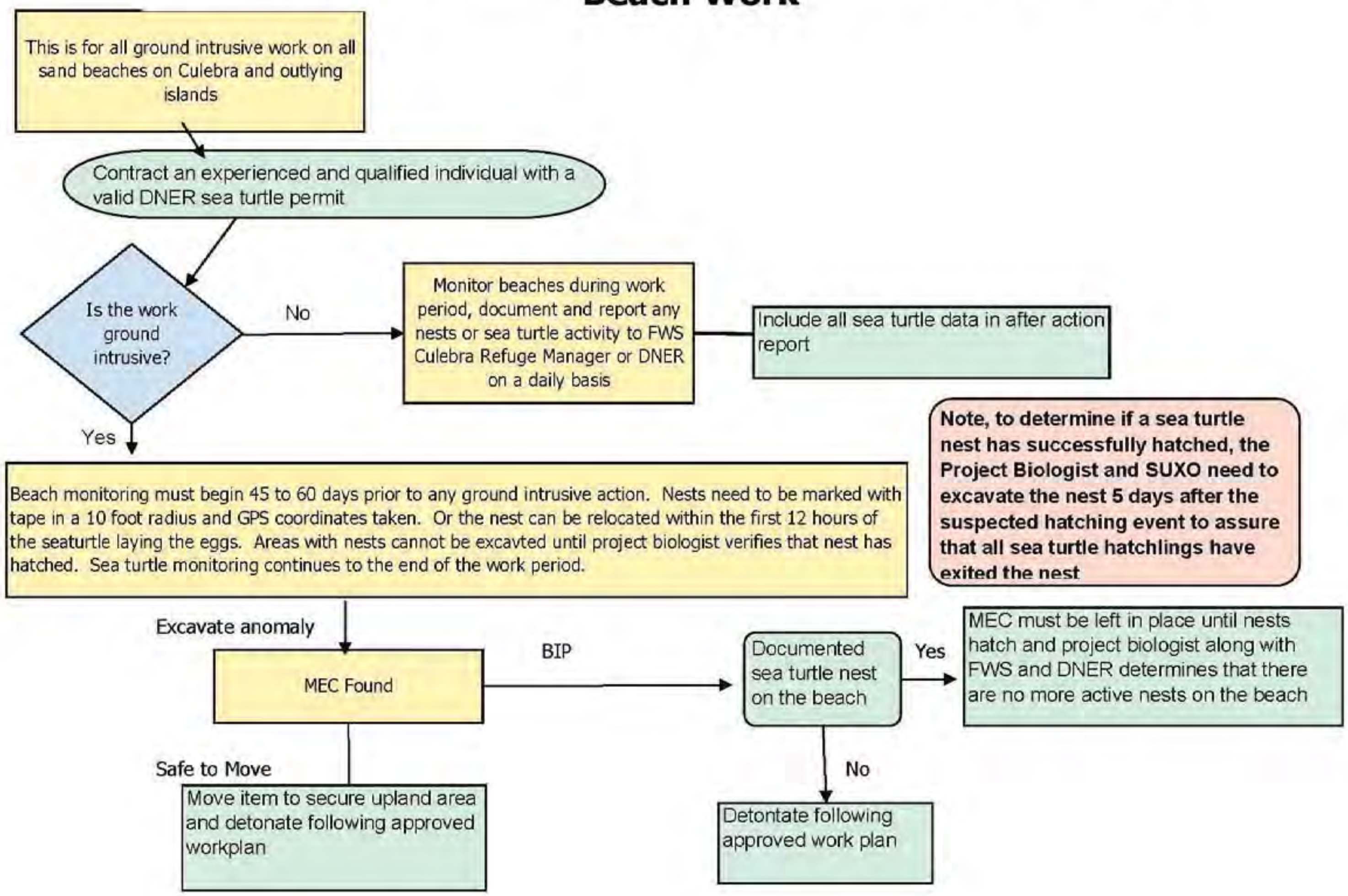
Prior to commencement of clearance activities, including vegetation removal and removal of unexploded ordnance, on Culebra, Culebrita, Cayo Norte and Cayo Luis Peña the contractor shall appoint a Project Biologist whose qualifications shall be submitted for the approval of the contracting officer and the FWS. All beach clearance activities, including vegetation removal and removal of unexploded ordnance, will be closely coordinated with FWS. In lieu of an independent Project Biologist, a USACE biologist could assist the contractor in this effort provided the USACE biologist has the appropriate training for conducting beach surveys. The Project Biologist shall perform morning beach patrols to identify the potential presence of new nests prior to and during the nesting season. When it is not nesting season, the Project Biologist or appropriately trained personnel shall conduct morning beach surveys prior to crews commencing daily activities to determine whether sea turtle nesting has occurred and to ensure that activities may be accommodated in a window of time when no nests are present.

If sea turtle nests are found on beaches being cleared of unexploded ordnance, the Project Biologist, the UXO supervisor, and/or monitoring personnel will communicate daily with the FWS Boqueron Endangered Species Specialist and the Culebra Islands NWR Refuge Manager as to whether new nests have been located, and their locations within the work area. If agreed upon by FWS, nest locations will be clearly marked to ensure clearance personnel avoid nests and no clearance activities will take place in the area until the hatchlings emerge and vacate the nest. Otherwise, nests will be relocated to a safe beach within 6-12 hours following nesting. The relocation program will be carried out by the Project Biologist and experienced personnel with the required DNER endangered species permits. This approach has been utilized by DNER personnel on Vieques from 1990-2000 to protect sea turtle nests from military operations with a hatching success of relocated nests of over 80%.

The Project Biologist shall also be responsible for training beach clearance crews prior to the initiation of clearance activities regarding the importance of endangered species, in particular the status of sea turtles at this location; the potential penalties associated with violations of the ESA; measures for crawl and nest identification; and sea turtle biology.

As an additional tool for sea turtle conservation, the following decision tree was prepared by the FWS to provide guidance on the sequence of events during ground-intrusive beach work. Project biologist shall work closely with UXO personnel to ensure these steps are followed.

Sea Turtle Conservation Measures for Ground Intrusive Beach Work



Designation of Beach Zones for Vegetation Removal and Munitions Detonation:

The information contained in this section was provided by the USFWS based on zones established during clearing activities for a Navy-led project in Vieques. The designation of zones based on number of nests, restrictions within the zones, etc. must be developed in coordination with the FWS to be specific to Culebra. The Corps shall require UXO contractors through the Project Biologist, to establish three work zones, based on sea turtle nesting data, and site inspections to ensure sea turtle nest protection during vegetation removal and munitions detonation activities. It shall be the Project Biologists responsibility to obtain specific nesting data for the beach area where the contractors will be working. This data can be obtained from the FWS Ecological Services Office in Cabo Rojo or the DNER office on Culebra or Fajardo.

The work zones proposed are:

<u>Zone 1</u>. No restrictions because sea turtle nesting is not expected within the area (rocky shore, no sand, etc).

<u>Zone 2</u>. Minor restrictions because of low historical sea turtle nesting events (fewer that 4 nests per year have occurred within the zone). Zone 2, beaches will be surveyed twice a week, 75 days prior to the activity by experienced and qualified personnel. Surveys should cover both the open sand and the area below the vegetation. No driving on the beach will occur. If no nests are found, cutting of trees smaller than 3 inches in diameter may occur. Manual cutting using machetes is the preferred alternative to allow for re-growth. If power tools such as chain saws are required, the FWS recommended pruning low branches instead of removing the trees (except for mesquite trees). Both techniques would allow for re-growth of suitable habitat. Mechanized removal of vegetation using mowers of vehicles should not be used near beach areas. When nests are found, a protection or exclusion zone of 8m should be designated around the nest and marked with flagging tape. Vegetation removal outside of the exclusion zone may occur if conducted manually. Vegetation removal within the nest area should be postponed until 5 days after hatching is documented, unless UXO is found in the vicinity of the nest.

Vegetation removal within the hawksbill sea turtle nesting habitat should not occur from June to mid December (peak of the nesting season). Hawksbill sea turtle nesting habitat varies from 10 m to 25m from the edge of the woody vegetation.

<u>Zone 3</u>. Major restrictions because 4 or more historical sea turtle nesting events have occurred within the zone. Zone 3, beaches will be surveyed every morning by a qualified biologist utilizing pedestrian surveys beginning 75 days prior to the scheduled start date of the project and until ordnance or vegetation removal actions are completed. Minimizing the amount of woody vegetation such as sea grape cleared would help minimize impacts to nesting hawksbill sea turtles. The rest of the conditions are the same as Zone 2.

When no nests are found on Zone 3 beaches, vegetation cutting may be conducted outside of the peak nesting season of the hawksbill sea turtle. A protection zone of 10 meters (measured landward from the edge of the woody vegetation) should be established to protect leatherback and green sea turtle nesting habitat. If leatherback and/or green sea turtle nests are left in situ (in place), vegetation removal activities should not occur within 10 meters of the landward edge of the nest track. The preferred alternative for cutting the vegetation, if nests are in situ, is hand cutting using machetes or power tools.

Vehicular Traffic

It should be noted that driving on sand beaches as a means of site access should be regarded as a measure of last resort after all other site access options have been explored. A designated entrance and an exit at the beach area, and monitoring of nesting events by qualified and experienced personnel is needed for vehicular beach access. If vehicular access is needed, we recommend the vehicular access be limited to the intertidal zone (below mean high water). Driving above the intertidal zone should not be allowed. All known nests should be marked by stake and survey tape or string in an area at least 20 feet (6 meters) in any direction from the center of the nest. No activities should enter in this area. Other alternative routes should be explored to avoid driving on sea turtle nesting beaches.

Vessel Traffic

For beach access from the ocean, should landing a vessel on the beach be necessary, the landing site shall be coordinated with the FWS Culebra National Wildlife Refuge personnel and the DNER. The route of the vessel shall be coordinated with NMFS to ensure that impacts to designated critical habitat and listed coral species are avoided. However, landing vessels on beaches should be regarded as a measure of last resort.

Beach activities on Culebrita, need to be coordinated with NMFS and FWS, the following vessel access SOPs will be implemented to minimize impacts to sea turtle refuge and foraging habitat, designated critical habitat, and listed coral species:

1. Culebrita will be accessed by entering Bahia Tortuga, the bay north of Beach E (as identified in the Engineering Evaluation/Cost Analysis for the cleanup of beaches on Culebrita and Flamenco Beach on Culebra). Contractors will tie boats to existing mooring buoys or, if the draft of vessels is shallow, anchor in the unvegetated, sandy zone between the seagrass beds and the beach.

2. No additional access points to beaches A, B, C, or D will be established as the contractor will bring all equipment and supplies to Beach E for offloading and transport overland or will offload personnel and equipment from an unanchored vessel into a inflatable craft that will then transit to access point previously established in coordination with NMFS and FWS. These access points do not currently exist and would have to be agreed upon.

In meetings with USACE, FWS, DNER, EQB and NMFS, it was agreed that the following cays will not be part of the cleanup project as they are inaccessible. The cays are:

1. Cayo Tiburón
2. Whale Rock
3. El Mono
4. Cayo Mono
5. Alcarazza/Fungi Bowl
6. The Washer

It was further agreed that access to the some of the cays that will be part of the cleanup project will be as follows:

1. Cayo Botella – contractors will use the Culebrita Island access in the bay northwest of the largest beach (Beach E) or anchor boats in the sandy bottom area south of the cay and use a inflatable craft, kayak, or swim to access the cay from the southeast where there is a small sand channel between areas of coral reefs.

2. Cayo Norte – boats will anchor in sand bottom in the small bay off the beach on the southeast of the island.

3. Pajarito Cay – from anchorage or mooring in Culebrita or Cayo Norte, access will be by inflatable craft entering the south side of the cay.

4. Cross Cay/Cayo Lobo – boats can anchor in unvegetated sandy bottom in the bay on the southeast side of the cay and anchors will not be dropped in areas containing coral colonies or seagrass beds.

The Corps, in coordination with the FWS, NMFS and DNER personnel have agreed that, in order to avoid impacts to listed coral species and designated critical habitat, the installation of mooring buoys to access Palada Cay/Cayo Geniqui, Cayo de Agua, Cayo Yerba and Cayo Ratón (also called Los Gemelos/Twin Rocks) will be completed if the clean-up activities will take place on these cays for more than two weeks. Prior to installation of mooring buoys at any given location in Culebra waters, the proposed locations shall be assessed for presence/absence of unexploded ordnance and to select final locations in unvegetated, sandy bottom. If the mooring buoys are not installed, the contractor will use a transit vessel to transport personnel to a site near each cay. The transit vessel will not weigh anchor and personnel will access the cays via an inflatable craft.

The following areas were identified using aerial photography, nautical charts and area maps and are proposed for installation of mooring buoys:

1. Cayo Geniquí/Palada Cay: Mooring buoy in 20-30 feet of water in the hardbottom area south of the cay to moor the transport boat. Access to the cay will be via inflatable craft.

2. Cayo del Agua: Mooring buoy in 20-30 feet of water on the south side of the cay to moor the transport boat. Access to the cay will be via inflatable craft.

3. Los Gemelos/Twin Rocks (Cayos Ratón and Yerba): Transit vessel will moor to the buoy serving Cayo del Agua and a inflatable craft will be used to access the cays.

These mooring buoy locations shall be coordinated with the United States Coast Guard.

In addition to establishment of access points, the following protocols shall be followed to minimize impacts to sea turtle refuge and foraging habitat, designated critical habitat, and listed coral species:

1. Access to the cays that have not been determined to be inaccessible and therefore form part of cleanup efforts will be dependent on wind, wave, and current conditions. During periods of rough seas, cays will not be accessed in order to minimize the potential for accidental groundings.

2. The transport boat utilized to provide access to the smaller cays will remain offshore and will not weigh anchor

   Clearance crews and equipment will be ferried to the cays with an inflatable-type craft and the landing point for this craft will be determined in coordination with NMFS and FWS.

<u>NMFS Protected Species Vessel Strike Avoidance Measures and Reporting</u>

Background
The National Marine Fisheries Service (NMFS) has determined that collisions with vessels can injure or kill protected species (e.g., endangered and threatened species, and marine mammals). The following standard measures should be implemented to reduce the risk associated with vessel strikes or disturbance of these protected species to discountable levels. NMFS should be contacted to identify any additional conservation and recovery issues of concern, and to assist in the development of measures that may be necessary.

Protected Species Identification Training
Vessel crews should use an Atlantic and Gulf of Mexico reference guide that helps identify protected species that might be encountered in U.S. waters of the Atlantic Ocean, including the Caribbean Sea, and Gulf of Mexico. Additional training should be provided regarding information and resources available regarding federal laws and regulations for protected

species, ship strike information, critical habitat, migratory routes and seasonal abundance, and recent sightings of protected species.

Vessel Strike Avoidance

In order to avoid causing injury or death to marine mammals and sea turtles the following measures should be taken when consistent with safe navigation:

1. Vessel operators and crews should maintain a vigilant watch for marine mammals and sea turtles to avoid striking sighted protected species.

2. When whales are sighted, maintain a distance of 100 yards or greater between the whale and the vessel.

3. When sea turtles or small cetaceans are sighted, attempt to maintain a distance of 50 yards or greater between the animal and the vessel whenever possible.

4. When small cetaceans are sighted while a vessel is underway (e.g., bow-riding), attempt to remain parallel to the animal's course. Avoid excessive speed or abrupt changes in direction until the cetacean has left the area.

5. Reduce vessel speed to 10 knots or less when mother/calf pairs, groups, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity; therefore, prudent precautionary measures should always be exercised. The vessel should attempt to route around the animals, maintaining a minimum distance of 100 yards whenever possible.

6. Whales may surface in unpredictable locations or approach slowly moving vessels. When an animal is sighted in the vessel's path or in close proximity to a moving vessel and when safety permits, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.

Additional Requirements for the North Atlantic Right Whale

The NMFS guidance includes additional requirements for the North Atlantic right whale, but these do not apply for the Culebra activities.

Injured or Dead Protected Species Reporting

Vessel crews should report sightings of any injured or dead protected species immediately, regardless of whether the injury or death is caused by your vessel.
Report marine mammals to the Southeast U.S. Stranding Hotline: 877-433-8299
Report sea turtles to the NMFS Southeast Regional Office: 727-824-5312
If the injury or death of a marine mammal was caused by a collision with your vessel, responsible parties should remain available to assist the respective salvage and stranding network as needed. NMFS' Southeast Regional Office should be immediately notified of the strike by email (takereport.nmfsser@noaa.gov) using the attached vessel strike reporting form.

For additional information, please contact the Protected Resources Division at:
NOAA Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701
Tel: (727) 824-5312
Or visit their website at: http://sero.nmfs.noaa.gov

Considerations for Other Species

The Corps and its contractors shall avoid contact with any bird or reptile found injured or otherwise in the way of the cleanup activities, until adequate coordination is done with the resource agencies. Detonation of UXO on cays should be conducted outside of the seabird nesting season. Some seabirds nest year round, in the event an item needs to be detonated near nests, the birds should be captured and held prior to the blow in place. This should be coordinated with the Project Biologist, FWS and DNER. In the event of manatee sighting in the vicinity of a work area, the work will stop until the animal(s) are at a safe distance.

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APPENDIX B
Addendum to the 2008 SOPs (April 2011)

FINAL

Addendum to the Standard Operating Procedures for Endangered Species Conservation and their Habitat

DERP-FUDS Project No. I02PR006802

Culebra, Puerto Rico

US Army Corps of Engineers

Jacksonville District

April 2011

US Army Corps of Engineers
Jacksonville District

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Final Addendum to the Standard Operation Procedures for Endangered Species Conservation and their Habitat on DERP-FUDS Project No. I02PR006802, Culebra, Puerto Rico

1.0 INTRODUCTION

In 2008, the U.S. Army Corps of Engineers (USACE) in coordination with the National Marine Fisheries Services (NMFS) Protected Resources Division and the U.S. Fish and Wildlife Services (FWS) developed a series of standard operating procedures (SOPs) to avoid or minimize impacts to listed species and their critical habitats pursuant to the Endangered Species Act (ESA) during Formerly Used Defense Site (FUDS) work at locations designated for investigation and cleanup on Culebra Island, its adjacent cays and in surrounding waters that serves as habitat for these species.

In recent communications, the FWS recommended to the USACE to modify the existing SOPs in order to include terrestrial listed species that have the potential to occur in the project areas and were not covered under the July 2008 SOPs. Based on FWS recommendations and on-going communications with their staff this addendum has been prepared.

The intent of this document is to 1) supplement the 2008 SOPs 2) serve as guidance for the USACE and its contractors in order to avoid or minimize impacts to terrestrial listed species and their designated critical habitat, and 3) satisfy the substantive requirements of the ESA.

2.0 TERRESTRIAL LISTED THREATENED OR ENDANGERED SPECIES

The purpose of this section is to provide a detailed description of the threatened and endangered terrestrial species and their habitat to be found in Culebra Island and its adjacent cays. Species include the Culebra giant Anole (*Anolis roosevelti*), Virgin Islands tree boa (*Epicrates monensis granti*), Wheeler's perperomia (*Peperomia wheeleri*) and *Leptocereus grantianus* (no common name).

The information used to describe the listed species and their habitat was obtained from state/federal agencies fact sheets, recovery and management plans, the Federal Register and internet search, among other sources.

2.1 Culebra Giant Anole (*Anolis roosevelti*)

2.1.1 General Description: The Culebra Island Giant Anole (*Anolis roosevelti*) is an extremely rare or possibly extinct lizard of the *Anolis* genus. It is native to Culebra Island, Puerto Rico. It is a rather large lizard reaching a length of approximately 160 mm snout-vent length. The color in life is brownish-grey with two lines on each side. One line begins around

Figures 1 and 2. Culebra Giant Anole. Source: http://eolspecies.lifedesks.org/node/1797

the ear and extends posteriorly to the groin; the other begins in the shoulder region and extends posteriorly into the groin. There is a distinct light spot on the temple, and the eyelids are yellow. The throat fan is grey except for the lower rear quarter which is light yellow. The tail is yellowish-brown and the underside of the belly is whitish. The tail is deeply scalloped and supports a large fin along most of its length. This fin is high: the third from the distal most ray is twice as long as the depth of the tail, and the fourth proximal ray is as long as the depth of the tail (**Figure 1 and 2**). The edge of the tail fin is scalloped between rays in *A. roosevelti*, as opposed to straight in *A. cuvieri*. *Anolis roosevelti* is additionally distinguished from *Anolis cuvieri* by being grey, not green or brown; by lacking postanal scales in males (present in *A. cuvieri*); by smooth scales under the base of the tail (keeled in *A. cuvieri*), and by its large size **Figure 3** shows *A. cuvieri* for comparison purposes.

2.1.2 Breeding Season and Behavior: Reproduction behavior is unknown. The only information available on its food and foraging behavior is that the species was sighted feeding on the fruits of Ficus trees. There are no information on population number and trends. There have been no confirmed observations of the species since 1932.

Figure 3. *Anolis cuvieri*. Source: http://www.drna.gobierno.pr/biblioteca/banco-de-fotos/Slide9.JPG/view fotos/Slide9.JPG/view

2.1.3 Habitat and Distribution: This lizard is presumably arboreal and restricted to the large Ficus and gumbo-limbo trees. There is no other information on its ecology on the island. In 1977, FWS determined that the *Anolis roosevelti* is an endangered species under the provisions of the ESA and declared most of the remaining forest in Culebra Island as critical habitat. The critical habitat area comprises Monte Resaca, Punta Flamenco, Playa Resaca, and Playa Brava. **Figure 4** shows the designated critical habitat areas for the Culebra Island Giant Anole.

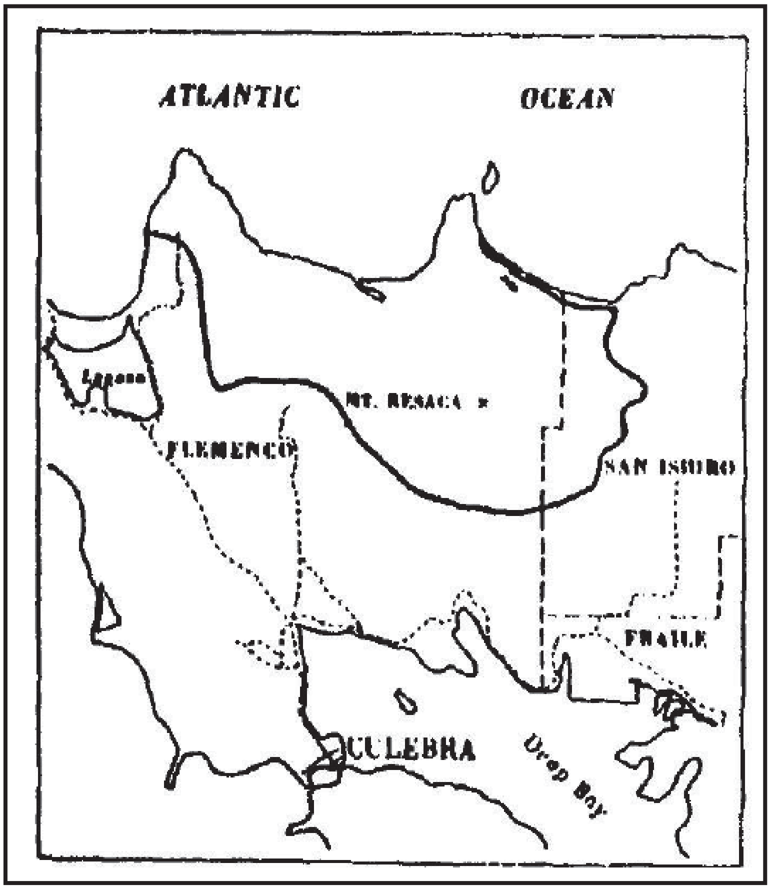

Figure 4. Boundaries of the critical habitat designated for the Culebra Island Giant Anole. Source: Critical Habitat Designations for PR and USVI (FWS 2007).

2.2 Virgin Islands Tree Boa (*Epicrates monensis granti*)

2.2.1 General Description: The adult body color is light plumbeous brown with darker blotches partially edged with black. The ventral surface is greyish-brown speckled with darker spots. This snake grows to slightly less than a meter snout-vent length (**Figure 5**). The Virgin Island (VI) boa was listed as an endangered species in 1979. Critical habitat has not been designated for this species.

2.2.2 Behavior: The VI boa is considered a nocturnal or crepuscular (active at twilight or sunrise) species, but can be active during daylight hours. Little is know of their food habits.

Figure 5. Virgin Island Tree Boa. Source: http://www.flickr.com/photos/deep-blue/2588456233/

2.2.3 Habitat and Distribution: The VI boa is considered endemic to Puerto Rico and the VI. The historical distribution of the VI boa suggests that this species was widely distributed throughout Puerto Rico and the VI, including the northeastern side of Puerto Rico, the offshore cay of Cayo Diablo, Culebra Island, and St. Thomas in USVI; Tortola, and Virgin Gorda in British Virgin Islands (BVI). Although the number of individuals at Culebra Island has not been determined, individuals have been sighted.

The VI boa's habitat has been described from two forest associations: subtropical dry forest and subtropical moist forest. The subtropical dry forest zone is the driest life zone found in VI, Vieques, southwestern Puerto Rico, plus all of Mona Island, Culebra Island and Desecheo. The dry forest habitat is characterized by small (<5m/ 15 ft) deciduous trees with small, coriaceous or succulent leaves and thorns, spines, and secondary defensive compounds, with high density of inter-digitating branches and vines greater than 1 cm (0.4 in) in diameter connecting adjacent tree canopies, and with a rainfall less than 750 mm (30 in) per year.

The species has also been sighted in mangrove forests including Button wood *(Conocarpus erectus)* and red mangrove, *(Rhizophora mangle)* on Culebra Island and Cayo Ratones. It was also found the VI boa in disturbed lower vegetation and artificial structures. Foraging boas are not restricted to trees, as they also use salt-tolerant shrub lands just above the high tide line.

2.3 Wheeler's Peperomia (*Peperomia wheeleri*)

2.3.1 General Description: *Peperomia wheeleri* is an evergreen, glabrous, erect herb which may reach 1 meter in height. The stems root only at the base and may be up to 1 centimeter in diameter. The opposite leaves are entire, fleshy, elliptic to elliptic-obovate, with 3 or 5 main veins ascending from the base. The lower side of the leaf is inconspicuosly black punctate. Inflorescenses are spikes, 10 to 16 centimeters long and 5 millimeters in diameter, which are borne solitary and opposite the leaves or at the leaf axils. Flowers are minute, approximately 0.5 millimeter in diameter (**Figure 6**).

2.3.2 Habitat and Distribution: The species is known to occur in Culebra Island and has been documented in the municipalities of Isabela and Quebradillas.

Culebra Island has an irregular topography and occurs on volcanic and intrusive rocks. The vegetation of this island is classified as belonging to subtropical dry forests. *P. wheeleri* is found in a more mesic environment, the semi-evergreen seasonal forest that consists of two strata, a tree canopy and herbaceous layer. The canopy reaches approximately 16 feet in height. Mature trees are approximately 7 to 15 feet apart (3 to 5 meters), separate by large granodiorite boulders. Roots form an entangled mass. *P. wheeleri* is a component of the understory of this semi-evergreen seasonal forest. This small herb grows on the humus which accumulates on these granodiorite boulders. Removal of the forest canopy alters the microclimatic conditions within this forest, resulting in the elimination of the humus substrate necessary for the survival of the species.

Figure 6. Wheeler's Peperonia. Source: http://www.fws.gov/caribbean/es/Images/Endangered/Peperomia_wheeleri.JPG

P. wheeleri is associated with the following canopy species: *Clusea rosea*, *Bursera simaruba* and *Ficus citrifolia*. It is also associated with other species growing in the herbaceous strata: several species of *Tillandsia*, *Anthurium acaule*, *Whittmackia lingulata* and *Epidendrum cochleatum*.

2.4 *Leptocereus grantianus* (No Common Name)

2.4.1 General Description: *Leptocereus grantianus* is a sprawling or suberect, nearly spineless cactus, which may reach up to 2 meters in height and 3 to 5 centimeters in diameter. The elongated stems have 3 to 5 prominent ribs with broadly scalloped edges. Ribs of young joints are thin, and the small areoles or spine-bearing areas may bear from one to three minute, nearly black spines which disappear as the joints grow older and the ribs become thicker. The flowers are solitary at terminal areoles, from 3 to 6 centimeters long, and nocturnal. The ovary and flower tube bear distinct areoles. The outer perianth segments are linear, green, and tipped by an areole like those of the tube and ovary. The inner perianth segments are numerous, cream-colored, oblong-obvate, obtuse, and about 8 millimeters long. Stamens are many and have yellow anthers. The stigma lobes are several and short. The fruit is subglobose to ellipsoid and about 4 centimeters in diameter (**Figure 7**).

This species is similar to another endemic species, *L. quadricostatus*, known from southern and southwestern Puerto Rico. These species differ primarily in flower morphology and in the characteristic areoles.

2.4.2 Habitat and Distribution: It is endemic to Culebra Island, and island located just off the northeastern corner of Puerto Rico. The species is found in the subtropical dry forest life zone in dry thickets which grow on a crumbling rock substrate on a steep bank just above the shoreline. Associated species include the sea grape (*Coccoloba uvifera*) and almacigo (*Bursera simaruba*). This species is currently known to occur in Punta Melones, Villas de Mi Terruño at Sardineras Ward, and Punta Soldado. In addition, the species has been introduced in a private property located at Fraile Ward, and at the Observation Point located within the Culebra National Wildlife Refuge in Punta Flamenco.

Figure 7. *Leptocereus grantianus*. Source: http://www.fws.gov/caribbean/ES/Images/Leptocereus_grantianus.jpg

L. grantianus was determined to be an endangered species in 1993 pursuant to ESA. Critical habitat has not been designated for this species.

3.0 MEASURES TO AVOID OR MINIMIZE POSSIBLE IMPACTS

The following measures will be implemented to avoid or minimize impacts to terrestrial threatened or endangered species and their habitat during investigation and cleanup work on Culebra Island and its adjacent cays.

3.1 General Procedures

3.1.1 Protected Species Identification Training/Briefing: Prior to initiate work all personnel shall receive training or briefings regarding the importance of endangered species, their characteristics, how they can be identified, potential habitats, types of material in which their may hide, actions to take if are sighted and avoidance measures to be followed. This training or briefing shall be prepared and offered by qualified personnel (e.g. biologist, environmental scientist, botanist, among others).

3.1.2 Civil and Criminal Penalties: The Contractor shall instruct all personnel associated with the project of the potential presence of threatened or endangered species. All personnel shall be advised that there are civil and criminal penalties for harming, harassing or killing threatened or endangered species protected under the ESA and Commonwealth of Puerto Rico Endangered Species Regulation.

3.1.3 Qualified Personnel: Each team performing vegetation clearance/removal (e.g. pruning, trimming, and cutting) shall be accompanied by qualified and experienced personnel in order to identify the presence or absence of threatened or endangered species. The Contractor shall submit their qualifications to the USACE and the FWS.

3.1.4 Coordination: All related work will be coordinated with the resource agencies (FWS, DNER and NMFS) prior initiation. The Contractor will provide a preliminary schedule and the areas (including the proposed transects and grids) where investigation or cleanup activities will be performed. Changes to the schedule and working areas will be provided to the resource agencies. Any access and work on the adjacent cays will be closely coordinated with FWS and DNER. Seabirds breeding season (May-August) shall be considered during the cays access coordination.

3.1.5 Reports: The Contractor shall maintain a log detailing sightings. The log shall include, but not limited to, the following information: date and time, location, species, and any actions taken during the work period. All data shall be forwarded to USACE Environmental Branch.

3.1.6 Detonation Activities: If determined that detonation activities are required, the related work and its conservation measures will be closely coordinated with the resource agencies.

3.2 Culebra Giant Anole Avoidance and Monitoring

3.2.1 In order to avoid impacts to this species transects/grids monitoring surveys will be conducted by qualified personnel to determine its presence or absence. The areas where the vegetation will be cleared shall be inspected prior to proceed with vegetation clearance.

3.2.2 According to the obtained information, this species is presumably active in daytime. For that reason, if it is sighted the vegetation clearance work shall cease to ensure the protection of the species. The activities will not be resumed until the animal has moved, at least, 100 feet outside the transect/grid limits or is at a safe distance.

3.2.3 The vegetation where the species was sighted shall not be cleared, until coordination with FWS has been completed.

3.2.4 The capture or collection of this species is prohibited. This species is protected under ESA.

3.2.5 <u>It should be noted that this species has not been sighted since 1932. If this species is identified during investigation or cleanup work, the USACE Environmental Branch and FWS personnel must be notified immediately. It location shall be documented and provide it to FWS in order to facilitate additional field investigations. The USACE and FWS points-of-contact (POC) are included in Section 4.0.</u>

3.3 Virgin Islands Tree Boa

3.3.1 Boa Monitoring: Boas have the potential to occur within the work area limits, in trees or bushes, under stored materials or inactive equipment stored in shady locations. Qualified personnel shall conduct the boa monitoring. Boas are active mostly during the night. Therefore, a daily search around and in machinery shall be completed at the beginning of each working day, prior to start-up of engines of quarry machinery, bulldozers, trucks, etc. Particular attention should be paid to motors and other warm areas that may be entered at night by the animals in an attempt to warm themselves.

3.3.2 If search of machinery does not discover any specimens, areas that are about to be cleared of vegetation shall be inspected next, especially piles of brush, leaf litter and rotting vegetation. These areas may be prodded gently with a blunt stick.

3.3.3 Relocation Actions: If a boa is discovered, all work shall stop within a 50 foot radius of the boa's location. One person shall keep watch on the boa while another contacts the designated boa monitor. If it is sighted within the transect limits, the boa shall be allowed to leave the site naturally. If the boa does not show any intention of leaving the area naturally, it will be relocated off the transect limits to an area with similar characteristic (e.g. vegetation cover) in order to resume the activities. If relocation is required 1) the boa monitor shall contact the USACE, FWS, and DNER POCs 2) shall provide the proposed relocation site location and its description, and 3) then will perform the capture, and relocation of the boa. The FWS and/or DNER POCs shall agree with the relocation site prior its relocation. The captured animal must be maintained in a cool, shady place (not inside a parked car) until relocation is completed.

3.3.4 The areas where boas have been relocated shall be clearly marked, documented, and provided to the USACE, FWS and DNER POCs.

3.3.5 Capture and Relocation Supplies and Equipment: At least three items should be provided by the contractor to the boa monitor, and maintained available on-site to handle and carry snakes if they are spotted: These are: a blunt snake hook, netting or burlap bags with closing ties, and a 6 x 6 or 8 x 8 foot tarpaulin.

3.4 Listed Vegetation Avoidance Measures

3.4.1 <u>Cutting or pruning of any of these species (*Peperomia wheeleri* and *Leptocereus grantianus*) is prohibited. These species are listed as endangered and are protected under ESA.</u>

3.4.2 Prior to the beginning of any vegetation clearance, the Contractor's qualified personnel shall identify if any of the listed species described in Section 2 are present or absence within the work area. The Contractor shall contact the FWS in order to obtain additional information (e.g. GIS shapefiles, location maps, etc.) on the locations and populations of these species. This information will be used to determine the transects/grids dimensions and their final locations. During the investigation activities qualified personnel shall conduct visual surveys to ensure the presence or absence of these species and to avoid or minimize possible impacts.

3.4.3 Vegetation clearance in areas where specimens of Wheeler's Peperomia are found shall be closely coordinated with FWS and DNER. Removal of the forest canopy could alter the microclimatic conditions within the forest, resulting in the elimination of humus substrate necessary for the survival of the species. This species is associated with the following canopy species: *Clusea rosea*, *Bursera simaruba* and *Ficus citrifolia*. It is also associated with other species growing in the herbaceous strata: several species of *Tillandsia*, *Anthurium acaule*, *Whittmackia lingulata* and *Epidendrum cochleatum*. Particular attention should be paid to these areas.

3.4.4 Cutting or pruning vegetation within Wheeler' Peperomia habitat, including forested areas with boulders that are densely covered by bromeliads, orchids or anthuriums, shall be avoided to the maximum extend possible in order to maintain the microclimate conditions that contribute to the suitability of this endangered species.

3.4.5 Cutting or pruning of any species of cacti shall be avoided in order to prevent impacts to *Leptocereus grantinanus* species.

3.4.6 If any of these species (*Peperomia wheeleri* and *Leptocereus grantianus*) is found within the proposed transect/grid, the route will be realigned. The species shall be clearly marked in order to ensure its protection.

4.0 POINT OF CONTACT FOR SOP COORDINATION

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APPENDIX B

Guide with the minimum information required for the Daily Observer Log Sheet

DAILY OBSERVER LOG SHEET
DERP-FUDS PROPERTY NO. I02PR0068
CULEBRA, PUERTO RICO

PROJECT INFORMATION	
Contractor:	Munition Response Site#:
USACE Contract#:	Project Location:
Observer Name (and Company):	Observer Location:
Date: Time:	Shift Start: Shift End:
Sunrise: Sunset:	Crew:

Weather and Visibility Information

Location	Time	Glare	Water Clarity	Seas (wave height)	Visibility	Wind Speed and Direction	Conditions on Land	Estimated % Cloud Cover

Sighting Log

Time	Location Coordinates	Species	Total Number	Adults	Juveniles	Closest Distance to Vessel	Activity or Behavoir and Direct of Movement	Time Last Seen

Daily Summary

Species	Total Number	Total Number Outside 50 feet	Total Number Inside 50 feet	Action Taken

Remarks:

____

____

Observer Signature: ____

APPENDIX C

Recommended Coral Relocation and Reattachment Protocol

Coral Relocation and Reattachment Protocol
for
DERP-FUDS Project No. I02PR006802,
Culebra, Puerto Rico

In order to minimize impacts to coral species, non-listed corals with diameters >4.0 in (>10.2 cm), or branched corals will be detached and relocated, to the extent possible, to the area where they are already located in adequate substrate where deemed safe from the expected impact prior to munitions and explosives of concern (MEC) and/or Material Potentially Presenting an Explosive Hazard (MPPEH) removal or disposal. If corals that are listed or proposed for listing are attached to MEC/MPPEH, no relocation or MEC/MPPEH removal effort will be conducted. Instead, additional coordination with the Technical Project Planning (TPP) Team is a requirement for situations where ESA-listed corals or corals proposed for listing are present in areas or on MEC/MPPEH in such a way that the removal of MEC/MPPEH would affect these corals.

For non-listed corals measuring 10 cm or more in diameter or branching corals, the following protocol has been developed as a guideline to decrease coral stress during transplant. It is recommended that two teams or individuals be utilized during the relocation process: one team/individual responsible for removing corals and a second team/individual mobilized and prepared for reattachment activities.

GENERAL CONSIDERATIONS FOR CORAL HANDLING AND TRANSPORTATION

- Each coral may be carried by hand or in a bucket to the relocation site.
- In order to reduce stress to the coral from transport and to increase the likelihood of success, the coral colonies should remain submerged in seawater at all times.
- Corals should be handled as little as possible.
- Detached coral colonies should not be in contact with each other to prevent additional harm to their structures and tissue.
- If a bucket or container is used for transportation and transportation will be above water (such as on a vessel to get from the removal site to the transplant site), the seawater should be routinely changed to avoid prolonged exposure to increased water temperatures.
- Corals should be reattached the same day they are removed; they should not be stored overnight in transport containers.
- Prior to any relocation, photograph (two pictures - one from the top and one from the side) the corals with a ruler or other object showing the size of the colony in the photograph. This can be used to determine whether there is any tissue loss or death during the relocation.

- Record the coordinates where the coral is removed from and the species being relocated.
- Clear all encrusting organisms from the edges of the corals.
- Prevent damage to the edges of corals.
- When possible, remove the entire coral colony in one piece.
- When removal of the entire colony is not possible, a partial removal of the colony will be completed to maintain the phenotypic genetic composition of corals from the investigation site. In this case, field notes should indicate this decision was made.
- Notes should be made regarding orientation of the coral in its natural setting to mimic that position at relocation site. The water depth at which the corals are transplanted should also be the same as those from which corals are removed.
- Place corals upright in transport containers, avoiding contact with other corals.
- Avoid touching coral tissue with bare hands. Gloves should be worn while handling the corals.

Recommended tools for removal and reattachment:

- rubber or dive gloves
- putty knife
- other thin bladed tools with beveled edges
- baskets or buckets
- chisels with thin blades
- chipping hammer
- underwater paper to record and track coral movements
- wire brush
- masonry nails
- Portland Type II cement and/or marine epoxy

IDENTIFICATION OF ADEQUATE RELOCATION SITE

The selection of the relocation site should consider the following:

- The substrate is hard bottom, free of sediment bedload
- No fire corals (*Millepora* spp.), sponges or harmful algae in the vicinity that could hamper coral colony survival and growth.
- High benthic topographic relief
- No predators observed in the vicinity
- The size of the site allows for the relocation activity to be conducted without harming other corals. Keep in mind the preparation of the site, coral colony size and the materials used to reattach the coral.

CORAL RELOCATION

Once the specific reattachment locations have been identified, the following protocol/guidelines should be followed during the reattachment process:

- Document the site coordinates and substrate type and depth
- Prepare the reattachment surface with a wire brush, removing biota, such as algae, and any sediment to expose rock substrate. Care should be taken to avoid contacting existing corals with wire brush.

For massive corals:

- Drive masonry nails, at least three, into the substrate at the site where the coral colony will be placed. Larger corals will require additional nails.
- Prepare a thick mixture of Portland Type II cement with molding plaster added, as necessary, to accelerate hardening of cement. Marine epoxy could be used instead of cement.
    - Place cement/epoxy over the masonry nails. The amount of cement should be enough for the colony to be inserted in the mixture so that there are no empty spaces between the coral colony and the mixture.
    - Insert the detached coral in the cement mixture, exerting some downward pressure.
    - Minimize exposure of coral skeleton by placing cement in voids or along dead coral edges.

- For branched corals:
    - Using wire and/or cable ties to fasten the colony to the masonry nails.
    - The colony should not move once fastened. If it does, epoxy could be added in certain points.
    - Corals may also be attached to appropriate substrate with wire and/or cable ties or by wedging fragments into small crevices and voids.

- Document the reattachment process by taking pictures of the colony, from the top and the side once the process is finished, including a scaled reference item in the picture. Take notes on the method used to reattached the colony.

The following links can be used as reference for the process described above:

- http://www.youtube.com/watch?v=_XaUttAUHv4 (NOAA 2009)
- http://www.youtube.com/watch?v=qRlfOu7fERw (NOAA 2011)

Once all of the transplantation activities have been completed, a detailed effort should be undertaken to map the transplanted colonies. A map of all reattached corals shall be developed and submitted to the TPP Team. This map must be geo-referenced using high accuracy GPS technology, show locations and depths of corals, and should be created immediately upon completion of the transplantation project, while coral transplants are still easily identifiable. Geo-referencing may be accomplished either by 1) geo-referencing each individual coral location or 2) referencing a central marker or staked GPS position, relative to which all corals are mapped. Still photography shall be used to document transplantation activities.

APPENDIX D

List of seabirds that occur in the Project Area

Culebra National Wildlife Refuge
U. S. Fish and Wildlife Service

Culebra Archipelago's Seabirds

Fifteen species of seabirds nest on fourteen islands and cays of the Culebra Archipelago and other 12 species occasionally visit the archipelago and surrounding waters at different times of the year (as showed in table 2 and 3). This fact makes to the present day the Culebra NWR one of the most important reserves in the Caribbean for seabirds. As part of the current management activities, the Service protects and conserves these essential nesting areas for seabirds. However, there are some aspects that increase habitat vulnerability for these species, as predators and human disturbances.

Table 2. Culebra Archipelago Seabirds

Species Name	Nesting?	Species Name	Nesting?
Audubon's Shearwater	Yes	Least Tern	Yes
Masked Booby	Yes	Great Shearwater	No
Brown Booby	Yes	Manx Shearwater	No
Red-footed Booby	Yes	Wilson's Storm-Petrel	No
White-tailed Tropicbird	Yes	Leach's Storm-Petrel	No
Red-billed Tropicbird	Yes	Double-crested Cormorant	No
Laughing Gull	Yes	Common Tern	No
Royal Tern	Yes	Arctic Tern	No
Sandwich Tern	Yes	Pomarine Skua	No
Cayenne Tern	Yes	Black Noddy	No
Roseate Tern	Yes	Herald's Petrel	No
Bridled Tern	Yes	Brown Pelican	Yes
Sooty Tern	Yes	Magnificent Frigatebirds	No*
Brown Noddy	Yes		

*need to be confirmed, potential areas for nesting occur

Tabla 3. Seabird areas on Culebra Archipelago

Seabird areas on Culebra Archipelago	Bird Name	Observed or Nesting	Nesting Period	Resident or Migratory
Flamenco Peninsula	Sooty Tern	nesting	March to September	Migratory
Luis Peña Cay	Audubon's Shearwater	nesting	February to July	Migratory
	White-tailed Tropicbird	nesting	February to September	Migratory
	Red-billed Tropicbird	nesting	May to September	Migratory
Del Agua Cay	Audubon's Shearwater	nesting	February to July	Migratory

	White-tailed Tropicbird	nesting	February to September	Migratory
	Bridled Tern	nesting	April to August	Migratory
	Brown Noddy	nesting	April to August	Migratory
Ratón Cay	Audubon's Shearwater	nesting	February to July	Migratory
	Red-billed Tropicbird	nesting	May to September	Migratory
	Roseate Tern	nesting	April to July	Migratory
	Bridled Tern	nesting	April to August	Migratory
	Brown Noddy	nesting	April to August	Migratory
Yerba Cay	Audubon's Shearwater	nesting	February to July	Migratory
	Red-billed Tropicbird	nesting	May to September	Migratory
	Roseate Tern	nesting	April to July	Migratory
	Bridled Tern	nesting	April to August	Migratory
	Sooty Tern	nesting	March to September	Migratory
	Brown Noddy	nesting	April to August	Migratory
Lobo Cay	Audubon's Shearwater	nesting	February to July	Migratory
	White-tailed Tropicbird	observed	February to September	Migratory
	Red-billed Tropicbird	observed	May to September	Migratory
Lobito Cay	Audubon's Shearwater	nesting	February to July	Migratory
	Red-billed Tropicbird	nesting	May to September	Migratory
	Laughing Gull	nesting	April to September	Migratory
	Royal Tern	nesting	May to July (Sept to April)	Migratory
	Sandwich Tern	nesting	May to July (Sept to April)	Migratory
	Cayenne Tern	nesting	May to July	Migratory
	Bridled Tern	nesting	April to August	Migratory
Noroeste Cay	White-tailed Tropicbird	nesting	February to September	Migratory
	Bridled Tern	nesting	April to August	Migratory
	Sooty Tern	nesting	March to September	Migratory
	Brown Noddy	nesting	April to August	Migratory
Molinos Cay	White-tailed Tropicbird	nesting	February to September	Migratory
	Red-billed Tropicbird	nesting	May to September	Migratory
	Roseate Tern	nesting	April to July	Migratory
	Bridled Tern	nesting	April to August	Migratory
	Sooty Tern	nesting	March to September	Migratory
	Brown Noddy	nesting	April to August	Migratory
Alcarraza Cay	Audubon's Shearwater	nesting	February to July	Migratory
	Red-billed Tropicbird	nesting	May to September	Migratory
	Masked Booby	nesting	Throughout the year	Resident
	Brown Booby	nesting	Throughout the year	Resident
	Bridled Tern	nesting	April to August	Migratory
	Sooty Tern	nesting	March to September	Migratory
	Brown Noddy	nesting	April to August	Migratory

Matojo Cay	Audubon's Shearwater	nesting	February to July	Migratory
	Red-billed Tropicbird	nesting	May to September	Migratory
	Royal Tern	nesting	May to July (Sept to April)	Migratory
	Laughing Gull	nesting	April to September	Migratory
	Sandwich Tern	nesting	May to July (Sept to April)	Migratory
Geniquí Cays	Red-billed Tropicbird	nesting	May to September	Migratory
	Brown Booby	nesting	Throughout the year	Resident
	Laughing Gull	nesting	April to September	Migratory
	Bridled Tern	nesting	April to August	Migratory
	Brown Noddy	nesting	April to August	Migratory
	Red-footed Booby	nesting	Throughout the year	Resident
Culebrita Island	Audubon's Shearwater	nesting	February to July	Migratory
	White-tailed Tropicbird	observed	February to September	Migratory

General comments:

As showed in table 3, throughout the year, the Culebra Island offshore cays receive a lot of seabirds for nesting, roost or just visit the cays and surrounding waters for feeding. Some of these species are observed during the year as regular residents or visitors: Red-footed Booby, Brown Booby, Magnificent Frigatebirds, and Brown Pelican. The first two species nest regularly in cays and the last species need to be confirmed for nesting but are regularly observed roosting on trees, shrubs or flying over the cays.

Seabirds are pelagic birds. This means that they just come to land to nest and after that, these pass the rest of the time flying over the ocean looking for food. The nesting season of seabirds consists of the period of time that birds are present or near lands doing courtships, nesting area selections, nesting periods, etc. This period is finished when fledglings or juveniles abandon the colony area. The most critical months in Culebra Island for seabirds are from February to August. During this period, the seabirds, and depending on the species, are in the process of courtship, selection of nesting areas, laying eggs, feeding their chicks, and protecting their fledglings from predators. Areas more used by birds in the Culebra Archipelago are Yerba, Molinos, Alcarraza, Geniqui, Lobito, Agua, Raton and Matojo cays and Flamenco Peninsula.

The most common and dangerous perturbations in the seabirds colonies are predators and human disturbances. In the Culebra offshore cays, introduced predators such as cats and rats, can eat eggs and chicks. Also, other predators (i.e., goats and deer) in the cays can manipulate and change the nesting habitat by grazing. Human disturbances as loud noise made by jet skis, boats, and other sources, or just the presence of one or more persons near the colony (ies) may cause abandonment of nests by adults which may cause eggs overheat and predated by ants, rats or cats. It is very important not to disturb the colonies during nesting season. Any work or activity necessary to do near or in colony areas, should be completed outside of nesting period.

APPENDIX E

Equation to calculate the potential extent of acoustic impacts from underwater detonations

2. Overview of Impacts to Protected Species

Underwater explosions may affect marine life by causing death, injury, temporary threshold shifts (TTS or recoverable hearing loss), or behavioral reactions, depending on the distance an animal is located from a blast. An underwater explosion is composed of an initial shock wave, followed by a succession of oscillating bubble pulses. A shock wave is a compression wave that expands radially out from the detonation point of an explosion. At a distance from a detonation, the propagation of the shock wave may be affected by several components including the direct shock wave, the surface-reflected wave, the bottom-reflected wave, and the bottom-transmitted wave. The direct shock wave results in the peak shock pressure (compression) and the reflected wave at the air-water surface produces negative pressure (expansion). For an explosion with the same energy and at the same distance, an underwater blast is much more dangerous to animals than an air blast. The shock wave in air dissipates more rapidly and tends to be reflected at the body surface; in water the blast wave travels through the body and may cause internal injury to gas-filled organs due to impedance differences at the gas-liquid interface.

Beyond the distance from a detonation causing injury, explosives use in designated critical habitat, during certain times of year, or occurring in other biologically important habitats (e.g., migration corridors, spawning and nesting areas, and juvenile habitats) could have potentially adverse consequences on animals. In response to noise, behavioral reactions could potentially result in impairment of feeding, sheltering, reproduction, or other biologically important functions of animals. Exposure to a noise can also result in temporary or permanent hearing impairment, depending on the sound pressure level and exposure duration. Therefore, the hearing abilities of animals and behavioral disturbance are important considerations when assessing the potential impacts from projects resulting in noise.

2.1. Effects on Sea Turtles

Explosions are known to injure and kill sea turtles (Duronslet et al. 1986, Gitschlag 1990, Gitschlag and Herczeg 1994, Klima et al. 1988, O'Keefe and Young 1984). NMFS studied the effects of offshore oil and gas structure removals using 23 kg (50 lb) of nitromethane (Klima et al. 1988). Loggerhead (*Caretta caretta*) and Kemp's ridley (*Lepidochelys kempii)* sea turtles were located at distances of 213.4 m (700 ft), 365.8 m (1,200 ft), 548.6 m (1,800 ft), and 914.4 m (3,000 ft) from the platform removed with explosives. The charges were placed inside platform pilings at a depth of 5 m below the mudline. Four sea turtles within 365.8 m of the detonation were unconscious, as well as an individual at 914.4 m (3,000 ft). Sea turtles were expected to have drowned if not recovered from the water following the detonation. All turtles exposed to the blast exhibited everted cloacas and vasodilation lasting 2-3 weeks.

The sea turtle ear appears to be adapted to both aerial and aquatic environments. Sea turtles have a primitive reptilian ear and are considered to be hearing generalists, having limited hearing abilities at lower frequencies. Although there is some variation in sea turtle hearing measurements between species and size classes (Ketten and Bartol 2006), the available data suggest that species of sea turtles are likely sensitive to frequencies from approximately 100 Hertz (Hz) to 2,000 Hz (Lenhardt 1994, Lenhardt et al. 1996, McCauley et al. 2000a and 2000b, Moein et al. 1994, O'Hara and Wilcox 1990), with greatest underwater hearing sensitivities below 1,000 Hz (Ketten and Bartol 2006). Behavioral reactions to the sound produced from explosions may be important if they occur in biologically important areas such as foraging areas, near nesting beaches during nesting season, or in developmental juvenile habitats.

2.3. Effects on Marine Mammals

Blast damage in marine mammals has been investigated using both submerged terrestrial mammals (Goertner 1982, Yelverton et al. 1973, Richmond et. al 1973) and cadavers (Myrick et al. 1990, Ketten et. al 2003). At close ranges to a detonation, mortality and life threatening injuries may occur. At increasing distance from the blast, the effects of the shock wave lessen, but effects such as hearing loss and behavioral responses may still occur. There are a variety of factors that may affect noise effects on marine mammals. Marine mammals are at greatest risk of injury when they are at the same depth as, or slightly above, the explosion (Keevin and Hempen 1997). Risks drop off quite sharply above and below this depth; however, the pressure waves produced from an explosion may propagate very differently, depending on environmental factors. Additionally, smaller marine mammals are more susceptible to blast injury than larger animals at the same exposure levels. Frequently occurring or repeated detonations over a given time period may cause behavioral changes that disrupt biologically important behaviors or result in TTS.

The hearing abilities of marine mammals are generally classified as lower-frequency hearing for mysticetes (baleen whales) and higher-frequency hearing for odontocetes (toothed whales). Based on anatomical studies, mysticetes are believed to generally hear sounds in the 0.01 to 20 kHz range, depending on the species (e.g., Helweg et al. 2000, Parks et al. 2001, 2007). Odontocetes generally hear over a much broader range of higher frequencies from approximately 0.2 to 180 kHz (e.g., Cook et al. 2006, Erbe 2002, Houser and Finneran 2006, Kastelein et al 2003, Szymanski et al. 1999) with best hearing between approximately 5 and 100 kHz, depending on the species. Increasingly, more hearing measurements are becoming available for more odonotcete species and have been summarized elsewhere (Nedwell et al. 2004); however, the general range of hearing abilities described above can be used for planning projects that result in infrequent, impulsive sounds from underwater detonations of explosives.

2.4. Behavioral Reactions to Detonations

At ranges beyond those causing injury, animals are susceptible to behavioral disturbances from underwater noise in the frequencies of their hearing range. Explosions produce loud, broadband noise that is audible to many species, but the main frequencies produced are often influenced by the medium being blasted (e.g., rock, concrete, and pilings) and blasting technique (e.g., placement inside or outside the structure, burial or borehole depth, and type of charge). Important behavioral effects on feeding, resting, and reproduction should always be considered during project planning.

Based on the duration of noise produced from construction activities, repeated exposure to acoustic energy (e.g., pile driving, geophysical surveys, dredging, and vessel noise) could potentially result in a broader range of behavioral effects than single, impulsive energy waves, such as those resulting from detonations. Detonations resulting in a single, instantaneous detonation would not be expected to result in significant behavioral disturbance; however, temporary reactions or startle responses to the noise may occur. Likely reactions to a single detonation may range from no reaction (Madsen and Møhl 2000), annoyance, attraction to or avoidance of the noise, or a startle response from the sudden onset of the noise (SRS Technologies 2001). Observed reactions could include diving, surfacing, schooling, increased respiration, or swimming away from the noise (Collins et al. 2001, Richardson et al. 2001, Nowacek et al. 2007). The effects of startle responses are usually temporary and minor, although sudden onset of impulsive noises may have potentially adverse consequences (Jehl and Cooper 1980, SRS Technologies 2001).

Recommended exposure levels in which behavioral reactions are expected appear in Table 1. Single, discrete detonation events are generally not expected to result in significant changes in behavior under most circumstances; however, certain life history stages or behavioral states need consideration when assessing impacts of noise. In the southeast U.S., project areas in or near known spawning grounds, calving areas, nesting beaches, important foraging areas, migration corridors, or designated critical habitat may be more likely to disturb animals. These areas may have seasonal or environmental characteristics that are important to protected species. NMFS is available to assist with identifying any areas of potential concern near a project area.

Table 1. Onset of behavioral responses to a single impulsive noise.

Impact Zone	Cetaceans[a]	Sea Turtles[b]	Fishes[c]
Harassment (Behavior)	≥ 160 dB_{rms} re 1 μPa	166_{rms} dB re 1 μPa or 155 dB re 1 μPa-s	160 $_{peak}$ dB re 1 μPa

[a]Recommended interim criteria for marine mammals
[b]Based on McCauley et al 2000a
[c]Recommended level based on data from Skalski et al. 1992.

Although most single detonations typically don't result in significant behavioral changes, the level of behavioral response of an animal can be strongly dependent on the repetitiveness of the disturbing stimulus. As a guiding principal, projects involving multiple detonations per day should be evaluated for their potential to significantly affect the behavior of an animal. For any projects in which repetitive explosions may occur, the potential for adverse behavioral effects must be evaluated on a project-by-project basis with NMFS.

3. Defining Zones of Influence

Defining zones of influence allows NMFS and project planners to estimate the potential area affected and determine appropriate mitigation measures for protected species.

1. **Mortality Zone:** The distance from a detonation within which mortality may occur.

2. **Injury Zone:** the distance from a detonation within which non-lethal injury may occur, but mortality is not expected.

3. **Danger Zone:** The distance from a detonation within which both injury and mortality may occur.

4. **Harassment Zone (TTS):** the distance from a detonation within which temporary hearing loss may occur.

5. **Harassment Zone (Behavior):** the distance from a detonation within which behavioral reactions may occur.

6. **Watch Zone:** an additional buffer zone that may be monitored to detect animals that are heading towards the impacted area. The watch zone radius may vary depending on the type of project and species potentially occurring in the project area.

Different zones of influence should be considered when determining the range of effects from any given noise. Useful terms to describe zones of influence and estimate probable impacts from explosions (and avoidance of) are 1) a mortality zone, 2) an injury zone, 3) a danger zone (mortality and injury zones combined), 4) a harassment zone (TTS), 5) a harassment zone (behavior), and 6) a watch zone (Figure 1). Defining zones of influence is also important to establish common terminology to discuss potential impacts to protected species. The term *impact zone* may also be used in reference to the distance from an explosion within which the potential for adverse effects may occur, including the potential for mortality, injury, and harassment.

4. Calculating Zones of Influence

NMFS' Southeast Region currently accepts three general methods to calculate zones of influence, depending on the activity type: 1) energy and pressure thresholds; 2) unconfined blasts; and 3) confined blasts using stemmed charges. The zones of influence needed for a project area and how they are estimated will vary depending on the method used, as well as project-specific details.

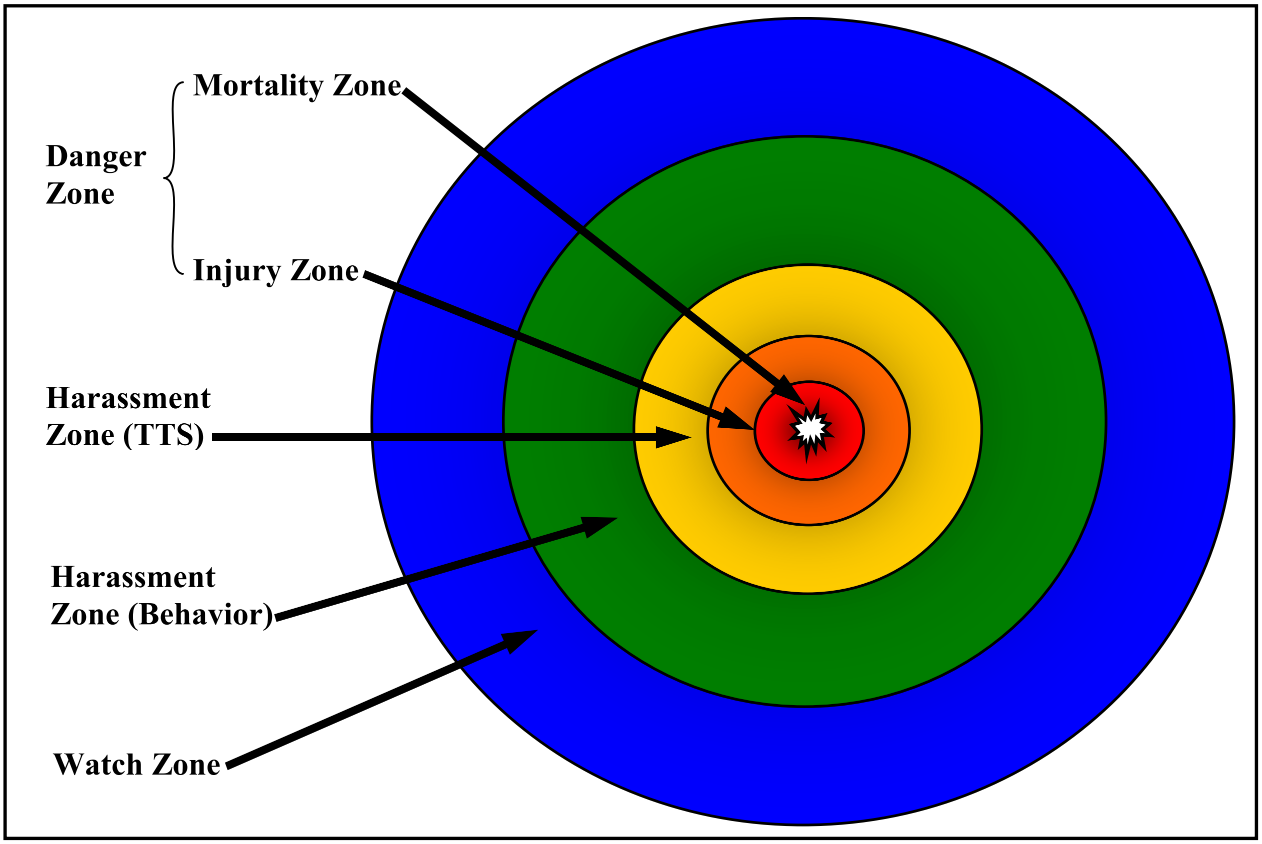

Figure 1. An example of zones of influence from explosives detonated in open water.

4.1. Energy and Pressure Thresholds

Threshold criteria for marine mammals and sea turtles were initially established for ship shock trials of the SEAWOLF submarine and the WINSTON S. CHURCHILL vessel, and description and derivation of these criteria can be found in the environmental impact statements prepared for these activities (Department of the Navy 1998 and 2001). Recently, these criteria have been revised and are currently undergoing further review by NMFS and may be applied to other protected vertebrate species. Standard impulsive and acoustic metrics used in this document are defined below.

Peak Pressure: peak pressure is commonly used to measure maximum positive pressure or peak amplitude of impulsive sources with units of psi.

Positive Impulse: Positive impulse is the time-averaged pressure disturbance from an explosive source with units in psi-ms.

Sound Exposure Level (SEL): SEL is the time cumulative sum of squares pressure divided by the duration of the sound. SEL levels have units of dB re 1 $\mu Pa^2 \cdot s$ and other an assessment of risk to multiple exposures, such as pile driving.

Energy flux density (EFD): EFD is the time integral of the squared pressure divided by the impedance. EFD levels have units of dB re 1 $\mu Pa^2 \cdot s$.

1/3-Octave band: The 1/3 octave selected is the hearing range at which the subject animals' hearing is believed to be most sensitive.

It is noteworthy that the EFD and SEL metrics are converted to decibels in a slightly different way, but are very similar. The SEL and EFD metrics often are used to refer to the same quantity, namely, the time integral of square pressure divided by the product of sound speed and density. This definition for EFD, however, is not strictly correct for complex pressure fields; SEL may be a more appropriate metric in an analysis of potential impacts from explosive sources. However, both SEL and EFD are reported in the literature and are comparable metrics. NMFS recommends that SEL should be used whenever possible.

Marine Mammal and Sea Turtle Mortality Thresholds

To determine the potential physical injury from explosions, pressure thresholds are used based on the mass of the animal. Studies with animals have shown that as the mass of the animal increases, the pressure required to result in lung injury increases. Pressure is commonly measured as positive impulse or peak pressures. Threshold levels can be established to estimate distances from an explosion in which different impacts varying in severity may occur, that may characterize levels at which harassment, injury, or death may be expected. Although body mass is associated with blast injury, there is no not association with auditory and behavioral effects discussed below. Predictive equations for lung injury Equation 1 and example thresholds based on body mass of sea turtles and marine mammals appear in Table 2.

The recommended threshold level for the onset of mortality in sea turtles and marine mammals from explosions (Yelverton and Richmond 1981) is given by:

1% mortality can be estimated by: $LN\ I = 2.588 + 0.386\ Ln\ M$, and

50% mortality can be estimated by $LN\ I = 3.019 + 0.386\ Ln\ M$

where I is positive impulse (psi-ms) and M is body mass (kg).

Example 4.1

Using the above equation to find the threshold level at which the onset of mortality (1%) is expected for a 27 lb (10 kg) juvenile green sea turtle in the Laguna Madre, Texas, we find:

<u>10 kg green sea turtle</u>

$LN\ I = 2.588 + 0.386\ Ln\ (10)$

$LN\ I = 2.588 + 0.889$

$LN\ I = 3.477$

Finding the inverse natural log to solve for impulse (I) yields:

$I = e^{3.477}$

$I = 2.71828^{4.33}$

I = 32.36 psi-ms

In general, smaller animals and their associated smaller impulse values result in larger impact zones. This equation does not consider the possible effects of animal depth; however, it is generally applicable to general estimating the onset of mortality for blasting projects in coastal areas, and it is highly conservative since it estimates the injury range at which only 1% of animals would be expected to experience lung injury. Following the calculation of the appropriate threshold level, the shock wave needs to be modeled to determine the range from the detonation at which the threshold level will be realized. These calculations are complex and require knowledge of the project details, environment, shock wave theory and modeling. These calculations are discussed in greater detail in Department of Defense (2001 and 2007).

To predict auditory effects from single explosions, two different acoustic energy thresholds (dual criteria) may be used to predict effects to sea turtles and marine mammals: a sound exposure level (SEL) and a pressure threshold (Table 2). The auditory criteria resulting in permanent

Table 2. Zones of influence for marine mammals and sea turtles from explosions.

Impact Zone	*Criterion Definition*	**Threshold Level**
Mortality Zone	Onset of severe lung injury (1% of animals; dependent on body mass)	Ln I = 2.588 + 0.386 Ln M[a]
Injury Zone	Onset of PTS	≥46 psi, 230 $_{peak}$ dB re 1 µPa, or 198 dB re 1 µPa^2-s
Harassment Zone (TTS)	Onset of TTS	≥23 psi[b], 224$_{peak}$ dB re 1 µPa[c]; or 183 dB µPa^2-s at frequencies in any 1/3 octave band above 100 Hz for odontocetes and sea turtles; or above 10 Hz for mysticetes.

[a]Yelverton and Richmond 1981
[b]Finneran et al 2002
[c]Southall et al. 2007

threshold shift (PTS or non-recoverable hearing loss) and TTS are applicable to single detonation events that do not result in repeated exposures to noise. Since auditory effects have not been shown to be associated with the size of the animal, specific threshold levels can be used.

However, repeated exposures to noise resulting from consecutive detonations of explosions may result in different threshold levels, this does not typically occur and is limited to some types of military testing and training exercises and special blasting requirements of some construction projects. Longer durations to noise exposure may result in greater magnitude effects on animals, and may require additional consideration when conducting a risk assessment. In general, longer duration noises have a greater likelihood to result in hearing loss, than shorter, impulsive noises of the same intensity.

Some specific models have been developed for some activities using these criteria (e.g., explosive removal of offshore oil and gas structures in the Gulf of Mexico) and are discussed elsewhere (Dzwilewski and Fenton 2003). When deciding which criteria to use, each threshold level must be calculated to determine the more conservative criteria that yields the larger zone of influence. NMFS currently recommends that the SEL be estimated to account for the total energy produced during detonations; however, peak pressure is also acceptable. In cases where empirical data exist, dual criteria exist for the impact threshold. If SEL levels are not used, the equivalent dB unit of measurement used should always be clearly reported.

Summary of Threshold Criteria
These criteria may be used to establish impact zone areas in which probable impacts can be expected, and appropriate mitigation measures designed to avoid or minimize the risk of harm to protected species. A discussion of the calculations conducted for these criteria are provided in the environmental impact statement prepared for the shock trial of the *Mesa Verde* (Department of Defense 2008). NMFS regards these criteria (Table 3) as the preferred approach to estimating impacts on sea turtles and marine mammals; however, potential impacts to sturgeon and the smalltooth sawfish are more difficult to quantify by discrete threshold levels and is dependent on the size class and/or life history stage of fishes in the project area. Additionally, many project planners often do not have the necessary information on the project to model the required distance at which the thresholds are realized. In absence of all the information necessary to complete the calculations, reasonable assumptions may be necessary to model shock wave propagation and determine dual criteria thresholds for protected species.

With information on the noise characteristics of the detonation and species affected, accurate estimates of impact zones can be determined for sea turtles and marine mammals. Some limitations of the criteria include assumptions about the propagation of shock waves, depth of charge, and variations in propagation environments at different project areas. Although specific threshold criteria can be set for protected species, modeling of threshold levels from explosions may be limited by modeling capabilities, and conservative assumptions regarding impact zones and potential effects to species may be needed. Because there are many other variables to consider, NMFS may request field verification measurements to be made prior to establishing final zones of influence when a large degree of uncertainty exists.

4.2. Unconfined Blasts
Unconfined or open-water blasts include a wide variety of explosives uses for construction, demolition, and other marine projects. For unconfined blasts, precise injury zones cannot be calculated without calculating pressure measurements. These equations are considered very conservative; and, therefore, are acceptable for protected species mitigation during project planning. Young (1991) developed predictive equations based on observed safe ranges (radius) from a detonation, and be used to predict the danger zone for protected species:

$$\text{Fish Danger Zone (ft)} = 95\ (\text{fish weight in lb})^{-.13}(\text{max lb/delay})^{.28}(\text{depth of charge in ft})^{.22}$$

$$\text{Sea Turtle Danger Zone (ft)} = 560\ \sqrt[3]{\text{max lb/delay}}$$

$$\text{Calf Porpoise Danger Zone (ft)} = 578\ (\text{max lb/delay})^{.28}$$

20-ft Whale Danger Zone (ft) = 327 (max lb/delay)$^{.28}$

The equation to estimate danger zones for fishes is based on data from open-water blasts in shallow water. Although it is based on a limited range of conditions, the equation is appropriate for sturgeon due to their association with riverine and coastal shallow-water habitats. Although the above models are based on observed safe ranges from an explosion where no apparent injury or mortality was observed, they do not precisely predict differing levels of effects within the range between the detonation point and safe distance (e.g., the specific distances in which mortality and injury are expected are not known). However, these models are very conservative predictors to avoid serious injury and mortality. NMFS considers the equations developed by Young to be very conservative at avoiding serious injury and harassment. Although they were not developed to predict distances to avoid non-serious injury (PTS), these effects of PTS may be found within these conservatively estimated danger zones.

Many variables are often unknown in planning phases, and these models are useful for predicting safe ranges to avoid mortality when more precise harassment zone modeling cannot be completed. NMFS may request an estimation of these zones of influence for section 7 consultation under the ESA, or when applying for an incidental harassment authorization under the MMPA if determined to be necessary. In such cases, a conservative estimate of a non-serious injury and harassment zone should be estimated based upon available information from similar projects or field measurements. If sufficient information is available, a more rigorous analysis of environmental impact modeling for zones of influence should be completed.

Example 4.2
A hypothetical demolition project plans to remove an existing two-lane causeway and construct a new six-lane causeway over an estuarine bay. A total of 8 blast events will be conducted over a 30-day period. For one detonation sequence, a total net explosive weight (NEW) of 200 lb (60-lb, two 50-lb, and a 40-lb charge) will be detonated with three 25 ms delays between each detonation. The charges will be detonated at a depth of 20 ft to sever support structures for removal. The species occurring in the project area and information for the detonation sequence appears in the table below.

Species in Project Area	**Abundance in Bay (0)**	**Charge Weights/Series (lb)**	**Max. NEW/25 ms Delay**
Gulf sturgeon	60	40	60
green sea turtle	3	50	
Kemp's ridley sea turtle	2	50	
loggerhead sea turtle	18	60	
bottlenose dolphins	37		

Subadult Gulf sturgeon utilize the project area during the scheduled blasting activities of January-February. Subadult sturgeon foraging in the area have weights ranging from 0.7 lb to 5.3 lb (Clugston et al. 1995).

Example Calculations
The equations to predict the danger zone for fishes, sea turtles, and dolphins to mortality and serious injury can be solved for each species by:

$$\begin{aligned}\text{Fish Danger Zone (ft)} &= 95\,(.70)^{-.13}(60)^{.28}(20)^{.22}\\ &= 95\,(1.05)(3.15)(1.93)\\ &= 95\,(6.38)\\ &= 606 \text{ ft}\end{aligned}$$

$$\begin{aligned}\text{Sea Turtle Danger Zone (ft)} &= 560\,\sqrt[3]{60}\\ &= 560\,(3.91)\\ &= 2{,}192 \text{ ft}\end{aligned}$$

$$\begin{aligned}\text{Dolphin Calf Danger Zone (ft)} &= 578\,(60)^{.28}\\ &= 578\,(3.15)\\ &= 1{,}821 \text{ ft}\end{aligned}$$

In the above example, the Gulf sturgeon danger zone (606 ft) is much smaller than that predicted for sea turtles (2,192 ft) and dolphins (1,821 ft). For sea turtles and dolphins, size of animals and depth of charge are not needed to solve the equation because they are based upon observed safe ranges. Although this may be convenient to solving the calculation, the resulting danger ranges for sea turtles and dolphins are conservatively large as a result. The danger zones predicted for sea turtles and marine mammals using these equations for explosive charges < 1,000 lb result in quite larger distances than those calculated using the energy and pressure criteria, and often approximate, but are slightly more conservative than, harassment zones predicted by the dual criteria thresholds for TTS. However, additional distances may be needed to account for these potential effects if they are determined to be beyond the danger range.

Visually Observable Species
For visually observable species, the size of the area to be monitored is usually determined by the species affected over the largest area, which in the above example are sea turtles. When estimations of zones of influence are necessary using the equations developed by Young, it may be desirable to compare the zones of influence predicted with the safe range equations with similar projects that have calculated more precise zones of influence for sea turtles and marine mammals using the dual criteria thresholds (Table 1). Field measurements are desirable requirements of operation plans of common types of activities to verify the predicted zones of influence.

Species Not Visually Observable
The most sensitive size class is accounted for by using the lowest mass of subadult Gulf sturgeon in the area (0.70 lb). Since sturgeon cannot be effectively monitored by visual observers, physical barriers, bubble curtains, or reducing the NEW of the charge might be considered by project planners. If such measures cannot be effectively deployed, seasonal restrictions may be an appropriate measure to avoid potential mortality altogether. The Young equation is considered appropriate for Gulf sturgeon because it was developed based on data for shallow-

depth, open-water explosions. In addition to their common association with shallow-water habitats, sturgeon generally spend most of their time on the bottom, where fishes are less vulnerable from open-water explosions (Young 1991), but not necessarily from buried charges. However, this open-water equation conservatively estimates safe ranges for species of sturgeon. It is important to note that as depth of the charge increases or the mass of the fish decreases, the distance of the safe range from the explosion will increase for a charge of equivalent NEW. Keevin and Hempen (1997) provide a thorough summary of other models to estimate lethal zones for fishes when additional parameters are known.

In summary, NMFS' Southeast Regional Office considers these conservative equations sufficient for mitigation planning purposes to avoid injury and mortality when more precise calculations of zones of influence cannot be completed. Additional considerations of impacts associated with non-lethal injury and harassment may be necessary, and may be dependent on the details of the project.

4.3. Confined Blasts Using Stemmed Charges

Confined blasts in boreholes are a method in which the explosive charge is placed in a borehole and capped with an inert material such as angular rock or crushed stone. Confined borehole blasting or stemmed charges are used primarily during channel and harbor deepening. Confined blasts increase the work done by the explosives while decreasing the amount of pressure released into the water column (Hempen et al. 2005, Nedwell and Thandavamoorthy 1992). Detonations in open water will produce both higher amplitude and higher frequency shock waves than contained detonations; thus, the technique of stemming charges results in reduced pressures and lower aquatic organism mortality than the same explosive charge weight detonated in open water (Hempen et al. 2007, Nedwell and Thandavamoorthy 1992).

The inert material must be irregularly shaped since regularly-shaped materials may be expelled during detonation and will not effectively "dampen" the blast wave. To be effective, the stemming material should be within 1/20 to 1/8 of the borehole diameter. The stemming material is not acceptable if it contains more than 10% fines (smaller than 1/20 of the borehole diameter). Stemming material should be placed at a minimum vertical length of three borehole diameters above the placed charge within sound rock or concrete. Since this approach has been based on specific measurements of underwater rock blasting projects, blasting methods that do not follow established methods for confined blasting should use an unconfined blast model to determine the appropriate impact zone or estimate zones of influence, such as that provided in section 4.2 above, or conduct field experiments to measure pressure and energy propagation from the specified blasting method so that new models may be derived.

The following equations are recommended to estimate the zones of influence for confined, stemmed charges (Hempen et al. 2007, Jordan et al. 2007):

Danger Zone Radius (ft) = $260 \sqrt[3]{\text{lb/delay}}$

Harassment Zone Radius (ft) = $520 \sqrt[3]{\text{lb/delay}}$

Watch Zone Radius (ft) = three times the distance of the mortality and injury zone

Example 4.3

Using the same blast scenario provided in example 4.2, but with confined, stemmed blasts instead of open-water, the zone of influence equations yield:

Danger Zone Radius (ft) $= 260\sqrt[3]{60}$
$= 1{,}018$ ft

Harassment Zone Radius (ft) $= 520\sqrt[3]{60}$
$= 2{,}036$ ft

Watch Zone Radius (ft) $= 3(260\sqrt[3]{60})$
$= 3{,}054$ ft

Based on studies to date (Hempen et al. 2005, Nedwell and Thandavamoorthy 1992), the above equation is believed to be highly conservative in estimating zones of influence for protected species, and mitigation based on this model has been tested in the field (Jordan et al. 2007). A limitation of this model, as with the above open-water blast equations, is that it does not estimate threshold levels for various types of effects from a confined blast, but estimates a conservative safe range from injury and mortality for all species. Although there would be a greater risk of mortality the closer an animal comes to the point of detonation, the distance is conservatively protective since both injury and mortality are assumed to have an equal chance of occurring if an animal were within the danger zone.

Hempen et al. (2007) estimated a mortality zone for fishes based on a low lethal level of 40 psi for stemmed charges. NMFS believes this level may be appropriate for larger size classes of fish, but not for smaller size classes (see Figure 2). If only large animals are found in a project area, the 40-psi criteria may be appropriate. NMFS recommends the equations above be used for estimating impacts to all size classes during project planning.

5. Assessing Impacts to Protected Species

Analytical frameworks are useful decision-making tools for protected species management. Analytical frameworks can be used to break down, or deconstruct, an activity into individual components, identify the potential effects of the noise components in the environment, and determine the level of risk posed by the noise-producing activity (Figure 4). Each noise component can be characterized by considering many factors such as the propagation characteristics of the noise, the environmental characteristics and habitat type, and species found in the area. Once all the important variables of the action and species are considered, a risk

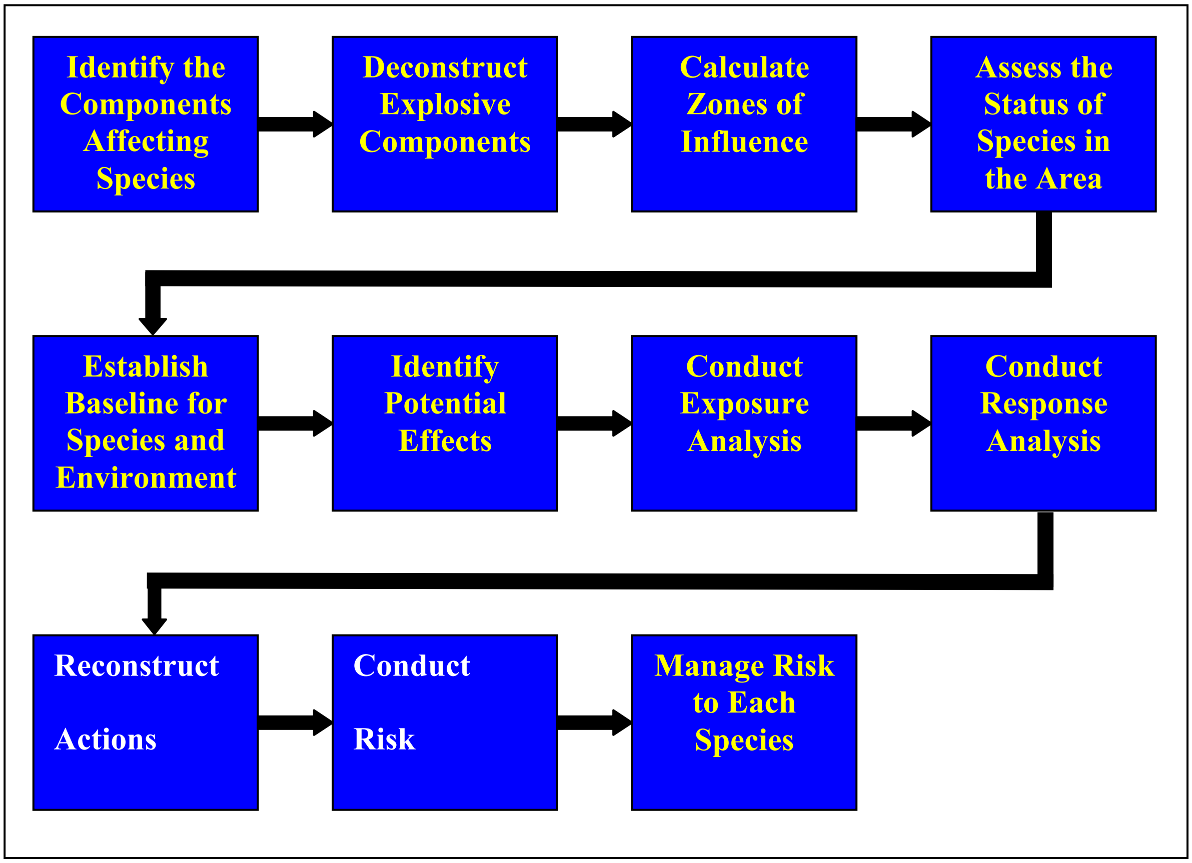

Figure 4. A general analytical framework to assess risk to protected species from explosions.

assessment is performed to determine the probability of undesirable effects occurring, and any measures to minimize or avoid those effects can then be considered.

Analytical frameworks utilize mathematical models or conceptual approaches to assess the potential risks to different species. The types of effects routinely considered include the potential for injury or death, the potential for harassment to occur, and habitat effects resulting from the activity. Information on any protected species in the project area is needed to properly assess any potential impacts. Information such as species abundance, animal behavior, hearing abilities, habitat characteristics, critical habitat designations, and other available information in the project area need to be considered. For example, a project can be deconstructed into its main components such as time of year, project duration, charge weights, number of explosions per day, and other variables (see *Summary of Information Needed* section below). Noise from the project can further be deconstructed into pressure units (psi) and dB units (EFD). Using the threshold criteria or models discussed in previous sections, zones of influence can be calculated to determine probable effects to protected species or critical habitat. For any effects that need mitigating, a number of different mitigation tools may be used to avoid or minimize impacts to protected species and their habitats.

Information Needed to Assess Impacts

A complete description of the activity and an assessment of impacts to protected species from explosives should be submitted with a request for consultation or incidental take authorization to NMFS. NMFS may also consider other actions associated with the use of explosives that may affect protected species such as vessel traffic, dredging, construction noise, effects on habitat quality, and other potential effects of the action. Any additional activities that may result in impacts to protected species or those identified in consultation with NMFS should also be identified. An analysis of all activity components that may affect protected species should be conducted, and those resulting in potentially adverse affects identified. For explosives use, a detailed blasting plan should be submitted with, or integrated within the impact analysis for a particular activity. The information needed for NMFS to assess activities using explosives includes:

- A description of the types of targets or structures on which explosives will be used;
- The type of explosives used;
- Details of the use of delays, stemming, charge placement, and depth of detonation;
- The total number of detonations or detonation sequences for the project, and number per day;
- The maximum explosive weight detonated per 25 ms period for each detonation sequence;
- The number of delays used and delay time for each detonation sequence;
- The time of year (months) the blasting is planned; and
- The total number of days blasting is expected to occur;
- A description of habitat in which explosives will be used including depth, salinity, water temperature, substrate type, and biota;
- A description of protected species and habitat in the project area;
- A summary of potential effects to species and habitat from the activity;
- An estimation of the zones of influence to protected species indicating the method by which they were calculated. Models and mitigation methods may be approved on a case-by-case basis, or as new information becomes available regarding blast modeling or exposure criteria for protected species;
- An analysis of effects to protected species;
- An analysis of effects on protected species habitats and primary constituent elements (PCEs) of any critical habitat, if designated in the project area;
- A proposed mitigation/monitoring plan for the project; and
- Observer qualifications

A well-prepared blasting plan can partially fulfill the recommendations for biological assessments (BAs) and environmental assessments (EAs). Guidelines on the preparation of a BAs and EAs, and information regarding section 7 consultation can be found on the Southeast Regional Office web site at http://sero.nmfs.noaa.gov/pr/pdf/BA_guide_comboeh081105.pdf.

Information regarding applying for an incidental take authorization under the Marine Mammal Protection Act may be found at http://www.nmfs.noaa.gov/pr/permits/incidental.htm.

6. Measures to Reduce the Risk of Harm to Protected Species

Environmental mitigation should be a part of every blasting plan and include appropriate measures identified in the risk assessment for the species and habitats found in the project area. For common activities requiring explosives, such as oil and gas structure decommissioning, some standard recommendations have been developed in coordination with NMFS. A "suite" of measures that applies to all the protected species found in a project area is desirable for flexibility in project planning, as well as for species-specific management needs. Because fish are not readily observable, visual surveys alone cannot avoid impacts; therefore, additional mitigation should be considered when protected species of fish are present in a project area. The suite of measures below should be considered when preparing protected species mitigation measures for blasting plans. Implementation of these measures does not necessarily ensure that all impacts will be avoided. Project-specific recommendations may be discussed during consultation with NMFS.

1. Establish zones of influence based upon protected species found in the project area, using an appropriate model.

2. The lowest NEW per detonation should be used to complete the work for a particular construction, severance, or demolition activity. Using smaller NEWs is associated with smaller impact zones where protected species (listed species and marine mammals) could be harmed. Shaped and fracturing charge designs are being developed and refined by the demolition industry that increase the efficiency of the work, resulting in smaller NEWs than for "bulk" charges. Water gel explosives have a lower detonation velocity, generating less shock energy than some other high-detonation velocity explosives (e.g., dynamite) and have lesser impacts on aquatic animals.

3. The use of delays should be maximized between individual blasts to separate the total NEW into a blast episode, creating a series of discrete, consecutive blasts. A blast episode consists of a single blast or a series of blasts that are detonated with a delay to lower the overpressure at a received distance in the environment. Discrete detonations using delays effectively reduce the zones of influence. For delay intervals less than 25 milliseconds (ms), NMFS recommends that zones of influence for protected species be estimated by calculating the distances for the summed explosive weight detonated per 25 ms period.

4. The use of bubble curtains, physical barriers, and other mitigation techniques to dampen the shock wave from detonations should be considered. The effectiveness of mitigation techniques may vary depending on the environment (e.g., currents and water depth), number and NEW of the explosives used, and other project details. Bubble curtains dampen or attenuate the sound transmitted through the bubble curtain. A bubble curtain for explosives may consists of shock-resistant materials at various depths and distances from an explosion. The bubble curtain should be effective at reducing pressure to levels below those resulting in harm to the species found in the project area.

5. The perimeter of impact zones should be established and demarcated (e.g., with landmarks or brightly colored buoys) for visual reference when conditions permit. Land- or ship-based observations may use binoculars and the naked eye to monitor the zones of influence. Fixed focus, vector binoculars are useful to establish distance from the project site and identify species. When aerial surveys are proposed, an aerial survey plan should be submitted to NMFS for approval with the mitigation plan.

6. Qualified observers should be used that have completed an approved training program to monitor the zones of influence. Each observer should be equipped with a two-way radio dedicated to protected species communication, polarized sunglasses, binoculars, a red flag or other backup communication, and any necessary data recording equipment.

7. Monitoring should be conducted from the highest vantage point(s) and/or other locations that provide the best, clear view of the entire zone of influence. These vantage points may be on the structure being removed or on nearby surface vessels such as crew boats.

8. A sufficient number of observers should be used to effectively monitor the established zones of influence under variable charge sizes and environmental conditions. The number of observers used may be dependent on numerous factors including whether aerial or vessel/shore-based observations are used, the size of the zones of influences, distance from shore, sea state, and observer fatigue.

9. For large zones of influence, or to augment visual observations, passive acoustic monitoring may be utilized to detect vocal species of marine mammals when animals are not readily observable at the surface. However, passive listening should not be used as a replacement for an adequate number of visual observers.

10. If divers are used during the demolition, they should be instructed to scan subsurface areas around the removal site for the presence/absence of protected species during the course of removal operations.

11. The chief observer should have authority to immediately halt activities should a protected species be observed within the impact zone, or is in the watch zone and in imminent danger of injury by heading toward the impact zone.

12. Surveys should be conducted before and after each blast episode. The duration and method of surveys should be determined in consultation with NMFS. Post-detonation observations are to start at the removal site and proceed in the direction of wind and current movement from the blast location.

13. Surface and/or aerial protected species surveys should be conducted in environmental conditions adequate for effective visual observation. Aerial surveys should be conducted during daylight hours and cease when marine conditions are not adequate for visual observations, or when the pilot/removal supervisor determines that helicopter operations must be suspended. Detonations should be delayed until conditions improve sufficiently for monitoring to be effectively completed.

14. When a protected species is sighted or heard within the impact zone, detonations should be postponed until it is verified to be outside of the impact zone.

15. Blasting should be limited to daylight hours (between one hour after sunrise and one hour before sunset). If pre-detonation and post-detonation surveys are to be conducted, pre-detonation surveys shall not begin prior to sunrise and detonations must not occur if the post-detonation survey cannot be concluded prior to sunset.

16. Detonation of scare charges to intentionally harass sea turtles or marine mammals into leaving a project area is prohibited. Scare charges using detonation cord are potentially harmful to fishes (California Department of Fish and Game 2002) if the mass of the explosives is not considered. In some cases, scare charges may be necessary to reduce the risk of mortality to sturgeon and smalltooth sawfish in the immediate area of a blast. Detonation caps not exceeding 0.5 g (Collins et al. 2001) may be approved on a case-by-case basis for use as scare charges for sturgeon and smalltooth sawfish. Scare charges not exceeding 0.5 g are also recommended to avoid the attraction of marine mammals, sea turtles, and piscivorous fishes that are stunned or wounded by the scare charge.

17. All protected species entering the impact zone should be allowed to move out of the area under their own volition. Enticing marine mammals to bow-ride or intentionally harassing animals into leaving the area is prohibited.

18. All “shock-tubes" and detonation wires should be recovered and removed after each blast.

19. The chief observer should submit a post-project report within 30 days of completion of the project to the permitting agency. The report should include project information, including but not limited to, a description of the project and explosives used, survey information, environmental conditions, and observations of protected species. Reports should be available to NMFS upon request.

20. Report dead or injured protected species to your local stranding network contacts. A list of sea turtle stranding responders is available at http://www.sefsc.noaa.gov/seaturtleSTSSN.jsp.
    A list of marine mammal stranding network responders for each state is available at http://www.nmfs.noaa.gov/pr/health/networks.htm or may be reported to the marine mammal stranding hotline at 877-433-8299.
    All other dead or injured protected species should be reported to NMFS’ Southeast Regional Office by telephone at (727) 824-5312, or by FAX at (727) 824-5309.

Additional Considerations
The following mitigation measures may be recommended under some circumstances to avoid impacts to important habitats and behaviors of protected species.

1. Avoid blasting techniques in regions that may affect any primary constituent elements of critical habitat designated for a listed species.

2. When blasting in inshore habitats, blasting should be conducted at low tide, above the water line to reduce the transmission of energy into the water column.

3. Sequence work to minimize impacts to biologically important areas such as migration corridors, important foraging areas, spawning habitats, near nesting beaches, calving areas, or in juvenile or developmental habitats protected species. These considerations may involve temporal or seasonal considerations when blasting in biologically important habitats.

4. No debris from the blasting operations should be left on the seafloor unless the structure is to be decommissioned as an artificial reef. The amount of debris scattered by blasting should be minimized to the greatest extent practicable (e.g., the use of blast mats). Methods should be used to minimize benthic and habitat disturbances such as removing structures below the mudline, use of blasting mats, and removing debris off the seafloor with appropriate methods, and in consultation with NMFS.

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APPENDIX J

LAB STANDARD OPERATING PROCEDURES AND CERTIFICATIONS

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EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL LLC
2425 New Holland Pike
Lancaster, PA 17601
Dorothy M. Love Phone: 717-556-7327

ENVIRONMENTAL

Valid To: November 30, 2016 Certificate Number: 0001.01

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

Testing Technologies

Atomic Absorption/ICP-AES Spectrometry, ICP-MS Spectrometry, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Gravimetry, High Performance Liquid Chromatography, Ion Chromatography, Misc.-Electronic Probes (pH, F^-, O_2), Oxygen Demand, Spectrophotometry (Visible), Spectrophotometry (Automated), Titrimetry, TCLP, Total Organic Carbon, Turbidity, Liquid Chromatography/Mass Spectrometry/Mass Spectrometry, High Resolution Gas Chromatography/Mass Spectrometry

Parameter/Analyte	**Tissue**	**Air**	**Nonpotable Water (*DW)**	**Solid Hazardous Waste**	
				Aqueous	**Solid**
Demands					
BOD	---------------	----------	SM 5210B-2001	---------------	----------
CBOD	---------------	----------	SM 5210B-2001	---------------	----------
COD	---------------	----------	EPA 410.4	---------------	----------
Total Carbon	---------------	----------	---------------	SM 5310C-2000	SM 5310B-2000 MOD
Total Inorganic Carbon	---------------	----------	---------------	SM 5310C-2000	SM 5310B-2000 MOD

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Total Organic Carbon	---------------	----------	EPA 415.1 EPA 9060 EPA 9060A SM 5310C-2000	EPA 9060 EPA 9060A SM 5310C-2000	EPA 9060 EPA 9060A SM 5310B MOD
Nutrients					
Ammonia	---------------	-----------	EPA 350.1 SM 4500 NH3 B & D-1997	---------------	EPA 350.1
Fluoride	---------------	-----------	SM 4500 FC-1997 EPA 300.0 EPA 340.2 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	EPA 300.0
Nitrate (as N)	---------------	----------	EPA 300.0 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	EPA 300.0
Nitrite (as N)	---------------	-----------	EPA 300.0 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	EPA 300.0
Nitrate/Nitrite	-------------	-----------	EPA 353.2	-------------	----------------
Orthophosphate (as P)	---------------	-----------	EPA 365.3	---------------	-----------
Total Kjeldahl Nitrogen	---------------	-----------	EPA 351.2	---------------	EPA 351.2
Total Phosphorus	---------------	-----------	EPA 365.1	---------------	EPA 365.1
Wet Chemistry					
Acid Volatile Sulfide	---------------	-----------	---------------	---------------	EPA-821-R-91-100
Acidity	---------------	-----------	SM 2310B-1997	---------------	-----------
Alkalinity	---------------	-----------	SM 2320B-1997	---------------	-----------
Bromide	---------------	-----------	EPA 300.0 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	-----------
Bulk Density	---------------	-----------	---------------	ASTM E868-82	ASTM E868-82
Chloride	---------------	-----------	EPA 300.0 EPA 325.3 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	EPA 300.0
Color	---------------	-----------	SM 2120B-2001	---------------	----------
Corrosivity	---------------	-----------	---------------	SW-846 Chapter 7	SW-846 Chapter 7

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Cyanide	EPA 9012A EPA 9012B	-----------	EPA 335.2 EPA 335.4 MOD EPA 9012A EPA 9012B ASTM D7511 OIA-1677-09	EPA 9012A EPA 9012B ASTM D7511 OIA-1677-09	EPA 9012A EPA 9012B
Dissolved Oxygen	---------------	-----------	SM 4500 OG-2001	---------------	-----------
Dissolved Silica	---------------	-----------	EPA 370.1 SM 4500 SiC-1997	---------------	-----------
Ferrous Iron	---------------	----------	SM 3500Fe B-MOD 1997	---------------	-----------
Filterable Residue	---------------	----------	SM 2540C-1997	---------------	-----------
Flashpoint	---------------	----------	---------------	EPA1010A	EPA 1010A
Grain Size	---------------	----------	---------------	---------------	ASTM D422
Hardness	---------------	----------	SM 2340C-1997	---------------	-----------
HEM-SGT	---------------	----------	EPA 1664A EPA 1664B	---------------	EPA 9071B
Hexavalent Chromium Digestion	EPA 3060A	----------	---------------	---------------	EPA 3060A
Hexavalent Chromium	EPA 7196A	----------	SM 3500 CrB-2009 EPA 218.6 EPA 7196A EPA 7199	EPA 218.6 EPA 7196A EPA 7199	EPA 7196A EPA 7199
Ignitability	---------------	----------	---------------	40 CFR 261.21	40 CFR 261.21
Non-filterable Residue	---------------	----------	EPA 160.2 SM 2540D-1997	---------------	-----------
Oxidation Reduction Potential	---------------	----------	ASTM D1498	ASTM D1498	ASTM D1498
Paint Filter Test	---------------	----------	EPA 9095A	EPA 9095A	EPA 9095A
pH	---------------	----------	SM 4500 H+B-2000 EPA 150.1 EPA 9040B EPA 9040C	EPA 9040B EPA 9040C EPA 9045C EPA 9045D	EPA 9040B EPA 9040C EPA 9045C EPA 9045D
Phenol	---------------	----------	EPA 420.4 EPA 9066	EPA 9066	-----------
Reactivity	---------------	----------	---------------	SW-846 Chapter 7.3	SW-846 Chapter 7.3
Settleable Residue	---------------	----------	SM 2540F-1997	---------------	-----------
Specific Conductance	---------------	----------	EPA 120.1 SM 2510B-1997 EPA 9050A	EPA 9050A	

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Sulfate	---------------	----------	EPA 300.0 EPA 375.4 EPA 9056 EPA 9056A	EPA 9056 EPA 9056A	EPA 300.0
Sulfide	---------------	----------	EPA 376.1 EPA 376.2 SM 4500 S2D-2000 SM 4500 S2F-2000	---------------	-----------
Surfactants	---------------	----------	SM 5540C-2000	---------------	-----------
Total Filterable Residue	---------------	----------	SM 2540C-1997	---------------	-----------
Total Residue	---------------	----------	EPA 160.3 SM 2540B-1997	---------------	-----------
Total Fixed and Total Volatile Solids, Dissolved Fixed and Dissolved Volatile Solids, Suspended Fixed and Suspended Volatile Solids			SM 2540 E-1997		
Turbidity	---------------	----------	EPA 180.1 SM 2130 B-2001	-----------	-----------
Volatile Residue	---------------	----------	EPA 160.4	-----------	-----------
Metals					
Metals Digestion	EPA 3050B	EPA 3050B	EPA 200.2 EPA 3050B EPA 3005A EPA 3010A EPA 3010A MOD	EPA 3050B EPA 3010A EPA 3010A MOD	EPA 3050B
Aluminum	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Antimony	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Arsenic	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Barium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Beryllium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Boron	EPA 6010B EPA 6010C	----------	EPA 200.7 EPA 6010B EPA 6010C	EPA 6010B EPA 6010C	EPA 6010B EPA 6010C
Cadmium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Calcium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Chromium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Cobalt	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Copper	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Iron	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Lead	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Molybdenum	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Magnesium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Manganese	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Mercury	EPA 7471A EPA 7471B	----------	EPA 245.1 EPA 7470A	EPA 7470A	EPA 7471A EPA 7471B

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Nickel	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Potassium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Selenium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Silicon	----------	----------	EPA 6010C	EPA 6010C	EPA 6010C
Silver	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Sodium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Strontium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Thallium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	----------	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Tin	EPA 6010B EPA 6010C	----------	EPA 200.7 EPA 6010B EPA 6010C	EPA 6010B EPA 6010C	EPA 6010B EPA 6010C

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Titanium	---------------	-----------	EPA 200.7 EPA 6010B EPA 6010C	EPA 200.7 EPA 6010B EPA 6010C	EPA 200.7 EPA 6010B EPA 6010C
Vanadium	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Zinc	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 200.8 MOD EPA 6020 EPA 6020A	EPA 200.7 EPA 200.8 EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A	EPA 6010B EPA 6010C EPA 6020 EPA 6020A
Zirconium	---------------	-----------	EPA 200.7 EPA 6010B EPA 6010C	EPA 200.7 EPA 6010B EPA 6010C	EPA 200.7 EPA 6010B EPA 6010C
Purgeable Organics (Volatiles)					
Volatile Preparation	---------------	----------	EPA 5030A EPA 5030B	EPA 5030A EPA 5030B	EPA 5035 EPA 5035A
Acetone	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Acetonitrile	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Acrolein	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Acrylonitrile	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Alpha Methyl Styrene	---------------	EPA TO-15	---------------	---------------	---------------
Allyl Chloride	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
tert-Amyl Alcohol	-----------	---------	------------------	---------------	EPA 8260B EPA 8260C
tert-Amyl Methyl Ether	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
tert-Butyl Alcohol	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
tert-Butyl formate	--------------	---------	-----------------	----------------	EPA 8260B EPA 8260C
Benzene	---------------	EPA TO-15 EPA TO-15 SIM EPA 18 mod EPA 25 mod	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
Benzyl Chloride	---------------	EPA TO-15	---------------	---------------	---------------
Bromobenzene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Bromochloromethane	---------------	-----------	EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Bromodichloromethane	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Bromoethene	---------------	EPA TO-15	---------------	---------------	---------------
Bromoform	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Bromomethane	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Butane	--------------	EPA 18 mod EPA 25 mod	------------------	------------------	---------------
1,3-Butadiene	---------------	EPA TO-15 EPA TO-15 SIM	-----------	-----------	-----------
2-Butanone	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
n-Butylbenzene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
sec-Butylbenzene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
tert-Butylbenzene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Carbon Disulfide	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Carbon Tetrachloride	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
2-Chloro-1,3-Butadiene	---------------	-----------	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Chloroacetonitrile	---------------	-----------	EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Chlorobenzene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1-Chlorobutane	---------------	-----------	EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Chlorodifluoromethane	---------------	EPA TO-15	-----------	-----------	-----------
Chloroethane	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
2-Chloroethyl Vinyl Ether	---------------	-----------	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Carbon Range Organics C1-C10 (including subsets of this range i.e. hydrocarbons as propane, hydrocarbons as methane, hydrocarbons as hexane)	---------------	EPA 18 mod EPA 25 mod	------------------	----------------	--------------
Chloroform	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Chloromethane	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
3-Chloroprene	---------------	EPA TO-15	-----------	-----------	-----------
2-Chlorotoluene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
4-Chlorotoluene	---------------	-----------	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Cyclohexane	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Di-Isopropyl Ether	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Dibromochloromethane	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2-Dibromo-3-chloropropane	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8011 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8011 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Dibromomethane	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2-Dibromoethane (EDB)	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8011 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8011 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2-Dichlorobenzene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,3-Dichlorobenzene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,4-Dichlorobenzene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
trans-1,4-Dichloro-2-Butene	---------------	---------	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Dichlorodi-fluoromethane	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1-Dichloroethane	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2-Dichloroethane	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1-Dichloroethene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
cis-1,2-Dichloroethene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
trans-1,2-Dichloroethene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Dichlorofluoromethane	---------------	EPA TO-15	EPA 524.2 (DW)	-----------	-----------
1,2-Dichloropropane	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,3-Dichloropropane	---------------	-----------	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
2,2-Dichloropropane	---------------	-----------	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1-Dichloropropanone	---------------	-----------	EPA 524.2 (DW)	-----------	-----------

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
1,1-Dichloropropene	---------------	-----------	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
cis-1,3-Dichloropropene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
trans-1,3-Dichloropropene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,4-Dioxane	---------------	EPA TO-15	EPA 8260B EPA 8260C EPA 8260 SIM	EPA 8260B EPA 8260C EPA 8260 SIM	EPA 8260B EPA 8260C EPA 8260 SIM
Ethanol	---------------	EPA TO-15	EPA 8260B EPA 8260C EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Ethane	---------------	EPA 18 mod EPA 25 mod	-----------	-----------	-----------
Ethyl Acetate	---------------	EPA TO-15	-----------	-----------	-----------
Ethyl Acrylate	---------------	EPA TO-15	-----------	-----------	-----------
Ethylbenzene	---------------	EPA TO-15 EPA TO- 15 SIM EPA 18 mod EPA 25 mod	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
Ethyl Ether	---------------	----------	EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Ethyl Methacrylate	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
4-Ethyltoluene	---------------	EPA TO-15	-----------	-----------	-----------

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Ethyl tert-Butyl Ether	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Freon-113	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Freon-114	---------------	EPA TO-15	-----------	-----------	-----------
Gasoline Range Organics (GRO) [Volatile Petroleum Hydrocarbons (VPH)]	---------------	-----------	EPA 8015B EPA 8015C EPA 8015D EPA 8260B EPA 8260C NW TPH-Gx MA VPH WA DOE VPH OA-1	EPA 8015B EPA 8015C EPA 8015D EPA 8260B EPA 8260C NW TPH-Gx MA VPH WA DOE VPH OA-1	EPA 8015B EPA 8015C EPA 8015D EPA 8260B EPA 8260C NW TPH-Gx MA VPH WA DOE VPH OA-1
Heptane	---------------	EPA TO-15	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Hexane	---------------	EPA TO-15 EPA 18 mod EPA 25 mod	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
2-Hexanone	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Hexachlorobutadiene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Hexachloroethane	---------------	EPA TO-15	EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Isooctane	---------------	EPA TO-15	-----------	-----------	-----------
Isopropyl Alcohol	---------------	EPA TO-15	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Isopropylbenzene	---------------	EPA TO-15	EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260COA-1
1,4-Isopropyltoluene	---------------	-----------	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methane	---------------	EPA 18 mod EPA 25 mod	-------------------	------------------	---------------
Methylacrylonitrile	---------------	-----------	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl Acetate	---------------	-----------	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl Acrylate	---------------	EPA TO-15	EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl Iodide	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl Ethyl Ketone	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methylene Chloride	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl Isobutyl Ketone	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methyl Methacrylate	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Methyl tert-Butyl Ether	---------------	EPA TO-15 EPA TO-15 SIM EPA 18 mod EPA 25 mod	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
4-Methyl-2-pentanone	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Methylcyclohexane	---------------	-----------	EPA 624 EPA 8260B EPA 8260C	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
2-Nitropropane	---------------	-----------	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Naphthalene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
Nitrobenzene	---------------	-----------	EPA 524.2 (DW)	-----------	-----------
Octane	---------------	EPA TO-15	-----------	-----------	-----------
Pentachloroethane	---------------	-----------	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Pentane	---------------	EPA TO-15 EPA 18 mod EPA 25 mod	-----------	-----------	-----------
Propionitrile	---------------	-----------	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Propane	---------------	EPA 18 mod EPA 25 mod	-------------------	----------------	---------------

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Propene	---------------	EPA TO-15	-----------	-----------	-----------
n-Propylbenzene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Styrene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 602 EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
tert-Amyl Ethyl Ether	---------------	-----------	EPA 8260B EPA 8260C EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1,1,2-Tetrachloroethane	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1,2,2-Tetrachloroethane	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Tetrachloroethene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Tetrahydrofuran	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW)	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Toluene	---------------	EPA TO-15 EPA TO-15 SIM EPA 18 mod EPA 25 mod	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
1,2,3-Trichlorobenzene	---------------	---------	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
1,2,4-Trichlorobenzene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1,1-Trichloroethane	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,1,2-Trichloroethane	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Trichloroethene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Trichlorofluoromethane	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2,3-Trichloropropane	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,2,4-Trimethylbenzene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
1,3,5-Trimethylbenzene	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Vinyl Acetate	---------------	EPA TO-15	EPA 624 EPA 8260B EPA 8260C EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Vinyl Chloride	---------------	EPA TO-15 EPA TO-15 SIM	EPA 624 EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B	EPA 8260B EPA 8260C	EPA 8260B EPA 8260C
Xylenes, total	---------------	EPA TO-15 EPA TO-15 SIM EPA 18 mod EPA 25 mod	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
1,2-Xylene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
1,3-Xylene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
1,4-Xylene	---------------	EPA TO-15 EPA TO-15 SIM	EPA 602 EPA 624 EPA 8021B EPA 8260B EPA 8260C EPA 524.2 (DW) EPA 6200B OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1	EPA 8021B EPA 8260B EPA 8260C OA-1
Extractable Organics (Semivolatiles)					
Organic Extraction	EPA 3540C EPA 3546 EPA 3550B EPA 3550C	---------	EPA 3510C EPA 3511	EPA 3510C EPA 3511	EPA 3540C EPA 3546 EPA 3550B EPA 3550C

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Acenaphthene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM
Acenaphthylene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270C SIM EPA 8270D EPA 8270D SIM
Acetic Acid	---------------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	---------
Acetophenone	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Acetylaminofluorene	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Alkylated PAHs	EPA 8270C SIM EPA 8270D SIM	---------	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM
4-Aminobiphenyl	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Amino-4,6-dinitrotoluene	---------------	---------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
4-Amino-2,6-dinitrotoluene	---------------	---------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Aniline	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Anthracene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Atrazine	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Benzaldehyde	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Benzidine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Benzoic Acid	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Benzo (a) Anthracene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Benzo (b) Fluoranthene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Benzo (k) Fluoranthene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Benzo (ghi) Perylene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Benzo (a) Pyrene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Benzo (e) Pyrene	EPA 8270C SIM EPA 8270D SIM	---------	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM
Benzyl Alcohol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Biphenyl	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Bis (2-chloroethoxy) Methane	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Bis (2-chloroethoxy) Ether	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Bis (2-chloroethyl) Ether	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Bis (2-chloroisopropyl) Ether	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Bis (2-ethylhexyl) Phthalate	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
4-Bromophenylphenyl Ether	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Butyl benzyl Phthalate	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Butyric Acid	--------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	--------------
Caprolactam	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Carbazole	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Carbon Range Organics C8-C44 (including subsets of this range i.e. HRO, MRO, ORO, RRO)	---------	---------	EPA 8015B EPA 8015C EPA 8015D EPA 8270C TN EPH	EPA 8015B EPA 8015C EPA 8015D EPA 8270C TN EPH	EPA 8015B EPA 8015C EPA 8015D EPA 8270C TN EPH
4-Chloroaniline	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
4-Chloro-3-methylphenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Chlorobenzilate	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1-Chloronaphthalene	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Chloronaphthalene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
2-Chlorophenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
4-Chlorophenyl Phenyl Ether	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Chrysene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Citric Acid	--------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	--------------
Cresols (Methyl Phenols)	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
cis-/trans-Diallate	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,4-Diamino-6-nitrotoluene	---------	---------	EPA 8330B	EPA 8330B	EPA 8330B
2,6-Diamino-4-nitrotoluene	---------	---------	EPA 8330B	EPA 8330B	EPA 8330B
Dibenzo (a,h) Acridine	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Dibenzo (a,h) Anthracene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Dibenzofuran	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270D SIM
Dibenzothiophene	EPA 8270C SIM EPA 8270D SIM	---------	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM
1,2-Dichlorobenzene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,3-Dichlorobenzene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,4-Dichlorobenzene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
3,3-Dichlorobenzidine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Diesel Range Organics (DRO) [Extractable Petroleum Hydrocarbons (EPH)]	---------	---------	EPA 8015B EPA 8015C EPA 8015D EPA 8270C CT ETPH MA EPH NWTPH DX NJ EPH TX1005/ TX1006 WADOE EPH OA-2	EPA 8015B EPA 8015C EPA 8015D EPA 8270C CT ETPH MA EPH NWTPH DX NJ EPH TX1005/ TX1006 WADOE EPH OA-2	EPA 8015B EPA 8015C EPA 8015D EPA 8270C CT ETPH MA EPH NWTPH DX NJ EPH TX1005/ TX1006 WADOE EPH OA-2
2,4-Dichlorophenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,6-Dichlorophenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Diethyl Phthalate	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Dimethoate	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
p-Dimethylaminoazobenzene	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
7,12-Dimethylbenz (a) Anthracene	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
alpha-,alpha-Dimethyphenethylamine	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,4-Dimethylphenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Dimethyl Phthalate	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
3,3-Dimethylbenzidine	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Di-n-butyl Phthalate	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Di-n-octyl Phthalate	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
3,5-Dinitroaniline	---------	---------	EPA 8330B	EPA 8330B	EPA 8330B
1,3-Dinitrobenzene	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B
2,4-Dinitrophenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,4-Dinitrotoluene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B
2,6-Dinitrotoluene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B
1,4-Dioxane	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Diphenylamine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Diphenyl Ether	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,2-Diphenylhydrazine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Ethyl Methane Sulfonate	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Fluoroanthene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Fluorene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Formic Acid	--------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	--------------
Hexachlorobenzene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Hexachlorobutadiene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Hexachlorocyclo-pentadiene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Hexachloroethane	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Hexachloropropene	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	--------	---------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Indeno (1,2,3-cd) Pyrene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Isodrin	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Isophorone	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Isosafrole	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Isobutyric Acid	--------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	--------------
Lactic Acid	--------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	--------------
Methapyriline	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
3-Methycholanthrene	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
2-Methyl-4,6-Dinitrophenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Methyl Methane Sulfonate	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1-Methylnaphthalene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
2-Methylnaphthalene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270C SIM EPA 8270D SIMEPA 8270D	EPA 8270C EPA 8270C SIM EPA 8270D SIM EPA 8270D
2-Methylphenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
4-Methylphenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Naphthalene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
1,4-Naphthoquinone	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1-Naphthylamine	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Naphthylamine	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
4-Nitroquinoline-1-oxide	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Nitroaniline	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
3-Nitroaniline	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
4-Nitroaniline	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Nitrobenzene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B	EPA 8270C EPA 8270D EPA 8330 EPA 8330A EPA 8330B
Nitroglycerin	---------	---------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
2-Nitrophenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
4-Nitrophenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Nitrotoluene	---------	---------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
3-Nitrotoluene	---------	---------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
4-Nitrotoluene	---------	---------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
5-Nitro-o-toluidine	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitroso-di-n-butylamine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosodiethylamine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosodimethylamine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosodimethylethylamine	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosomorpholine	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosodi-n-propylamine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosodiphenylamine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
n-Nitrosopiperidine	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
n-Nitrosopyrrolidine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	---------	---------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Oxalic Acid	---------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	---------
2,2-Oxybis (1-chloropropane)	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pentachlorobenzene	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pentachloronitrobenzene	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pentachlorophenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pentaerythritol Tetranitrate (PETN)	-----------	-----------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Perylene	EPA 8270C SIM EPA 8270D SIM	---------	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM	EPA 8270C SIM EPA 8270D SIM
Petroleum Range Organics	-----------	-----------	FLPRO	FLPRO	FLPRO
Phenacetin	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Phenanthrene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Phenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,4-Phenylenediamine	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2-Picoline	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pronamide	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Propionic Acid	--------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	---------

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Pyrene	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	---------	EPA 625 EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM	EPA 8270C EPA 8270D EPA 8270C SIM EPA 8270D SIM
Pyridine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Pyruvic Acid	--------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	--------------
Quinic Acid	--------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	--------------
Succinic Acid	--------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	--------------
Tartaric Acid	--------	---------	EPA 8015B EPA 8015D	EPA 8015B EPA 8015D	--------------
Safrole	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,2,4,5-Tetrachlorobenzene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,3,4,6-Tetrachlorophenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Tetraethyl Dithiopyrophosphate	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
Tetryl	--------	---------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Thionazin	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
o-Toluidine	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,3,5-Trinitrobenzene	--------	---------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
2,4,5-Trichlorophenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,4,6-Trichlorophenol	EPA 8270C EPA 8270D	---------	EPA 625 EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
O,O,O-Tri-ethylphosphorothioate	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
1,3,5-Trinitrobenzene	EPA 8270C EPA 8270D	---------	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D	EPA 8270C EPA 8270D
2,4,6-Trinitrotoluene	---------	---------	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B	EPA 8330 EPA 8330A EPA 8330B
Pesticides/Herbicides/ PCBs					
Organic Extraction	EPA 3540C EPA 3546 EPA 3550B EPA 3550C	---------	EPA 3510C EPA 3511	EPA 3510C EPA 3511	EPA 3540C EPA 3546 EPA 3550B EPA 3550C
Acifluorfen	---------	---------	EPA 8151A	EPA 8151A	EPA 8151A
Aldrin	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Azinphos Methyl (Guthion)	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
alpha-BHC	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
beta-BHC	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
delta-BHC	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
gamma-BHC (Lindane)	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Bentazon	---------	---------	EPA 8151A	EPA 8151A	EPA 8151A
Bolstar	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
alpha-Chlordane	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Chloramben	---------	---------	EPA 8151A	EPA 8151A	EPA 8151A
Chlordane (technical)	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Chlorobenzilate	---------	---------	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Chlorpyrifos	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Coumaphos	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
2,4-D	EPA 8151A	---------	EPA 8151A	EPA 8151A	EPA 8151A
2,4'-DDD	EPA 8081A EPA 8081B	---------	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
2,4'-DDE	EPA 8081A EPA 8081B	---------	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
2,4'-DDT	EPA 8081A EPA 8081B	---------	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Dalapon	EPA 8151A	---------	EPA 8151A	EPA 8151A	EPA 8151A
2,4-DB	EPA 8151A	---------	EPA 8151A	EPA 8151A	EPA 8151A
4,4'-DDD	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
4,4'-DDE	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
4,4'-DDT	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Demeton-O	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Demeton-S	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Diallate	---------	---------	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Diazinon	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
1.2-Dibromo-3-chloropropane (DBCP)	---------	---------	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Dicamba	EPA 8151A	---------	EPA 8151A	EPA 8151A	EPA 8151A
3,5-Dichlorobenzoic Acid	---------	---------	EPA 8151A	EPA 8151A	EPA 8151A
Dichlorvos	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Dichloroprop	EPA 8151A	---------	EPA 8151A	EPA 8151A	EPA 8151A
Dieldrin	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Dinoseb	EPA 8151A	---------	EPA 8151A	EPA 8151A	EPA 8151A
Disulfoton	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Diuron	---------	---------	EPA 8321A	EPA 8321A	EPA 8321A
Endosulfan I (alpha)	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Endosulfan II (beta)	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Endosulfan Sulfate	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Endrin	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Endrin Aldehyde	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Endrin Ketone	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Ethion	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Ethoprop	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Fensulfothion	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Fenthion	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Fenuron	---------	---------	EPA 8321A	EPA 8321A	EPA 8321A
Gamma-chlordane	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Heptachlor	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Heptachlor Epoxide	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Hexachlorobenzene	EPA 8081A EPA 8081B	---------	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Hexachlorocyclopentadiene	---------	---------	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Isodrin	---------	---------	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Malathion	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
MCPA	EPA 8151A	---------	EPA 8151A	EPA 8151A	EPA 8151A
MCPP	EPA 8151A	---------	EPA 8151A	EPA 8151A	EPA 8151A
Merphos	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Methoxychlor	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Mevinphos	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Mirex	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Parathion Ethyl	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Parathion Methyl	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
PCB-1016 (Arochlor)	EPA 8082 EPA 8082A	---------	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1221	EPA 8082 EPA 8082A	---------	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1232	EPA 8082 EPA 8082A	---------	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1242	EPA 8082 EPA 8082A	---------	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1248	EPA 8082 EPA 8082A	---------	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1254	EPA 8082 EPA 8082A	---------	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1260	EPA 8082 EPA 8082A	---------	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1262	EPA 8082 EPA 8082A	---------	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB-1268	EPA 8082 EPA 8082A	---------	EPA 608 EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
Aroclor 5432	----------	---------	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
Aroclor 5442	----------	---------	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
Aroclor 5460	----------	---------	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A	EPA 8082 EPA 8082A
PCB Congeners (209)	EPA 1668	---------	EPA 1668	EPA 1668	EPA 1668
Pentachlorophenol (PCP)	EPA 8151A	---------	EPA 8151A	EPA 8151A	EPA 8151A
Phorate	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Picloram	---------	---------	EPA 8151A	EPA 8151A	EPA 8151A

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Simazine	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Stirophos (Tetrachlorvinphos)	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
2,4,5-T	EPA 8151A	---------	EPA 8151A	EPA 8151A	EPA 8151A
Tokuthion (Prothiofos)	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
2,4,5-TP (Silvex)	EPA 8151A	---------	EPA 8151A	EPA 8151A	EPA 8151A
Toxaphene	EPA 8081A EPA 8081B	---------	EPA 608 EPA 8081A EPA 8081B	EPA 8081A EPA 8081B	EPA 8081A EPA 8081B
Trichloronate	---------	---------	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B	EPA 8141A EPA 8141B
Dioxins/Furans					
2,3,7,8-TCDD	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
2,3,7,8-TCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,7,8-PeCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
2,3,4,7,8-PeCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,7,8-PeCDD	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,4,7,8-HxCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,6,7,8-HxCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
2,3,4,6,7,8-HxCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,7,8,9-HxCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,4,7,8,-HxCDD	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,6,7,8-HxCDD	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,7,8,9-HxCDD	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,4,6,7,8-HpCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,4,7,8,9-HpCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
1,2,3,4,6,7,8-HpCDD	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
OCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
OCDD	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total HpCDD	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total HpCDF	EPA 1613B EPA 8290A	----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total HxCDD	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total HxCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total PeCDD	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total PeCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total TCDD	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Total TCDF	EPA 1613B EPA 8290A	-----------	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A	EPA 1613B EPA 8290A
Misc. Headspace Analysis					
Carbon Dioxide	---------	---------	RSK-175	RSK-175	---------
Ethane	---------	---------	RSK-175	RSK-175	---------
Ethene	---------	---------	RSK-175	RSK-175	---------
Methane	---------	---------	RSK-175	RSK-175	---------
Hazardous Waste Characteristics					
Toxicity Characteristic Leaching Procedure	---------	---------	---------	EPA 1311	EPA 1311
Synthetic Precipitation Leaching Procedure	---------	---------	---------	EPA 1312	EPA 1312
Other					
Perchlorate	---------	---------	EPA 6850	EPA 6850	EPA 6850
Hydrazine	---------	---------	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
Formaldehyde	---------	---------	- - - - - - - - - -	EPA 8315A	EPA 8315A
Methylhydrazine	---------	---------	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
1,1-Dimethylhydrazine	---------	---------	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
Volatile Preparation	---------	---------	EPA 5030A EPA 5030B	EPA 5030A EPA 5030B	EPA 5035 EPA 5035A

Parameter/Analyte	Tissue	Air	Nonpotable Water (*DW)	Solid Hazardous Waste	
				Aqueous	Solid
Organic Extraction	EPA 3540C EPA 3546 EPA 3550B EPA 3550C	---------	EPA 3510C EPA 3511	EPA 3510C EPA 3511	EPA 3540C EPA 3546 EPA 3550B EPA 3550C
Perfluorinated Alkyl Acids (PFAAs)					
N-ethyl perfluorooctane-sulfonamidoacetic acid (NEtFOSAA)			EPA 537 MOD (DW and NPW)	EPA 537 MOD	
N-methyl perfluorooctane-sulfonamidoacetic acid (NMeFOSAA)			EPA 537 MOD (DW and NPW)	EPA 537 MOD	
Perfluorobutanesulfonate			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
Perfluorodecanoic acid			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
Perfluorododecanoic acid			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
Perfluoroheptanoic acid			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
Perfluorohexanesulfonate			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
Perfluorohexanoic Acid			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
Perfluorononanoic Acid			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
Perfluoro-octanesulfonate			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
Perfluorooctanoic Acid			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
Perfluorotetradecanoic Acid			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
Perfluorotridecanoic Acid			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
Perfluoroundecanic Acid			EPA 537 MOD (DW and NPW)	EPA 537 MOD	EPA 537 MOD
8:2 Fluorotelomersulfonate			EPA 537 MOD	EPA 537 MOD	

* **DW noted in parenthesis for drinking water method**

eurofins Lancaster Laboratories Environmental	**Document Title: Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection**	**Eurofins Document Reference: 1-P-QM-WI -9029396**

Eurofins Document Reference	1-P-QM-WI -9029396	**Revision**	2
Effective Date	Oct 13, 2015	**Status**	Effective
Historical/Local Document Number	Analysis DOD - 13395, 13413		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

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Revision Log:

Revision: 2		**Effective Date:** This version
Section	**Justification**	**Changes**
Sample Collection, Preservation, and Handling	Reflects current sample amount used for extraction	Changed sample amount from 2 grams to 10 grams.
Reagents and Standards	Reflects current standards in use.	Updated 8330 ICV standard
HPLC Instrument Conditions	Reflects current conditions	Changed gradient information.
Table 1	Reflects current LOQ	Updated LOQs based on latest study
Figure 1A, 1B, 2A, 2B	Enhancement	Added new chromatograms for primary and confirmation analysis of Level 3 standards.

Revision: 01		**Effective Date:** Sep 26, 2014
Section	**Justification**	**Changes**
		New

Reference:

1. *Test Methods for Evaluating Solid Wastes*, EPA SW-846, Method 8330B, Rev. 2, October 2006

4 *Chemical Hygiene Plan*, current version.

Cross Reference:

Document	Document Title
Analysis #6915, 11122, 11125, 13432	Extraction of Nitroaromatics and Nitroamines by Method 8330/A/B in Water
Analysis #6917, 11137, 11138, 13433	Sonication Extraction of Nitroaromatics and Nitroamines by Method 8330/A/B in Solids
1-P-QM-PRO-9015493	QC Data Acceptability and Corrective Action
1-P-QM-PRO-9015496	Monitoring QC Data Acceptance Limits
1-P-QM-PRO-9015497	Preventative and Corrective HPLC Maintenance for the Pesticide Residue Analysis Department
1-P-QM-QMA-9015390	Demonstrations of Capability
1-P-QM-QMA-9017309	Determining Method Detection Limits and Limits of Quantitation

Scope:

The method is applicable for the determination of trace levels of nitroaromatics and nitroamines from explosives in soil and water samples. Table I lists these compounds and their limits of quantitation (LOQ).

Basic Principles:

Soil samples are extracted with acetonitrile in an ultrasonic bath. Aqueous samples with low concentrations of explosive residues are extracted with a solid phase extraction procedure using Porpak RDX SPE cartridges and acetonitrile.

Separation of the nitroaromatics and nitroamines is performed using reversed-phase chromatography with a water/methanol mobile phase on a C18 column. The explosive residues are detected by their ultraviolet absorbance at 254 nm and 214nm. A second dissimilar column is used to confirm any positive identification of the analytes made on the primary column.

Reference Modifications:

Method 8330B recommends an expiration for intermediate dilutions of 1 year and fresh preparation of calibration standards on the day of calibration. Our ongoing verification of working standards using an initial verification standard has shown that the standards are stable over a 60 day timeframe.

Definitions:

1. Analytical Batch – A group of field and Quality Control (QC) samples of the same matrix, extracted together under the same conditions and period of time, using the same lot(s) of chemicals.

2. Continuing calibration verification (CCV) – A mid-level standard used to verify that the analytical response is reliable, and has not changed significantly from the current Initial Calibration curve (ICAL). The verification of the ICAL that is required during the course of analyses at periodic intervals.

3. Initial Calibration Verification (ICV) – Second source calibration verification. A standard obtained or prepared from a source independent of the source of standards for the ICAL. Used to verify the integrity of the standards used for initial calibration.

4. Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

5. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

6. Method blanks – A designated sample designed to monitor for sample contamination during the analysis process. A volume of deionized laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.

7. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample matrix.

Interferences:

Method interferences are caused by impurities in solvents, reagents, glassware or other hardware used in sample processing. The UV detector is a general detector and many organics responds. All glassware is rinsed with solvent before use and a method blank is performed with each batch of samples to demonstrate that the system is free of contaminants.

Tetryl decomposes rapidly in methanol/water solutions, as well as with heat. All samples expected to contain tetryl should not be exposed to temperatures above room temperature.

Safety Precautions and Waste Handling:

1. See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

2. All laboratory waste is accumulated, managed, and disposed of in accordance with all federal and state laws and regulations.

3. Avoid inhaling solvents and chemicals and getting them on the skin. Wear gloves when handling neat materials.

4. Samples suspected of being high in explosives must be handled carefully. (Method 8510 can be used to screen for high levels of explosives.)

5. Prior to performing moisture analysis, all soil samples must be found to contain less than 1% by weight total explosives (see Calculation section).

    a. If samples are found to contain greater than this level, wet weight results must be reported.

    b. If moisture determination is deemed safe, contact client services to add moisture analysis to the sample.

6. All HPLC vials and solvent waste is disposed of in designated vial collection bins and solvent waste containers in the laboratory. Each of these is then emptied into appropriate designated containers in the lab-wide storage facility for subsequent disposal.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret data, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, one blind sample, or one ICAL with ICVs and/or CCVs. Refer to 1-P-QM-QMA-9015390 (LOM-SOP-ES-238) for more guidance on these options.

Sample Collection, Preservation, and Handling:

Samples (waters and solids) must be collected in amber glass jars with Teflon™-lined lids and stored in the dark at 0° to 6°C, not frozen.

Each water extraction requires a 1-L sample which must be extracted within 7 days of collection. Each soil extraction requires 10 g of soil which must be extracted within 14 days of collection. HPLC analysis must be within 40 days of extraction.

Apparatus and Equipment:

1. HPLC with dual high-pressure pump and gradient capabilities – HP1260 or equivalent

2. HPLC autosampler – HP1260 or equivalent

3. HPLC oven – HP1260 or equivalent

4. 2-HPLC UV detectors – Agilent Mutiwavelength Detector collecting 254nm and 214nm

5. Chrom Perfect data system or equivalent

6. Phenomenex: Synergi Hydro-RP: 250mm x 4.6 mm x 4um (primary column) or equivalent

7. Phenomenex: Luna Phenyl-Hexyl: 250mm x 4.6mm x 5um (confirmation column) or equivalent

8. Analytical balance

Reagents and Standards:

A. Reagents

1. Acetonitrile (CH_3CN) – HPLC grade

2. Methanol (CH_3OH) – HPLC grade

3. Calcium chloride ($CaCl_2$) – Reagent grade; prepare an aqueous solution of 5 g/L. Store in glass for up to 1 year at room temperature.

4. Reagent water, HPLC water, or Milli-Q water

B. Standards

1. Stock standard mixes of the nitroaromatic and nitroamine compounds listed in this method can be purchased from Restek and Accustandard.

   NOTE: Because of the reactive nature of these compounds and the danger from explosion, it is recommended that the neat compounds not be purchased.

2. All standards are prepared using Class-A volumetric pipettes, flasks, and syringes.

3. The ampulated stocks are stored according to the manufacturer's instructions and are valid until manufacturer's expiration date.

4. Working standards are prepared in 50:50 acetonitrile/$CaCl_2$ solution (5 g/L).

5. All standards must be stored at 0° to 6°C, not frozen.

6. Intermediate dilutions are prepared every 60 days and calibration standards are made every 60 days. Surrogates and matrix spikes are prepared every 6 months for all methods.

7. Standards are sonicated prior to bottling fresh daily. This helps warm the standards up to room temperature and gives the standards mixing as well.

8. Stock Standards:

Stock	Description	Vendor	Cat #	Concentration µg/ml
1	8330B Explosives Mix	Restek	33204	1000
2	Nitroglycerin Standard	Restek	31498	1000
3	PETN Explosives Standard	Restek	31600	1000
4	3,5-DNA (ICV)	Restek	31661	1000
5	3,4-DNT	Restek	31452	1000
6	8330 Explosive (ICV)	Restek	33905	1000
7	PETN (ICV)	Accustandard	M-8330-ADD-2	100
8	Nitroglycerin (ICV)	Accustandard	M-8330-ADD-1	100
9	2,4-Diamino-6-NT	Accustandard	M-8330-ADD-12	100
10	2,6-Diamino-4-NT	Accustandard	M-8330-ADD-13	100

9. Intermediate solutions:

   a. Intermediate 1 – Add 1mL stock 1 and stock 5 to a 10 mL volumetric flask. Dilute to volume with acetonitrile.

   b. Intermediate 2 –Add 0.24mL of stock 2 and stock 3 to a 10 mL volumetric flask. Dilute to volume with acetonitrile.

   c. Intermediate 3 (ICV) – Add 0.5mL of stocks 4, 5, and 6 to a 5 mL volumetric flask. Dilute to volume with acetonitrile.

d. Intermediate 4 (PETN/nitroglycerin ICV) – Add 1 mL stock 7 and stock 8 to a 10mL volumetric flask. Dilute to volume with acetonitrile.

e. Intermediate 5 (Diamino intermediate) – Add 0.2mL of stock 9 and stock 10 to a 1mL volumetric flask. Dilute to volume with acetonitrile.

10. Working Standard Preparation, Surrogates and Spikes:

Standard ID	Stock	Aliquot Vol. mL	Final Vol. mL	Solvent	µg/L
Surrogate	Stock 5	5	50	Acetonitrile	100000
8330 Level 5	Intermediate 1	0.2	10	1:1 ACN/$CaCl_2$	2000
	intermediate 2	3.3			
8330 Level 4	Intermediate 1	0.1	10	1:1 ACN/$CaCl_2$	1000
	Intermediate 2	1.6			
8330 Level 3	Intermediate 1	0.125	25	1:1 ACN/$CaCl_2$	500
	Intermediate 2	1.5			
8330 Level 2	Intermediate 1	0.01	10	1:1 ACN/$CaCl_2$	100
	Intermediate 2	.4			
8330 Level 1	Level 5	0.125	10	1:1 ACN/$CaCl_2$	25
	Intermediate 2	0.15			
8330 MDL STD	Level 2	1	10	1:1 ACN/$CaCl_2$	10
	Intermediate 2	0.04			
8330 Soil Matrix Spike	Stock 3	0.75	25	1:1 ACN/$CaCl_2$	NA
	Stock 2	0.75			
	Stock 1	0.25			
8330 Water Matrix Spike	Stock 3	1.6	25	1:1 ACN/CaCl2	NA
	Stock 2	1.6			
	Stock 1	0.5			
8330 ICV Standard	Intermediate 3	0.05	10	1:1 ACN/CaCl2	500
	Intermediate 4	2.0			
Diamino Level 1	Intermediate 5	0.015	10	1:1 ACN/CaCl2	30
Diamino Level 2	Intermediate 5	0.05	10	1:1 ACN/CaCl2	100
Diamino Level 3	Intermediate 5	0.625	25	1:1 ACN/CaCl2	500
Diamino Level 4	Stock 9	0.1	10	1:1 ACN/CaCl2	1000
	Stock 10	0.1			
Diamino Level 5	Stock 9	0.2	10	1:1 ACN/CaCl2	2000
	Stock 10	0.2			
Diamino MDL STD	Intermediate 5	0.005	10	1:1 ACN/CaCl2	10
Diamino Matrix Spike	Stock 9	0.75	25	1:1 ACN/CaCl2	3000
	Stock 1	0.75			

11. Standards Database Entry:

Enter each working standard into the system as follows:

Level 1: 83301 (8330 PREFIX) 8330B Mix
Level 2: 83302
Level 3: 83303
Level 4: 83304
Level 5: 83305
Level 1: NITR1 (NITR PREFIX) Diamino compounds
Level 2: NITR2
Level 3: NITR3
Level 4: NITR4
Level 5: NITR5

Extraction Procedure:

See analysis 13432 for the extraction of water samples and analysis 13433 for the extraction of solid samples.

HPLC Instrument Conditions:

A. Dual column analysis

Below are the recommended chromatographic conditions for the reversed-phase separation. Modifications to these conditions can be made at the discretion of the analyst to improve resolution or the chromatographic process. In general, a simultaneous dual column approach must be used. Single column conditions are listed as well.

Connect a T splitter to the autosampler exit line, then to short lines connected to each of two columns. The primary column must be directed into a multiwavelegth detector acquiring at 254 nm and 214 nm. The confirmation column must be connected to a multiwavelength detector acquiring at 254 and 214nm. There must be a total of four channels of data on chromperfect. There must be two start signals, using stacked connections.

Primary channels:	Phenomenex: Synergi Hydro-RP: 250mm x 4.6mm x 4um. Mutliwavelength detector at 254 nm and 214 nm
Confirmation channels:	Phenomenex: Luna Phenyl-Hexyl: 250mm x 4.6mm x 5um. Mutliwavelenghth detector at 254 nm and 214 nm
Gradient:	57% MeOH hold to 2 min, 71% MeOH at 22 min, 71% MeOH to 90% MeOH at 28 min, 90% MeOH to 55% MeOH at 30 min..
Total Flow:	2.0mL/min
Oven:	Primary 32°C, Confirmation 25°C
Injection Size:	70 µL

Calibration:

1. Prepare a sequence using the following suggested order of injections:

1.	Conditioner
2.	Conditioner
3.	83301
4.	83302
5.	83303
6.	83304
7.	833058
8.	MD83X (MDL Standard)
9.	IC83X (ICV Standard)
10.	NITR1
11.	NITR2
12.	NITR3
13.	NITR4
14.	NITR5
15.	MDNTX (MDL Standard)
16.	BLANKA
17.	LCSA
18.	LCSDA
19.	SAMPLE1
20.	SAMPLE1 MS
21.	SAMPLE1 MSD
22. – 25.	SAMPLE2 – 6
26.	83303
27.	NITR3
28. – 36.	TEN SAMPLES
37.	83303
38.	NITR3
39. – 47.	TEN SAMPLES
48.	83303
50.	NITR3

NITR ICAL standards and check standards are run as needed when 2,4-diamino-6-nitrotoluene and/or 2,6-diamino-4-nitrotoluene are requested target analytes.

2. Initial Calibration (ICAL)

   a. An external 5-point calibration is performed by injecting working standards at 5 levels.

      An example chromatogram of a midlevel standard is shown in Figure 1A, for the primary column.

   b. If the relative standard deviation (RSD) from these 5-response factors is less than or equal to 20%, then the overall average response factor is used to calculate unknown analyte concentrations from the peak heights.

   c. If the RSD is > 20%, a linear fit is used.

   d. Do not force or extrapolate to zero.

   e. The correlation coefficient must meet $\geq$0.99 for the curve to be valid.

   f. Samples cannot be analyzed until a compliant ICAL is achieved.

   g. See 1-P-QM-PRO-9015497 (SOP-PP-029) if instrument maintenance is needed to troubleshoot and/or correct any problems.

3. Initial Calibration Verification (ICV)

   a. Inject the ICV after the ICAL and evaluate prior to sample analysis. An initial verification standard must be bottled fresh on the day of calibration to ensure no degradation of the target analytes has occurred when running method 8330B.

   b. The concentration for each analyte must be within ± 30% from the nominal value.

4. Continuing Calibration Verification (CCV)

    a. A continuing calibration is run after each set of ten samples.

    b. CCV uses the Level 3 calibration standard

    c. The concentration quantitated for the calibration check standards must be within 20% difference (%D) of the nominal concentration. No allowance for grand mean.

5. The scaling of chromatograms and peak integration parameters is set so that the peaks for each compound of interest are detected and integrated at the concentration of the Method Detection Limit (MDL). This ensures that the quantitation limits and MDLs can be met.

Retention Time (RT) Windows

1. Established as 3x the standard deviation determined over a 72-hour period, or at no less than ±0.1 min, applied to the mid-point initial calibration standard.

2. If the RTs for a continuing calibration standard fall outside the windows, update the midpoint RT using that standard.

    a. Save this under an appropriate name to indicate an update has occurred.

    b. All subsequent continuing standards run within a 24-hour period must fall within this window.

    c. RTs cannot be updated more than once per day.

    d. If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure:

1. Analyze the samples using the chromatographic conditions listed in the HPLC Instrument Conditions section and the sequence listed in the Calibration section of this document.

2. Peaks are identified by matching retention times within retention time windows established for the target analytes.

3. All positive identifications for target compounds made on the C18 column must be confirmed by injection on the Phenyl-Hexyl.

4. For analytes that are detected on both columns,

   a. Report the result from the primary column.

   b. There are cases, however, where use of confirmatory data necessary.

      For example, if a target compound detected on the primary column is not detected on the confirmation column, the result is reported as “not detected” using the confirmation data. If there are interferences on the primary column masking the result for a target analyte, the result may need to be reported from the confirmation data. All initial and continuing calibration requirements apply to the second column data.

5. See Figures 1A, 1B, 2A, and 2B for identification of compounds.

6. If the response for any target compound exceeds the upper calibration standard, a dilution must be performed which brings the response into the upper end of the calibration curve.

Calculations:

1. Waters:

$$\frac{Peak\ ht. \times FV \times DF}{RF \times IV} = Concentration\ (\mu g/L)$$

Where:

Peak ht. = Peak height found in sample

RF = Average response factor [peak height/(µg/L)] from the initial calibration

FV = Final volume of sample extract in mL (normally 10 for waters)

DF = Dilution factor if applicable

IV = Initial volume of sample extracted in liters (500 mL)

2. Soils:

$$\frac{Peak\ ht. \times FV \times DF}{RF \times IW} = Concentration\ (\mu g/kg)$$

Where:

Peak ht. = Peak height found in sample

RF = Average response factor [peak height/(µg/L)] from the initial calibration

FV = Final volume of sample extract in mL (normally 10 mL for soils)

DF = Dilution factor if applicable (normally 2 for soils)

IW = Initial weight of soil extracted in grams

NOTE: Prior to performing moisture analysis, all soil samples must be found to contain less than 1% by weight total explosives. Percent by weight is calculated by dividing the ppm value by 10,000.

Statistical Information/Method Performance:

Refer to 1-P-QM-PRO-9015496 (SOP-PP-025) for QC establishing/monitoring control limits.

Reporting limits, including method detection limits (MDLs) and limits of quantitation (LOQs), are generated according to 1-P-QM-QMA-9017309 (LOM-SOP-ES-203). MDLs are determined by taking seven spiked replicates through the entire extraction and analysis procedure. Initially, these are run on each instrument used for the analysis. Results from all instruments are compared and pooled together to determine a final reporting MDL. NELAC allows for an annual verification of the MDL in lieu of an EPA MDL study. Copies of the annual studies are maintained by the department supervisor. Updates to the LIMS are made as needed by the QA Department and only as directed by the supervisor. The department database is updated via a download from the LIMS.

Quality Assurance/Quality Control:

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted, a blank, an LCS, an MS, and MSD must be extracted. If there is limited sample which prevents the preparation of the MS/MSD, then an LCSD must be prepared instead.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed.

3,4-DNT is added as a surrogate to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the HPLC run.

See 1-P-QM-PRO-9015493 (SOP-PP-002) for more information on QC acceptance criteria and corrective action.

Table I

LOQs of Nitroaromatics/Nitroamines

			Limit of Quantitation (LOQ)	
Compound	CAS	Abbrev.	Soil (µg/kg)	Water (µg/L)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	2691-41-0	HMX	300	0.6
Hexahydro-1,3,5-trinitro-1,3,5-triazine	121-82-4	RDX	120	0.6
1,3,5-Trinitrobenzene	99-35-4	1,3,5-TNB	120	0.6
1,3-Dinitrobenzene	99-65-0	1,3-DNB	120	0.6
Methyl-2,4,6-trinitrophenylnitramine	479-45-8	TETRYL	300	0.6
Nitrobenzene	98-95-3	NB	300	0.6
2,4,6-Trinitrotoluene	118-96-7	2,4,6-TNT	120	0.6
4-Amino-2,6-dinitrotoluene	1946-51-0	4-Am-DNT	120	0.6
2-Amino-4,6-dinitrotoluene	355-72-78-2	2-Am-DNT	120	0.6
2,4-Dinitrotoluene	121-14-2	2,4-DNT	300	0.6
2,6-Dinitrotoluene	606-20-2	2,6-DNT	120	0.6
2-Nitrotoluene	88-72-2	2-NT	120	0.6
3-Nitrotoluene	99-08-1	3-NT	120	0.6
4-Nitrotoluene	99-99-0	4-NT	120	0.6
Pentaerythritol tetranitrate	1607-17-6	PETN	2400	10
Nitroglycerin	55-63-0	NG	2400	10
3,5-Dinitroaniline	618-87-1	3,5-DNA	120	0.6
2,4-Diamino-6-nitrotoluene	6629-29-4		300	0.6
2,6-Diamino-4-nitrotoluene	59229-75-3		300	0.6

LOQs in this table are subject to change. The LIMS contains the most current LOQs.

Figure 1A

Chromatogram of Level 3 Standard (0.5 µg/mL)

Primary column/Run with simultaneous dual column analysis – Phenomenex: Synergi Hydro-RP: 250mm x 4.6mm x 4um.
UV – 254 nm – Top
UV – 214nm – Bottom

Temperature: 32°C

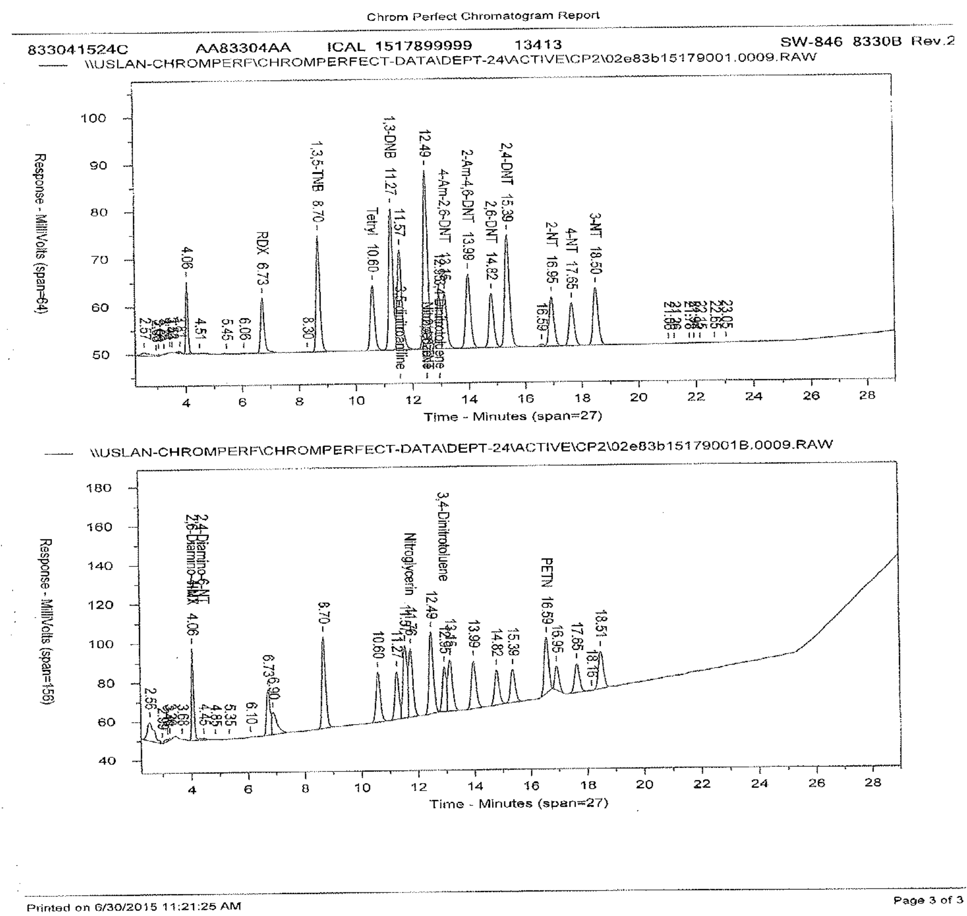


Figure 1B

Chromatogram of Level 3 Standard 2,4-Diamino-6-nitrotoluene and 2,6-Diamino-4-nitrotoluene (0.5 µg/mL)

Primary column/Run with simultaneous dual column analysis – Phenomenex: Synergi Hydro-RP: 250mm x 4.6mm x 4um.
UV – 254 nm – Top
UV – 214nm – Bottom

Temperature: 32°C

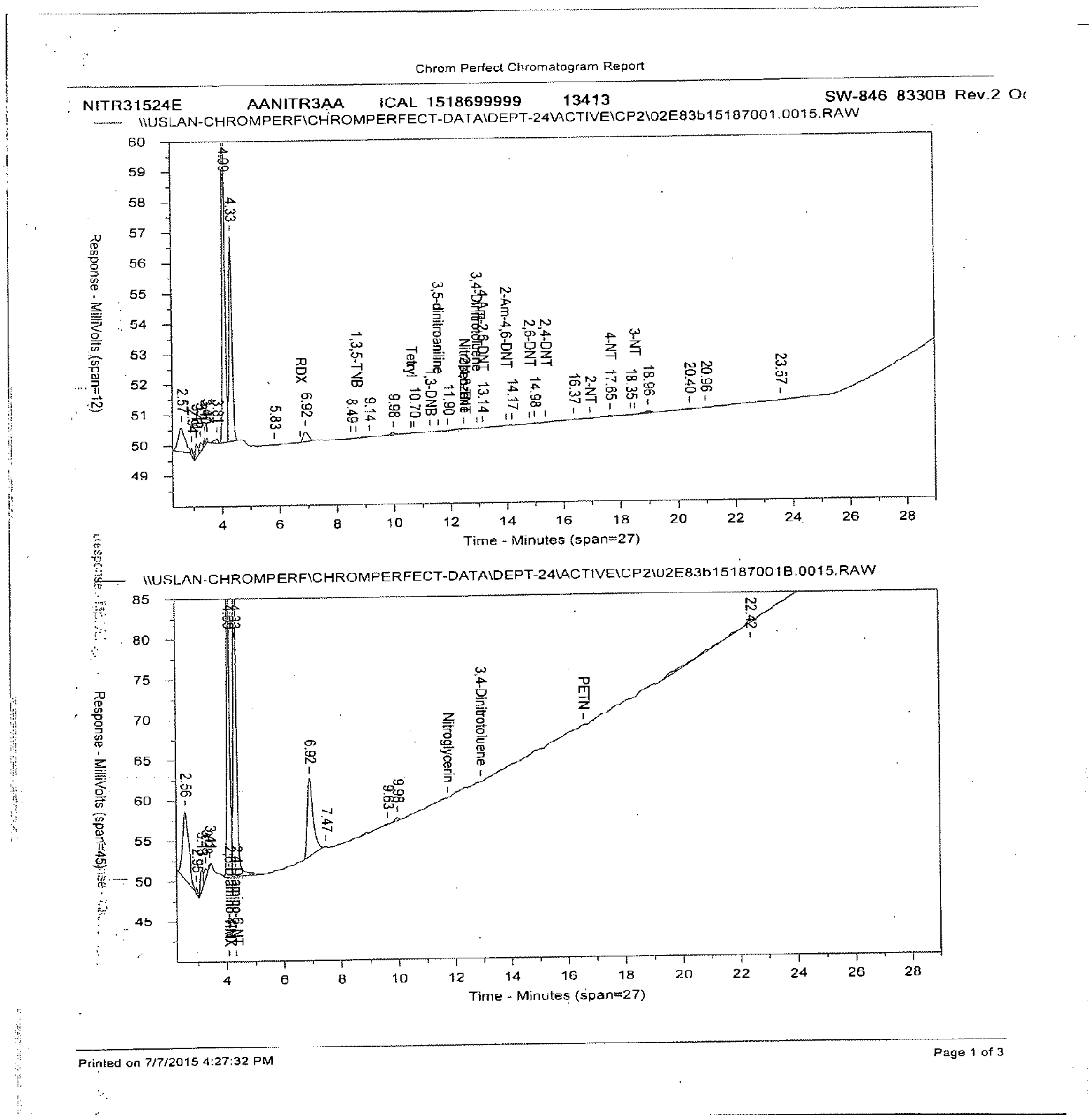


Figure 2A

1.1 Chromatogram of 8330 Mix – 0.5 µg/mL

Confirmatory column/with Simulataneous Dual column analysis – Phenomenex: Luna Phenyl-Hexyl: 250mm x 4.6mm x 5um

UV – 254 nm – top

UV – 214nm – bottom

Temperature: 25°C

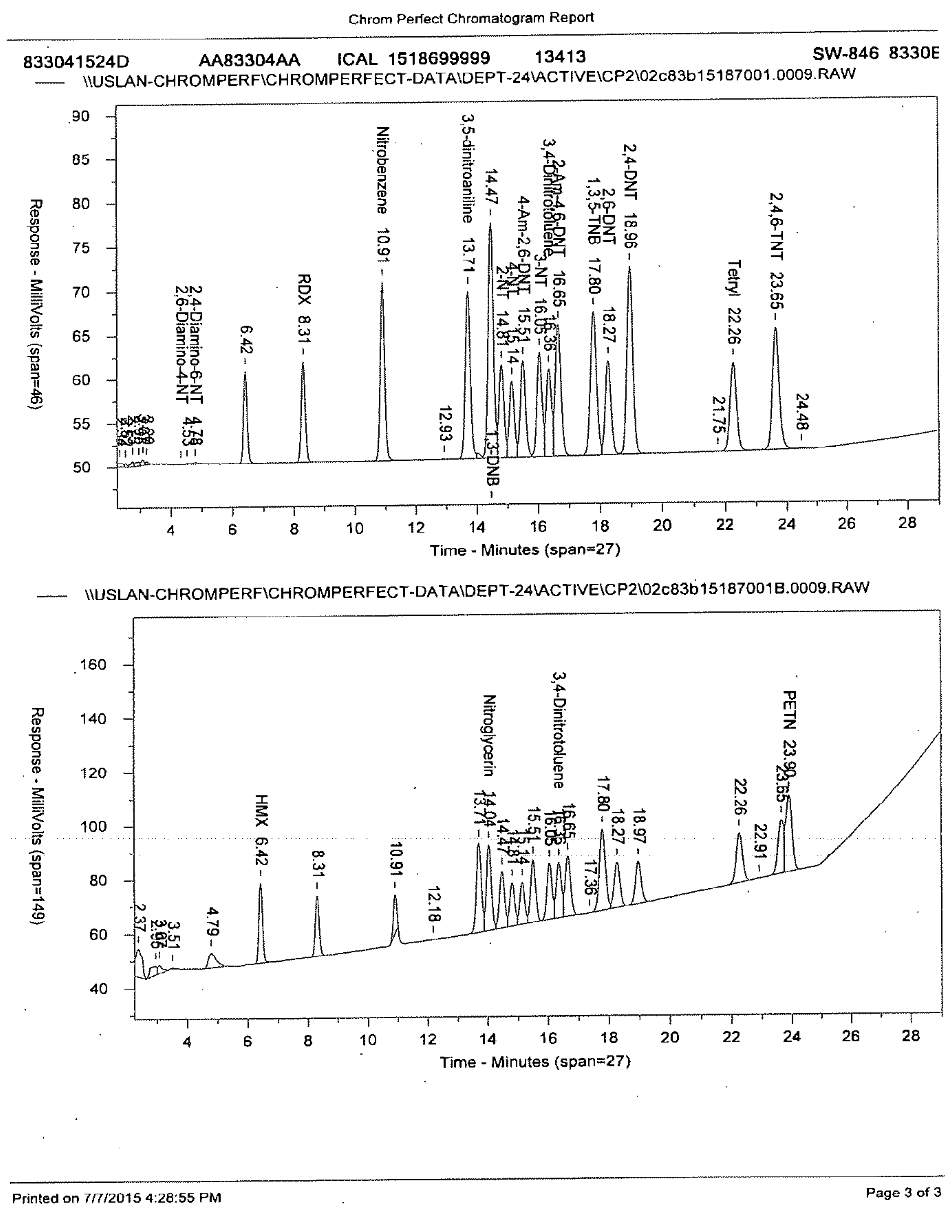


Figure 2B

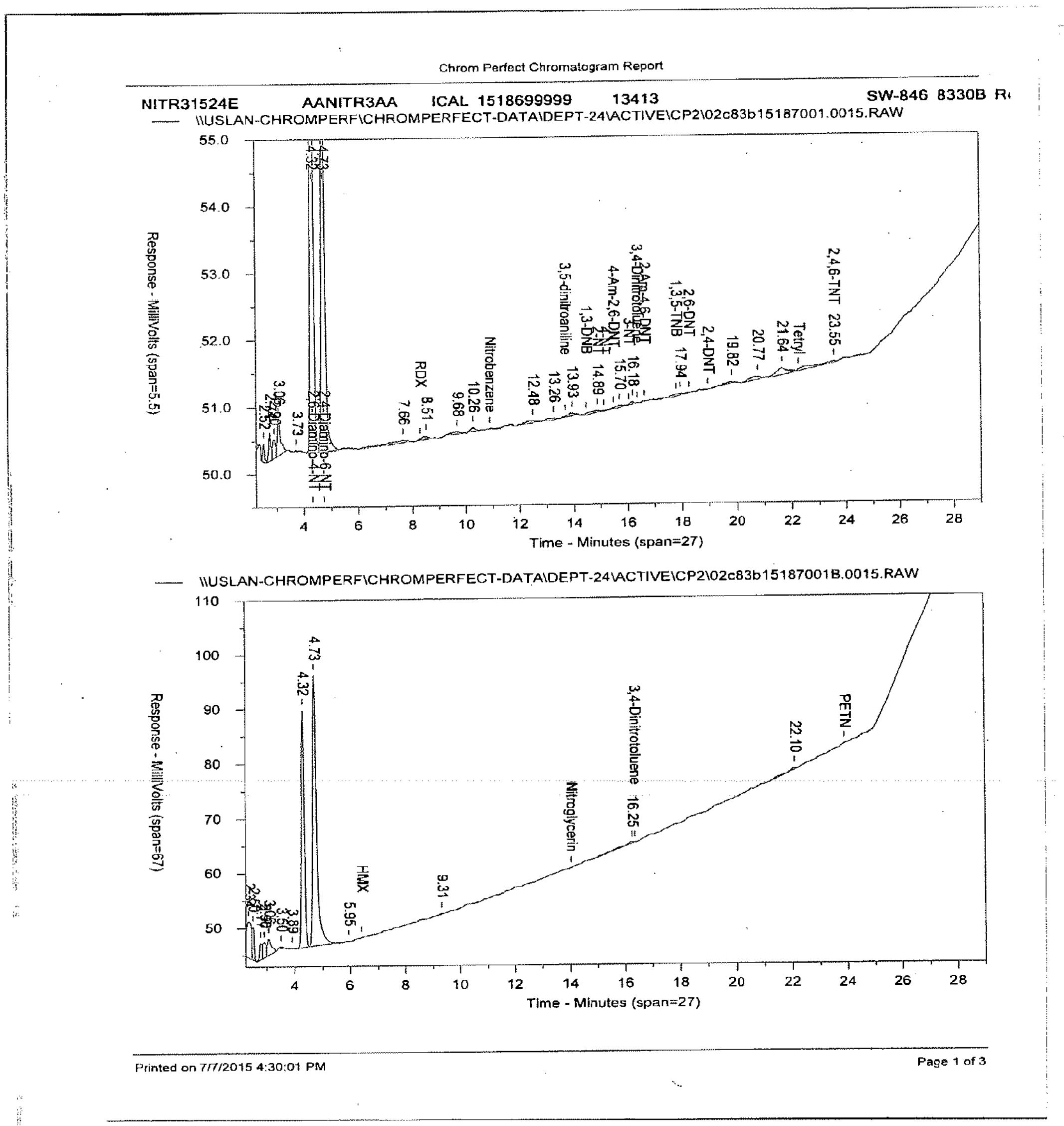
Chromatogram of Level 3 Standard 2,4-Diamino-6-nitrotoluene and 2,6-Diamino-4-nitrotoluene (0.5 µg/mL)

Confirmatory column/with Simulataneous Dual column analysis – Phenomenex: Luna Phenyl-Hexyl: 250mm x 4.6mm x 5um

UV – 254 nm – top

UV – 214nm – bottom

Temperature: 25°C



Lancaster Laboratories Environmental	Document Title: Ultrasonic Extraction of Nitroaromatics and Nitroamines by Method 8330/A/B in Soilds	Eurofins Document Reference: 1-P-QM-WI -9015173

Eurofins Document Reference	1-P-QM-WI -9015173	**Revision**	14
Effective Date	Jun 23, 2016	**Status**	Effective
Historical/Local Document Number	Analysis DOD - 6917, 11137, 11138, 13433		
Local Document Level	Level 3		
Local Document Type	TEST - Testing Document		
Local Document Category	ANALYSIS-ES - Analysis-Environmental Science		

Prepared by	Joseph Feister
Reviewed and Approved by	Susan Goshert;Review;Thursday, June 9, 2016 10:23:38 AM EDT Heidi Roberts;Review;Thursday, June 9, 2016 11:42:02 AM EDT Ruth Callaghan;Approval;Thursday, June 9, 2016 12:21:57 PM EDT

Revision Log:

Revision: 14		**Effective Date:** This version
Section	**Justification**	**Changes**
Document Title	Enhancement	Revised title to Ultrasonic Extraction of Nitroaromatics and Nitroamines by Method 8330/A/B in Solids
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Definitions	Common terms defined in higher level documents	Removed section and defined first use of acronyms in document
Procedure A.4	Reflects current practice	Revised the name of the spike solutions from water to soil
Procedure A.7	Enhancement	Added speed of centrifuge
Procedure A.9	Reflects current process	Updated bottling steps
Procedure B	Reflects current process	Added prep information for analysis 13413

Revision: 13		**Effective Date:** Sep 29, 2014
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Document Title	Enhancement	Add method to the title: Sonication Extraction of Nitroaromatics and Nitroamines by Method 8330/A/B in Solids
Historical/Local Document	New LIMS prep scan	Added prep 13433
Throughout Document	Reflects re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers
Reference	Procedure will be used for this method	Added 8330B method reference
Cross Reference	New analysis	Added Analysis #13395, 13413
Reagents and Standards 6.	New LIMS scans for analysis	Added analysis 13395 & 13413
Procedure 4. – 6.	Clarification/New analysis number	Clarified spiking requirements for analyses & added analysis 13413

Reference:

1. *Test Methods for Evaluating Solid Wastes*, EPA SW-846 Method 8330, September 1994.

2. *Test Methods for Evaluating Solid Wastes*, EPA SW-846 Method 8330A, Rev. 1, February 2007

3. *Test Methods for Evaluating Solid Wastes*, EPA SW-846 Method 8330B, Rev. 2, October 2006.

4. *Chemical Hygiene Plan,* current version.

Cross Reference:

Document	Document Title
Analysis #6916, 6918, 10595, 10596, 10131, 10132	Nitroaromatics and Nitroamines in Water and Solids by HPLC with UV Detection by Method 8330/A
Analysis 13395, 13413	Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection
1-P-QM-PRO-9015475	Glassware Cleaning for Organic Extractions
1-P-QM-PRO-9015490	Organic Extraction Standards Storage and Handling

Scope:

This method is applicable for the extraction of trace levels of nitroaromatics and nitroamines from explosives in solid samples.

Basic Principles:

A portion of sample to be analyzed is placed in a vial and dried with sodium sulfate. Acetonitrile (ACN) is added and the sample is vortexed to suspend the soil in the solvent. The sample is then placed into a chilled ultrasonic bath and sonicated for 18 hours. After sonication, it is centrifuged for 15 to 20 minutes and a portion of the ACN is removed from the vial. The volume of the removed aliquot is doubled by adding an equal volume of calcium chloride solution. The extract is then filtered through 1-μm Teflon® filters.

Reference Modifications:

Drying during homogenization results in loss of the analytes of interest, therefore, the samples are not dried or crushed with a mortar and pestle or passed through a 30-mesh sieve. Sodium sulfate is added to absorb any water that may be present in the sample.

The sample is centrifuged to provide better separation of the soil and solvent.

Filtration through a 1-µm filter is sufficient to remove particles from the extract, since the sample is not ground with a mortar and pestle and passed through a sieve.

Interferences:

Method interferences may be caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. All glassware is rinsed with solvent before use and a method blank is performed with each batch of sample to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling:

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Samples suspected of being high in explosives must be handled carefully. Soil samples must not be dried in an oven and not ground with a mortar and pestle if high concentrations of explosives are suspected. Method 8510 is used to screen for high levels of explosives if suspected. Lumps of material that have a chemical appearance must be suspect and not ground. Explosives are generally a finely ground, grayish-white material.

Prior to performing moisture analysis, all soil samples must be found to contain less than 1% by weight total explosives. If samples are found to contain greater than this level, wet weight results must be reported. If moisture determination is deemed safe, contact client services to add moisture analysis to sample.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or must be disposed of in the designated containers. These will then be transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) may be disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the technicians training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that is carried through all steps of the extraction and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling:

Samples are collected in wide-mouth glass jars with PTFE-lined lids. They must be extracted within 14 days of collection. All samples must be stored refrigerated 0°to 6°C, not frozen.

Apparatus and Equipment:

1. Top loader balance – Capable of weighing to 0.01 g
2. Disposable pipettes
3. Pipettes – Class A, assorted sizes
4. Disposable syringes – 20-mL
5. Disposable cartridge membrane filters – 1.0-µm Teflon ®
6. Volumetric flasks – Class A, assorted sizes
7. Glass vials – 25 mL
8. Vortex mixer
9. Temperature controlled ultrasonic bath
10. Glass bottles
11. Wash bottles
12. Glass jars
13. Syringes – Assorted sizes
14. Graduated cylinders – Class A, assorted sizes

15. Centrifuge – Beckman Allegra or equivalent

Reagents and Standards:

1. Acetonitrile (ACN) – HPLC grade. Store at room temperature for up to one year.

2. Calcium chloride ($CaCl_2$)– Reagent grade.

    a. To prepare solution, add 5.0 g $CaCl_2$ to approximately 800 mL of reagent water in a 1000-mL volumetric flask. Shake until the $CaCl_2$ goes into solution. Use a wash bottle to dilute to 1000 mL with reagent water.

    b. Store at room temperature in a glass bottle. Reagent is stable 1 year.

    c. Larger volumes may be prepared as long as equivalent volumes are used.

    d. Document all reagent preparation in the appropriate logbooks or database.

3. Sodium sulfate (Na_2SO_4) – Reagent grade or equivalent. Bake at approximately 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

4. Sand – Standard Ottawa or equivalent. Bake at approximately 400°C for a minimum of 4 hours prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

5. Acetone - Pesticide grade or equivalent. Store at room temperature for up to 1 year.

6. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding Analysis #6916, 6918, 10595, 10596, 10131, 10132 and Analysis #13395 & 13413.

Preparation of Glassware:

See 1-P-QM-PRO-9015475 (SOP-OE-001).

Calibration:

Not applicable for this procedure

Procedure:

NOTE: All samples must be properly prepared prior to extraction. The preparation could include homogenization, drying, etc. Please ask your group leader if you have any questions.

A. For Prep 6917, 11137, 11138:

1. Weigh 2.0 to 2.4 g of sample into a 25-mL glass vial.

   a. Record the initial weight and any comments about the sample on the extraction sheet.

   b. The background, Matrix Spike(MS), and Matrix Spike Duplicate(MSD) are performed on three separate aliquots of a field sample.

2. The Blank, Laboratory Control Sample (LCS), and Laboratory Control Sample Duplicate (LCSD) (if applicable) are prepared by weighing 2.0 to 2.4 g of sand into a vial.

   Record the weight on the extraction log.

3. Add approximately 2 g of sodium sulfate to all vials and mix.

4. Use pipettes to add surrogate standards and spiking solutions.

   a. Surrogates are added to all samples (including all QC).

   b. Spikes are added to the LCS, LCSD (if applicable), MS, and MSD samples.

   c. Typically, the surrogates and spikes are as follows:

   d. Analysis 6918 & 10596

      (1) Surrogate: 0.1 mL Explosives Soil Surrogate.

      (2) Spike: 0.5 mL Explosives Soil Spike.

   e. Analysis 10132

      (1) Surrogate: 0.1 mL Explosives Soil Surrogate.

      (2) Spike: 0.5 mL Explosives Soil Spike.

      (3) Prepare a separate LCS/LCSD using 0.5 mL Diaminonitrotoluenes Spike.

   f. See analysis 6916, 10595 and/or 10132 for spike details.

   g. See 1-P-QM-PRO-9015490 (SOP-OE-017) for storage and handling of spikes.

5. Use a graduated cylinder to add 10 mL of ACN and vortex swirl the sample for approximately 1 minute to suspend the soil in the ACN.

6. Place the sample in a cooled (<30°C) ultrasonic bath that contains a level of water equal to the level of solvent in the vial and sonicate for 18 hours.

   Document the temperature of the bath when the samples are placed in the bath and the temperature of the bath when the samples are removed on the batchlog.

7. After sonication, centrifuge the sample between 1000 and 1500 rpm for 15 to 20 minutes

8. Use a pipette to place 5 mL of calcium chloride solution (5 g/L) into a 10-mL volumetric flask that has been rinsed with acetone.

   a. Use a disposable pipette to bring to volume using the solvent layer of the centrifuged sample.

   b. Mix thoroughly.

   c. Allow the mixture to stand 15 minutes.

9. Filter the sample through 0.45-μm GHP filters using a 10-mL disposable syringe.

   a. Discard the first 3 mL.

   b. Filter into two clear GC vials.

   c. Filter the remaining sample into a clear 12 mL vial.

   d. Store in the refrigerator at 0°to 6°C, not frozen, until analysis.

   e. Document the final volume as 20.0 mL on the batchlog.

B. For Prep 13433:

1. Weigh 10.0 to 10.4 g of sample into a 40-mL glass vial.

   a. Record the initial weight and any comments about the sample on the extraction sheet.

   b. The background, MS, and MSD are performed on three separate aliquots of a field sample.

2. The Blank, LCS, and LCSD (if applicable) and Diamino LCS and Diamino LCSD are prepared by weighing 10.0 to 10.4 g of sand into a vial.

   Record the weight on the extraction log.

3. Add approximately 2 g of sodium sulfate to all vials and mix.

4. Use pipettes to add surrogate standards and spiking solutions.

   a. Surrogates are added to all samples (including all QC).

   b. Spikes are added to the LCS, LCSD (if applicable), MS, and MSD samples. Diamino Stocks are added to the Diamino LCS and Diamino LCSD.

   c. Typically, the surrogates and spikes are as follows:

   d. Analysis 13413

      (1) Surrogate: Add 0.1 mL 8330B Surrogate Standard

      (2) Spike: Add 2.0 mL 8330B Explosives LOD into LCS, LCSD, MS and MSD if applicable

(3) Stocks: Add 0.18 mL of 2,6-Diamino-4-nitrotoluene and 0.18 mL of 2,6-Diamino-6-nitrotoluene stocks into Diamino LCS and Diamino LCSD.

e. See analysis 13413 for spike details.

f. See 1-P-QM-PRO-9015490 (SOP-OE-017) for storage and handling of spikes.

5. Use a graduated cylinder to add 20 mL of ACN and vortex swirl the sample for approximately 1 minute to suspend the soil in the ACN.

6. Place the sample in a cooled (<30°C) ultrasonic bath that contains a level of water equal to the level of solvent in the vial and sonicate for 18 hours.

   Document the temperature of the bath when the samples are placed in the bath and the temperature of the bath when the samples are removed on the batchlog.

7. After sonication, centrifuge the sample between 1000 and 1500 rpm for 15 to 20 minutes.

8. Use a pipette to place 5 mL of calcium chloride solution (5 g/L) into a 10-mL volumetric flask that has been rinsed with acetone.

   a. Use a disposable pipette to bring to volume using the solvent layer of the centrifuged sample

   b. Mix thoroughly.

   c. Allow the mixture to stand 15 minutes.

9. Filter the sample through 0.45-µm GHP filters using a 10-mL disposable syringe.

    a. Discard the first 3 mL.

    b. Filter into two clear GC vials.

    c. Filter the remaining sample into a clear 12 mL vial.

    d. Store in the refrigerator at 0°to 6°C, not frozen, until analysis.

    e. Document the final volume as 40.0 mL on the batchlog.

Calculations:

See analysis method.

Statistical Information/Method Performance:

See analysis method.

Quality Assurance/Quality Control:

A batch is defined as the samples to be extracted on any given day, but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. For each batch of samples extracted, a blank, LCS, MS, and MSD must be extracted. If there is limited sample that prevents the preparation of the MS/MSD, then an LCSD must be prepared instead. If the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing must be used.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed instead.

Eurofins Document Reference	1-P-QM-PRO-9030806	**Revision**	3
Effective Date	Sep 8, 2016	**Status**	Effective
Historical/Local Document Number	N/A		
Local Document Level	Level 3		
Local Document Type	SOP-ES - Standard Operating Procedure - Environmental Sciences		
Local Document Category	SS - Sample Support		

Prepared by	Chad Wettig
Reviewed and Approved by	Anneliese Owen;Review;Wednesday, August 24, 2016 5:26:35 PM EDT Christiane Sweigart;Approval;Monday, August 29, 2016 8:50:54 PM EDT

Revision Log:

Revision: 3		Effective Date: This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Reagents and Standards	Reflects current process	Replaced the LCS used and the spike to prepare the LCS Replaced the grinding cycle to one
Procedure	Clarification	Defined the grinding cycles based on sample matrix

Revision: 2		Effective Date: Sep 1, 2015
Section	**Justification**	**Changes**
Safety Precautions and Waste Handling	Applicable to the procedure	Updated the requirement for ear protection
Apparatus and Equipment Throughout Document	Change in procedure	Removed drying cabinet and added drying rack
Reagents and Standards	Clarification	Updated the requirement for the blank sand storage conditions
Procedure	Clarification	Updated and defined the options for laying samples out to dry

Reference:

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 8330B, Revision 2, October 2006.

2. DOD Environmental Data Quality Workgroup, Frequently Asked Questions (FAQs) Concerning the Implementation of EPA SW-846 Method 8330B, November 2014.
   www.denix.osd.mil/edqw/.../EDQW-8330B-FAQs-November-2014.docx

3. *ITRC (Interstate Technology & Regulatory Council). 2012. Incremental Sampling Methodology. ISM-1. Washington, D.C.: Interstate Technology & Regulatory Council, Incremental Sampling Methodology Team. www.itrcweb.org.*

4. *Chemical Hygiene Plan,* current version.

Cross Reference:

Document	Document Title
Analysis #6917, 11137, 11138, 13433	Ultrasonic Extraction of Nitroaromatics and Nitroamines by Method 8330/A/B in Soilds
Analysis #13395, 13413	Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection
1-P-QM-FOR-9007935	Incident Report Form
1-P-QM-QMA-9017312	Sample Requisition

Purpose:

The purpose of this SOP is to outline the sample preparation procedures of solids prior to extraction Analysis #6917, 11137, 11138, 13433 and Analysis #13395, 13413 by SW-846 8330B.

Scope:

This SOP covers the processing of samples such as soils, solid wastes, and sediments for analysis of nitroaromatics and nitramines by SW-846 8330B. The processes discussed include drying, sieving, grinding and subsampling.

This procedure is not applicable to volatile samples. Separate containers must be sent for the volatile analysis.

Safety Precautions and Waste Handling:

Personnel must wear safety glasses, lab coat, and latex or nitrile gloves when performing this procedure. Ear protection is recommended but not required while running the Puck Mill.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications:

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP.

Each new technician will train with an experienced technician for approximately one month. Once training is completed, the technician is required to perform this procedure on their own, referencing a qualified technician for any questions. They also must have the ability to read sample labels, document in the electronic notebook, fill out forms, print labels and incomplete lists, and complete and verify analyses in the computer system. This will be documented in the training records.

Apparatus and Equipment:

1. Aluminum baking trays 18” x 26”
2. Teflon Pan Liner
3. Glass Trays
4. Drying Rack
5. # 10 Stainless Steel Sieves
6. Spatula- stainless steel, wooden, or Teflon
7. essa Puck Mill
8. 800cc or 2,000cc Dish and Puck Set
9. 125 mL and 250 mL glass jars with Teflon lined caps
10. 1,000 mL glass jars with Tweflon lined caps
11. Nitrile Gloves
12. Top loading balance- capable of weighing samples 3200g to 0.01g
13. 0.3 mL sampling spoon
14. Desiccator
15. Amber Bottles

Reagents and Standards:

1. Reagent water – water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.

2. Methanol, store at room temperature up to 1 year.

3. Blank Sand – Pre-cleaned and baked in an oven for 4 hours at 400°C and stored in a sealed container at room temperature.

4. Chemware Ultra – Pure PTFE Boiling Stones (For Metals)

5. Expray – A colorimetric field screening test kit used to test for certain explosives

6. LCS – 5 mL custom spike from Phenova that is added to 500 grams of a clean soil/sand matrix material and stored in a glass screw top jar.

   The Phenova custom standard is a 5 mL spiking solution containing 17 analytes at a final spiked concentration of 2000 ug/kg (with Nitroglycerin and PETN at a final spiked concentration of 10,000 ug/kg) in Acetonitrile. Each standard is provided as a premeasured 5.00 mL spike flame sealed in a 10 mL amber ampoule, designed for "snap and spike" use where quantitative transfer of 100% of the 5 mL is applied to 500 g solid matrix.

   This purchased LCS will be ground for one 60 second cycle, subsampled into amber jars containing 10 grams each, and frozen for up to 6 months. Each bottle will be individually labeled, including the lot number and expiration date.

Procedure:

A. Print an incomplete list for the LIMS analysis numbers 2203 (ISM Sample Milling) and 13564 (ISM Sample Sieving).

1. This will list all samples that have not been completed.

2. The incomplete list also shows which samples are to be analyzed on a rush or priority basis.

B. Receive the sample(s) from the Sample Administration (SA) hold walk-in.

NOTE: Any samples that are not received from the SA walk-in but still are showing on the incomplete list after verification is complete must be requisitioned to determine the status of the sample. See 1-P-QM-QMA-9017312.

C. Lab notes and Hazardous samples.

1. Lab notes supersede standard sampling instructions. Always read these before doing anything to a sample.

2. If the sample container contains a hazardous label, the lab notes should indicate the reason.

3. If lab notes do not indicate the reason for the hazard, the sample(s) must be flagged and returned to sample entry before anything further is done.

4. If a strong smell or any other hazardous issues are observed:

   a. 1-P-QM-FOR-9007935 must be filled out and distributed as indicated on the form.

   b. The samples must be returned to SA for a hazardous sticker to be placed on the container's lid as well as lab notes explaining what was noticed during the homogenization procedure.

5. Please check with your group leader or a safety representative if you feel the hazard doesn't warrant proceeding.

D. Preparation

NOTE: Always use clean equipment and gloves for each new sample.

1. The preparation of all samples must be documented using the Incremental Sampling Methodology Logbook.

2. Sample Administration (SA) will provide labels for all subsamples.

3. Preparing Samples by ISM Sample Milling (Analysis 2203)

   a. Notes

      (1) Total sample volumes should be approximately 1000 grams, the minimum sample volume that should be ground using the mill is 200 grams. If limited sample volumes are received contact your supervisor so a technical decision can be made or the client service representative can contact the client for further instructions.

      (2) Samples submitted that are expected to have high levels of explosives need to be tested using Expray following the manufacturer's instructions. Document the results.

   b. Label the side of the aluminum baking tray with the sample number. Choose one of the following options to dry the sample;

      (1) Transfer the sample to a glass tray spreading the sample out to facilitate drying. Place the glass tray onto the aluminum baking tray. This option is the most cost effective when metals are being processed.

(2) Line the aluminum tray with a Teflon pan liner; transfer the entire sample to the tray spreading the sample out to facilitate drying. This option is used when metals are required, using step 1 is the most cost efficient method and should be used unless the client directs option 2 to be performed.

(3) Transfer the sample to the aluminum tray spreading the sample out to facilitate drying. This is option is for explosives only and must not be used when metals are processed.

NOTE: If the amount of sample in one bottle requires multiple trays to be used each tray will need a label.

c. Record the time and date the drying process started. Place the tray(s) containing sample in the drying racks. Samples normally take 24 to 48 hours to dry.

d. Repeat the steps above if multiple bottles are supplied for a particular sample number.

e. A sample is generally considered dry when it is free flowing and larger clumps break apart easily. To test that the sample is dry, scan the sample number in the preparation application, and choose the dry weight option.

(1) Label an aluminum drying dish with sample id and weigh out approximately 10 grams of sample to the aluminum drying dish.

(2) Record the weight.

(3) Return the sample and drying dish to the drying rack for a minimum of 2 hours

(4) Reweigh the dish, if the weight did not change by more than 0.05 grams or < 4% the sample is considered dry (proof of constant weight).

(a) If the weight changed by more than 0.05 grams return the sample and dish to the drying cabinet for a minimum of at least an additional 2 hours. After that time weigh the sample again, if the weight did not change by more than 0.05 grams the sample is considered dry.

(b) If the weight is not constant after the 3rd weighing cycle the sample is not considered dry and must be placed back in the drying rack for an additional 24 to 48 hours at which time the constant weight step needs repeated.

(5) Discard the weighing dish along with the sample used to determine if the constant weight was reached.

f. After the sample is dry the entire dried sample weight must be taken and recorded. Place the sample on a tarred glass tray and record the sample weight to the nearest gram.

g. Using a #10 sieve pass the soil through breaking up any clumps of soil. All excess soil including vegetation (unless part of the client requirements), should be weighed and recorded including a brief description of this material. The excess non-passable sample should be placed in a jar and returned to sample storage.

h. Once sieving is complete the samples need ground to a fine powder using the puck mill. The 800cc bowls can accommodate 120 to 640 grams and the 2000cc bowls accommodate 300 to 1000 grams. Large sample volumes may require multiple aliquots to be ground.

NOTE: Do not under load or overload the bowls. Under loading the bowl (aliquots < 100 g) will cause excess wear on the bowl and puck. Overloading will decrease the grinding efficiency.

i. Place the appropriate puck in the corresponding bowl, transfer the appropriate amount of sieved sample to the bowl, place the lid on the bowl and load in to the puck mill. Record the bowl ID number.

j. Once the bowl is loaded close the lid to the mill and start the operations by holding the green start button. This will seal the bowl in place using house air. The mill is set to run in one minute increments. All samples must be ground for a minimum of 2 one-minute cycles and no more than 5 one-minute cycles to ensure proper grinding is achieved.

   The number of increments is determined based on the sample type (fine samples require less increments, sample with clumps and those that were wet before the drying cycle require multiple increments) along with how the sample reacts when in the bowl (starts to clump or turns to a fine dust).

k. Allow the sample and bowl to cool for approximately one minute in between each grinding cycle.

l. Repeat the grinding process if the sample was split into multiple aliquots. The bowl, puck, and lid must be cleaned when processing different samples however this does not need done if working on multiple aliquots of the same sample.

   NOTE: The cleaning process consists of thoroughly washing the equipment with reagent water and detergent solution, rinsing with DI water, drying with a paper towel, and finally rinsing with methanol. It is important not to let the bowl or puck air dry to reduce the chances of the equipment rusting.

m. Transfer the entire sample to a glass or aluminum tray (if metals are required glass trays or aluminum trays lined with Teflon paper must be used) while at the downdraft table. All aliquots can be placed on the same tray. Mix the sample thoroughly.

n. Spread the sample out so that it is approximately 2 mm thick.

o. Using a sampling device create at least 30 specific sections to sample from. An increment from each section will be used to create the necessary subsamples.

p. Place a jar on the balance and tare. Take an increment from each section created using the 0.3 mL sampling spoon. Record the final weight.

Repeat this step if multiple subsamples are needed.

E. Quality Control

1. Each group of samples processed will need a sand blank made at the start of the batch, after every 10 samples milled, and/or at the end of every batch following the same steps as described in the procedure using 200 grams for each preparation. Contact Sample Administration if additional blanks need entered in to the LIMS. Each group of samples that are entered will come with sample labels for each blank to be prepared.

2. Sand blanks will be composited, when appropriate, for analysis. A composited blank will not exceed three individual blanks to make up one composite.

3. If any samples in the batch are requisitioned for metals analysis, a blank for metals must be processed.

4. One field sample must be done in triplicate per batch. The technician will need to indicate which sample is being used for triplicate volume and produce additional sample labels. Procedure D.3.p. will need repeated for the 2nd and 3rd aliquots.

F. Multiple ELLE sample numbers per submitted sample

1. An ‘as received’ sample may contain multiple sample numbers.

   Since these samples are linked in the LIMS, additional labels will be created for subsamples based off of the analyses that are entered. Each label will have a unique sample ID and will need processed through taking multiple increments as described previously in the procedure.

2. A client designated QC (quality control) sample may also be spread out over several sample numbers and designated as a background, matrix spike, matrix spike duplicates, or duplicate.

   Each sample will be processed individually as a unique sample going through the entire procedure resulting in each QC type having a subsample created with a unique sample number when completed.

3. The technician designated QC sample.

   When a group does not have a sample submitted with QC designated the technician will choose a sample to create QC from. This can be changed by the user if limited sample is received for the designated sample. When processing the sample multiple labels with unique sample ID's will be printed to create a (MS) matrix spike and (MSD) matrix spike duplicate subsample.

United States Department of Agriculture
Animal and Plant Health Inspection Service
4700 River Road
Riverdale, MD 20737

Permit to Receive Soil

Regulated by 7 CFR 330

This permit was generated electronically via the ePermits system.

PERMITTEE NAME:	Duane Luckenbill	**PERMIT NUMBER:**	P330-13-00350
COMPANY:	Eurofins Lancaster Laboratories Environmental	**APPLICATION NUMBER:**	P525-131031-002
RECEIVING ADDRESS:	2425 New Holland Pike Lancaster, PA 17601	**DATE ISSUED:**	12/03/2013
MAILING ADDRESS:	2425 New Holland Pike Lancaster, PA 17601		
PHONE:	(717) 656-2300		
FAX:	(717) 656-2681	**EXPIRES:**	**12/03/2016**

PORTS OF ARRIVAL/PLANT INSPECTION STATIONS: AK, Anchorage; AL, Huntsville; AL, Mobile; AZ, Douglas; AZ, Lukeville; AZ, Naco; AZ, Nogales; AZ, Phoenix; AZ, San Luis; AZ, Tucson; CA, Calexico; CA, Fresno; CA, Long Beach; CA, Oakland; CA, Ontario; CA, Otay Mesa; CA, Port Hueneme; CA, Sacramento; CA, San Diego; CA, San Francisco; CA, San Jose; CA, San Ysidro; CA, Tecate; CO, Denver; CT, Hartford; CT, New Haven; DE, Dover; DE, Wilmington; FL, Ft. Lauderdale; FL, Ft. Myers; FL, Ft. Pierce; FL, Jacksonville; FL, Key West; FL, Miami; FL, Orlando; FL, Pensacola; FL, Port Canaveral; FL, Port Everglades; FL, Sanford; FL, Tampa; FL, West Palm Beach; GA, Atlanta; GA, Savannah; GU, Agana; HI, Hilo; HI, Honolulu; HI, Kahului; HI, Kailua-Kona; HI, Lihue; ID, Eastport; IL, Chicago; IN, Indianapolis; KY, Louisville; MA, South Boston; MD, Baltimore; MD, Beltsville; ME, Bangor; ME, Calais; ME, Houlton; ME, Portland; MI, Detroit; MI, Port Huron; MI, Romulus; MI, Sault Saint Marie; MN, Duluth; MN, Grand Portage; MN, International Falls; MN, Minneapolis; MO, Kansas City; MO, St. Louis; MP, Commonwealth of the Northern Mariana Islands; MS, Gulfport; MS, Port Bienville; MT, Raymond; MT, Roosville; MT, Sweetgrass; NC, Raleigh; NC, Wilmington; ND, Dunseith; ND, Pembina; ND, Portal; NJ, Linden; NJ, Newark; NM, Albuquerque; NM, Columbus; NM, SantaTeresa; NV, Las Vegas; NY, Albany; NY, Alexandria Bay; NY, Brooklyn; NY, Buffalo; NY, Champlain, Rouses Point; NY, Jamaica; NY, Jamaica; NY, Newburgh; OH, Ashtabula; OH, Cincinnati; OH, Cleveland; OH, Columbus; OH, Toledo; OH, Wilmington; OK, Oklahoma City; OR, Portland; PA, Allentown; PA, Harrisburg; PA, Philadelphia; PA, Pittsburgh; PA, Scranton; PR, Aguadilla; PR, Carolina; PR, Fajardo; PR, Mayaguez; PR, Ponce; RI, Warwick/Providence; SC, Charleston; TN, Memphis; TN, Nashville; TX, Austin; TX, Brownsville; TX, Corpus Christi; TX, Dallas; TX, Del Rio; TX, Eagle Pass; TX, El Paso; TX, Fabens; TX, Falcon; TX, Fort Hancock; TX, Galveston; TX, Hidalgo; TX, Humble; TX, Laredo; TX, Los Indios; TX, Pharr; TX, Port Arthur; TX, Presidio; TX, Progresso; TX, Rio Grande City; TX, Roma; TX, San Antonio; TX, Victoria; UT, Salt Lake City; VA, Dulles; VA, Norfolk; VI, St. Croix; VI, St. Thomas; VT, Berlin; WA, Blaine; WA, Oroville; WA, Port Angeles; WA, SeaTac; WA, Sumas; WI, Green Bay; WI, Milwaukee

HAND CARRY: No

Under the conditions specified, this permit authorizes the following:

Quantity of Soil per Shipment and Treatment

3 lbs or less: Sterilization will interfere with intended use - Your facility MUST be inspected and approved to receive this soil

SPECIAL INSTRUCTIONS TO INSPECTORS

See permit conditions below

Permit Number P330-13-00350

THIS PERMIT HAS BEEN APPROVED ELECTRONICALLY BY THE FOLLOWING PPQ HEADQUARTER OFFICIAL VIA EPERMITS.	DATE
Osmond Baron	12/03/2013

WARNING: Any alteration, forgery or unauthorized use of this Federal Form is subject to civil penalties of up to $250,000 (7 U.S.C.s 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C.s 1001)

INSTRUCTIONS TO DHS CBP INSPECTORS FOR IMPORTED SOIL SHIPMENTS ROUTED TO RECEIVING FACILITY:

For hand carry of soil, an official of CBP Agricultural Programs and Trade Liaison (APTL) would have been notified to document and facilitate the entry of the soil (See hand carry conditions below if stipulated). Otherwise:

1. Validate the permit in ePermits using the CBP search feature by logging on to:
https://epermits.aphis.usda.gov/epermits
2. Confirm that the shipment is being routed directly to a USDA APHIS PPQ Inspected Facility authorized to receive soil by logging on to: https://web01.aphis.usda.gov/PPQ/AuthSoilLabs.nsf/web?openform
3. Confirm that the imported shipment has a valid USDA PPQ Form 550 Black/White label.
4. Confirm that the carrier of the shipment imported under this USDA PPQ 525 permit is commercially bonded.
5. For questions or concerns, contact the USDA APHIS PPQ Permit Unit in Riverdale, MD, at 866-524-5421 and ask to speak with a compliance officer.

PERMIT GUIDANCE

Receipt or use of foreign isolates or samples from countries under sanctions requires specific permission from the U.S. Department of Treasury (see http://www.treasury.gov/resource-center/sanctions/Programs/Pages/Programs.aspx. for current country/regional listings) for current country listings.

This permit does not authorize importation, interstate movement, possession, and/or use of strains of genetically engineered regulated organisms (created by the use of recombinant DNA technology).

If an animal pathogen is identified in your shipment, to ensure appropriate safeguarding, please refer to http://www.aphis.usda.gov/import_export/animals/animal_import/animal_imports_anproducts.sh

tml.

If a human pathogen is identified, please see the CDC Etiologic Agent Import Permit Program at http://www.cdc.gov/od/eaipp/

This permit does not fulfill the requirements of other federal or state regulatory authorities. As appropriate, please contact the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the U.S. Food and Drug Administration, the Centers for Disease Control and Prevention, the APHIS Veterinary Services unit, or your State's Department of Agriculture to ensure proper permitting.

If you are considering renewal of this permit, an application should be submitted at least 90 days prior to the expiration date of this permit to ensure continued coverage. Permits requiring containment facilities may take a longer period of time to process.

Approved Sterilization Methods:
All soil residues must be dry-heated, incinerated, hydroclaved or autoclaved.

DRY HEAT Treatment: use one of the following schedules:
110- 120.5 degrees C (230-249 F) for 16 hours
121-154 degrees C (250-309 F) for 2 hours
154.4 - 192.5 degrees C (310-379 F) for 30 minutes
193-220 degrees C (380-429 F) for 4 minutes
221-232 degrees C (430-450) for 2 minutes
Time starts when the entire sample reaches the required temperature, and a suitable temperature probe must be used for verification.

INCINERATION: With the exception of metal and glass containers, all regulated and associated material must be

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reduced completely to ash at the end of the incineration cycle.

AUTOCLAVE soil and other material using the following conditions:
a. Soil must be autoclaved at 121 degrees Centigrade (250 degrees Fahrenheit) for a minimum of 30 minutes at 15 psi.
b. Autoclave tape or other indicators must be placed on each bag or sharps container prior to treatment. The autoclave tape or other indicator on each container must be checked to verify color change before disposal.
c. The autoclave log must be completed by each user for each autoclave cycle. All parameters must be noted as listed on the log for each autoclave load.
d. If the autoclave does not attain the minimum time and/or temperature or the autoclave tape does not change color, a notation must be made in the comment section of the autoclave log. The load must then be re-autoclaved after placing new tape on the material. If minimum time and temperature is not attained on the second cycle, users must contact the person responsible for maintaining the unit to initiate repairs. Waste must then be treated at an alternate autoclave facility that is approved by USDA.
e. Thermometers on the autoclave must be calibrated annually, and a written record must be maintained. This must be done by an authorized autoclave service company during routine servicing.
f. Every 6 months, you should use a commercially available test indicator kit that uses bacterial spores Bacillus stearothermophilus that are rendered unviable at 250 degrees F or 121 degrees C. For the test, ampules of B. stearothermophilus are autoclaved along with a load of waste. Upon completion of the cycle, the ampules are incubated for 48 hours and then observed for any sign of growth, which indicates insufficient sterilization.

HYDROCLAVE: Soil must be hydroclaved at 121oC/250oF for a minimum of 30 minutes or 1

PERMIT CONDITIONS

This permit authorizes the importation of soil from all foreign sources (except countries with sanctions or embargoes by U.S. State Department) only for chemical/ physical analysis in a controlled laboratory environment at the named facility on the permit.

1. This permit is issued only for the named permit holder at the address(s) identified on this permit. This permit cannot be transferred or assigned.

2. The permit holder verifies United States residency by initialing and accepting these permit conditions. If you are not a United States resident, it is unlawful for you to initial or accept these permit conditions because a USDA 525 soil Permit can only be issued to United States residents.

3. The permit holder is solely responsible for ensuring compliance with all statutory requirements and specifically listed permit conditions. Failure to comply with the terms and conditions of this permit is cause for the following: (a) cancellation of this permit, (b) cancellation of other permits issued to the permit holder, (c) seizure and/or destruction of regulated organisms, (d) denial of future permit applications by this permit holder, (e) liability for civil penalties, and (f) criminal prosecution under provisions in the Plant Protection Act.

4. Any alteration, forgery, unauthorized use of this permit and/or associated Federal Forms are subject to civil and criminal penalties including fines and imprisonment.

5. This permit must not be used for the movement or use of plant pathogens listed in the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. If any organism listed as a Select Agent is identified from materials associated with this research, the permit holder is required to notify APHIS, Agricultural Select Agent Program (ASAP) within one business day by phone at 301-851-3300, and within seven (7) days submit APHIS/CDC Form 4 (Report of Identification of a Select Agent or Toxin in a Clinical or Diagnostic Laboratory) to APHIS, ASAP; 4700 River Rd, Unit 2, Riverdale, MD 20737 (see instructions at: http://www.aphis.usda.gov/programs/ag_selectagent/index.shtml). Failure to comply with this requirement is a violation of the Agricultural Bioterrorism Protection Act of 2002.

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6. If a regulated organism is received in this shipment, the permit holder must take all prudent measures to contain the organism(s) and notify the permit unit within one business day by calling 866-524-5421 or by e-mail to pest.permits@aphis.usda.gov. The permit holder must immediately notify the permit unit of the destruction of regulated organisms received under this permit, as above. Similarly, the permit holder must immediately notify the permit unit if facilities are destroyed or decommissioned for any reason.

7. You as the permit holder are responsible for maintaining a valid permit for as long as the soil is in your possession. APHIS does not issue extensions or renewals of existing permits; the permit holder must submit a new permit application at least three months prior to the expiration of this permit, and obtain a new permit to continue uninterrupted authorization for the soil approved under this permit.

8. If an accidental release into the environment occurs, notification must be made within one business day to APHIS, PPQ, 4700 River Rd., unit 133; Riverdale, MD 20737; 866-524-5421. A written report of the incident must be submitted identifying: (a) the name of the permit holder (responsible person), (b) the permit number, (c) the country or State of origin of the soil, (d) the nature of the release, and (e) measures already taken to contain, reduce or limit the effects of the accidentally released soil. Any plans prepared to contain, reduce or limit the effects of the accidentally released soil may be submitted as developed.

9. Without prior notice and during reasonable hours, authorized PPQ and/or State regulatory officials shall be allowed to inspect the conditions associated with the regulated soil authorized under this permit.

10. The permit holder must maintain an official permanent work assignment at the address identified on this permit. If the permit holder ceases assignment/affiliation at the address identified on this permit, or personnel circumstances change in any way, then a compliance officer must be notified at the PPQ permit unit immediately (that is, within one business day) by either (a) email to pest.permits@aphis.usda.gov, (b) fax to 301-734-4300 or 8700/5392, or (c) conventional mail to USDA PPQ Permit Unit, 4700 River Road, Riverdale, MD 20737. Should the permit holder depart from the organization/facility, the permit holder must either (a) request cancellation of this permit and comply with all permit-specific termination conditions, (b) apply for and receive a permit to move the soil to a new facility, or (c) relinquish control of the regulated soil to a qualified individual who obtained a permit for the continued use of this regulated soil prior to this permit holder's departure.

11. A copy of this permit must accompany all shipments authorized under this permit.

12. CBP-AI and PPQ have the authority to order and approve treatment, re-exportation or destruction of a shipment, a portion of a shipment or any other material associated with the shipment (i.e. pallets, packaging, and means of conveyance). If an official of CBP-AI or PPQ determines that the shipment requires treatment as a condition of entry, is contaminated with a quarantine plant pest or pests, is commingled with prohibited plant material or the required documentation is incomplete or missing, then that official may order and approve treatment, re-exportation or destruction of a shipment, a portion of a shipment or any other material associated with the shipment (i.e. pallets, packaging, means of conveyance).

13. All solid wood packing material (SWPM) accompanying the shipment must be in compliance with ISPM 15 treatment regulations and IPPC stamp requirements and enforcement. Noncompliant shipments will be treated, re-exported or destroyed at the consignee's expense.

14. All costs and arrangements for safeguarding and transportation of the cargo are the responsibility of the importer, broker or other parties associated with the shipment.

15. All operations must be consistent with information submitted in association with the above listed APHIS-PPQ inspected facility and subject to the conditions below.

16. Soil must be shipped in a securely closed, watertight container (primary container, test tube, vial, etc.) which must be enclosed in a second, durable watertight container (secondary container).

17. The shipment must be free from foreign matter or debris, plants and plant parts including noxious weeds and infestations by other macroorganisms such as insects, Cyst nematodes, mollusks and acari. Authorized material found to be commingled with unauthorized material will be subject to the same action (i.e. re-export, destruction) as unauthorized material.

18. The imported article can be released without treatment at the port of entry to the permittee's address listed on the permit or label or to an authorized user only if the final destination is an approved facility listed at https://web01.aphis.usda.gov/PPQ/AuthSoilLabs.nsf/web?openform.

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19. The soil must not be used in field research or release into the environment before sterilization.

The soil must not be used for isolation or culture of organisms, or for extracting and concentrating organisms from the soil.

The soil must not be used as a growing medium.

20. Further distribution of soil is not allowed without prior approval from Federal officials [State Plant Health Director or designee] (or from Federal officials with State concurrence): Access the website at http://www.aphis.usda.gov/ppq/sphd/ for a list of State Plant Health Offices. Access the website at http://nationalplantboard.org/member/index.html for a list of State Plant Regulatory Officials.

21. While in storage, all soil must be kept locked (e.g. in freezer, cabinet) in the approved lab with access limited to authorized personnel or they will be in a restricted access building that requires a key card entry and access is restricted to authorized personnel only; or it must be in locked room restricted to authorized personnel only.

22. The soil must be handled as quarantined material until sterilized. This will include keeping the soil enclosed in containers when not in use and labeling all containers and/or storage areas: "Quarantine Soil- Sterilize Before Disposal"

23. All packing material, media, substrate, and shipping containers must be sterilized or destroyed as approved and prescribed by the permit conditions after removing the soil.

24. All unconsumed soil, containers and effluent must be autoclaved, incinerated or properly sterilized by the permittee at the conclusion of the project as approved and prescribed by the permit conditions.

25. Any water residues (effluent) from the processing of soil samples must be treated by an approved sterilization procedure such as hydroclave or autoclave.

26. All soil residues must be dry-heated, incinerated, hydroclaved or autoclaved.

Incineration: With the exception of metal and glass containers, all regulated and associated material must be reduced completely to ash at the end of the incineration cycle.

27. Equipment and supplies used to conduct operations or that have contacted the soil must be decontaminated using one of the following methods:

(a) Material can be soaked in a fresh bleach solution of 10 percent (1:10) for at least 30 minutes. (1:10 is a convention that means 1 in 10 or1 part 9 parts = 10 parts total, which is a 10 percent solution)
(b) Material can be soaked in 70 percent ethanol
(c) Flamed with ethanol
(d) Treated with quaternary ammonium compounds.
Note also that autoclaving, hydroclave, incineration, and dry heat sterilization are also acceptable sterilization/decontamination methods.

28. You must attach a PPQ Form 550 Black/White label to the exterior of each shipment being imported under this permit. If you are e-authenticated, you are instructed to request labels using the My shipment/my label option within ePermits at least 7 days in advance. Labels also may be requested by email at: BlackWhiteGreenYellow.labelrequest@aphis.usda.gov. All email requests must come from the permit holder or their authorized contact, if requested by an authorized contact the permit holder must be copied on all requests. You must specify PPQ Form 550 Black/White labels, the specific port(s) of entry and number of labels for each port when requesting labels. The requested labels will be sent to you through a bonded carrier.

29. Underlying packaging/wrapping must carry the address, billing, and any other information required to direct the shipment to its final destination (i.e., the permit holder's address; Please note: USDA APHIS does not defray any additional shipping costs incurred for transiting the shipment through an inspection station as the initial US destination).

END OF PERMIT CONDITIONS

Permit Number P330-13-00350

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APPENDIX K

PROJECT SCHEDULE

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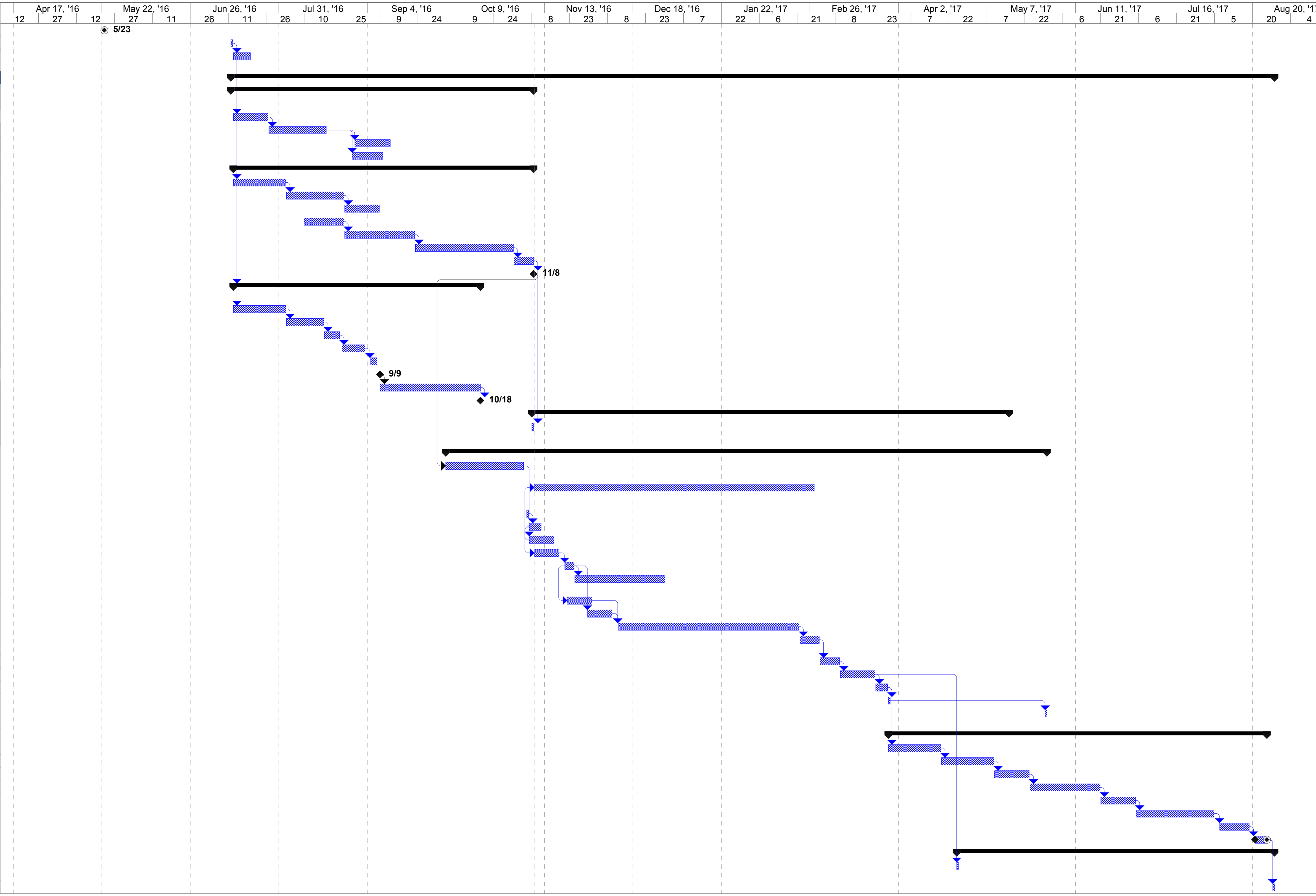
Proposed Schedule
Specific Areas within the Northwest Peninsula
Culebra Island, Puerto Rico

ID	Task Name	Duration	Start	Finish
1	**Base Award**	0 days	Mon 5/23/16	Mon 5/23/16
2	Project Kickoff Conference Call	1 day	Tue 7/12/16	Tue 7/12/16
3	Kickoff Meeting Minutes and Project Schedule	5 days	Wed 7/13/16	Tue 7/19/16
4	**Culebra Island**	**298 days**	**Tue 7/12/16**	**Mon 8/28/17**
5	**Task 1- PMP, MEC-QAPP, and QASP**	**88 days**	**Tue 7/12/16**	**Tue 11/8/16**
6	**PMP and QASP**	**37 days**	**Tue 7/12/16**	**Wed 8/31/16**
7	Draft PMP and QASP	10 days	Wed 7/13/16	Tue 7/26/16
8	USACE Review	17 days	Wed 7/27/16	Thu 8/18/16
9	Final PMP	10 days	Tue 8/30/16	Mon 9/12/16
10	Final QASP (provided by USACE)	10 days	Mon 8/29/16	Fri 9/9/16
11	**MEC-QAPP (FFP)**	**87 days**	**Wed 7/13/16**	**Tue 11/8/16**
12	Draft MEC-QAPP	15 days	Wed 7/13/16	Tue 8/2/16
13	USACE Review	17 days	Wed 8/3/16	Thu 8/25/16
14	Draft Final MEC-QAPP	10 days	Fri 8/26/16	Thu 9/8/16
15	CX Review	12 days	Wed 8/10/16	Thu 8/25/16
16	Draft Final MEC-QAPP	20 days	Fri 8/26/16	Thu 9/22/16
17	Regulator Review (on board)	28 days	Fri 9/23/16	Mon 10/31/16
18	Final MEC-QAPP	7 days	Tue 11/1/16	Tue 11/8/16
19	Approval of Final MEC-QAPP	0 days	Tue 11/8/16	Tue 11/8/16
20	**Task 1a - Optional ESS Amendment**	**70 days**	**Wed 7/13/16**	**Tue 10/18/16**
21	Draft TCRA ESS	15 days	Wed 7/13/16	Tue 8/2/16
22	USACE Review	11 days	Wed 8/3/16	Wed 8/17/16
23	Draft Final TCRA ESS	4 days	Thu 8/18/16	Tue 8/23/16
24	CEHNC-EM-CX Review	7 days	Thu 8/25/16	Fri 9/2/16
25	Final TCRA ESS	3 days	Mon 9/5/16	Wed 9/7/16
26	Interim Approval - USATCES	0 days	Fri 9/9/16	Fri 9/9/16
27	USATCES, DDESB Review	28 days	Fri 9/9/16	Tue 10/18/16
28	Approval of Final TCRA ESS	0 days	Tue 10/18/16	Tue 10/18/16
29	**Task 2, GIS**	**136 days**	**Tue 11/8/16**	**Mon 5/15/17**
30	Pre-Response GIS	1 day	Tue 11/8/16	Tue 11/8/16
31	Post-Response GIS	1 day	Mon 5/15/17	Mon 5/15/17
32	**Task 3, TCRA Field Activities**	**173 days**	**Wed 10/5/16**	**Tue 5/30/17**
33	Task 3a Beach Monitoring (Pre-Intrusive)	24 days	Wed 10/5/16	Fri 11/4/16
34	Task 3a Beach Monitoring	80 days	Wed 11/9/16	Mon 2/27/17
35	**Fieldwork**	**122 days**	**Tue 11/8/16**	**Tue 4/25/17**
36	Mobilization	1 day	Sun 11/6/16	Sun 11/6/16
37	Project Site Setup	5 days	Mon 11/7/16	Fri 11/11/16
38	Vegetation Removal	8 days	Mon 11/7/16	Wed 11/16/16
39	Site Survey	8 days	Wed 11/9/16	Fri 11/18/16
40	Surface Clearance	4 days	Mon 11/21/16	Thu 11/24/16
41	Analog Clearance (Non DGM Areas)	27 days	Fri 11/25/16	Fri 12/30/16
42	IVS & Blind Seeding	8 days	Tue 11/22/16	Thu 12/1/16
43	DGM Survey	8 days	Wed 11/30/16	Fri 12/9/16
44	AC Cueing	52 days	Mon 12/12/16	Tue 2/21/17
45	Reacq and Intrusive Select AC Targets	6 days	Wed 2/22/17	Wed 3/1/17
46	Reacq and Intrusive DGM Targets	6 days	Thu 3/2/17	Thu 3/9/17
47	Reac and Intrusive of AC Targets	10 days	Fri 3/10/17	Thu 3/23/17
48	Site Breakdown	3 days	Fri 3/24/17	Tue 3/28/17
49	Demobilize From the Site	1 day	Wed 3/29/17	Wed 3/29/17
50	TCRA Suburface (Turtle Nest) If Needed	1 day	Tue 5/30/17	Tue 5/30/17
51	**Task 4, TCRA SSF Report**	**108 days**	**Wed 3/29/17**	**Fri 8/25/17**
52	Draft TCRA SSF Report	15 days	Wed 3/29/17	Tue 4/18/17
53	USACE Review	15 days	Wed 4/19/17	Tue 5/9/17
54	Draft Final TCRA SSF Report	10 days	Wed 5/10/17	Tue 5/23/17
55	CX Review	20 days	Wed 5/24/17	Tue 6/20/17
56	Draft Final TCRA SSF Report	10 days	Wed 6/21/17	Tue 7/4/17
57	Regulator Review	23 days	Wed 7/5/17	Fri 8/4/17
58	Final TCRA SSF Report	10 days	Mon 8/7/17	Fri 8/18/17
59	Approval Final TCRA SSF Report	5 days	Mon 8/21/17	Fri 8/25/17
60	**Task 5, Administrative Record**	**90 days**	**Tue 4/25/17**	**Mon 8/28/17**
61	Update Administrative Record / Public Notice	1 day	Tue 4/25/17	Tue 4/25/17
62	Final Administrative Record Update	1 day	Mon 8/28/17	Mon 8/28/17



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Task | Milestone | Summary | Project Summary

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APPENDIX L

VERIFICATION AND VALIDATION PLAN

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APPENDIX L
VERIFICATION AND VALIDATION PLAN

TIME CRITICAL REMOVAL ACTION (TCRA)
SPECIFIC AREAS WITHIN THE NORTHWEST PENINSULA
CULEBRA ISLAND, PUERTO RICO

DERP-FUDS Project No. I02PR006816

Contract No. W912DY-10-D-0023
Task Order No. 0022

Prepared for:

U.S. Army Engineering and Support Center, Huntsville

Prepared by:

HydroGeoLogic, Inc.
11107 Sunset Hills Road, Suite 400
Reston, VA 20190

November 2016

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Introduction

This Advanced Classification Validation Plan has been developed to describe procedures for verifying the classification results of the Time Critical Removal Action (TCRA) at Specific Areas within the Northwest Peninsula (NWP), Culebra, Puerto Rico (PR) under Contract W912DY-10-D-0023, Task Order 0022. The intent is to provide assurance that there are no native target of interest (TOI) classified as non-TOI. The validation process will be performed by selection of a number of 'validation digs' designed to test the assumptions inherent in the classification approach.

This plan is intended to describe the validation rationale and a description of the initial approach. The final number and distribution of validation digs required will be dependent upon a number of factors including but not limited to the details of the classification approach, performance against the quality control (QC) and quality assurance seeds, and the quality of the partial receiver operating characteristic (ROC) curves derived from the intrusive investigations. It is anticipated that this plan will be amended prior to implementation based upon the above factors.

Background

The TCRA has two main components: an initial detection survey, followed by a cued classification survey. The initial detection survey is essentially the first step in classification where potential anomalies are rejected based upon the detection threshold. Once an anomaly is identified, using advanced classification, there are three ways for a target to be classified as a TOI:

1. Match any of the candidate TOI items in the library
2. Be a member of a cluster or group of similar polarizabilities (βs) that are identified as TOI through training digs
3. Have features that are typical of TOI (axial symmetry, thick walled, large)

Because the goal of the validation process is to demonstrate that no TOI were classified as non-TOI, it is instructive to restate the above in terms of how anomalies are classified as non-TOI. From this perspective, anomalies are classified as non-TOI by:

1. The anomaly screening process (anomalies below a response threshold or a size filter threshold are non-TOI)
2. Not matching any of the candidate TOI in the library
3. Not belonging to an identified cluster of anomalies with similar βs that are subsequently found to be TOI
4. Not having βs that indicate the item is large, axially symmetric, and thick walled

The following discussion presents an initial approach to classification validation for each mode of classification (including initial selection), with emphasis on describing what thresholds will be tested and the rationale for these tests. Any validation failures will require a root cause analysis and appropriate corrective action developed and implemented in consultation with the U.S. Army Corps of Engineers.

Anomaly Screening Verification

Anomaly selection will be performed using a traditional 'response amplitude' metric and possibly followed by a size filter for further screening. In conventional EM61 detection surveys the former is the amplitude response of the monostatic, vertically coupled transmit (Tx)/receive (Rx) coil configuration. For cases where 20-mm projectiles are off the table in terms of TOI, it is often additionally advantageous to screen anomaly sizes to prevent lots of unnecessary small nonhazardous metallic objects from making it on the cued target list.

The anomaly selection threshold(s) – i.e. the amplitude response threshold, and possibly the size filter screening threshold – will be established after site specific noise levels have been measured and several days of DGM data have been collected. An evaluation of whether to use a size filter for additional screening along with the details of the determination of the threshold(s) will be reported in the Target Selection Technical Memorandum.

If a size filter is used, 10% (not to exceed 200) of the rejected targets closest to the screening threshold used for the selected detection target list will be re-added to the cued target list to validate that threshold. A validation failure will result if any TOI are found at or shallower than their maximum detection depth when those validation targets are intrusively investigated or if any QC seed items are screened out by the size filter screening threshold.

Library-match Threshold Verification:

Classification will be based primarily on the decision statistic generated by comparing the β values estimated for each surveyed target and the β values in the munitions library developed for the project. The decision statistic indicates the fit correlation between a target and the best fit item in the library, with higher metrics indicating a better fit between the target and the corresponding item in the library.

This library matching process will be performed for each single-solver model and every target model in each of the multi-solver candidate realizations. For each flag position, the highest value decision metric (i.e. most likely TOI) from the combined set of single-solver and multi-solver models will be used as the decision statistic for that position. A stop-dig decision statistic threshold will be established as described in SOP AC-07.

The stop-dig threshold will be verified by intrusively investigating anomalies beyond the threshold. The number of digs required to achieve this confirmation will depend to a large degree on the dig results – particularly the results for anomalies that were ranked just prior to the stop-dig threshold. Ten percent (not to exceed 200) of the anomalies will be investigated beyond the last TOI on the ranked dig list. The 10% (not to exceed 200) will most likely include some anomalies above the stop-dig threshold and some anomalies below the stop-dig threshold. A validation failure will result if any TOI are found at anomalies with decision statistics below the stop-dig threshold.

Non-TOI Validation

In addition to the verification targets investigated as described above, 10% (not to exceed 200) of the anomalies classified as non-TOI across the project site will be selected for validation. Rather than selecting the targets based on ranking on the dig lists, specific targets classified as non-TOI will be chosen by the project team. The method(s) used for selecting the validation targets will be discussed by the project team, but three possible methods of identifying these targets are described below.

Cluster Analysis

Cluster analysis identifies groups of items with similar polarizabilities, with the underlying assumption that within a cluster the items will all be very similar in size, shape and composition. Identified clusters in which most or all items have been classified as non-TOI may represent a group of TOI that were not expected at the site and for which library entries did not exist during the classification process.

Feature Space Analysis

Feature space analysis involves examining the target specific features such as size and decay, which are also involved in cluster analysis. In this case, rather than requiring that a group of items all resemble each other, there may be a single trait specific to a single target classified as non-TOI that suggests it is worth examining. Examples include targets with large sizes or very slow decays that stand out in a size/decay plot but did not match any library examples and were classified as non-TOI.

Random Selection

Validation targets are selected randomly throughout the list of non-TOI. Random selection can be performed using random number generators in programs such as Microsoft Excel that can be used to re-sort the non-TOI target IDs on the ranked dig list, selecting 1 out of every X non-TOI targets on the ranked dig list with X determined based on the total number of non-TOI targets, or simply by picking out non-TOI anomaly IDs while proceeding down the ranked dig list.

For each selected validation target, the data analyst will be required to provide a short rationale for why that target was classified as a non-TOI. Examples of acceptable rationales include, but are not limited to:

- Too small to be TOI
- Decays too quickly to be TOI
- Asymmetric or plate-like (wrong shape)
- Geologic response
- Detection anomaly due to instrument noise

All validation targets will be excavated and the resulting sources, or lack of a source, will be qualitatively compared to the stated rationale for the non-TOI classification. Recovery of a TOI from one of these targets will stop work and require a thorough re-examination of the classification process. A qualitative mismatch between a recovered source and the non-TOI rationale will require a root cause analysis and possible corrective action.

APPENDIX M

EXPLOSIVES MANAGEMENT PLAN

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APPENDIX M
EXPLOSIVES MANAGEMENT PLAN

TIME CRITICAL REMOVAL ACTION (TCRA)
SPECIFIC AREAS WITHIN THE NORTHWEST PENINSULA
CULEBRA ISLAND, PUERTO RICO

DERP-FUDS Project No. I02PR006816

Contract No. W912DY-10-D-0023
Task Order No. 0022

Prepared for:

U.S. Army Engineering and Support Center, Huntsville

Prepared by:

HydroGeoLogic, Inc.
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Reston, VA 20190

November 2016

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LIST OF ACRONYMS AND ABBREVIATIONS

ATF	Alcohol, Tobacco, Firearms and Explosives
BDC	Bomb Data Center
DDESB	Department of Defense Explosives Safety Board
DoD	Department of Defense
DOT	Department of Transportation
ESS	explosive safety submission
HGL	HydroGeoLogic, Inc.
IAW	in accordance with
MEC	munitions and explosives of concern
NEW	net explosive weight
PM	project manager
SOP	standard operating procedure
SUXOS	Senior UXO Supervisor
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer

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1.0 EXPLOSIVES MANAGEMENT PLAN

1.1 GENERAL

1.1.1 This Explosives Management Plan, consistent with Data Item Description WERS-002.01, outlines the procedures that will be used to perform munitions and explosives of concern (MEC) identification and disposal operations at Specific Areas within the Northwest Peninsula, Culebra Island, Puerto Rico. HydroGeoLogic, Inc. (HGL) will acquire all required federal and state permits. Licenses or permits will be posted and available for inspection at the project site location where explosive materials are used. The procedures are in accordance with (IAW) the following:

- Federal Acquisition Regulation 45.5;
- Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) Publication 5400.7;
- Department of Defense (DoD) Manual 6055.9-M;
- Explosive Law for Commonwealth of Puerto Rico;
- Department of Transportation (DOT) regulations; and
- HGL Standard Operating Procedure (SOP) 501.01.1 Explosive Materials Accountability and Management.

1.2 LICENSES/PERMITS

1.2.1 ATF

1.2.1.1 HGL holds an ATF Type 20, manufacturer of explosives, license to purchase and use explosives on project sites. The original license is posted at the HGL munitions response team headquarters in Huntsville, Alabama. A copy of this license will be posted at each project site where explosive materials are stored and used, and will be available for federal, state, or local inspections. Accountability and use of the explosives will remain with HGL unless custody is transferred to the Government or other agency with a current ATF explosives license.

1.2.2 Commonwealth of Puerto Rico

1.2.2.1 The Commonwealth of Puerto Rico requires oversight by a licensed blaster. HGL will comply with the Commonwealth of Puerto Rico explosives regulations and permit requirements. HGL will ensure that the proper blasting permits and licenses are in place prior to any disposal operations.

1.3 ACQUISITION

1.3.1 Order Quantity

1.3.1.1 HGL will order the appropriate amount of demolition explosive materials from an authorized explosives dealer for MEC disposal operations. Explosives will be properly stored and guarded until used IAW procedures described below in Section 1.5. The demolition explosive materials anticipated for use on this project are shown in Table 1.1.

1.3.2 Acquisition Source and Method of Delivery

1.3.2.1 HGL will order explosives from an ATF-licensed explosives dealer. The explosives dealer will be responsible for all permits and documentation required by federal, state, and local regulations for shipment and transportation of explosives. Demolition explosives will be stored on site IAW the Department of Defense Explosives Safety Board (DDESB)-approved explosive safety submission (ESS). Prior to delivery of the demolition explosives, HGL will confirm shipment data including the type, class, and net explosive weight (NEW).

1.3.2.2 Shipments of explosives will be by vessel or by commercial carrier from the explosives dealer. The explosives dealer is responsible for all permits and documentation required by Federal, Commonwealth of Puerto Rico, and local regulations for movement of explosives. HGL will coordinate with the Mayor's Office and the Puerto Rico State Police to receive and transport the explosives to the Type II magazine or to the site identified for the demolition operations. The Senior UXO Supervisor (SUXOS) will be authorized to request and receive explosives from the commercial explosives dealer.

1.3.3 Listing of Proposed Explosives

1.3.3.1 Hazard Classification/Division 1.4 explosives will be used whenever possible because they are safer to handle, easier and less expensive to ship and store, and more readily available. The demolition explosive materials anticipated for use on this project are shown in Table 1.1. Depending on site conditions or availability, alternate donor explosives may be used.

Table 1.1
List of Proposed Explosives

Nomenclature	Description	Estimated Quantity	Hazard Classification
Blasting Cap, Nonel	Zero Delay	25 each	1.4B
Nonel, Lead-In Roll	Shocktube	15,000 feet	1.4B
Cord, Detonating	50- or 100-Grain	800 feet	1.4D
Perforator, Jet, 19-Gram	Shape Charge	50 each	1.4D
Binary Explosives, Liquid	Helix	As Required	Flammable 3 Oxidizer 5.1

1.4 INITIAL RECEIPT

1.4.1 Only those HGL employees listed on the explosives authorization list may sign for receipt of explosives from an explosives dealer. Upon the day of receipt of explosive materials at a project site, the SUXOS will check the lot number or manufacturer's marks, compare the nomenclature/description of each type of explosive item against the explosives dealer delivery manifest, and record this information on HGL Manufacturer of Explosives Record of Acquisition and Magazine Data Card - Daily Summary of Magazine Transactions forms.

1.4.1 Receipt of Explosives

1.4.1.1 The original acquisition receipt documents and explosive usage inventory will be maintained on file by the SUXOS. The Magazine Data Card - Daily Summary of Magazine Transactions form will be kept current and updated upon each delivery, issue, return, and inventory of explosive materials. At the completion of the project, all original explosive materials records will be sent to HGL's Huntsville office, where they will be maintained for a period of 5 years. Copies of these records will be included in the final report.

1.4.2 Reconciling Discrepancies

1.4.2.1 The SUXOS will first inventory explosives received by verifying the lot number/manufacturer's marks, nomenclature/description, and quantity of the items. The SUXOS will reconcile the delivery shipping documentation with the requested amounts ordered and received. Any shortages or overages will be reported to the project manager (PM), who will contact the explosive materials distributor and reconcile any differences. HGL will then notify the explosives dealer and, when required, the ATF to reconcile any discrepancies.

1.5 STORAGE OF DEMOLITION EXPLOSIVES

1.5.1 Explosives storage facilities will be established IAW the DDESB-approved ESS, HGL SOP 501.01.1 Explosive Materials Accountability and Management (Appendix B), and HGL SOP 503.01.1 Explosives Storage Inspection and Security (Appendix B). Strict physical security and safeguarding of explosive materials will be strictly maintained at all times when explosive materials are stored, being delivered, or used. HGL will store the demolition explosive material on site in two Type 2 ATF-approved explosive storage magazines. The magazines physical location is noted in the ESS. HGL will comply with ATF, other federal, and local storage and compatibility criteria and procedures when siting explosives storage magazines, which will include the following:

- Use portable, approved ATF Type 2 explosive storage magazines;
- Maintain the magazine(s) in compliance with the explosive safety quantity distance requirements established by ATFP 5400.7 and DoD Manual 6055.9-M; and
- Install sufficient magazines or a type of magazine with an attached, separate detonator magazine to comply with explosive compatibility requirements, (for example, bulk explosives, initiating explosives).

1.5.2 Magazines will be placed within a chain link fence IAW DoD Manual 5100.76-M and EM 385-1-97. Explosive storage magazine facilities will be inspected every 7 days by the SUXOS, UXO Quality Control Specialist (UXOQCS), or UXO Safety Officer (UXOSO) (or their qualified designee) to ensure the integrity of the enclosure. The SUXOS and UXOQCS will enforce access control and security of all explosives materials used on site.

1.6 TRANSPORTATION

1.6.1 Transportation of explosive materials will comply with all DOT (49 CFR, Parts 171-173), DoD, and local regulations. Even though permits are not required for transporting via public transportation routes the small quantities of 1.4 explosives anticipated to be used on site, the most expeditious route will be used when transporting explosive demolition materials. Blasting caps and high explosives will be transported to the site in day boxes or in appropriate containers meeting federal explosives storage requirements and secured in the bed of a pickup truck. The transporter of the demolition explosives will transport explosives to the site by the least populated and safest route. If required, HGL will request permission from the Mayor's Office to use the local docks or Ferry Dock in the City of Dewey, Culebra. If required, coordination will be made with the Puerto Rico State Police to provide an escort during transport of explosives to or from the magazine to each munitions response site on the island, or to the docks on the island.

1.6.1 Vehicle Safety Requirements

1.6.1.1 Transport Checklist

1.6.1.1.1 Explosives will be transported in closed vehicles whenever possible. The load will be braced and covered (placed in day boxes or in an appropriate container). Minimum requirements for vehicles transporting explosives or UXO/MEC are listed below:

- The vehicles will be inspected using the HGL Motor Vehicle Inspection-Hazardous Materials form.
- If required, the vehicle will be properly placarded per DOT requirements.
- The vehicles will be equipped with a first aid kit, 10-BC fire extinguisher(s), and a means of communication with the UXOSO.
- The engine will be off when loading or unloading explosives.
- The wheels will be chocked during loading and unloading to prevent movement.
- At no time will any bare explosives come into contact with spark-producing metal. Vehicle cargo beds will have wooden or plastic liners, dunnage, or sand bags to protect the explosives from contacting the metal bed and fittings.
- Explosives may be transported in vehicles with plastic bed liners if the explosives are in an authorized or original shipping container.

1.6.1.2 General Precautions

1.6.1.2.1 When transportation of explosives requires travel on public highways, the SUXOS and UXOSO will coordinate to provide the UXO team with a safe transportation route plan (if required). Every effort will be made to take a route with the least public exposure. For transportation of demolition material, HGL will comply with the following:

- Explosives will be placed in an ATF Type 3 magazine (day box) meeting the design specification of ATFP 5400.7, 27 CFR § 555.203(c).
- Initiating explosives, such as blasting caps, will remain separated from other explosives at all times. Blasting caps may be transported in the same vehicle as donor explosives as long as they are in a separate container and secured away from other explosive items.
- Separate ATF Type 3 day boxes will be used to transport blasting caps and donor explosives. The two containers will be placed in the bed of a vehicle, block, and braced separately using ratchet tie-down straps, bolts, or other suitable means to keep the containers from shifting.
- Compatibility requirements will always be observed.
- Only UXO-qualified personnel who have been “cleared” by the ATF will have access and authority to issue explosive materials. The receiving party will sign the receipt documents for accountability.
- Vehicle operators transporting explosives on public roads will be UXO-qualified HGL employees, ATF “cleared,” who possess a valid state driver’s license.
- When transporting 1,000 pounds or less of Compatibility Group 1.4B and 1.4S, 99 pounds or less of Compatibility Group 1.4D (detonating cord explosive content does not exceed 100 grains per linear foot), a commercial driver’s license and vehicle placarding are not required. If the above are not applicable, the driver will have a commercial Class C driver’s license with a hazardous material endorsement when transporting hazardous material on public roads.
- If the above are not applicable, the driver will have a commercial Class C driver’s license with a hazardous material endorsement when transporting hazardous material on public roads. Additionally, the vehicles will be inspected using DoD Form 626.
- Vehicle operators will comply with posted speed limits, but will not exceed a safe and reasonable speed for road/field conditions. Vehicles transporting explosives off road will not exceed 25 miles per hour.
- Personnel will not ride in the cargo compartment of a vehicle transporting explosives.

1.7 RECEIPT PROCEDURES

1.7.1 The SUXOS will strictly control access to all explosives. All issues, turn-ins, and inventories of explosives will be properly documented and verified, through physical count, by the UXOQCS.

1.7.1 Records Management and Accountability

1.7.1.1 Upon receipt, the type, quantity, and lot number of each explosive item will be checked against the manifest. ATF requires HGL to maintain explosives records for commercial purchases for a period of 5 years. Original copies of all explosive material purchases, receipts, issuances, inventories, and usage transaction records will be maintained on site by the SUXOS IAW 27 CFR § 555.13 and will be available for inspection by authorized agencies. Explosive items will be tracked by their respective manufacturer's marks of identification or lot numbers until the items are expended, transferred to Government control, or returned to the original ATF-licensed explosives dealer. Upon completion of project field operations, all original explosives records will be sent to HGL's Huntsville, Alabama, office for archiving throughout the life of HGL's explosives license. Copies of all records will be maintained on site by the SUXOS and be available for inspection by authorized agencies.

1.7.2 Authorized Individuals

1.7.2.1 HGL is required to provide commercial suppliers with documentation of individuals authorized to request and receive explosives. The individual authorized to receive and issue explosives is the SUXOS, and if the SUXOS is not available, an identified and authorized UXO technician or manager. Only those HGL employees who are listed as "cleared" on the current HGL notice of clearance from the Federal Explosive Licensing Center and listed on the authorized agent list will be permitted to purchase and receive explosive materials for a specific project site.

1.7.2.2 Only HGL UXO-qualified employees who have undergone a successful ATF background check IAW 18 U.S. Code § 843(h), as well as 27 CFR §§ 555.33 and 555.45(c), will have direct physical access to purchase, store, and transport explosive materials on HGL project sites. Every HGL employee who is required to handle, transport, or store explosives must clearly understand their responsibilities for properly safeguarding and securing explosive materials.

1.7.3 Certification

1.7.3.1 The SUXOS or Certified Puerto Rico Blaster performing demolition will sign and date the explosives usage record certifying that the explosives were used for their intended purpose.

1.7.4 Procedures for Reconciling Receipt Documents

1.7.4.1 The SUXOS (or their qualified designee) will reconcile the delivery shipping documentation with the requested amounts ordered and received. Any shortages or overages will be reported to the explosives supplier to reconcile any differences.

1.8 INVENTORY

1.8.1 When explosives are received on site and once every 30 days thereafter the SUXOS and UXOQCS (or their qualified designee) will perform a true and accurate physical inventory of all explosive materials stored on site. All inventories will be properly documented on a Magazine Data Card - Daily Summary of Magazine Transactions form. The SUXOS will strictly control access to all explosives and will review all requests for explosives for the site.

1.9 MAGAZINE INSPECTION

1.9.1 The SUXOS and the UXOQCS (or their qualified designee) will be responsible for the explosive storage magazine inspections and security. Explosive storage magazine facilities will be inspected every 7 days to ensure the integrity of the enclosure.

1.9.1 Project Startup Inspection

1.9.1.1 Prior to establishing explosive magazine storage and receiving explosive materials, a joint explosives security survey inspection will be conducted by the SUXOS and UXOQCS using the Explosive Storage and Security Survey Checklist located in HGL SOP 503.01.1 Explosives Storage Inspection and Security. The result of this survey will be documented using the Explosive Storage Magazine Inspection Checklist and in the daily report prepared by the SUXOS.

1.9.2 Seven-Day Inspections

1.9.2.1 Physical inspections will commence upon initial acquisition of explosive materials. The Explosive Storage Magazine Inspection Checklist will be used for conducting and documenting explosive storage inspections. Upon completion of this inspection, the checklist will be signed by the individual conducting the inspection. The SUXOS will also sign the inspection checklist upon completion of his review of this form. This inspection checklist will be maintained with the site's project files. This inspection includes, but is not limited to, the following:

- Explosive storage magazine(s) grounding systems;
- Placards and signage;
- Fire hazards;
- Posting of fire/chemical hazards and safety information;
- Explosive compatibility;
- NEW limits;
- Housekeeping;
- Explosive storage magazine integrity;
- Evidence of forced entry, sabotage, tampering or vandalism;
- Vegetation;
- Magazine lock and key accountability; and
- Display of emergency point of contact information.

1.9.3 Grounding Inspection

1.9.3.1 A local qualified electrician will be contracted to perform grounding installation meeting the lightening protection system criteria of EM 385-1-97. The lightning protective system must be reinspected by the electrician every 2 years.

1.10 REPORTING LOSS OR THEFT OF EXPLOSIVE MATERIALS

1.10.1 If it is confirmed that MEC or explosive materials are missing, the SUXOS will immediately notify the USACE, ATI, and HGL PMs, and each agency identified below in the following order:

1. Local law enforcement authorities;
2. Local ATF office;
3. HGL UXO safety managers;
4. USACE KO. Notification must be immediately by telephone and in writing within 24 hours of the discovery; and
5. ATF U.S. Bomb Data Center (BDC). Notification must be within 24 hours of discovery. Report loss or theft of explosives telephonically using ATF E-Form 5400.5, Report of Theft or Loss-Explosive Materials and the following emergency contact information:

Emergency Contact Information		
Agency	**Telephone Number**	**Hours**
CESAJ PM, Wilberto Cubero	(904) 232-1426	Work hours
USAESCH COR, Rebecca Terry	(256) 895-1788	Work hours
HGL Deputy PM, Scott Schroepfer	(707) 330-6411	Work and After hours
Local Law Enforcement	911	
ATF BDC	(800) 461-8841	Mon-Fri, 8:00 a.m. – 5:00 p.m. EST
	(888) 283-2662	After hours
	(866) 927-4570 (fax)	
HGL Huntsville Office	(256) 970-2103	Mon-Fri, 7:30 a.m. – 4:30 p.m. CST
	(256) 714-5808	After hours

1.10.2 Once all required notifications have been made, the completed Report of Theft or Loss–Explosive Material form (ATF E-Form 5400.5) will be faxed to the BDC ([866] 927-4570).

WARNING:

FAILURE TO REPORT THE THEFT OR LOSS OF ANY EXPLOSIVE MATERIALS MISSING FROM STOCK **WITHIN 24 HOURS** OF DISCOVERY TO THE APPROPRIATE FEDERAL AND LOCAL AUTHORITIES IS A FELONY OFFENSE.

1.11 PROCEDURES FOR RETURN TO STORAGE OF EXPLOSIVES NOT EXPENDED

1.11.1 The SUXOS and demolition supervisor (or their qualified designee) will return unexpended explosives to storage at the end of explosive operations and record the transaction as a return on the appropriate magazine data cards.

1.11.2 Each explosive item will be counted. All containers will be opened and their contents counted. Any discrepancies will be noted. The original receipt document will be adjusted to reflect the returned material and will be signed by the individual returning the explosives and a second authorized HGL UXO technician.

1.12 PROCEDURES FOR DISPOSAL OF REMAINING EXPLOSIVES

1.12.1 ATF requires accurate accounting of all explosive materials purchased and used; therefore, when work is completed or temporarily suspended at a project site, all unused explosives will be either

- Disposed of by detonation; or
- Returned to the ATF-licensed dealer from which the explosives were originally purchased.

1.13 FORMS

1.13.1 The ATI team will use internal forms for explosives receipt, issue, inventory, and vehicle inspections.

APPENDIX N

WASTE MANAGEMENT PLAN

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APPENDIX N
WASTE MANAGEMENT PLAN

TIME CRITICAL REMOVAL ACTION (TCRA)
SPECIFIC AREAS WITHIN THE NORTHWEST PENINSULA
CULEBRA ISLAND, PUERTO RICO

DERP-FUDS Project No. I02PR006816

Contract No. W912DY-10-D-0023
Task Order No. 0022

Prepared for:

U.S. Army Engineering and Support Center, Huntsville

Prepared by:

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November 2016

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1.0 WASTE MANAGEMENT PLAN

1.1 WASTE DISPOSAL

1.1.0.1 All waste generated will be properly characterized and disposed of in accordance with all applicable regulations and through approved channels. It is expected that the only waste generated will be investigation derived waste (IDW) generated as a result of this project.

1.1.1 Nonhazardous Wastes

1.1.1.0.1 Environmental sampling may generate several waste streams requiring disposal. IDW may include personal protective equipment, solid waste, and decontamination water. In addition, scrap metal may be generated as a result of the investigation of metallic geophysical anomalies. Based on the nature of the site and existing data, it is expected that only nonhazardous IDW will be generated during the field sampling event. Nonhazardous IDW such as decontamination fluids from the washing and rinsing of sampling equipment will be collected and properly disposed of. It is expected that solid IDW (for example, rubber gloves and other plastics) will be collected separately in trash bags and disposed of as municipal solid waste.

1.1.2 Hazardous Wastes

1.1.2.0.1 The HGL team does not anticipate generating contaminated or hazardous wastes during the execution of the project; however, if hazardous wastes are generated they will be disposed of in accordance with (IAW) with the procedures described in the following sections.

1.1.2.1 Packaging, Labeling, Storage, and Disposal

1.1.2.1.1 All hazardous materials will be stored in authorized containers and labeled IAW applicable regulations. Any waste generated by the HGL team will be collected, stored, and labeled IAW applicable regulations.

1.1.2.2 Manifesting and Transporting Wastes

1.1.2.2.1 The HGL team does not anticipate there will be any hazardous wastes that will need to be manifested or transported. However, in the unlikely event that hazardous materials and wastes are generated, they will be manifested and transported IAW applicable DOT and EPA regulations. Transportation of all wastes and materials will be conducted IAW applicable DOT regulations, including use of labels, use of placards, and documentation of transportation.

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APPENDIX O

BLIND SEED FIREWALL PLAN

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FINAL

BLIND SEED FIREWALL PLAN

TIME CRITICAL REMOVAL ACTION (TCRA)
SPECIFIC AREAS WITHIN THE NORTHWEST PENINSULA
CULEBRA ISLAND, PUERTO RICO

DERP-FUDS Project No. I02PR006816

Contract No. W912DY-10-D-0023
Task Order No. 0022
HGL Project No. H10022

Prepared for:

U.S. Army Engineering and Support Center, Huntsville

Prepared by:

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1.0 INTRODUCTION

1.1 This Blind Seed Firewall Plan has been developed to describe general procedures for maintaining the confidentiality for the locations of blind quality control (QC) seeds placed for the EM61 detection survey and Metal Mapper 2 X 2 advanced classification survey. Only specific project personnel need to have knowledge and access to the QC seed information in order to ensure the integrity of the data collection, processing, analysis, and classification efforts. During the preparation of the UFP-QAPP the HGL QC Geophysicist and the USACE Technical Representative will agree on the number, type, and spatial distribution of QC seeds.

2.0 QUALITY CONTROL PERSONNEL

2.1 HGL and Parsons personnel involved in data collection, processing/classification and intrusive investigation activities on the project will be prevented from having access to information related to the detailed information for the QC seeds buried at each QC seed location. The information will be provided to them only as needed for post-classification analyses, such as a root-cause analysis, and only after documented permission to share the information has been received from the USACE Technical Representative and/or USACE Project Manager (PM). The following personnel are the only members of the project team who will have access to the detailed QC seed information:

- HGL Unexploded Ordnance Quality Control Specialist (TBD)
- HGL QC Geophysicist (Tim Deignan)
- HGL Field QC Geophysicist (Joshua Defrates)
- HGL Quality Control Manager (Jan Kool)
- USACE Technical Representative (Kelly Enriquez)
- USACE Ordnance and Explosives Safety Specialist (OESS)

3.0 INFORMATION TRANSFER/STORAGE

3.1 The QC seed information will be recorded by the HGL Field QC Geophysicist upon placement of the seeds in the field. Unless permission is received from the USACE Technical Representative and/or USACE PM to share with other members of the project team, information may only be transferred between the individuals identified. The information will be stored on the HGL Denver, Colorado Geophysics Server in a password protected folder that is only accessible by the identified personnel.

4.0 COMMITMENT TO CONFIDENTIALITY

4.1 The personnel identified in this document, or others added with the USACE Technical Representative and/or PM's permission, will be required to provide a letter of confidentiality (either email or hard copy) to comply with the requirements established in this document. This letter of confidentiality will be kept on record by the HGL Quality Control Manager and added to the project files. This letter of confidentiality will be provided to the USACE PM prior to fieldwork.

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APPENDIX P

QUALITY ASSURANCE SURVEILLANCE PLAN

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FINAL
QUALITY ASSURANCE AND SURVEILLANCE PLAN FOR TIME CRITICAL REMOVAL ACTION (TCRA) SPECIFIC AREAS WITHIN THE NORTHWEST PENINSULA CULEBRA ISLAND, PUERTO RICO

CONTRACT NO. W912DY-10-D-0023
TASK ORDER NO. 0022
DERP-FUDS PROJECT NUMBER: I02PR006816

Prepared for

U.S. Army Corps of Engineers

November 2016

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LIST OF ATTACHMENTS

FINAL
QUALITY ASSURANCE SURVEILLANCE PLAN FOR TIME CRITICAL REMOVAL ACTION (TCRA) SPECIFIC AREAS WITHIN THE NORTHWEST PENINSULA CULEBRA ISLAND, PUERTO RICO

1.0 INTRODUCTION

This Performance-Based Quality Assurance Surveillance Plan (QASP) has been developed pursuant to the requirements of the Performance Work Statement (PWS) for Contract No W912DY-10-D-0023-Task Order No. 0022. This plan sets forth procedures and guidelines that the U.S. Army Corps of Engineers (USACE) will use in evaluating the technical and safety performance of the Contractor. A copy of the Performance Metrics is furnished in the PWS so that the Contractor will be aware of the methods that the Government will employ in evaluating their performance on this contract.

2.0 PURPOSE OF THE QASP

The QASP is intended to accomplish the following:

a. Define the roles and responsibilities of participating Government officials;

b. Define the types of work to be performed with required end results;

c. Document the evaluation methods that will be employed by the Government in assessing the Contractor's performance;

d. Provide the Surveillance Activity Checklists and Corrective Action Request (CAR) forms that will be used by the Government in documenting and evaluating the Contractor's performance;

e. Describe the process of performance documentation; and

f. Outline quality assurance procedures to be employed by the Government during performance of this task order to confirm that the site characterization is conducted utilizing proper procedures and in accordance with the approved work and safety plans.

3.0 ROLES AND RESPONSIBILITIES OF PARTICIPATING GOVERNMENT OFFICIALS

The Corps of Engineers Jacksonville District (CESAJ) Project Manager (Wilberto Cubero):

- The CESAJ is responsible for managing all actions associated with the Culebra Formerly Used Defense Sites (FUDS), including projects that are underway and planned in the future.
- Responsible for overall project direction, including technical, contracting and customer-related issues.

- Works closely with the team to ensure that the project is delivered consistent with the appropriate USACE regulation and other relevant FUDS guidelines.
- Responsible for all project resources, budget, and information.
- Reviews vouchers and make recommendations to the Contracting Officer for payment action based on completion of designated milestones.
- Reports problems or discrepancies to the Contracting Officer as soon as possible.
- Responsible for all communications and coordination with stakeholders.
- Provides support in the Right of Entry process.
- Oversees the implementation of the QASP.
- Reviews contractor submittals.
- Schedules and provides labor codes and funding for all surveillance activities with the appropriate USACE Supervisor [ordnance and explosives (OE) Safety Group, Geotechnical Branch, etc.]
- Initiates periodic contractor evaluations in the Contractor Performance Assessment Reporting System (CPARS).

The USACE Contracting Officer's Representative (COR) (Rebecca Terry):

- Responsible for technical administration of the project and assures proper surveillance of HGL's performance.
- Responsible for monitoring, assessing, recording, and reporting on the technical performance of HGL on a day-to-day basis.
- May call upon the technical expertise of other Army officials and subject matter experts (SMEs) as required. These officials/SMEs may be called upon to review technical documents and products generated by HGL.

The USACE Technical Manager (Kelly Longberg):

- Participates in preparation of the statement of work (SOW)/PWS to ensure that Technical requirements are adequately addressed.
- Participates in proposal review.
- Coordinates reviews of contractor submittals for compliance with contract requirements.
- Coordinates reviews of contractor submittals for compliance with Department of Defense (DOD), Department of the Army (DA) and USACE explosives and chemical warfare material (CWM) safety requirements.
- Coordinates Periodic Inspections of contractor compliance with DOD, DA, and USACE explosives and CWM safety requirements and explosives/CWM related procedures described in the Quality Assurance Project Plan (QAPP).

- Conducts or Supports other surveillance activities as required by the project team.
- Supports all on-site quality assurance (QA) activities.
- Develops the final Quality Assurance Report.

The USACE Contract Specialist (Brian N. Ballard):

- Monitors contract performance.
- Maintains central repository for all QA tasks required for payment.
- Issues all acceptance/rejection statements.

The USACE OE Safety Specialist (TBD):

- Participates in preparation of SOW/PWS to ensure that Occupational Health and Safety requirements are adequately addressed.
- Participates in preparation of SOW/PWS to ensure that Explosive Safety guidance requirements are adequately addressed.
- Conducts reviews of contractor submittals for compliance with DOD, DA and USACE explosives safety requirements.
- Performs periodic inspections of contractor compliance with DOD, DA, and USACE explosives safety requirements and explosives-related procedures described in the QAPP.
- Makes unscheduled, periodic site visits as part of the Government surveillance.
- Conducts or Supports other surveillance activities as required by the project team.
- Supports all on-site QA activities.

The USACE Safety Office (TBD):

- Participates in preparation of SOW/PWS to ensure that Safety requirements are adequately addressed.
- Conducts reviews of contractor submittals for compliance with DOD, DA and USACE, and Occupational Safety and Health Administration (OSHA) safety and health requirements.
- Coordinates with USACE team members to perform periodic inspections of contractor compliance with accepted Accident Prevention Plan, engineer manual (EM) 385-1-1, and other DA requirements.
- Makes unscheduled, periodic site visits as part of the Government surveillance.

The USACE Geophysicist (Kelly Enriquez)

- Participates in preparation of SOW/PWS to ensure that Geophysical Investigation requirements are adequately addressed.

- Participates in proposal review to evaluate geophysical tasks.
- Reviews contractor submittals (documents and data) for compliance with contract requirements.
- Coordinates with USACE team members to perform periodic inspections of contractor's compliance with approved plans and performance requirements.
- Reviews Contractor's quality control (QC) documentation to ensure accuracy and final Government acceptance.
- Conducts surveillance activities as described in Attachment A and others as required by the project team.
- Verification of anomaly selection criteria and /or existing site condition assumptions.

The USACE Chemist (Michael D'Auben)

- Participates in preparation of SOW/PWS to ensure that munitions constituents (MC) requirements are adequately addressed.
- Participates in proposal review to evaluate Environmental Sampling and Chemical Analysis tasks.
- Reviews the QAPP for compliance with standard protocols for Environmental Sampling and Chemical Analysis.
- Conducts reviews of Environmental Sampling and Chemical Analysis Data.
- Conducts random site inspections of contractor compliance with environmental sampling requirements of the QAPP. This includes ensuring that the contractor is utilizing appropriate sampling techniques, collecting the quantity of primary and QA/QC samples as stated in the QAPP and completing the chain of custody (COC) correctly with the approved analytical methodology.
- Reviews Quality Control Plan (QCP) reporting requirements and accepts reported QC measures.

The USACE Biologist (Paul DeMarco)

- Assists in the planning and completion of threatened and endangered species avoidance.

The USACE geographic information systems (GIS) team member to be determined (TBD)

- Participates in preparation of SOW/PWS to ensure that GIS requirements are adequately addressed.
- Reviews contractor's Geospatial Information and Electronic submittals.
- Reviews QCP reporting requirements and accepts reported QC measures

The USACE Environmental and Munitions Center of Expertise (EM-CX):

- Reviews Explosives Safety Submission (ESS) and QAPP.
- Provides Direct Reporting Unit (DRU) approval for the ESS.
- Submits ESS to US Army Technical Center for Explosives Safety (USATCES) for review, DA approval, and submission to the DOD Explosives Safety Board (DDESB) for their review and approval.
- Coordinates resolution of USATCES and DDESB comments on ESS.

The USACE Risk Assessor team member (TBD)

- Participates in preparation of SOW/PWS to ensure that risk assessment requirements are adequately addressed.
- Participates in proposal review to evaluate risk assessment-related tasks.
- Participates in technical project planning (TPP) meetings, as appropriate.
- Evaluates screening levels for environmental media
- Reviews the QAPP to ensure that planned effort will support the level of risk assessment intended.
- Conducts reviews of human health and ecological risk assessments.
- Reviews QCP reporting requirements and accepts reported QC measures/standards.
- Reviews reports containing risk assessments, to include decision-making regarding results of risk assessments

4.0 METHODOLOGIES TO BE USED TO MONITOR THE CONTRACTOR'S PERFORMANCE

Even though the Government, through its Contracting Officer Representative (COR), will be monitoring the contractor's performance on a continuing basis, the volume of tasks performed by the contractor makes technical inspections of every task and step impractical. Accordingly, USACE will use the Surveillance Activity Table (Attachment A) as the basis for monitoring the contractor's performance under this contract. The contractor's performance will be evaluated by the Contracting Officer using the Performance Metrics for CPARS provided as in this PWS.

4.1 QUALITY ASSURANCE SURVEILLANCE ACTIVITIES

In general, the work will be evaluated in terms of how well the requirements of the task order are satisfied, the extent to which the work performed follows the approach found in the contractor's technical proposal, clarity of documentation, and timeliness of scheduled task accomplishment. At the discretion of the COR or the Contracting Officer or Specialist, other government officials approved by the Contracting Officer or Specialist may be asked to evaluate a particular deliverable or set of deliverables.

QC documentation must be generated in accordance with (IAW) a documented QCP and the Performance Requirements Tables, as specified in the PWS. All such documentation will be reviewed as part of this QASP. In addition, SOPs will be followed to avoid or minimize impacts to listed species and their designated critical habitat, and species proposed for Endangered Species Act (ESA) listing.

In the event a requirement is not met and the contractor submits the data to the Government, the contractor shall provide rationales for accepting them. All such rationales will be reviewed as part of this QASP. If the rationales are either insufficient or technically unfeasible, or are attempts to justify non-conformances that should be corrected to meet project needs, the submittal(s) will be rejected. Non-conformances identified as part of this QASP will result in the entire lot being returned to the Contractor and require all necessary correction(s) be performed to meet requirements. The Government will issue a CAR to the contractor to document this action.

4.2 QUALITY ASSURANCE FOR TECHNICAL MANAGEMENT

The QA Surveillance Activities for Technical Management are based on the following:

1) Data packages, including all associated QC documentation, e.g. Checklists, QC Checks, Field notes, Daily reports, Field Work Record Forms provided to the Government periodically upon request.
2) Periodic on-site inspections

4.3 QUALITY ASSURANCE FOR GEOPHYSICS

The Quality Assurance Surveillance Activities for Geophysics are based on the following:

1) Data packages, including all associated QC documentation, are submitted to the Government in lots and IAW data item description (DID) Worldwide Environmental Remediation Services (WERS)-004.01. The Contractor shall propose the lot size and criteria for designation (i.e. woods vs. open, global positioning system (GPS) vs Robotic Total Station (RTS) vs line and fiducial, array vs man-portable, etc.) for Government concurrence.
2) Periodic site visits to assess field work compliance with the QAPP.
3) The Government will provide quality assurance reviews of the submitted documents and records listed in Worksheet #29 of the QAPP.
4) Government personnel will bury validation seeds according to the Validation Seed Plan to be developed by the Government.
5) In the event a requirement is not met and the contractor submits the data to the Government, the contractor shall provide rationales for accepting them. All such rationales will be reviewed as part of this QASP. If the rationales are either insufficient or technically unfeasible, or are attempts to justify non-conformances that should be corrected to meet project needs, the submittal(s) will be rejected. Non-conformances

identified as part of this QASP will result in the entire lot being returned to the Contractor and will require all necessary corrections be performed to meet the stated requirements. The Government will issue a CAR to the contractor to document this action.

4.4 QUALITY ASSURANCE FOR GEOSPATIAL DATA

The Quality Assurance Surveillance Activities for Geospatial Data are based on the following:

1) Data packages, including all associated QC documentation, are submitted to the Government in lots and IAW DID WERS-007.01.

4.5 QUALITY ASSURANCE FOR CHEMISTRY

The Quality Assurance Surveillance Activities for Chemistry are based on the following:

1) Data packages, including all associated QC documentation, are submitted to the Government in lots and IAW DID WERS-009.01.
2) Periodic site visits to assess field work compliance with the QAPP.

4.6 QUALITY ASSURANCE FOR ON-SITE SAFETY/OPERATIONS QA

The Quality Assurance Surveillance Activities for On-Site Safety/Operations QA are based on the following:

1) Occupational health and safety guidance
2) Explosive safety guidance
3) On-Site Safety Inspections
4) Review of QC documents retained on site during field activities
5) On-Site operations inspections to assess field work compliance with the QAPP/Accident Prevention Plan (APP).
6) QA checks as requested by the project manager (PM) or government project delivery team (PDT) members

4.7 QUALITY ASSURANCE FOR SAFETY OFFICE/OPERATIONS QA

The Quality Assurance Surveillance Activities for Site Safety/Operations QA are based on the following:

1) Occupational health and safety guidance
2) Periodic site visits to assess field work compliance with the QAPP/ APP.

5.0 QUALITY ASSURANCE REPORTING FORMS

The forms used to document surveillance activities include Daily Quality Assurance Report (Attachment B), U.S. Army Engineering and Support Center, Huntsville (HNC) Form 948, Form 7, Memorandum for Record, and Quality Assurance Forms (Attachment D). Nonconformance will be documented on a CAR, see Attachment C. Non-conformances are documented at the discretion of the person conducting the surveillance activity, but should be fair and reasonable. Each CAR will be annotated as a Critical nonconformance, Major nonconformance, or Minor nonconformance. CARs will be provided to the Contracting Officer for distribution to the contractor. The contractor will be required to correct explosives safety issues immediately. All other CARs will provide a reasonable suspense date for the contractor to review and take appropriate action, usually 15 calendar days. The contractor is required to provide written responses to all CARs.

Completed forms will be consolidated and provided to the Contracting Officer at the end of each month for that month's surveillance activities. These forms, when completed, will document the contractor's compliance with contract requirements and completion of milestone activities. The Contracting Officer will evaluate contractor performance using the definitions contained in the CPARS and the metrics identified in this PWS.

6.0 ATTACHMENTS

Attachment A Surveillance Activity Table (Provided separately)

Attachment B Daily QA Report

Attachment C Corrective Action Request

Attachment D Quality Assurance Forms (Provided separately)

- D-1 Digital Geophysical Mapping Quality Assurance Form (Data Submittal)
- D-2 Digital Geophysical Mapping Quality Assurance Form
- D-3 Digital Geospatial Data/Electronic Submittal Quality Assurance Form
- D-4 Geospatial Quality Assurance Form (Data Submittal)
- D-5 On-Site Safety/Operations QA
- D-6 Chemistry Quality Assurance Form (Data Submittal)
- D-7 Analog Geophysics Quality Assurance Form (Data Submittal)
- D-8 AGC Dynamic Data Quality Assurance Form
- D-9 AGC Cued Data Quality Assurance Form

Attachment E Final Quality Assurance Report.

ATTACHMENT A

SURVEILLANCE ACTIVITY TABLE

Attachment A
Surveillance Activities Table

(1) Definable Feature of Work	(2) Reference	(3) Performance Indicators	(4) Surveillance Method	(5) Performance Documentation & QA Surveillance Record File	(6) Performance Assessment Record (PAR) Category	(7) Responsible QA Team Member
Document Reviews						
UFP-QAPP	PWS	Document submitted and accepted in compliance with contract schedule. Resubmissions required based on amount and nature of government comments regarding Formatting, completeness, Technical Accuracy, Regulatory compliance, Conciseness, Decisions supported by data.	100% review of submitted documents.	Corrective Action Requests (CAR), CEHNC Form 7, Contracting Officer Transmittal Memo; kept in official contract file.	Quality of Product or Service	PDT
Reports/Other Documents	PWS/Worksheet #29 of QAPP					
Project Execution						
QAPP Execution	T.O. (see PWS)	Work done in compliance with approved plans and data submittals accepted by government IAW performance documentation	Periodic Inspection	Corrective Action Requests (CAR), Geophysical QA Forms, GIS QA Forms, Chemistry QA Forms, QAR, HNC 948, Memorandum for Record, Trip Reports; Kept in official project file	Quality of Product or Service	PDT
DFW 1: Site Preparation (Grid Installation and Surface Sweep)	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	Daily QC; periodic QA	QC Results (Daily QC Report) Team Leader Grid Sheet - (MEC/MPPEH Only) (or electronic equivalent), Team Leader Grid Sheet - (MD, range-related debris [RRD], and Other Debris) (or electronic equivalent), Project QC database	Quality of Product or Service	PDT

Attachment A (continued)
Surveillance Activities Table

(1) Definable Feature of Work	(2) Reference	(3) Performance Indicators	(4) Surveillance Method	(5) Performance Documentation & QA Surveillance Record File	(6) Performance Assessment Record (PAR) Category	(7) Responsible QA Team Member
DFW 2: Conduct Validation Seeding, QC Seeding, and Construct IVS	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	100% review of submitted deliverables	Production Area QC Seed Report	Quality of Product or Service	PDT
DFW 3: Assemble and Verify Correct Operation of Geophysical Sensor to Be Used for the Detection Survey (IVS Data Collection)	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	100% review of submitted deliverables	Raw and processed data; IVS Technical Memorandum	Quality of Product or Service	PDT
DFW 4: Conduct Detection Survey	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	Daily QC; periodic QA; 100% review of submitted deliverables	Raw data files, field notes; Access database with dig results	Quality of Product or Service	PDT
DFW 5: Conduct Detection Survey Processing and Target Selection	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	Daily QC; periodic QA; 100% review of submitted deliverables	Weekly QC Report; Processed data files and maps, processing notes, target list; Project QC Database; Target Selection Technical Memorandum	Quality of Product or Service	PDT
DFW 6: Validate Dynamic Survey and Cued Target List	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	Daily QC; periodic QA; 100% review of submitted deliverables	Dynamic Data Usability Assessment	Quality of Product or Service	PDT
DFW 7: Assemble Advanced Geophysical sensor and Test Sensor at IVS	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	100% review of submitted deliverables	Raw and processed data; IVS Technical Memorandum	Quality of Product or Service	PDT

Attachment A (continued)
Surveillance Activities Table

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Definable Feature of Work	**Reference**	**Performance Indicators**	**Surveillance Method**	**Performance Documentation & QA Surveillance Record File**	**Performance Assessment Record (PAR) Category**	**Responsible QA Team Member**
DFW 8: Collect Cued Data	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	Daily QC; periodic QA; 100% review of submitted deliverables	Raw data files, field notes; Project QC Database	Quality of Product or Service	PDT
DFW 9: Conduct Cued Data Processing	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	Daily QC; periodic QA; 100% review of submitted deliverables	Weekly QC Reports Processed data, processing notes, supporting classification images Project QC Database	Quality Of Product or Service	PDT
DFW 10: Classify Anomalies and Make Dig/No-Dig Decisions	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	100% review of submitted deliverables	Access database with training dig results Ranked dig list	Quality Of Product or Service	PDT
DFW 11: Validate Cued Survey and Classification	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	100% review of submitted deliverables	Cued Data Usability Assessment	Quality Of Product or Service	PDT
DFW 12: Intrusive Investigation	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	Daily QC; periodic QA; 100% review of submitted deliverables	Daily QC Report, Weekly QC Report, disposal reports Access database with reacquisition, and dig results	Quality Of Product or Service	PDT
DFW 13: Verify Intrusive Results (Advanced Classification-Review dig results versus predicted results)	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	100% review of submitted deliverables	Comparison results	Quality Of Product or Service	PDT

Attachment A (continued)
Surveillance Activities Table

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Definable Feature of Work	**Reference**	**Performance Indicators**	**Surveillance Method**	**Performance Documentation & QA Surveillance Record File**	**Performance Assessment Record (PAR) Category**	**Responsible QA Team Member**
DFW 14: Conduct Final DUA	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	100% review of submitted deliverables	Final Data Usability Assessment	Quality Of Product or Service	PDT
DFW 15: Analog Removal	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	Daily QC; periodic QA; 100% review of submitted deliverables	QC Results (Daily QC Report)Team Leader Grid Sheet - (MEC/MPPEH Only) (or electronic equivalent), Team Leader Grid Sheet - (MD, RRD, and Other Debris) (or electronic equivalent), Grid Drawing Sheet (or electronic equivalent), Access database with analog removal results, Project QC database	Quality Of Product or Service	PDT
DFW 16: MPPEH/MEC Handling, Certification, and Disposal	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	Daily QC; periodic QA; 100% review of submitted deliverables	Certify/Verify MPPEH as MDAS; Maintain Chain of Custody for MDAS; DD Form 1348-1A; MDAS Disposal Documentation	Quality Of Product or Service	PDT
DFW 17: MC Sampling	QAPP WS #17A and #22A	Work done in compliance with approved QAPP	Analysis of QC/QA samples; 100% review of submitted deliverables	Daily QC Reports Field logbooks Chain-of-Custody forms Air Bills Sample Log-in, Instrument print-out and raw data Laboratory review checklists, PM Checklists, Data Validation Reports	Quality Of Product or Service	PDT

Attachment A (continued)
Surveillance Activities Table

(1) Definable Feature of Work	(2) Reference	(3) Performance Indicators	(4) Surveillance Method	(5) Performance Documentation & QA Surveillance Record File	(6) Performance Assessment Record (PAR) Category	(7) Responsible QA Team Member
Schedule						
Project Management: Schedule Control/Reporting	T.O. /WP{see PWS, list governing documents, reference existing or create checklists etc.}	Number of instances of contractor impacts on schedule attributable to the contractor and impacts not identified.	100% of project status reports including weekly and monthly as applicable.	PM checklist; kept in PM file	Schedule	Government PM
Cost (Not Applicable for Firm Fixed Price)						
Project Management: Cost Control/Reporting	T.O. /WP{see PWS, list governing documents, reference existing or create checklists etc.}	Number of instances of contractor impacts on cost attributable to the contractor and unauthorized cost overruns.	100% of project status reports including weekly and monthly as applicable.	PM checklist; kept in PM file	Cost Control	Government PM
Business Relations						
Meeting preparation and professional conduct	T.O. {see PWS, list governing documents, reference existing or create checklists etc.}	Number of customer/Stakeholder/PDT complaints regarding: 1. Personnel prepared and knowledgeable in areas of expertise. 2. Professional and ethical conduct.	Feedback	Trip report, Email, letters, Stakeholder/customer survey forms; kept in PM file	Business Relations	Government PM/PDT

Attachment A (continued)
Surveillance Activities Table

(1) Definable Feature of Work	(2) Reference	(3) Performance Indicators	(4) Surveillance Method	(5) Performance Documentation & QA Surveillance Record File	(6) Performance Assessment Record (PAR) Category	(7) Responsible QA Team Member
Management of Key Personnel						
Project Management: Personnel	T.O. {see PWS, list governing documents, reference existing or create checklists etc.}	Number of instances regarding contractor Personnel and their qualifications for filling key positions/functions.	Periodic Inspection	Trip report, QARs, CARs HNC 948; kept in official project file	Management of Key Personnel and Resources	PDT
Safety						
Execution of Explosives Management Plan & Explosives Siting Plan	DOD 6055.9-STD, EP 385-1-95, DA Pam 385-64, WP, {see PWS, list governing documents, reference existing or create checklists etc.}	Number and type of violations and/or accidents regarding compliance with explosives safety & OSHA requirements.	Periodic Inspection	QARs, CARs, HNC 948, Trip Reports; Kept in Project Safety Specialist file	Safety	Government Safety Specialist
Other (List other QA as required by T.O. or Guidance						
{LIST ACTIVITY TO BE QA}	{List governing documents}	{List quality required}	{list required Frequency of QC and expected Frequency of QA}	{List QA documents required}	{List Category}	{List Responsible Team or Person}

ATTACHMENT B

DAILY QUALITY ASSURANCE REPORT

ATTACHMENT B
USACE Ordnance and Explosive Project
Daily Quality Assurance Report

CONTRACT WITH DELIVERY ORDER:
CONTRACT NO. W912DY-10-D-0023, TASK ORDER NO. 0022
HydroGeoLogic Inc.

SITE: ____

DATE: ______________ **TELEPHONE NUMBER:** _________________________
FAX NUMBER: ________________________________

WEATHER:

USACE PROJECT TEAM MEMBER & TITLE:
Becky Terry and Wilberto Cubero, USACE Project Manager
Kelly Longberg, USACE Technical Manager
Mike D'Auben, USACE Chemist
Kelly Enriquez, USACE Geophysicist

GRIDS COMPLETED BY CONTRACTOR:

SURVEILLANCE ACTIVITY or ACTIVITIES:

GRIDS THAT PASSED GOVERNMENT QA:

CORRECTIVE ACTION REQUESTS (CAR) and/or Form 948 ISSUED:

CONTRACTOR KEY PERSONNEL ON-SITE:

GENERAL OBSERVATIONS:

LESSONS LEARNED:

DISTRIBUTION:
1-CEHNC-OE-CWM-DC (Project Manager)
1-CEHNC-OE-S (FILE)
1-CEHNC-ED (Project Engineer)
1-CEHNC-CT (Contract Specialist)

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ATTACHMENT C

CORRECTIVE ACTION REQUEST

Attachment C
Corrective Action Request

CORRECTIVE ACTION REQUEST	**NO.** *(1,2,3, etc. for the T.O.)*
USACE Representative: Becky Terry and Wilberto Cubero, USACE Project Manager Date Issued: Issued to: Response Due: (*Based on type of nonconformance*) Contract# and T.O.: W912DY-10-D-0023, TO 0022 Project Name/Location: TCRA Specific Areas within the Northwest Peninsula, Culebra Island, Puerto Rico	
Nonconformance Type (circle one): Critical Major Minor	
Description of Condition Found:	
Contractor Representative Signature (Noting that CAR Received):	
(The Contractor will provide the following information to the Contracting Officer and USACE PM by the "Response Due" date above. Please contact the USACE Representative listed above if you have any questions)	
Actual Cause: (Contractor will investigate and determine cause of condition reported above. Actual cause should be stated as specifically as possible)	
Action Taken to Correct Condition: (Corrective Action should address root cause, not the symptom)	
Action Taken to Prevent Recurrence:	
Action Taken to Monitor Effectiveness of Corrective Action: (Generate data as proof. State the monitoring method put in place and who is responsible for reviewing data.)	
Contractor Representative Signature/Title/Date Signed: (Form must be signed before returning)	
(USACE Project Team Use Only) Review of Corrective Action: 1) Has condition improved? ___ Yes ___ No 2) Additional corrective action required? ___ Yes ___ No Comments: Completed form provided to Contracting Officer: (Date)	

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ATTACHMENT D

QUALITY ASSURANCE FORMS

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DIGITAL GEOPHYSICAL MAPPING QUALITY ASSURANCE FORM *(DATA SUBMITTAL)*

U.S. Army Engineering & Support Center, Huntsville
NWP TCRA, Culebra, PR, HGL
Lot ID:

QA Acceptance: Yes ☐ No ☐
QA Reviewer: ____________
Date: ____________

	Pass	Fail	See Comments	NA
1) Submittal Ontime	☐	☐	☐	☐
2) Submittal Complete (raw/processed data files (mapping & QC), maps, field data sheets, updated Access DB (includes QC results, target selection tables, etc.)	☐	☐	☐	☐
3) Performance Requirements Results: (all results documented & failures have RCAs)				
(a) Static Repeatability	☐	☐	☐	☐
(b) Along Line Measurement Spacing	☐	☐	☐	☐
(c) Speed	☐	☐	☐	☐
(d) Coverage	☐	☐	☐	☐
(e) IVS Dynamic Detection Repeatability	☐	☐	☐	☐
(f) IVS Dynamic Positioning Repeatability	☐	☐	☐	☐
(g) GSV Blind Seed Dynamic Detection Repeatability	☐	☐	☐	☐
(h) GSV Blind Seed Dynamic Positioning Repeatability	☐	☐	☐	☐
(g) Geodetic Equipment Functionality	☐	☐	☐	☐
(h) Geodetic Internal Consistency	☐	☐	☐	☐
(i) Geodetic Accuracy	☐	☐	☐	☐
(j) Geodetic Repeatability	☐	☐	☐	☐
4) Review of Maps/Gridded data (Assess Potential Field) (visual check: background levelling, striping, latency, noise, in particular view seed items for dynamic detection repeatability)	☐	☐	☐	☐
5) Target Selection (following selection criteria for anomaly & dig lists, each single anomaly has one unique ID, cultural features noted/not selected to dig, no gridding artifacts, reporting of anomaly characteristics accurate)	☐	☐	☐	☐
6) Root Cause Analyses/Non-conformances Reported & Accepted	☐	☐	☐	☐
7) Any additional field observations/QA (add notes below)	☐	☐	☐	☐

Quality Assurance Comments:

DIGITAL GEOPHYSICAL MAPPING QUALITY ASSURANCE FORM *(Anomaly Resolution)*

U.S. Army Engineering & Support Center, Huntsville
NWP TCRA, Culebra, PR, HGL
Lot ID:

QA Acceptance: Yes ☐ No ☐
QA Reviewer: ____________
Date: ____________

	Pass	Fail	See Comments	N/A
1) Submittal Ontime/Complete (updated Access Tables) (documentation complete & failures have RCAs)	☐	☐	☐	☐
2) Instrument Checks (static repeatability checks, test strip, GPS functionality)	☐	☐	☐	☐
3) Reacquisition Results (offset within allowable distance, reacquisition amplitude >= 80% original, "No contacts" with original values >x, etc.)	☐	☐	☐	☐
4) Anomaly Resolution (acceptance sampling) (post-dig amplitude < criteria or fully documented rationale)	☐	☐	☐	☐
5) Intrusive Investigation Results (database is consistent and complete)	☐	☐	☐	☐
6) Root Cause Analyses/Non-conformances Reported & Accepted	☐	☐	☐	☐
7) Any additional field observations/QA (add notes below)	☐	☐	☐	☐

Quality Assurance Comments:

Draft DIGITAL GEOSPATIAL DATA/ELECTRONIC SUBMITTAL QUALITY ASSURANCE FORM

U.S. Army Engineering & Support Center, Huntsville
Culebra TCRA, Puerto Rico, USAESCH
Submittal Phase: (Circle One)
Recon SI RI/FS NTCRA NCRA OTHER ESS ESP

Recommend Payment: Yes ☐ No ☐
QA Reviewer: ____________
Date: ____________

	Pass	*Fail*	*See Comments*	*Field Observation*	*N/A*
1) Submittal Ontime/Complete Submittal	☐	☐	☐	☐	☐
2) All required data submittals (feature classes and tables) provided (SDSFIE Data Checker used for features, attributes, and domains)	☐	☐	☐	☐	☐
3) All data submitted geospatially correct and projected within correct coordinate system as per Project Requirements	☐	☐	☐	☐	☐
4) Root Cause Analyses/Non-conformances Reported & Accepted (Insurance that all data sets, digital pictures, and supporting document files are supplied to completely support all finding and conclusions of the Final Report.)	☐	☐	☐	☐	☐
5) Any additional field observations/QA (add notes below)	☐	☐	☐	☐	☐

Quality Assurance Comments:

Draft GEOSPATIAL QUALITY ASSURANCE FORM *(DATA SUBMITTAL)*

U.S. Army Engineering & Support Center, Huntsville
Culebra TCRA, Puerto Rico, USAESCH
Submittal Phase: (Circle One)
Recon SI RI/FS NTCRA NCRA OTHER ESS ESP

Recommend Payment: Yes ☐ No ☐
QA Reviewer: ______________
Date: ______________

	Pass	*Fail*	*See Comments*	*Field Observation*	*N/A*
1) Submittal Ontime	☐	☐	☐	☐	☐
2) Submittal Complete (Are all corresponding sections of the written report, conveyed within the electronic submittal CD/DVD? I.e. field data sheets, digital pictures, chemical data and analysis, GIS Feature Classes, other Report Appendices)	☐	☐	☐	☐	☐
3) Performance Requirements Results (Do all of the supplied GIS files have correct spatial reference? Is Meta Data provided for all data sets created by the Contractor? Do the supplied electronic files, match the Final written report in content and revision? Can the Final Written Report be produced in whole from the electronic submittal?)	☐	☐	☐	☐	☐
4) Geospatial Data (shape file or personal geodatabase) for GIS, MicroStation for CADD, must conform to the SDSFIE for GIS or A/E CADD Standard for CADD.					
(a) Data Format					
i. ASCII text comma delimited file (table with column headings and point data only)	☐	☐	☐	☐	☐
ii. ESRI shape file	☐	☐	☐	☐	☐
iii. ESRI Coverage	☐	☐	☐	☐	☐
iv. ESRI personal geodatabase	☐	☐	☐	☐	☐
v. ESRI SDE geodatabase	☐	☐	☐	☐	☐
vi. MicroStation/AutoCAD	☐	☐	☐	☐	☐
vii. Other (Specify Type): ______________	☐	☐	☐	☐	☐
(b) Horizontal Datum:					
i. WGS 84	☐	☐	☐	☐	☐
ii. NAD 83 (Preferred)	☐	☐	☐	☐	☐
iii. NAD 27	☐	☐	☐	☐	☐
iv. Other (Specify Type): ______________	☐	☐	☐	☐	☐
(c) Vertical Datum:					
i. NAVD 88 (Preferred)	☐	☐	☐	☐	☐
ii. NAVD 29	☐	☐	☐	☐	☐
iii. Other (Specify Type): ______________	☐	☐	☐	☐	☐
(d) Coordinate System/Zone:					
i. State of project Location: _____	☐	☐	☐	☐	☐
ii. State Plane Zone (i.e. East, West, North, South, Number)	☐	☐	☐	☐	☐
iii. UTM Zone No. ___ Circle One: South North	☐	☐	☐	☐	☐
(e) Project:					
i. Geographic	☐	☐	☐	☐	☐
ii. Transverse Mercator	☐	☐	☐	☐	☐
iii. Lambert Conformal Conic	☐	☐	☐	☐	☐
iv. Albers	☐	☐	☐	☐	☐
v. Other (Specify Type): ______________	☐	☐	☐	☐	☐

Draft GEOSPATIAL QUALITY ASSURANCE FORM *(DATA SUBMITTAL)*

U.S. Army Engineering & Support Center, Huntsville
Culebra TCRA, Puerto Rico, USAESCH
Submittal Phase: (Circle One)
Recon SI RI/FS NTCRA NCRA OTHER ESS ESP

Recommend Payment: Yes ☐ No ☐
QA Reviewer: ____________________
Date: ____________________

	Pass	*Fail*	*See Comments*	*Field Observation*	*N/A*
(f) Horizontal Measure:					
i. Feet	☐	☐	☐	☐	☐
ii. Meters	☐	☐	☐	☐	☐
iii. Latitude/Longitude	☐	☐	☐	☐	☐
iv. Other (Specify Type): ____________________	☐	☐	☐	☐	☐
(g) Vertical Measure:					
i. Feet	☐	☐	☐	☐	☐
ii. Meters	☐	☐	☐	☐	☐
iii. Other (Specify Type): ____________________	☐	☐	☐	☐	☐
5) Actual Submittal Date, Contractor, Project Name, and Location, and Phase of Project, shown on CD or DVD of electronic submittal	☐	☐	☐	☐	☐

Quality Assurance Comments:

Draft On-Site Safety/Operations QA
Culebra TCRA, WD12DY-10-D-0023

Audit Date (Start):_______________ Audit Date (End):______________

To include in part or whole, but not limited to the following checkpoints.

CHECKPOINTS:

1. Documentation Requirements	YES	NO	N/A	COMMENTS
a. Notice to Proceed from KO	☐	☐	☐	
b. Approval Letter for Work Plan/SSHP	☐	☐	☐	
c. Approval Letter for UXO Personnel Identified by Name & Position	☐	☐	☐	
d. Approval Letter, FAA (If Required)	☐	☐	☐	
e. Certificate of Grounding, Lightning Protection (if Required)	☐	☐	☐	
f. Explosive Permits/License (If Required)	☐	☐	☐	
g. GFE Transfer Documentation (If Required)	☐	☐	☐	
h. Approval Letter, Public/Personnel Withdraw Distance 1 Frag in 600 sq. ft.	☐	☐	☐	
i. Dig Permits for Utilities (If Required).	☐	☐	☐	
2. Site-Specific Safety & Health Plan (SSHP)	**YES**	**NO**	**N/A**	**COMMENTS**
a. Emergency Notification List Posted & Available	☐	☐	☐	
b. Emergency Routes/Maps Available & Issued to Each Team	☐	☐	☐	
c. Work Task Identified in Hazard Analysis. Approved SSHP	☐	☐	☐	
d. MSDS(s) On-Site. Approved SSHP	☐	☐	☐	
e. Visitors/Safety Briefing Log Current and Updated	☐	☐	☐	
f. All Personnel On-Site in the Proper PPE.	☐	☐	☐	
g. Minimum of Two Personnel On-Site First Aid/CPR Trained, EM 385-1-1, Section 3, Page 19. Paragraph 03.A.02	☐	☐	☐	
h. 16-Unit First Aid Kits or Kits Approved by a Licensed Physician in the Ratio of one for every 25 persons or less. EM 385-1-1, Section 3, Page 19. Paragraph 03.A.03	☐	☐	☐	
3. Technical Management Reference EM 1110-1-4009	**YES**	**NO**	**N/A**	**COMMENTS**
a. Procedures Established for the Discovery of RCWM	☐	☐	☐	
b. Procedures Developed for Discovery of MEC Which Cannot Be Destroyed in Place	☐	☐	☐	
c. Project Grid Size, Layout, Lane Width(5' or Less) Established	☐	☐	☐	
d. Established Procedures for Changed Site Conditions	☐	☐	☐	
e. Organizational chart Current and Indicates Assignment, Duties, Responsibilities to include Geophysical Teams	☐	☐	☐	
f. Procedured for Reporting and Disposition of MPPEH	☐	☐	☐	
g. Procedures Established for Disposal of MEC in Populated/Sensitive Areas	☐	☐	☐	
h. Procedures Established for Managing, reporting, Venting and Disposing of MD and RRD	☐	☐	☐	
i. Additional Task and Procedures being Followed (e.g. PAO, Community Relations, Weekly & Monthly Project Status reports)	☐	☐	☐	
j. Procedured Established for Recording, reporting and implementing Lessons Learned	☐	☐	☐	
k. Limitations Posed and Ability of Detection System(s) Chosen.	☐	☐	☐	
l. Proper use of Geophysical Detections Systems used	☐	☐	☐	
4. Facilities. Reference EM 385-1-1	**YES**	**NO**	**N/A**	**COMMENTS**
a. Adequate Work Space & Facilities (Restrooms etc.)	☐	☐	☐	
b. Good Housekeeping (No Fire Hazards, Tripping Hazards etc.)	☐	☐	☐	
c. Approved and Suitable Containers for Flammable Toxic or Explosive Materials	☐	☐	☐	

d. Approved/Adequate Explosive Storage Facilities	☐	☐	☐	
e. Fire/Emergency Exits Clear & Unbarred	☐	☐	☐	
f. Personnel Limits Maintained	☐	☐	☐	
g. Site Security Adequate	☐	☐	☐	
h. Toilets. EM 385-1-1, Section 2, page 14, Paragraph 02.B Toilets.	☐	☐	☐	
i. Washing Facilities. EM 385-1-1, Section 2, Page 16. Paragraph 02.C Washing Facilities	☐	☐	☐	
j. Safety and health bulletin is posted and is updated (01.A.06) with all requirements	☐	☐	☐	
k. Deficiency log is posted and kept up to date (01.A.06.F)	☐	☐	☐	
l. AHAs are updated as operations/tasks change (should describe current tasks, hazards etc… (01.A.06.d.7 & 01.A.A.13.d)	☐	☐	☐	
5. Equipment. Reference Approved WP/Manufacture Operators Manual	**YES**	**NO**	**N/A**	**COMMENTS**
a. Tools Appropriate and Serviceable	☐	☐	☐	
b. Proper Personnel Protective Equipment (PPE) Present, Serviceable & Utilized	☐	☐	☐	
c. Equipment Calibrated (Last cal Date___________ Next cal Date___________)	☐	☐	☐	
d. Survey Equipment Inspected & Serviceable	☐	☐	☐	
e. Heavy Equipment Inspected & Serviceable IAW EM 385-1-1, Section 16	☐	☐	☐	
1. Are Equipped with at Least One Dry Chemical or CO2 Fire Extinguisher - Minimum rating of 5-BC - IAW EM 385-1-1, Section 16.	☐	☐	☐	
f. Two Separate Means of Communications, Radio(s)/Cell Phone, Land Line(s).	☐	☐	☐	
g. Geophysical Equipment On-Hand & Serviceable	☐	☐	☐	
6. Explosive Storage Requirements. Reference EP 1110-1-18	**YES**	**NO**	**N/A**	**COMMENTS**
a. Proper Storage Containers Type 2 Magazines conforming to standards set forth in Section 55.206 of ATFP 5400.7, ATF Explosives Law and Regulations	☐	☐	☐	
b. Placards. Each magazine will display the placards required by DOT regulations in accordance with DOD 6055.9-STD and DA Pam 385-64 for Hazard division of OE stored in the magazine.	☐	☐	☐	
c. Explosive Compatibility Groups. Segregated into the appropriate hazard divisions criteria listed in Chapter 3, DOD 6055.9-STD.	☐	☐	☐	
d. Physical Security. Contractor shall conduct and document physical security survey, the survey is to determined if fencing or guards are required.	☐	☐	☐	
e. Locks. Shall meet the standards listed in Section 55.208 (a) (4), ATFP 5400.7.	☐	☐	☐	
f. A key control system will be documented in the Work Plan, EP 1110-1-18	☐	☐	☐	
g. Lightning Protection. Magazine constructed of metal that has 3/16 inch steel or longer in accordance with National Fire Protection Association (NFPA) 780.	☐	☐	☐	
h. Lightning Protection. Magazine grounded in accordance with NFPA.	☐	☐	☐	
i. Lightning Protection. Magazine is located at least 6.5 feet from the nearest fence.	☐	☐	☐	
j. Lightning Protection. BRAC, IRP and Active Installation will meet the provisions of DOD 6055.9-STD. Army installations will also meet the provisions of DA Pamphlet 385-64.	☐	☐	☐	
k. Fire Protection. Extinguishers of appropriate size (minimum 10 BC) and type will be located in all explosives storage facilities.	☐	☐	☐	
l. Explosive Limits Maintained, 100 lbs. NEW or less	☐	☐	☐	
m. Waiver. MACOM approval for storage of commercial of explosives on-site (if required).	☐	☐	☐	
7. Explosive Management Plan. Reference Approved WP/49 CFR	**YES**	**NO**	**N/A**	**COMMENTS**
a. Signature Authority On-Hand	☐	☐	☐	
b. Periodic Inventories Conducted On-Schedule	☐	☐	☐	
c. Accountability Records Maintained	☐	☐	☐	
d. Lost/Stolen Reporting Procedures In Place	☐	☐	☐	
e. Final Disposition Procedures Documented	☐	☐	☐	
f. Key Control/Security	☐	☐	☐	

8. Transportation of OE. Reference EP 1110-1-18, Chapter 15/49 CFR	YES	NO	N/A	COMMENTS
a. Hazardous Waste Manifest (EPA Form 8700-22) (if required)	☐	☐	☐	
b. Hazard Classification of OE IAW TB 700-2	☐	☐	☐	
c. Training of Transporting OE IAW 49 CFR, Part 172 & State Applicable State Requirements	☐	☐	☐	
d. Documented Organizational Responsibilities for Transportation of OE	☐	☐	☐	
e. Approved Transportation Plan	☐	☐	☐	
f. Pre-operational Checks of Vehicles Being Conducted	☐	☐	☐	
g. All Operators Licensed For Vehicle	☐	☐	☐	
h. Fire Fighting & First Aid Equipment On Board	☐	☐	☐	
i. Cargo Properly Segregated/Blocked And Braced and in Proper Container	☐	☐	☐	
j. Proper DOT Placards/Fire Fighting Symbols Used	☐	☐	☐	
9. MEC Operational Plan. Reference Approved WP & EP 1110-1-18	**YES**	**NO**	**N/A**	**COMMENTS**
a. Contractor Following Methodology Defined in WP	☐	☐	☐	
1. UXOSO Conducted Physical Check Prior to Sweep Operations	☐	☐	☐	
2. Daily Safety Meeting Conducted by UXOSO/SSHO	☐	☐	☐	
b. Geophysical Detection Magnetometer Used	☐	☐	☐	
1. Pre-Operational Checks Performed Prior to Sweep Operations	☐	☐	☐	
2. Operational Condition Annotated in Log Book	☐	☐	☐	
3. UXO Teams	☐	☐	☐	
4. Quality Control	☐	☐	☐	
5. Quality Assurance	☐	☐	☐	
c. Operational Teams Operating IAW WP	☐	☐	☐	
1. UXO Supervisor Conducted Physical Check Prior to Sweep Operation	☐	☐	☐	
2. Pre-Sweep Operational/Safety Brief Conducted	☐	☐	☐	
3. Individual Sweep Lanes/Transects Marked IAW WP	☐	☐	☐	
4. Contacts Marked & Investigated Properly	☐	☐	☐	
5. Results of Sweep Operation Recorded	☐	☐	☐	
6. All MEC, Inert Items & MD Examined by at Least Two UXO Personnel	☐	☐	☐	
(a.) AEDA (Range Residue) IAW T.O. and Properly Addressed in WP	☐	☐	☐	
7. All MPPEH's Clearly Marked	☐	☐	☐	
d. QC Operations IAW WP	☐	☐	☐	
e. Non-MD Being Collected (as Required)	☐	☐	☐	
f. MD Inspected/Vented/Segregated	☐	☐	☐	
g. Geophysical Test Grids Appropriate and IAW WP	☐	☐	☐	
10. Disposal Operations Planned On-Site IAW the Approved WP and 60A-1-1-31/1-1-22	**YES**	**NO**	**N/A**	**COMMENTS**
a. Disposal Method IAW WP	☐	☐	☐	
b. Adequate Security For Disposal Operation	☐	☐	☐	
c. Disposal Notification List Available	☐	☐	☐	
d. All Necessary Notifications Made	☐	☐	☐	
e. Movement of MEC Items, Or is MEC Consolidation Feasible	☐	☐	☐	
f. Protective Measures/Tamping Being Used/Appropriate for MEC Being Destroyed	☐	☐	☐	
g. Limits of the Exclusion Zone Established and Are All Personnel Aware of Limits	☐	☐	☐	
h. Disposal Procedures	☐	☐	☐	
1. Misfire Procedures Properly Performed (Electric)	☐	☐	☐	
2. Misfire Procedures Properly Performed (Non-Electric)	☐	☐	☐	

11. Quality Control Plan. Reference WP	YES	NO	N/A	COMMENTS
a. QC Operational/Checks Being Conducted IAW WP	☐	☐	☐	
b. QC Grid/Transect Established IAW WP	☐	☐	☐	
c. Results of QC Checks Being Recorded	☐	☐	☐	
d. Pass/Fail Criteria Clearly defined IAW SOW/DID OE-005-05.01	☐	☐	☐	
12. Vegetation Removal Reference WP/SSHP & OSHA Req.	**YES**	**NO**	**N/A**	**COMMENTS**
a. Vegetation Removal & Localized, if Required	☐	☐	☐	
b. Equipment Operated To Prevent Impact With Possible Surface MEC	☐	☐	☐	
c. Cutting Does Not Present Impalement Hazard	☐	☐	☐	
d. UXO Personnel Monitoring Cutting Operation	☐	☐	☐	
e. UXO Discovered Marked/Handled Appropriately	☐	☐	☐	
f. Equipment Being Operated Safely & IAW Equipment Operators Manual/WP	☐	☐	☐	
13. OTHER OCCUPATIONAL HEALTH AND SAFETY CHECKS/EM 385-1-1	**YES**	**NO**	**N/A**	**COMMENTS**
a. Training. Verify that all training has been conducted for new employees.	☐	☐	☐	
b. Safety and Health Inspections. Ensure that inspections are being conducted in accordance with section 7 of the APP. SSHO daily safety inspections, and he will document all deficiencies and corrective actions in a written log	☐ ☐	☐ ☐	☐ ☐	
c. PPE. Verify that the proper PPE is being worn, that it is stored properly and that all workers have been training and medically clear to wear the PPE. Verify that the workers know what the canister change out schedule is for their Level C respirator. (APP D-11-1)	☐	☐	☐	
d. Hazardous material storage. Verify that all hazardous material is being stored properly. All flammable material are in an appropriate flammable storage locker, all cylinders are being stored IAW Section 20 of EM 385-1-1 and that the contractor has an up to date hazardous material inventory per 06.B of EM 385-1-1.	☐	☐	☐	
e. Motor vehicles, machinery and mechanized equipment. Ensure equipment has all the required safety devises to include seat belts, backup alarm, horn, headlights and tail lights, fire extinguishers etc and that the equipment is being inspected per section 18 of the EM.	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	

Draft CHEMISTRY QUALITY ASSURANCE FORM (DATA SUBMITTAL)

U.S. Army Engineering & Support Center, Huntsville
Culebra TCRA, Puerto Rico, USAESCH
Lot ID:

Recommend Payment: Yes ☐ No ☐
QA Reviewer: ____________
Date: ____________

	Pass	*Fail*	*See Comments*	*Field Observation*	*N/A*
1) Submittal Ontime	☐	☐	☐	☐	☐
2) Submittal Complete (Electronic Data Deliverables, Daily Quality Control Reports, ERIS Data Uploaded to Database, Data Validation Report, Chemistry related project communication)	☐	☐	☐	☐	☐
3) Daily Quality Control Reports					
a) Submittal on-time (daily during field work)	☐	☐	☐	☐	☐
b) Sampling effort in agreement with approved Work Plan.	☐	☐	☐	☐	☐
c) Any deviation from approved work plan documented	☐	☐	☐	☐	☐
d) Required attachments included (sample tables, COC, additional environmental sampling related project forms)	☐	☐	☐	☐	☐
4) Electronic Data Deliverables (Project Specific library file, DTD file, SEDD stage 2A or 2B XML file, Post-review file, Annotated error log)					
a) Library and Laboratory data correspond	☐	☐	☐	☐	☐
b) Error Reports in agreement	☐	☐	☐	☐	☐
c) Post validation files in agreement with flagged data	☐	☐	☐	☐	☐
5) ERIS Data (Data Upload accurate and complete)	☐	☐	☐	☐	☐
6) Data Validation Report					
a) Validation Report addresses all data packages	☐	☐	☐	☐	☐
b) Identifies analytical problems	☐	☐	☐	☐	☐
c) Identifies Impact on Data Usability	☐	☐	☐	☐	☐
7) Chemistry Related Project Communication (holding times/temperature exceedances, lost or damaged samples, other chemistry related issues)	☐	☐	☐	☐	☐

Quality Assurance Comments:

ANALOG GEOPHYSICS QUALITY ASSURANCE FORM *(DATA SUBMITTAL)*

U.S. Army Engineering & Support Center, Huntsville
NWP TCRA, Culebra, PR, HGL
Lot ID:

QA Acceptance: Yes ☐ No ☐
QA Reviewer: ____________
Date: ____________

	Pass	Fail	See Comments	N/A
1) Submittals Ontime (Data submitted periodically throughout the progression of field work)	☐	☐	☐	☐
2) Submittal Complete (field data sheets, updated Access DB (includes QC results, dig results, etc.))	☐	☐	☐	☐
3) Performance Requirements Results: (all results documented & failures have RCAs)				
(a) Repeatability (Instrument Functionality)	☐	☐	☐	☐
(b) Dynamic Repeatability	☐	☐	☐	☐
(c) Coverage, Detection and Recovery	☐	☐	☐	☐
(d) Anomaly Resolution	☐	☐	☐	☐
(e) Geodetic Equipment Functionality	☐	☐	☐	☐
(f) Geodetic Accuracy	☐	☐	☐	☐
(g) Geodetic Repeatability	☐	☐	☐	☐
5) Intrusive Investigation Results (database is consistent and complete)	☐	☐	☐	☐
6) Root Cause Analyses/Non-conformances Reported & Accepted	☐	☐	☐	☐
7) Any additional field observations/QA (add notes below)	☐	☐	☐	☐

Quality Assurance Comments:

AGC DYNAMIC DATA QUALITY ASSURANCE FORM

U.S. Army Engineering & Support Center, Huntsville
NWP TCRA, Culebra, PR, HGL
Lot ID:

Recommend Acceptance: Yes ☐ No ☐
QA Reviewer: ____________________
Date: ____________________

	Pass	*Fail*	*See Comments*	*Field Observation*	*N/A*
1) Submittal Ontime (per QAPP Table 14.1 & SOPs)	☐	☐	☐	☐	☐
2) Submittal Complete (per QAPP Table 14.1 & SOPs) (SOP Checklists, Daily/Weekly QC reports, processed data files, maps, processing notes, target list, field notes, surface sweep memo, updated Access DB)	☐	☐	☐	☐	☐
3) Measurement Performance Criteria Results (QAPP WS #12 & 22)					
(a) all results documented & failures have RCAs	☐	☐	☐	☐	☐
(b) Instrument Function Test repeatable (25%)	☐	☐	☐	☐	☐
(c) IVS amplitude & position repeatable (25%, 25cm)	☐	☐	☐	☐	☐
(d) In-line measurment spacing (<=25cm)	☐	☐	☐	☐	☐
(e) Coverage (<=0.75m cross track)	☐	☐	☐	☐	☐
(f) All seeds detected (<=40cm)	☐	☐	☐	☐	☐
(g) Current >=5A	☐	☐	☐	☐	☐
(h) Valid position data (GPS/RTS fix)	☐	☐	☐	☐	☐
(i) Valid position Data (IMU data valid)	☐	☐	☐	☐	☐
4) Target Selection (Target selection Memo provided, following selection criteria, each single anomaly has one unique ID, cultural features noted/not selected to dig)	☐	☐	☐	☐	☐
7) Root Cause Analyses/Non-conformances Reported & Accepted	☐	☐	☐	☐	☐
8) Any additional field observations/QA (add notes below)	☐	☐	☐	☐	☐

Quality Assurance Comments:

AGC CUED DATA QUALITY ASSURANCE FORM

U.S. Army Engineering & Support Center, Huntsville
NWP TCRA, Culebra, PR, HGL
Lot ID:

Recommend Acceptance: Yes ☐ No ☐
QA Reviewer: ____________
Date: ____________

	Pass	*Fail*	*See Comments*	*Field Observation*	*N/A*
1) Submittal Ontime (per QAPP Table 14.1 & SOPs)	☐	☐	☐	☐	☐
2) Submittal Complete (per QAPP Table 14.1 & SOPs) (SOP Checklists, Daily/Weekly QC reports, processed data, plots, field notes, updated Access DB; ranked dig list)	☐	☐	☐	☐	☐
3) Measurement Performance Criteria Results (QAPP WS #12 & 22)					
(a) All results documented & failures have RCAs	☐	☐	☐	☐	☐
(b) Instrument Function Test repeatable (25%)	☐	☐	☐	☐	☐
(c) IVS library match repeatable (0.9)	☐	☐	☐	☐	☐
(d) IVS position offset (<=.25m)	☐	☐	☐	☐	☐
(e) IVS background decays acceptable	☐	☐	☐	☐	☐
(f) Backgrounds acceptable	☐	☐	☐	☐	☐
(f) All seeds classified as dig (<=30cm XY offset< <25cm Z)	☐	☐	☐	☐	☐
(g) Predicted size estimates qualitatively match seed size	☐	☐	☐	☐	☐
(h) Current between 5.5-9	☐	☐	☐	☐	☐
(i) Inversion model supports classification (fitCoh >0.8)	☐	☐	☐	☐	☐
(j) Inversion model supports classification (fitXY<0.4 from sensor)	☐	☐	☐	☐	☐
5) Root Cause Analyses/Non-conformances Reported & Accepted	☐	☐	☐	☐	☐
6) Any additional field observations/QA (add notes below)	☐	☐	☐	☐	☐

Quality Assurance Comments:

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ATTACHMENT E

FINAL QUALITY ASSURANCE REPORT OUTLINE

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ATTACHMENT E

FINAL QUALITY ASSURANCE REPORT OUTLINE
FOR THE
TIME CRITICAL REMOVAL ACTION
SPECIFIC AREAS WITHIN THE NORTHWESTERN PENINSULA
CULEBRA ISLAND, PUERTO RICO

CONTRACT NO. W912DY-10-D-0023
TASK ORDER NO. 0022

1. Describe QA methods used (or reference where they are documented) and pass/fail criteria.

2. Summarize field QA activities performed and describe any special conditions encountered or special circumstances.

3. Describe any constraints or problems encountered.

4. Summarize data quality assurance activities performed and describe any special conditions encountered or special circumstances.

5. Provide list of all CEHNC 948s issued for QA failures and describe corrective actions taken.

6. List/describe lessons learned.

7. Include a final statement that contract requirements were met regarding quality of services provided.

8. Signature of Project Engineer preparing the report.

9. List supporting data/references and where they are filed.

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APPENDIX Q

DATA MANAGEMENT AND VALIDATION

APPENDIX Q
DATA MANAGEMENT AND VALIDATION

1.0 INTRODUCTION

Following sample collection and analysis, the data must be reviewed, reported, and validated. The procedures described in this appendix are conducted to ensure that the data were collected and obtained in accordance with this quality assurance project plan (QAPP), the applicable guidance documents, and good practices. The overall goal is to ensure that the data quality requirements of the project are met.

2.0 LABORATORY DATA MANAGEMENT REQUIREMENTS

The project laboratories are responsible for providing complete and correct data to HydroGeoLogic, Inc. (HGL) for all requested analyses. The QAPP addresses the project-specific requirements for analyses in Worksheets #12, #15, #24, and #28. Following analysis of the samples, the laboratory will perform a series of steps in order to deliver an acceptable final data report to HGL.

2.1 DATA REDUCTION

Data reduction is the process for collecting and transforming measurements, through mathematical and statistical formulas, into final reportable measurements. The calculations may be performed manually or electronically. Data reduction is performed by the analyst and consists of calculating concentrations in samples from the raw data. The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings, and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values. Calculations and data reduction steps for various methods are summarized in the respective laboratory standard operating procedures (SOPs) (see Attachment D) or program requirements.

Copies of all raw data and the calculations used to generate the final results, such as bound laboratory notebooks, strip-charts, chromatograms, spreadsheets, and computer record files, are retained on file as specified in this QAPP. Should HGL determine that the laboratory's data reduction processes require an in-depth review, these calculations and the associated raw data will be provided to HGL on request.

2.2 DATA REVIEW

Data review is performed to assess whether the quality control (QC) requirements are met. Project laboratories will perform data review on 100 percent of the data deliverables. No data may be released to HGL without the appropriate analyst and supervisory review performed and documented.

The individual analyst continually reviews the quality of data through evaluating the results of calibration checks, QC samples, and performance evaluation samples. The analyst performs data review during, immediately following, and after the completed analysis. The laboratory supervisor, analyst, or data specialist performs a secondary review of the data. The data reviewer is trained by the quality assurance (QA) manager or section leader to perform the data review.

The analytical laboratory data reviewer who has the initial responsibility for the correctness and completeness of the data will conduct the first level of review, which may contain multiple sublevels of all project related data. Data reduction, QA review, and reporting by the laboratory will be completed as follows:

- Raw data produced by the analyst are processed and reviewed for attainment of QC criteria as outlined in the SOPs, laboratory QA manual, and established U.S. Environmental Protection Agency (EPA) methods, as well as for overall reasonableness. These general QC criteria are modified by the requirements of this QAPP and the *U.S. Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories* (QSM), version 5.0.
- After entry into the laboratory information management system (LIMS), a computerized report is generated and sent to the laboratory data reviewer.
- The data reviewer will decide whether any sample reanalysis is required.
- Upon acceptance of the preliminary reports by the data reviewer, final reports will be generated.

The laboratory data reviewer will evaluate the quality of the work based on an established set of laboratory guidelines. This person will review the data package to ensure the following:

- Sample preparation information is correct and complete,
- Analysis information is correct and complete,
- The appropriate SOPs have been followed,
- Analytical results are correct and complete,
- QC samples are within project-specific control limits, and
- Special sample preparation and analytical requirements have been met.

Documentation is complete when all anomalies in the preparation and analysis have been documented.

The laboratory will perform the in-house analytical data reduction and QA review under the direction of the laboratory QA director. The laboratory program administrator (PA) is responsible for assessing data quality and advising the project manager of any data that were rated “preliminary” or “unacceptable,” or other notations that would caution the data user of possible unreliability.

2.3 LABORATORY DOCUMENTATION

Analytical reports transmit final results, methods of analysis, levels of reporting, associated QC data, and method performance data. The laboratory will submit the data report for each sample delivery group using a reporting format that presents the information required to support a Stage 4 validation as described in *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA, 2009). Each data report will include summary pages, full data including raw data, instrument printouts, and manually completed log sheets. In addition, issues affecting the analytical process will be noted in the case narrative included in each report. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two or three significant figures.

Data are normally reported in units commonly used for the analyses performed. Concentrations in liquids are expressed in terms of weight or activity per unit volume (e.g., micrograms per liter [µg/L] or milligrams per liter [mg/L]). Concentrations in solid or semisolid matrices are expressed in terms of weight or activity per unit weight of sample (e.g., micrograms per kilogram [µg/kg] or milligrams per kilogram [mg/kg]). Solid and semisolid matrices will also be reported on a dry weight basis. The sample-specific sensitivity limits (detection limits [DLs], limits of detection [LODs], and limits of quantitation [LOQs]) are reported adjusted for subsample size and percent moisture, as well as all appropriate concentration, dilution, and extraction factors.

If any analytical anomalies are encountered during the analyses (e.g., an out-of-control matrix duplicate), it will be documented in a case narrative and copies of the sample discrepancy reports or corrective action reports must be included in the laboratory data reports.

2.4 LABORATORY RECORD-KEEPING

At a minimum, the project laboratories will retain all data related to sample preparation, analysis, and general observations in appropriate hardbound laboratory notebooks or files. Laboratory notebook pages must be reviewed, signed, and dated by the author and receive an independent secondary review by a peer or supervisor who signs/initials and dates the data pages.

Corrections to notebook entries are made by drawing a single line through the erroneous entry and writing the correct entry next to the one that is crossed out. All corrections are initialed and dated by the individual performing the correction.

After delivering acceptable hard copy and/or electronic data deliverables, the laboratory will store the original project data for at least 5 years unless otherwise specified in the subcontract agreement.

2.5 LABORATORY ACCREDITATION

Project analytical data will be produced by the Lancaster, Pennsylvania, facility of Eurofins Lancaster Laboratories, Inc.

2.5.1 Department of Defense Requirements

This project requires that the analytical data be generated by a laboratory that has been accredited under the DoD Environmental Laboratory Accreditation Program (ELAP). This accreditation involves the successful completion of an on-site audit by an auditing firm contracted by the DoD and the evaluation of performance evaluation sample results. Project laboratories required to maintain current DoD ELAP accreditation for all analyses, matrices, and analytes applicable to this project throughout the duration of this work.

2.5.2 Commonwealth Requirements

The Puerto Rico Department of Natural and Environmental Resources does not currently maintain an accreditation program for laboratories analyzing environmental samples. Should such a program be implemented during this project, Lancaster will be required to take all steps necessary to implement compliance.

2.5.3 Other Assessment and Audit Tasks

No subcontractor laboratory technical system audits are planned for this project; however, an audit may be performed at any time during this program at HGL's discretion or at client direction. In the event that laboratory performance does not meet QAPP requirements and/or significant data quality issues arise, HGL reserves the right to perform additional system/project audits at any time throughout the program.

3.0 SUBCONTRACTOR DATA MANAGEMENT REQUIREMENTS

Upon receipt of a laboratory data package and the associated electronic data deliverables (EDD), HGL will perform data management tasks required to ensure that all analyses were performed in accordance with project requirements. The data management requirements include conducting data verification, data evaluation, and data validation to determine the usability of the data for the original project objectives. Data verification, data evaluation, and data validation are each separate levels of review that can be performed by themselves or in conjunction with each other. Evaluation activities will be documented in the QA reports listed in Worksheet #33 and will be used to assess the usability of project data in levels of detail ranging from an analyte- and sample-specific basis to the overall data set for the sampling event (see Attachment B).

3.1 DATA VERIFICATION

Initially, laboratory deliverables are received at HGL in both .pdf (laboratory data report) and EDD formats, as discussed previously. HGL will perform data verification on every report submitted by a laboratory. Upon receipt of the laboratory deliverables, a data management staff member will perform the following actions:

- The deliverable will be inspected to verify that results were received for each requested analysis for each sample. If a result is missing, the staff member will determine whether the laboratory submitted a deficiency report that accounts for the missing data.
- The data deliverable will be inspected for completeness based on the requirements specified in this plan. Inspection will verify only that all required report elements are present, not that the data within the report are complete.

3.2 ELECTRONIC DATA VERIFICATION

The EDDs will be compared to the pdf version of the laboratory data report by the HGL data management coordinator. HGL will perform this review on 10 percent of the electronic data results. If a discrepancy is identified, the laboratory will be required to correct the error.

3.3 DATA EVALUATION

Data evaluation is performed to assess whether the QC requirements for field duplicates, laboratory duplicates, equipment blanks, surrogates, matrix spikes (MSs)/matrix spike duplicates (MSDs), percent solids, method blanks, and laboratory control samples (LCSs) were met. Data evaluation will be performed on 100 percent of the laboratory deliverables generated during this program. This data evaluation procedure will be performed in conjunction with the data validation performed on each data report and described below.

3.4 DATA VALIDATION

Data validation is a systematic process to ensure that all chemical analytical information meet uniform requirements and to determine that the usability and defensibility of the data are adequate for their intended use. Validation of analytical results will be performed by a Parsons chemist and another Parsons chemist will perform peer review of each data validation report. All applicable analytical data packages will be validated to ensure compliance with specified analytical, QA/QC requirements, data reduction procedures, data reporting requirements, and required accuracy, precision, and completeness criteria. Each validation report will be subject to peer review. Once finalized, each report will be transmitted to HGL.

Data validation will be performed on 100 percent of the results for environmental samples. Validation will consist of a review of those elements that compose a Stage 4 data validation as described in *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA, 2009). This level of data validation corresponds to Level 4 data validation described in SOP CHEM-01 in Appendix I; however, the EPA guidance document provides recommendations for minimum levels of review, and where SOP CHEM-01 provides additional guidelines not provided in the EPA document, such as evaluation of manual integration, the SOP guidance should be incorporated into the validation process.

The data will be validated against the acceptance criteria presented in Appendices B and C of the QSM, version 5.0 and other applicable guidance. Data validation guidelines are presented below in Table Q.1, and data qualifiers are defined in Table Q.2. The data validation guidelines are based on the requirements of the QSM, version 5.0, and the analytical methods. The qualification requirements and data qualifiers are based on the EPA National Functional Guidelines for data review. These guidelines were developed for the review of data generated using Contract Laboratory Program analytical methods, and the qualification guidelines presented in Table Q.1 have been modified to accommodate differences between Contract Laboratory Program method requirements and the method requirements presented in the SW-846 methods and the QSM.

Upon completion, the data validator will provide a data validation report and will provide an annotated EDD that contains all final data result qualifiers. These data qualifiers will then be uploaded into the project database.

Table Q.1
Data Qualification Guidelines

Control Parameter	Exceedance of Control Limits	Qualification of Detected Results[1]	Qualification of Nondetected Results[2]	Associated Results
Compliance of sample receipt condition checks (Stage 1 QC Elements)				
Sample temperature	Evidence of frozen samples	J	UJ	All method results in affected sample or cooler
	Temperature > 6 °C	J−	UJ	All method results in affected sample or cooler
	Temperature > 12 °C	J−	R	All method results in affected sample or cooler
Sample condition	Issues noted by field team, sample receipt department, or analyst	Validator judgment	Validator judgment	All method results in affected sample
Analytical documentation (see Worksheet #35B)	Discrepancies noted by validator	Validator judgment	Validator judgment	All method results in affected sample
Completeness and compliance checks of batch- and sample-related QC (Stage 2A QC Elements)				
Holding time	Holding time exceeded	J−	UJ	All method results in affected sample
	Holding time exceeded maximum allowed holding time by greater than a factor of 2	J−	R	All method results in affected sample
Analyte quantitation	Analyte concentration ≥ DL but < LOQ	J	Not applicable	Affected results in sample
	Analyte concentration above calibrated range, no corresponding diluted result	J	Not applicable	Affected results in sample
Method (preparation) blanks	Analyte detected ≥ DL in blank: Multiply by 5 to obtain artifact threshold [3]	Results below artifact threshold: U	Not applicable	Affected analyte results in preparation batch
Surrogate recovery	recovery > UCL LCL > recovery ≥ 10% recovery < 10%	J+ J− J−	Not applicable UJ R	All method results in affected sample[4]
LCS recovery	recovery > UCL LCL > recovery ≥ ME recovery < ME	J+ J− J−	Not applicable UJ R	Affected analyte results in the preparation batch
LCS/LCSD RPD	RPD > CL	J	Not applicable	Affected analyte results in the preparation batch
MS/MSD [5]	recovery > UCL LCL > recovery Precision > CL	J+ J− J	Not applicable UJ Not applicable	Parent sample only; evaluate applicability to other samples

Table Q.1 (Continued)
Data Qualification Guidelines

Control Parameter	Exceedance of Control Limits	Qualification of Detected Results[1]	Qualification of Nondetected Results[2]	Associated Results
Field duplicate RPD	RPD > CL and both sample and duplicate results ≥5x LOQ	J	NA	Parent and duplicate samples only
	Result difference ≥LOQ and either sample or duplicate result <5x LOQ or nondetect[7]	J	Not applicable (lower result is a detect) or UJ (lower result is a nondetect)	Parent and duplicate samples only
Completeness and compliance checks of instrument-related QC (Stage 2B QC Elements)				
Initial calibration linearity	Method-specific criteria (Worksheet #24)	J	UJ	Affected analyte results associated with the initial calibration
ICV (second source) performance	Method-specific criteria (Worksheet #24)	J	UJ	Affected analyte results associated with the initial calibration or analytical sequence
CCV %D	Method-specific criteria (Worksheet #24)	J	UJ	Affected analyte results associated with the continuing calibration
Detected analyte retention time	Criteria not met (Worksheets #12 and #24)	Validator judgment	Not applicable	Affected target analytes in affected samples
Confirmation	RPD >40%	J	Not applicable	Affected target analytes in affected samples
	Result not confirmed	Validator judgment	Not applicable	Affected target analytes in affected samples
Recalculation and transcription checks of reported results (Stage 3 Review Elements)				
Calculation and transcription verification; performed on 10% of sample and QC results	Errors or inconstancies noted	Validator judgment	Validator judgment	Results associated with the error; also notify HGL Project Manager or Project Chemist
Evaluation of raw instrument outputs against method requirements (Stage 4 Review Elements)				
Evaluation and verification of instrument outputs against method requirements; performed on 10% of raw data	Errors or inconstancies noted	Validator judgment	Validator judgment	Results associated with the error; also notify HGL Project Manager or Project Chemist

Table Q.1 (Continued)
Data Qualification Guidelines

Control Parameter	Exceedance of Control Limits	Qualification of Detected Results[1]	Qualification of Nondetected Results[2]	Associated Results
Manual integrations documented and technically justifiable; performed on 100% of manual integrations	Errors or inconstancies noted	Validator judgment	Validator judgment	
Standards traceability; performed on 100% of standards	Errors or inconstancies noted	Validator judgment	Validator judgment	

Table Q.1 (Continued)
Data Qualification Guidelines

Control Parameter	Exceedance of Control Limits	Qualification of Detected Results[1]	Qualification of Nondetected Results[2]	Associated Results
Other validator actions				
Multiple results reported for an analyte in a single sample/method combination due to multiple dilution levels or reanalysis due to QC issue	NA; the validator will review the available data and associated QC results and determine the "best" data point for each analyte reported for each sample	X	X	Applied to all results not selected as the "best" data point.
General data review	QC element not performed	Validator judgment	Validator judgment	Results associated with missing QC element

Notes:
[1] The priority of qualifiers for detected results is: X > R > J > J+ or J− > no qualifier.
[2] The priority of qualifiers for nondetected results is: X > R > UJ > U.
[3] The artifact threshold derived from method (preparation) blank contamination should be adjusted on a sample-specific basis to account for dilution and subsample size.
[4] If surrogate recoveries are added prior to dilution and have been diluted out (>5x dilution), no qualification is required.
[5] MS/MSD and post-digestion spike results for an analyte are not considered applicable if the concentration in the parent sample is >4x the spike concentration.
[6] If the spiked sample or duplicate is not considered represented of the analytical batch, only the parent sample is qualified.
[7] When comparing the results of a duplicate pair which consists of a detected result and a nondetected result, the numerical value of the nondetected result should be considered to be the LOQ. Two results below the LOQ or a result below the LOQ and a nondetection are always considered to be in control.

CCV = continuing calibration verification
CL = control limit
%D = percent difference
DL = detection limit
ICB = initial calibration blank
ICV = initial calibration verification
LCL = lower control limit
LOD = limit of detection
LOQ = limit of quantitation
LCS = laboratory control samples
LCSD = laboratory control sample duplicate
MS = matrix spike
MSD = matrix spike duplicate
QC = quality control
RPD = relative percent difference
%RSD = percent relative standard deviation
UCL = upper control limit

Table Q.2
Data Qualifier Definitions

Qualifier	Definition
No qualifier	Confirmed identification. The analyte was positively identified at the reported concentration. The reported concentration is within the calibrated range of the instrument and the result is not affected by any deficiencies in the associated QC criteria.
J	The analyte was detected; the quantitation is an estimate.
J+	The analyte was detected; the quantitation is an estimate and may be biased high.
J−	The analyte was detected; the quantitation is an estimate and may be biased low.
R	The result is rejected because of serious deficiencies in the ability to analyze the sample and meet QC criteria. Following the data validation process, this result must be evaluated during the data usability evaluation to determine if R is the appropriate final qualifier (see Appendix B, Section 3.3). Data that retain the R qualifier after usability assessment will be reported without an associated numerical value.
U	Not detected. The associated numerical value indicates the analyte DL. When applied to a result considered to be an artifact, the associated numerical value is the detected concentration prior to qualification.
UJ	Not detected. The associated numerical value may be inaccurate due to associated QC discrepancies.
X	Excluded. The data point is associated with reanalyses or diluted analyses and is excluded because another result has been selected as the definitive result for the analyte.

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