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FINAL SAMPLING AND ANALYSIS PLAN FOR MUNITIONS AND EXPLOSIVES OF CONCERN SUPPLEMENTAL REMEDIAL INVESTIGATION AT OPERABLE UNIT 5 (OU 5) SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA WITH TRANSMITTAL LETTER NAS CECIL FIELD FL

04/28/2011

TETRA TECH NUS

TETRA TECH

PITT-04-11-065

April 28, 2011

Project 112G02267

BRAC PMO SE
Attn: Mr. Art Sanford
4130 Faber Place Drive
North Charleston, South Carolina 29405

Reference: CLEAN Contract No. N62470-08-D-1001
Contract Task Order JM09

Subject: Final Sampling and Analysis Plan
Supplemental MEC RI at OU5, Site 15 [Blue 10 Ordnance Disposal Area]
Naval Air Station Cecil Field
Jacksonville, Florida

Dear Mr. Sanford:

Enclosed please find the final Sampling and Analysis Plan (SAP) for Munitions and Explosives of Concern (MEC) Supplemental Remedial Investigation (RI) at OU5, Site 15 [Blue 10 Ordnance Disposal Area]. Also enclosed are responses to U.S. EPA comments on the draft version of the subject document and FDEP acceptance of the document without revision letter. Copies have been sent to the members of the NAS Cecil Field Partnering Team as identified below.

Field work is anticipated to begin May 23, 2011. If you have any questions, please call Linda Klink at 412-921-8650 or me at 412-921-8163.

Sincerely,

Robert F. Simcik, P.E.
Project Manager

RFS/clm

Enclosure

cc: D. Vaughn-Wright, U.S. EPA (electronic copy)
D. Grabka, FDEP (1 copy)
M. Davidson, BRAC PMO SE (electronic copy)
M. Halil, CH2MHill (electronic copy)
L. Klink, Tetra Tech NUS (1 copy)
J. Trepanowski, Tetra Tech NUS (cover letter only)
S. Currie, Tetra Tech NUS File JM09 (1 copy unbound)
B. Capito, NAVFAC Mid-Atlantic (cover letter only)

Tetra Tech NUS, Inc.
661 Andersen Drive, Pittsburgh, PA 15220-2745
Tel 412.921.7090 Fax 412.921.4040 www.ttnus.com

RESPONSE TO EPA COMMENTS DATED MARCH 1, 2011
DRAFT SAMPLING AND ANALYSIS PLAN DATED JANUARY 2011
FOR MUNITIONS RESPONSE PROGRAM MEC SUPPLEMENTAL REMEDIAL INVESTIGATION AT OPERABLE UNIT 5, SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA
NAS CECIL FIELD, JACKSONVILLE, FLORIDA

General Comment

Comment: The document is well written and follows the UFP QAPP format.

Response: Comment acknowledged.

Minor Comments

1. **Comment:** Worksheet #3 – for all documents EPA requests a hard copy for the draft. However, any draft final and final versions may be electronic.

   Response: Instructions noted. Worksheet #3 has been updated to indicate that the EPA will receive a hard copy for the draft version only and electronic copy for all versions of the project documents.

2. **Comment:** Worksheet #7 – Please list Art Sanford's employer. I thought he worked for a Navy contractor.

   Response: Art Sanford is formally the Remedial Project Manager (RPM) for the Navy, affiliated with the Base Realignment and Closure (BRAC) Program Management Office (PMO) Southeast (SE). Art Sanford's organization has been clarified throughout the SAP as BRAC PMO SE as necessary. Note that Art Sanford is a Navy contractor and employed by SGIS whose parent company is Salient Federal Solutions.

3. **Comment:** Worksheet #9 – Under Consensus Decisions, NOSSA will review the ESS document. EPA understands that this is an internal document but we would like to be kept informed of any issues raised by NOSSA.

   Response: The ESS document was reviewed by NOSSA concurrent with regulatory review of the SAP. NOSSA comments on the ESS were largely editorial, although a few comments have resulted in corresponding changes to the SAP as follows:

   - Section 17.2 - Paragraph 1 and 2 now read as follows:
     "The Tetra Tech Technical Lead must designate the personnel authorized and qualified to inspect MPPEH and document its explosives safety status as either MDAS or MDEH in writing ~~to the Commanding Officer (CO)~~ *by the BRAC PMO SE Director* ~~of the cognizant Facilities Engineering Command (FEC)~~.

     Persons certifying and verifying MDAS or MDEH will be designated in writing by the ~~NAVFAC CO~~ *BRAC PMO SE Director* as qualified and certified to do so. In the event that HTRW is encountered on site, the work site will be evacuated until

the Tetra Tech CLEAN HSM, with the concurrence of the Navy RPM, identifies and implements appropriate protective measures."

- Worksheet 20 - Soil, Detector-aided surface survey – step-out transects, QC survey Requirements – To make the use of blind seed more straightforward when conducting UXO detector-aided surface survey on step-out transects, the blind seed frequency will be per step-out transect vs. per day and so Worksheet 20 now reads as follows:

  "At least one blind seed item ~~and no more than six~~ will be placed *on each step-out transect to verify operator and instrument performance.* ~~in each estimated daily lot of work."~~

In addition, since the draft SAP was submitted, Tetra Tech has developed a new standard operating procedure (SOP), SOP 08 (UXO Documentation), and existing SOPs and field forms have had minor editorial revisions/streamlining and have replaced the original forms from the draft version provided in Appendix B and C. These revised SOPs and associated field forms supersede those in the Draft SAP.

4. **Comment:** Worksheet #10 – EPA understands that no soil sampling is planned for this effort at this time. However, as was discussed during the February BCT meeting, there could be situations where a soil sample would be needed after MEC removal. Please explain under what situations soil sampling may be needed.

   Response: The Navy does not anticipate any conditions that would require additional soil sampling at this time, but as discussed at the February BCT meeting, the option of collecting a soil sample will be kept open in the event something unexpected is identified. As identified in Meeting Minutes 2661, soil sampling conducted in conjunction with a blow-in-place (BIP) detonation might occur, but at this time we are not aware of any munitions that would require us to collect soil samples purely based on their presence. No change to the document text is required at this time.

Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard Jr.
Secretary

April 15, 2011

BRAC PMO SE
Attn: Mr. Art Sanford
4130 Faber Place Drive
Suite 202
North Charleston, SC 29405

RE: Draft Sampling and Analysis Plan (SAP) for Munitions Response Program MEC Supplemental Remedial Investigation at Operable Unit 5, Site 15 – Blue 10 Ordnance Disposal Area, Naval Air Station Cecil Field, Jacksonville, Florida.

Dear Mr. Sanford:

I have completed my review of the Draft Sampling and Analysis Plan (SAP) for Munitions Response Program MEC Supplemental Remedial Investigation at Operable Unit 5, Site 15 – Blue 10 Ordnance Disposal Area, Naval Air Station Cecil Field, dated January 2011 (received January 13, 2011), prepared and submitted by Tetra Tech NUS, Inc. The Draft SAP adequately describes the supplemental investigation to be performed to address remaining data gaps regarding MEC and MPPEH. I have signed Worksheet #4 and have attached a copy of it to this letter.

If you have any concerns regarding this letter, please contact me at (850) 245-8997.

Sincerely,

David P. Grabka

David P. Grabka, P.G.
Remedial Project Manager

CC: Tim Bahr, FDEP
John Flowe, City of Jacksonville
Rob Simcik, TtNUS, Pittsburgh
Mike Halil, CH2M Hill, Jacksonville
Mike Fitzsimmons, FDEP, Northeast District

JJC JJC ESN ESN

SAP Worksheet No. 4 -- Project Personnel Sign-Off Sheet

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

1. In the case of regulatory agency personnel with oversight authority, approval letters or e-mails will constitute verification that applicable sections of the SAP have been reviewed. Copies of regulatory agency approval letters/e-mails will be retained in the project files and are listed in Worksheet No. 29 as project records.

2. E-mails will be sent to Navy and Tetra Tech project personnel who will be requested to verify by e-mail that they have read the applicable SAP/sections and the date on which they were reviewed. Copies of the verification e-mails will be included in the project files as identified in Worksheet No. 29.

A copy of the signed Worksheet No. 4 will be retained in the project files and is identified as a project document in Worksheet No. 29.

Name	Organization/Title/Role	Telephone Number (optional)	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Navy and Regulator Project Team Personnel					
Art Sanford	Navy/RPM/ Manages project activities for Navy	843.743.2135	See Worksheet No. 1 for signature	All	
Debbie Vaughn-Wright	USEPA/RPM/ Provides USEPA regulator input	404.562.8544		All	
David Grabka	FDEP/RPM/ Provides State regulator input	850.245.8997	David P. Grabka	All	4/15/11
Michael Green	NAVFAC/MRP Senior Technical Advisor/ Reviews SAP and QA documentation for Navy	757.322.8108	See Worksheet No. 1 for signature	All	

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62470-08-D-1001

Sampling and Analysis Plan
for
Munitions Response Program MEC Supplemental Remedial Investigation
at
Operable Unit 5, Site 15 - Blue 10 Ordnance Disposal Area

Naval Air Station Cecil Field
Jacksonville, Florida

Contract Task Order JM09

April 2011

BRAC Program Management Office Southeast
4130 Faber Place Drive, Suite 202
North Charleston, South Carolina 29405

TETRA TECH NUS, Inc.

SAP Worksheet No. 1 -- Title and Approval Page

SAMPLING AND ANALYSIS PLAN FOR MUNITIONS RESPONSE PROGRAM MEC SUPPLEMENTAL REMEDIAL INVESTIGATION AT OPERABLE UNIT 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA

April 2011

Prepared for:
BRAC Program Management Office Southeast
4130 Faber Place Drive, Suite 202
North Charleston, South Carolina 29405

Prepared by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406

Prepared under:
Comprehensive Long-Term Environmental Action Navy Contract
No. N62470-08-D-1001
Contract Task Order JM09

Review Signatures:

Linda Klink
Technical Lead
Tetra Tech NUS, Inc.
Linda Klink

Dr. Thomas Johnston
Quality Assurance Manager
Tetra Tech NUS, Inc.
T.E. Johnston 4-27-11

Robert Simcik
Project Manager, Base Coordinator
Tetra Tech NUS, Inc.

Approval Signatures:

Art Sanford
Navy Remedial Project Manager
BRAC PMO SE
Arthur Sanford

Michael Green
MRP Senior Technical Advisor
NAVFAC LANT
(see attached)

SAP Worksheet No. 1 -- Title and Approval Page

DRAFT
SAMPLING AND ANALYSIS PLAN
FOR
MUNITIONS RESPONSE PROGRAM
MEC SUPPLEMENTAL REMEDIAL INVESTIGATION AT
OPERABLE UNIT 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

January 2011

Prepared for:
BRAC Program Management Office Southeast
4130 Faber Place Drive, Suite 202
North Charleston, South Carolina 29405

Prepared by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406

Prepared under:
Comprehensive Long-Term Environmental Action Navy Contract
No. N62470-08-D-1001
Contract Task Order JM09

Review Signatures:

Linda Klink
Technical Lead
Tetra Tech NUS, Inc.

Dr. Thomas Johnston
Quality Assurance Manager
Tetra Tech NUS, Inc.
1-11-11

Robert Simcik
Project Manager, Base Coordinator
Tetra Tech NUS, Inc.

Approval Signatures:

Art Sanford
Navy Remedial Project Manager
BRAC PMO SE

Michael Green
MRP Senior Technical Advisor
NAVFAC LANT
GREEN.MICHAEL.DAVID.1042977876
Digitally signed by GREEN.MICHAEL.DAVID.1042977876
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=GREEN.MICHAEL.DAVID.1042977876
Date: 2011.03.09 09:55:05 -05'00'

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ACRONYMS

APP	Accident Prevention Plan
BATFE	Bureau of Alcohol, Tobacco, and Firearms and Explosives
BCT	BRAC Cleanup Team
BEC	BRAC Environmental Coordinator
bgs	Below ground surface
BIP	Blow-in-place
BRAC	Base Realignment and Closure
CEHNC-CX-MM	Military Munitions Division of the EM CX
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Contaminant of Concern
CSM	Conceptual Site Model
CTO	Contract Task Order
CWM	Chemical Warfare Material
DDESB	Department of Defense Explosive Safety Board
DERP	Defense Environmental Restoration Program
DGM	Digital geophysical mapping
DID	Data Item Description
DMM	Discarded Military Munitions
DoD	Department of Defense
DQO	Data quality objective
DRMO	Defense Reutilization and Marketing Office
EM	Engineering Manual
EM CX	Environmental and Munitions Center of Expertise
EOD	Explosive Ordnance Disposal
ESQD	Explosive Safety Quantity Distance
ESS	Explosives Safety Submission
ESTCP	Environmental Security Technology Certification Program
EZ	Exclusion Zone
FCREPA	Florida Committee on Rare and Endangered Plants and Animals
FDEP	Florida Department of Environmental Protection
FEC	Facilities Engineering Command
FFA	Federal Facility Agreement

FS	Feasibility Study
FTMR	Field Task Modification Request
GIS	Geographic Information System
GPO	Geophysical prove-out
GPS	Global Positioning System
GSV	Geophysical System Verification
HASP	Health and Safety Plan
HDOP	Horizontal Dilution of Precision
HE	High Explosive
HFD	Hazardous Fragmentation Distance
HSM	Health and Safety Manager
HTRW	Hazardous, Toxic, and Radiological Waste
ISO	Industry Standard Object
IVS	Instrument Verification Strip
JEDC	Jacksonville Economic Development Commission
LANT	Atlantic
LUC	Land Use Control
MC	Munitions Constituents
MD	Munitions Debris
MDAS	Material Documented as Safe
MDEH	Material Documented as an Explosive Hazard
MEC	Munitions and Explosives of Concern
MFD	Maximum Fragmentation Distance
MGFD	Munitions with the Greatest Fragmentation Distance
mm	Millimeter
MPPEH	Material Potentially Presenting an Explosive Hazard
MRP	Munitions Response Program
MRS	Munitions Response Site
NA	Not Applicable
NAD	North American Datum
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
NAVSEA	Naval Sea System Command
NEW	Net Explosive Weight
NIRIS	Naval Installation Restoration Information Solution
NOSSA	Naval Ordnance Safety and Security Activity

NOSSAINST	NOSSA Instruction
NPL	National Priorities List
NTR	Navy Technical Representative
OP	Operations Pamphlet
OPNAVINST	Naval Operations Instruction
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PA	Preliminary Assessment
PAH	Polynuclear Aromatic Hydrocarbon
PDF	Portable Document Format
PM	Project Manager
PMO	Program Management Office
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAC	Remedial Action Contractor
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SCG	Storage Compatibility Group
SE	Southeast
SI	Site Inspection
SMP	Site Management Plan
SOP	Standard Operating Procedure
SSO	Site Safety Officer
SUXOS	Senior UXO Officer Supervisor
TBD	To Be Determined
Tetra Tech	Tetra Tech NUS, Inc.
TP	Target Practice
TRPH	Total Recoverable Petroleum Hydrocarbons
Tetra Tech	Tetra Tech NUS, Inc.
UFP	Uniform Federal Policy
µg/L	Micrograms per Liter

USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
VSP	Visual Sample Plan
YWWA	Yellow Water Weapons Area

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (Tetra Tech) has prepared this Sampling and Analysis Plan (SAP) for Munitions and Explosives of Concern (MEC) Supplemental Remedial Investigation (RI) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62470-08-D-1001, Contract Task Order (CTO) JM09. This plan has been prepared to supplement the RI at Munitions Response Site (MRS) Operable Unit (OU) 5, Site 15-Blue 10 Ordnance Disposal Area, which is located at the former Naval Air Station (NAS) Cecil Field, Jacksonville, Florida.

The Navy conducted various testing, training, and disposal activities related to military munitions at NAS Cecil Field, which was established in 1941 and provided facilities, services, and material support for the operation and maintenance of Naval weapons, aircraft, and other units of operation forces as designated by the Chief of Naval Operations. MEC is present at Site 15 resulting from these activities. The term MEC includes Discarded Military Munitions (DMM), Unexploded Ordnance (UXO), and Munitions Constituents (MC) in high enough concentrations to pose an explosive hazard. MC is any material originating from UXO, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) to address MC and MEC at closed and other than operational ranges. The DoD is following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process for the investigation and remediation of these sites. The Navy is responsible for implementing the Munitions Response Program (MRP) at NAS Cecil Field.

Site 15 is approximately 1,000 feet by 2,400 feet in size and was used as a skeet range and trap range from the early 1940s to the mid-1950s. Ordnance was disposed of at Site 15 from the mid-1960s through 1977, and disposal consisted of burning of ordnance materials in a large metal chamber and static firing of rockets. The majority of ordnance disposed of at the site was burned and included small arms munitions up to 20 millimeters (mm) in size, parachute and distress flares, Mark IV signal cartridges, rocket igniters, cartridge-activated devices, and 2.75-inch and 5-inch rockets. Rocket propellant also was reportedly placed on the ground and ignited in the area of the burn chamber. Rockets were disposed of by static firing of both 2.75-inch and 5-inch rockets from a firing pad located south of the burn chamber. An estimated 2.5 tons of ordnance were disposed of at the site each month; overall, an estimated 350 tons of ordnance was disposed of while the site was in operation.

Since the closure of NAS Cecil Field in September 1999, most of the facility has been transferred to the Jacksonville Port Authority (now Jacksonville Aviation Authority) and the City of Jacksonville. According

to the reuse plan, the facility will have multiple uses but will be used primarily for aviation-related activities. NAS Cecil Field is subject to the Base Realignment and Closure (BRAC) Law of 1993.

A Record of Decision (ROD) for OU 5, Site 15, was signed in June 2008 documenting selection of a remedy to address chemical contamination at Site 15. Remedial activities were conducted in 2008 and 2009 and included soil excavation, on-site solidification/stabilization, and off-site treatment and disposal of chemically contaminated soil to allow low-intensity recreational reuse of the site. A Land Use Control (LUC) Remedial Design (RD), prepared in 2009, provides specifications to limit land use to low-intensity recreational activities consistent with the property's proposed reuse as a natural resource corridor. Chemical contamination at Site 15 has been addressed through this remedy. For safety purposes during remedial activities, a munitions survey was conducted at Site 15 in and around the soil excavation areas, and MEC and munitions debris (MD) were found and removed from excavation areas before the soil was excavated. Note that the MD terminology in effect at the time of the remediation has since been replaced with material documented as safe (MDAS). Based on the occurrence of MEC and munitions-related debris in the surveyed areas, it was determined that MEC and MDAS (formerly MD) are likely present in areas that were not surveyed as part of the remedial action for the chemically contaminated soil.

In April and May 2010, practicing UXO avoidance, further investigation of MEC/MPPEH using widely spaced transects was conducted at Site 15 in support of an RI for MEC/MMPEH. Both the ground surface and shallow subsurface (0 to 1 foot below ground surface [bgs]) were investigated using detector-aided survey techniques. The MEC RI concluded that Site 15 still contains MPPEH on the ground surface and MEC may be present outside of the former Ordnance Disposal Area where multiple MPPEH items were identified at the surface and MEC was removed from the surface/subsurface during 2008-2009 remedial activities (depicted by pink grid squares on Figure ES-1). Furthermore, for the subsurface, the anomaly distribution was defined but the sources/types of the anomalies could not be determined since intrusive investigation was not included in the scope of work. The three remaining data gap areas of concern for the subsurface based on the MEC RI include the following:

- **Bike Path/Asphalt Access Road** - The area within approximately 100 feet of the paved bike path and asphalt access road has a high density of subsurface anomalies (depicted by red transects on Figure ES-1) that based on the conceptual site model (CSM) may be the result of using this area for staging munitions-related material prior to disposal. In addition, this area is expected to be a high traffic area based on the planned future land use. Therefore, confirmation of the sources of the anomalies was recommended.

- **High-Density Areas Outside of the Ordnance Disposal Area** - The high density subsurface anomaly areas located in the northeastern and southeastern portions of the site (depicted by red transects on Figure ES-1) are located outside of the Ordnance Disposal Area. These areas are near MPPEH (anticipated to be MDAS) that was found on the surface and may indicate currently unidentified subsurface source areas such as pits or disposal areas. Therefore, confirmation of the source of anomalies was recommended.

- **Existing RI Grid Boundary –** Based on the CSM, anomalies located along the 2010 RI extent of the transect investigation (depicted largely by blue and green transects on Figure ES-1) are expected to be non-MEC/MPPEH related because of the distance from the Ordnance Disposal Area where MEC/MPPEH was historically encountered. Therefore, confirmation of the absence of MEC/MPPEH was recommended.

MEC found during the 2008-2009 remedial areas was within and adjacent to the Ordnance Disposal Area; therefore this primary area of MEC concern will be included in a Feasibility Study (FS) to evaluate remedial alternatives. MEC/MPPEH found during the 2008-2009 remediation activities and 2010 RI provides adequate information concerning MEC/MPPEH on the ground surface for the FS to evaluate remedial alternatives. MEC and material documented as explosive hazard (MDEH) in the areas between transects investigated during the RI are presumed to be a concern for recreational users at the site on the ground surface; the MEC/MPPEH density in these areas will be estimated in the FS based on the information gathered to date. The FS will consider information resulting from the 2008-2009 remediation activities, the RI, and the subject Supplemental RI in developing alternatives.

This supplemental investigation is primarily to address remaining data gaps for the subsurface by intrusively investigating and determining the sources of shallow subsurface anomalies (0 to 1 foot bgs) detected during the MEC RI outside of areas already known to have contained MEC items (former Ordnance Disposal Area). The Ordnance Disposal Area and the area within approximately 200 feet of the disposal area is not included in this Supplemental RI because it is already assumed to contain MEC/MPPEH and will be included in the FS for evaluation of remedial alternatives. UXO Technicians will use hand-digging techniques to unearth and examine items that are the sources of the magnetic anomalies. Step-out transects (200 feet) from the existing RI grid boundary will be determined in the field by the UXO Team (including the Technical Lead) if MEC/MDEH are encountered along transects at the existing RI grid boundary. These step-out transects will be investigated in accordance with this Uniform Federal Policy (UFP)-SAP and consistent with the April 2010 UFP-SAP for MRP MEC RI at Operable Unit 5, Site 15-Blue 10 Ordnance Disposal Area. The Supplemental MEC RI does not include the

investigation of subsurface soil anomalies at depths greater than 1 foot bgs because the future land use is light recreational and land use controls (LUC) prohibit intrusive activities.

This SAP has been prepared in accordance with DoD requirements for developing Quality Assurance Project Plans (QAPPs) for the management of environmental data collection and the use of environmental data as described in the UFP-QAPP (aka SAP). The Navy MRP Workgroup modified the SAP worksheets to be applicable to MEC investigations, and these modified worksheets have been used in the preparation of this Supplemental MEC RI SAP, which includes the applicable 28 of the 37 original worksheets.

SAP Worksheet No. 2 -- SAP Identifying Information

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number: Site 15 - Blue 10 Ordnance Disposal Area, Naval Air Station (NAS) Cecil Field, Jacksonville, Florida
Operable Units: Operable Unit (OU) 5
Contractor Name: Tetra Tech NUS, Inc. (Tetra Tech)
Contract Number: N62470-08-D-1001
Contract Title: Comprehensive Long-Term Environmental Action Navy (CLEAN)
Work Assignment Number: Contract Task Order (CTO) JM09

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) (USEPA, 2005) and United States Environmental Protection Agency (USEPA) Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS (2002).

2. Identify regulatory program: Department of Defense (DoD) Military Munitions Response Program (MMRP) using the general Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process.

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session	Date
Base Realignment and Closure (BRAC) Cleanup Team (BCT) Meeting	November 3, 2010

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

Title	Date
Sampling and Analysis Plan for Munitions Response Program. Munitions of Explosive Concern (MEC) Remedial Investigation at Operable Unit 5, Site 15 - Blue 10 Ordnance Disposal Area	April 2010

6. List organizational partners (stakeholders) and connection with lead organization:
USEPA Region 4 – Regulatory Oversight
Florida Department of Environmental Protection (FDEP) – Regulatory Oversight

7. Lead organization (see Worksheet 7 for detailed list of data users)
BRAC Program Management Office Southeast (BRAC PMO SE)

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

See the crosswalk table regarding SAP worksheets that are NA on Munitions and Explosives of Concern (MEC) projects.

UFP-QAPP Worksheet No.	Required Information	Crosswalk to Related Information
A. Project Management		
Documentation		
1	Title and Approval Page	Not Applicable (NA)
2	Table of Contents SAP Identifying Information	NA
3	Distribution List	NA
4	Project Personnel Sign-Off Sheet	NA
Project Organization		
5	Project Organizational Chart	NA
6	Communication Pathways	NA
7	Personnel Responsibilities and Qualifications Table	NA
8	Special Personnel Training Requirements Table	NA
Project Planning/Problem Definition		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	NA
10	Problem Definition, Site History, and Background. Site Maps (historical and current)	NA
11	Site-Specific Project Quality Objectives	NA
12	Measurement Performance Criteria Table	NA
13	Sources of Secondary Data and Information, Secondary Data Criteria and Limitations Table	NA
14	Summary of Project Tasks	NA
15	Reference Limits and Evaluation Table	Not used – No samples proposed for collection/analysis during MEC survey/investigation
16	Project Schedule/Timeline Table	NA
B. Measurement Data Acquisition		
Sampling Tasks		
17	Project Design and Rationale	NA
18	Sampling Locations and Methods/Standard Operating Procedure (SOP) Requirements Table	NA
19	Analytical Methods/SOP Requirements Table	Not used – No samples proposed for collection/analysis during MEC survey/investigation
20	Field Quality Control Sample Summary Table	NA
21	Project Sampling SOP References Table, Sampling SOPs	NA
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	NA

UFP-QAPP Worksheet No.	Required Information	Crosswalk to Related Information
Analytical Tasks		
23	Analytical SOP References Table	Not used – No samples proposed for collection/analysis during MEC survey/investigation
24	Analytical Instrument Calibration Table	Not used – No analytical instrument calibration data will be required to support MEC surveys/investigation
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Not used – No analytical instrument equipment maintenance, testing, or inspections will be required to support MEC surveys/investigation
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving, and Disposal Sample Handling Flow Diagram	Not used – No analytical sampling handling system will be required to support MEC surveys/investigation
27	Sample Custody Requirements Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	Not used – No samples are proposed for collection/analysis during the MEC survey/investigation
Quality Control (QC) Samples		
28	Laboratory QC Samples Table, Screening/Confirmatory Analysis Decision Tree	Not used – No analytical laboratory QC sampling will be required to support MEC surveys/investigation
Data Management Tasks		
29	Project Documents and Records Table	NA
30	Analytical Services Table Analytical and Data Management SOPs	Not used – No analytical services will be required to support MEC surveys/investigation
C. Assessment Oversight		
31	Planned Project Assessments Table	NA
32	Assessment Findings and Corrective Action Responses	NA
33	Quality Assurance (QA) Management Reports Table	NA
D. Data Review		
34	Verification (Step I) Process Table - Preparatory and Initial Inspection	NA
35	Validation (Steps IIa and II b) Process Table	NA
36	Analytical Data Validation (Steps IIa and IIb) Summary Table	NA
37	Usability Assessment	NA

SAP Worksheet No. 3 -- Distribution List

(UFP-QAPP Manual Section 2.3.1)

Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-Mail or Mailing Address	Document Control Number
Art Sanford	Navy Remedial Project Manager (RPM)/Manages Project Activities for Navy	BRAC PMO SE	843.743.2135	art.sanford@navy.mil	NA
Mark Davidson	Naval Facilities Engineering Command (NAVFAC) BRAC Environmental Coordinator (BEC)/Manages BRAC Activities for the Navy	NAVFAC	843.743.2124	mark.davidson@navy.mil	NA
Stacin Martin	Navy Technical Representative (NTR)/Provides technical direction approves all contractual budget, scope, and schedule changes.	NAVFAC Atlantic (LANT)	757.322.4780	Stacin.martin@navy.mil	NA

Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-Mail or Mailing Address	Document Control Number
Michael Green (electronic upload)	NAVFAC Munitions Response Program (MRP) Senior Technical Advisor/ Reviews SAP and QA Documentation for Navy	NAVFAC LANT	757.322.8108	mike.green@navy.mil	NA
Bonnie Capito (copy of final cover letter only)	Librarian and Records Manager	NAVFAC LANT	757.322.4785	bonnie.capito@navy.mil	NA
Debbie Vaughn-Wright (hardcopy of draft only, electronic copy all versions)	USEPA RPM/ Provides USEPA Regulator Input	USEPA Region 4	404.562.8539	vaughn-wright.debbie@epamail.epa.gov	NA
David Grabka	FDEP RPM/ Provides State Regulator Input	FDEP	850.245.8997	david.grabka@dep.state.fl.us	NA
Mike Halil	CH2MHill Project Manager (PM)/ Remedial Action Contactor (RAC) Managed historical project MEC support Activities	CH2MHill	904.777.4812 ext. 233	michael.halil@CH2M.com	NA
Robert Simcik	Tetra Tech PM, Base Coordinator/ Manages Activities at the Base	Tetra Tech	412.921.8163	robert.simcik@tetratech.com	NA

Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-Mail or Mailing Address	Document Control Number
Linda Klink	Tetra Tech Technical Lead/ Manages Project Activities	Tetra Tech	412.921.8650	linda.klink@tetratech.com	NA
Ralph Brooks	Unexploded Ordnance (UXO) Program Manager/ Manages UXO Technicians and MEC Hazards/ Activities	Tetra Tech	770.413.0965 x231 404.661.4916 (cell)	ralph.brooks@tetratech.com	NA
Other Field Personnel To Be Determined (TBD)	Senior UXO Supervisor (SUXOS)/Supervises UXO Field Activities UXO Quality Control Specialist (UXOQCS)/Provides QC during UXO Field Activities UXO Safety Offices (UXOSO)/Manages UXO Safety Operations	Tetra Tech	TBD	TBD	NA
Dr. Tom Johnston	Tetra Tech QA Manager (QAM)/ Provides QA Oversight	Tetra Tech	412.921.8615	tom.johnston@tetratech.com	NA

Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-Mail or Mailing Address	Document Control Number
Matt Soltis [Health and Safety Plan (HASP) only]	Health and Safety Manager (HSM)/Manages Corporate Health and Safety Program	Tetra Tech	412.921.8912	matt.soltis@tetratech.com	NA
John Trepanowski (copy of cover letter only)	Program Manager/Manages Program Activities	Tetra Tech	610.491.9688	john.trepanowski@tetratech.com	NA
Garth Glenn (copy of cover letter only)	Deputy Program Manager/Manages Program Activities	Tetra Tech	757.461.3926	garth.glenn@tetratech.com	NA
Glenn Wagner (copy of final cover letter, portable document format (PDF) of final report, and hardcopy of report and Appendices)	Administrative Record Assistant	Tetra Tech	412.220.2211	glenn.wagner@tetratech.com	NA

SAP Worksheet No. 4 -- Project Personnel Sign-Off Sheet

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

1. In the case of regulatory agency personnel with oversight authority, approval letters or e-mails will constitute verification that applicable sections of the SAP have been reviewed. Copies of regulatory agency approval letters/e-mails will be retained in the project files and are listed in Worksheet No. 29 as project records.

2. E-mails will be sent to Navy and Tetra Tech project personnel who will be requested to verify by e-mail that they have read the applicable SAP/sections and the date on which they were reviewed. Copies of the verification e-mails will be included in the project files as identified in Worksheet No. 29.

A copy of the signed Worksheet No. 4 will be retained in the project files and is identified as a project document in Worksheet No. 29.

Name	Organization/Title/Role	Telephone Number (optional)	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Navy and Regulator Project Team Personnel					
Art Sanford	BRAC PMO SE/Navy RPM/ Manages project activities for Navy	843.743.2135	See Worksheet No. 1 for signature	All	
Debbie Vaughn-Wright	USEPA/RPM/ Provides USEPA regulator input	404.562.8530		All	
David Grabka	FDEP/RPM/ Provides State regulator input	850.245.8997		All	
Michael Green	NAVFAC/MRP Senior Technical Advisor/ Reviews SAP and QA documentation for Navy	757.322.8108	See Worksheet No. 1 for signature	All	

Name	Organization/Title/Role	Telephone Number (optional)	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Mark Davidson	NAVFAC BRAC PMO SE/BEC/ Manages BRAC activities for the Navy	843.743.2124		All	
Stacin Martin	NAVFAC LANT/NTR/ Provides project technical direction, approves all contractual budget, scope, and schedule changes.	757.322.4780		All	

Tetra Tech Project Team Personnel

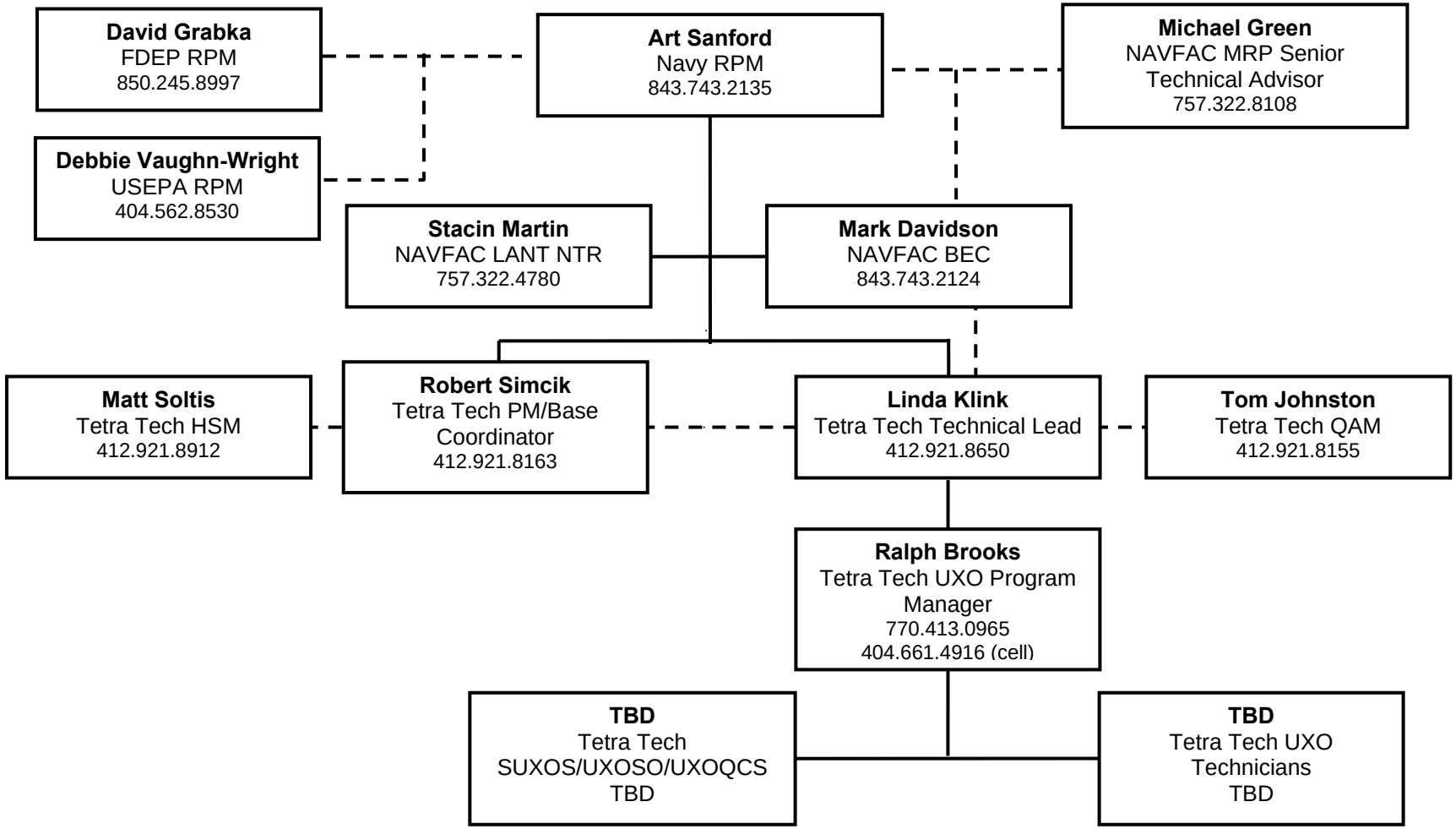
Robert Simcik	Tetra Tech/PM, Base Coordinator/ Manages activities at the Base	412.921.8163	See Worksheet No. 1 for signature	All	
Linda Klink	Tetra Tech/Technical Lead/ Manages project activities	412.921.8650	See Worksheet No. 1 for signature	All	
Ralph Brooks	Tetra Tech/UXO Program Manager/ Manages UXO Technicians and MEC hazards/activities	770.413.0965 x231 404.661;4916 (cell)		All	
Dr. Tom Johnston	Tetra Tech/QAM/ Provides QA oversight	Tetra Tech	See Worksheet No.1 for signature	All	
Matt Soltis	Tetra Tech/HSM/ Manages Corporate Health and Safety Program	412.921.8912	See signature on HASP	HASP and Worksheet No. 17	

Name	Organization/Title/Role	Telephone Number (optional)	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
TBD	Tetra Tech/Field Personnel/ Implement field program individual roles per Worksheet No. 3. - SUXOS - UXOQCS - UXI Technicians	TBD	See Field forms - MRP FF.1 - SAP Worksheet No. 4 (Field Personnel) to be signed in the field	All	

SAP Worksheet No. 5 -- Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1)

Lines of Authority ———— Lines of Communication



SAP Worksheet No. 6 -- Communication Pathways

(UFP-QAPP Manual Section 2.4.2)

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
MEC Find or other reportable find (i.e., hazardous waste source/dangerous item)	Tetra Tech Field Staff	TBD	TBD	Within 30 minutes of an MEC find, Tetra Tech UXO Technicians will notify field staff, secure area, and contact Tetra Tech UXO Manager.
	Tetra Tech UXO Staff	TBD	TBD	
	Tetra Tech UXO Program Manager	Ralph Brooks	770.413.0965 x 231 404.661.4916 (cell)	Tetra Tech UXO Manager will verbally inform Tetra Tech Technical Lead on the same day.
	Tetra Tech Technical Lead	Linda Klink	412.921.8650	Tetra Tech Technical Lead will notify Navy RPM and NTR on the same day.
	Navy RPM	Art Sanford	843.743.2135	
	NAVFAC NTR	Stacin Martin	757.322.4780	Navy RPM will make notifications as stated in the approved ESS. Naval Ordnance Safety and Security Activity (NOSSA) will be informed on the same day as an MEC find if the Explosive Safety Quantity Distance (ESQD) or net explosive weight (NEW) increases beyond those identified in the approved ESS or other explosive safety concerns warrant.

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
Field issues that require significant change in field tasks or scope of field work	Tetra Tech UXO Program Manager Tetra Tech Technical Lead NAVFAC NTR Navy RPM	Ralph Brooks Linda Klink Stacin Martin Art Sanford	770.413.0965 x 231 404.661.4916 (cell) 412.921.8650 757.322.4780 843.743.2135	The responsible person will inform Tetra Tech Technical Lead on the day the issue is discovered. Tetra Tech Technical Lead will inform NAVFAC NTR and RPM within 1 business day. NAVFAC NTR will issue scope change approval (via e-mail or verbally with follow-up e-mail or other documentation) if warranted. Scope change will be implemented and authorized by the Navy before work is executed. Document via a Field Task Modification Request (FTMR) form within 2 days.
SAP amendments	Tetra Tech Technical Lead NAVFAC NTR Navy RPM	Linda Klink Stacin Martin Art Sanford	412.921.8650 757.322.4780 843.743.2135	Tetra Tech Technical Lead will notify NAVFAC NTR and RPM via e-mail within 1 business day of recognizing a need for change and will also notify the Project Team. If amendment is minor (editorial or minor clarification), only notify Navy RPM/NTR an no need for SAP amendment.

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
Fieldwork schedule changes	Tetra Tech Technical Lead NAVFAC NTR Navy RPM	Linda Klink Stacin Martin Art Sanford	412.921.8650 757.322.4780 843.743.2135	The Tetra Tech Technical Lead will verbally inform NAVFAC NTR and RPM on the day that schedule change is known and document in the monthly report. If report deliverable date is expected to be delayed as a result, document via schedule impact letter as soon as impact is realized.
Recommendations to stop work and initiate work upon corrective action	Tetra Tech UXO Program Manager Tetra Tech Technical Lead Tetra Tech PM, Base Coordinator Tetra Tech QAM Tetra Tech HSM NAVFAC NTR Navy RPM	Ralph Brooks Linda Klink Robert Simcik Tom Johnston Matt Soltis Stacin Martin Art Sanford	770.413.0965 x 231 404.661.4916 (cell) 412.921.8650 412.921.8163 412.921.8912 412.921.8615 757.322.4780 843.743.2135	Within 1 hour, the UXO Manager (via e-mail or verbally with follow-up e-mail or other documentation) will inform Tetra Tech Technical Lead. Tetra Tech Technical Lead will inform (verbally or via e-mail) the listed Project Team members.

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
UXO survey data issues	Tetra Tech UXO Program Manager Tetra Tech Technical Lead Tetra Tech QAM	Ralph Brooks Linda Klink Tom Johnston	770.413.0965 x 231 404.661.4916 (cell) 412.921.8650 412.921.8615	UXO field team will notify Tetra Tech UXO Manager as soon as the impact is realized. Tetra Tech UXO Manager will notify Tetra Tech Technical Lead and QAM on the same day.
Corrective actions for field program	Tetra Tech QAM Tetra Tech Technical Lead Navy RPM	Tom Johnston Linda Klink Art Sanford	412.921.8615 412.921.8650 843.743.2135	Tetra Tech QAM will notify Tetra Tech Technical Lead within 1 day that the corrective action has been completed. Tetra Tech Technical Lead will then notify the Navy RPM within 1 day.

SAP Worksheet No. 7 -- Personnel Responsibilities and Qualifications Table

(UFP-QAPP Manual Section 2.4.3)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Art Sanford	Navy RPM/ Manages project activities for Navy	BRAC PMO SE	Functions as primary Navy interface with the Tetra Tech PM, Tetra Tech Technical Lead, and Regulatory RPMs. • Oversees Tetra Tech management of project. • Provides Navy input through participation in technical meetings, review of SAP and project documents, and regular discussion with Tetra Tech PM, Tetra Tech Technical Lead, and Regulatory RPMs.	To be provided upon request.
Stacin Martin	NTR/ Provides project technical direction, approves all contractual budget, scope, and schedule changes.	NAVFAC LANT	Provides technical direction for NAVFAC • Oversees Tetra Tech management of project • Approves all contractual, budget, scope, and schedule changes. • Review of SAP and project documents	To be provided upon request.
Mark Davidson	BEC/ Manages BRAC activities for Navy	NAVFAC	Supports issues as identified by the Navy RPM.	To be provided upon request.

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
David Grabka	FDEP RPM/ Provides State regulator Input	FDEP	Functions as primary state regulatory interface with the Navy RPM. • Provides regulatory input through participation in technical meetings, review of SAP and project documents, and regular discussion with Navy RPM. • Provides approval of documents in accordance with the requirements of the Federal Facility Agreement (FFA) and current Site Management Plan (SMP) for NAS Cecil Field.	To be provided upon request.
Debbie Vaughn-Wright	USEPA RPM/ Provides USEPA regulator Input	USEPA Region 4	Functions as primary USEPA regulatory interface with the Navy RPM. • Provides regulatory input through participation in technical meetings, review of SAP and project documents, and regular discussion with Navy RPM. • Provides approval of documents in accordance with the requirements of the FFA and current SMP for NAS Cecil Field.	To be provided upon request.
John Trepanowski	Program Manager/ Manages program activities	Tetra Tech	Oversees NAVFAC CLEAN Program for Tetra Tech.	M.S., Mining Engineering B.S., Mining Engineering 27 years of engineering experience

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Robert Simcik	PM, Base Coordinator/ Manages activities at the Base	Tetra Tech	Oversees project, financial, schedule, and technical day-to-day management of the project. • Ensures timely resolution of project-related technical, quality, and safety questions associated with Tetra Tech operations. • Functions as the primary Tetra Tech interface with the Navy RPM and Tetra Tech field and office personnel. • Coordinates and oversees maintenance of all Tetra Tech project records.	B.S., Civil Engineering A.S., Petroleum Engineering Technology 26 years of engineering experience Professional Engineer
Linda Klink	Technical Lead/ Manages Project activities	Tetra Tech	Oversees subject Site 15 project, financial, schedule, and technical day-to-day management. • Ensures timely resolution of Site 15-related technical, quality, and safety questions associated with Tetra Tech operations. • Functions as the primary Tetra Tech Site 15 interface with the Navy RPM and Tetra Tech field and office personnel. • Ensures that Tetra Tech health and safety issues related to the Site 15 project are communicated effectively to all on-site and off-site personnel. • Coordinates and oversees Site 15 work performed by Tetra Tech field and office technical staff (including data interpretation and report preparation). • Coordinates and oversees maintenance of all Tetra Tech Site 15 project records. • Coordinates and oversees review of Tetra Tech Site 15 deliverables. • Prepares and issues Site 15 final Tetra Tech deliverables to the Navy.	M.S., Environmental Engineering (Water Resources) B.S., Chemical Engineering 28 years of environmental engineering experience Professional Engineer

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Ralph Brooks	UXO Program Manager/ Manages project UXO Technicians and MEC hazards/ activities	Tetra Tech	Oversees selection of qualified UXO personnel, establishes overall QC program for UXO activities, and addresses UXO-related issues as identified by field personnel.	B.S., General Studies Graduate, Navy Explosive Ordnance Disposal (EOD) School - Indian Head 25 years of military EOD experience 6 years commercial UXO experience
TBD	SUXOS/ Supervises UXO field activities	Tetra Tech	Supervises the conduct of all on-site UXO-related operations. Prepares daily reports of field activities. Conducts daily site safety briefings. Escorts non-UXO personnel in suspect MEC areas. Determines location and identification of suspect MEC. Conducts detector-aided surveys.	Minimum of 10 years prior military EOD and/or commercial UXO experience in munitions response actions or range clearance activities. [Department of Defense Explosive Safety Board (DDESB) Technical Paper (TP) 18]
TBD	UXOSO)/ Manages UXO safety operations	Tetra Tech	Ensures that initial site-specific training is delivered to all field personnel before field activities begin and that all safety control measures have been established. Ensures that all UXO-specific certifications are filed on site and are available for Navy inspection. Enforces personnel limits and safety exclusion zones (EZs). Conducts, documents, and reports safety inspections.	Minimum of 8 years prior military EOD and/or commercial UXO experience in munitions response actions or range clearance activities and applicable safety standards. (DDESB TP 18)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
TBD	UXOQCS/ Provides QC during UXO field activities	Tetra Tech	Conducts QC audits. Identifies, documents, and reports corrective actions.	Minimum of 8 years prior military EOD and/or commercial UXO experience in munitions response actions or range clearance activities and the transportation, handling, and storage of munitions and commercial explosives. (DDESB TP 18). Specialized training in quality as stated in NOSSA Instruction (NOSSAINST) 8020.15B
TBD	UXO Technician III/ Manages UXO field team	Tetra Tech	Supervises UXO Tech I and II while performing project tasks. Escorts non-UXO personnel in suspect MEC areas. Determines location and identification of suspect MEC. Conducts detector-aided surveys.	Minimum of 8 years prior military EOD and/or commercial UXO experience in munitions response actions or range clearance activities. [Department of Defense Explosive Safety Board (DDESB) Technical Paper (TP) 18]

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Tom Johnston	QAM/ Provides QA oversight	Tetra Tech	Reviews SAP and conducts data quality review. Ensures quality aspects of the CLEAN program. • Develops, maintains, and monitors QA policies and procedures. • Provides training to Tetra Tech staff in QA/QC policies and procedures. • Conducts systems and performance audits to monitor compliance with environmental regulations, contractual requirements, SAP requirements, and corporate policies and procedures. • Audits project records. • Assists in the development of corrective action plans and ensuring correction of non-conformances reported in internal or external audits. • Ensures that this SAP meets Tetra Tech, Navy, FDEP, and USEPA requirements. • Prepares QA reports for management.	Ph.D., Analytical Chemistry, 31 years experience
Matt Soltis	HSM/ Manages corporate Health and Safety Program	Tetra Tech	Oversees CLEAN Program Health and Safety Program • Provides technical advice to the Tetra Tech PM and Tetra Tech Technical Lead on matters of health and safety. • Oversees the development and review of the HASP. • Conducts health and safety audits. • Prepares health and safety reports for management.	B.S., Industrial Safety Sciences, 24 years environmental experience

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
TBD	Site Safety Officer (SSO),/ Manages UXO safety operations	Tetra Tech	• Controls specific health and safety-related field operations such as personnel decontamination, monitoring of worker heat or cold stress, and distribution of safety equipment. • Conducts and documents a daily health and safety briefing each day while on site. • Ensures that field personnel comply with all procedures established in the HASP. • Identifies assistant SSOs in his/her absence. • Terminates work if an imminent safety hazard, emergency situation, or other potentially dangerous situation is encountered. • Ensures the availability and condition of health and safety monitoring equipment. • Coordinates with the UXO Manager and Technical Lead to institute and document any necessary HASP modifications. • Ensures that facility personnel and subcontractors are adequately advised and kept clear of UXO and potentially contaminated materials.	TBD

In some cases, one person may be designated responsibilities for more than one position. For example, the UXOSO may also be responsible for SSO duties. This action will be performed only as credentials, experience, and availability permits.

All personnel performing UXO duties will be in compliance with the requirements of DDESB TP 18.

SAP Worksheet No. 8 -- Special Personnel Training Requirements Table

(UFP-QAPP Manual Section 2.4.4)

Project Function	Specialized Training by Title or Description of Course	Training Provider/ Verifier	Training Date	Personnel/ Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/ Certificates
Project Operations	Site Orientation, Ethics Training, and UXO Avoidance	SUXOS	Upon arrival at NAS Cecil Field	All personnel	Tetra Tech	Documentation of special training requirements will be maintained on site. After the field investigation is complete, special training documentation will be maintained in the permanent project file.
	Accident Prevention and First Aid	SSO				
	Overview of Project Plans	SUXOS				
QA/QC	Tetra Tech corporate Quality Assurance Program Training	Tetra Tech Corporate	Mandatory biennial training; received prior to participation in field activities	UXOQCS		
Site Supervisor	Formal Supervisor Training	Tetra Tech	Current	SUXOS		
Safety	Formal Safety Training	Tetra Tech	Current	UXOSO		
Munitions Response	MEC Safety Training	UXOSO SUXOS	Training will have been received prior to participation in field activities	Personnel entering EZ		
Grid/Transect Layout, Surface Surveying	Use of Hand-Held Global Positioning System (GPS)	SUXOS		UXO Team		
MEC Data Collection	Surface Survey and MEC Management and Accountability SOPs	SUXOS		UXO Team		

All field personnel will have appropriate training to conduct the field activities to which they are assigned. Additionally, each site worker will be required to have completed a 40-hour course (and 8-hour refresher, if applicable) in health and safety training as described under Occupational

Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(b)(4). Safety requirements are addressed in greater detail in the Tetra Tech HASP (provided under spate cover).

In some cases, one person may be designated responsibilities for more than one position. For example, the UXOSO may also be responsible for SSO duties. This action will be performed only as credentials, experience, and availability permits.

SAP Worksheet No. 9 -- Project Scoping Session Participants Sheet

(UFP-QAPP Manual Section 2.5.1)

Project Name: NAS Cecil Field, Supplemental MEC Remedial Investigation (RI) **Projected Date(s):** Field work anticipated for Spring 2011 **Project Manager/Base Coordinator:** Robert Simcik **Technical Lead:** Linda Klink	**Site Name:** OU 5, Site 15 - Blue 10 Ordnance Disposal Area **Site Location:** NAS Cecil Field, Jacksonville, Florida
Date of Session: November 3, 2010 **Scoping Session Purpose:** NAS Cecil Field BCT Meeting	

Name	Title	Affiliation	Phone Number	E-Mail Address	Project Role
Art Sanford	Navy RPM	BRAC PMO SE	843.743.2135	art.sanford@navy.mil	Navy RPM
David Grabka	State Regulatory PM	FDEP RPM	850.245.8997	david.grabka@dep.state.fl.us	Provides State regulator Input
Linda Klink	Technical Lead	Tetra Tech	412.921.8650	linda.klink@tetratech.com	Manages project activities
Rob Simcik	PM/Base Coordinator	Tetra Tech	412-921-8163	robert.simcik@tetratech.com	Manages activities at the Base
Mike Halil	Project Manager	CH2MHill	904.777.4812 ext. 233	michael.halil@CH2M.com	Historical knowledge

Comments/Decisions:

The NAS Cecil Field BCT Meeting discussed the Supplemental RI addressing data gaps remaining after the 2008-2009 MEC/MPPEH removal and 2010 RI. The proposed intrusive hand tool excavation locations and number of excavations was also discussed. Ultimately, the RI and Supplemental RI data will be used to support the preparation of a Feasibility Study (FS), which will present options for the final remedy.

Greg Fraley (USEPA Region 4) was not able to attend this meeting. Dave Grabka (FDEP) was his proxy.

Linda Klink (Tetra Tech) presented a preliminary plan for team discussion, summarized as follows:

- For the Supplemental RI effort, the number of hand digs per transect was determined using statistics. The estimated minimum number of hand digs of anomalies per transect was determined using Visual Sample Plan (VSP) Software and the estimated hand dig requirements are as follows:
  - Existing RI Grid Boundary = 54 anomalies
  - Bike Path/Asphalt Access Road = 55 anomalies
  - High Density Areas = 27 anomalies
  - Then totaled (136)

- Contingency step-out transects and additional hand digs as needed will be implemented.

Consensus Decisions:

- The existing ESS document used during the 2008-2009 soil removal activities can be used, but it will need to be updated/revised. Doug Murray (NOSSA) will be able to do a quick review of the document when it is provided to him. The NOSSA direction has since changed. On December 15, 2010, NOSSA directed that a new ESS be prepared using the newer format. Note the ESS is a document internal to the Navy and is not reviewed by the regulators.

- Field work will follow approval of the final Supplemental RI SAP (field work planned for dry season/cooler weather versus summer weather). The draft Supplemental RI SAP will not be issued for review until regulatory agency approval of the RI Report.

- It is likely that annual inspections will be required as part of the land use controls (LUCs) at this site after site activities have been completed. It was also identified that the reuse plan at this area is low-level recreational use, and no new paths or new changes that would be an "attraction" or "cause a visitor to spend more time at that specific location" would be permitted.

- A Remedial Action Completion Report will be prepared that recommends no further action at the site concerning chemical contamination, but the report will identify there is a remaining MEC issue that is being addressed. FDEP identified that two rounds of groundwater sampling analytical results (7.5 micrograms per liter [µg/L] on 2/4/10 and 2.2 µg/L on 9/10/10) appear to have satisfied the requirement to determine that groundwater at Site 15 is not adversely impacted by the historical activities conducted, and no action with regard to groundwater is needed.

SAP Worksheet No. 10 -- Problem Definition/Conceptual Site Model

(UFP-QAPP Manual Section 2.5.2)

10.1 FACILITY BACKGROUND

NAS Cecil Field (USEPA ID No. FL5 170 022 474) is located 14 miles southwest of Jacksonville, Florida. Figure 10-1 shows the general location of NAS Cecil Field. The majority of Cecil Field is located within Duval County, and the southernmost part of the facility is located in Clay County. NAS Cecil Field was established in 1941 and provided facilities, services, and material support for the operation and maintenance of Naval weapons, aircraft, and other units of the operation forces as designated by the Chief of Naval Operations. NAS Cecil Field was placed on the National Priorities List (NPL) by USEPA in December 1989. The Navy, USEPA, and FDEP signed an FFA for NAS Cecil Field in 1990. Pursuant to the FFA, the Navy has conducted RIs and response actions under CERCLA authority.

NAS Cecil Field is subject to the Base Realignment and Closure Law of 1993. Since the closure of NAS Cecil Field in September 1999, most of the facility has been transferred to the Jacksonville Port Authority (now Jacksonville Aviation Authority) and City of Jacksonville. According to the reuse plan, the facility will have multiple uses, but will be used primarily for aviation-related activities.

10.2 SITE 15 REGULATORY STATUS

OU 5, Site 15 - Blue 10 Ordnance Disposal Area, covers approximately 85 acres and was historically used for ordnance disposal. Following an RI for chemical contamination that identified polynuclear aromatic hydrocarbon (PAHs), metals (arsenic and lead), and total recoverable petroleum hydrocarbon (TRPH) soil contamination that required remediation, a Record of Decision (ROD) for OU 5, Site 15, was signed in June 2008 for selection of a remedy for these chemical contaminants (Tetra Tech, 2008). Remedial activities were conducted in 2008 and 2009 in accordance with the ROD and included soil excavation, on-site solidification/stabilization, and off-site treatment and disposal of contaminated soil to allow low-intensity recreational reuse of the site (AGVIQ-CH2MHill, 2009). The MEC-related remedial action activities related to safety during contaminated soil removal are discussed in the Remedial Action Completion Report for Soil Remedial Activities (AGVIQ-Ch2MHill, 2009).

An LUC Remedial Design (RD), prepared by Tetra Tech in 2009, provides specifications to limit land use to low-intensity recreational activities consistent with the property's proposed reuse as a natural resource corridor. Medium- and high-intensity recreational, residential, and commercial/industrial uses are not permitted. Low-intensity recreational use consists of activities such as hiking, biking, horseback riding, birding, and hunting. No man-made attractions will be provided that would entice people, particularly

small children, to frequently visit the site, which is consistent with the property's proposed reuse as a natural resource corridor. Non-permitted medium-intensity recreational use includes picnicking and camping, and high-intensity recreational use includes children's playgrounds and contact sports such as baseball, football, and soccer. LUCs also prohibit excavation of soil from Site 15 without prior written approval from the Navy, USEPA, and FDEP (Tetra Tech, 2009). Figure 10-2 provides the general arrangement of Site 15 overlain by the controlled land use parcel boundaries.

10.3 SITE 15 DESCRIPTION AND HISTORY

Site 15 - Blue 10 Ordnance Disposal Area (Figure 10-2), is located in the southwestern section of the former Yellow Water Weapons Area (YWWA) of NAS Cecil Field. The site is relatively flat. Site 15 was used for ordnance disposal from the 1960s to 1977, and disposal consisted of burning of ordnance materials in a large metal burn chamber and static firing of rockets. Skeet and trap ranges were also located at the site from the early 1940s to mid-1950s. The former skeet and trap ranges were approximately 1,000 feet by 2,400 feet in size, with the long axis of the ranges being parallel to and east of the existing access road.

The former ordnance disposal structures were located west of the skeet and trap ranges. The majority of ordnance disposed of at the site was burned and included small arms munitions up to 20 millimeters (mm) in size, parachute and distress flares, Mark IV signal cartridges, rocket igniters, cartridge-activated devices, and 2.75-inch and 5-inch rockets. Rocket propellant also was reportedly placed on the ground and ignited in the area of the burn chamber. Rocket motors were disposed of by static firing of both 2.75-inch and 5-inch rockets from a firing pad located south of the burn chamber. An estimated 2.5 tons of ordnance were disposed of at the site each month; overall, an estimated 350 tons of ordnance were disposed of while the site was in operation.

In the 1980s, environmental investigations were initiated that included soil, groundwater, sediment, and surface water sampling. These investigations showed that Site 15 soil was contaminated with PAHs, metals (arsenic and lead), and TRPH. A ROD to address the chemical contamination was signed in 2008, and remedial action was conducted in 2008 and 2009 to remove contaminated soil from 17 excavation areas (A through Q as shown on Figure 10-3) with concentrations of contaminants in excess of cleanup goals. Chemical contamination at Site 15 has been addressed through the remedy (Tetra Tech, 2009).

Because historical activities at Site 15 included munitions operations, a munitions survey was first conducted for safety purposes in and around the planned soil excavation areas to address any MEC

hazards. MEC and munitions debris (MD) were located during the pre-excavation munitions survey and were removed from excavation areas before soil excavation operations commenced. Note that the MD terminology in effect at the time of the remediation has since been replaced with MDAS.

10.4 SITE 15 PREVIOUS MEC INVESTIGATION/REMEDIATION

Based on the findings of an MEC Preliminary Assessment (PA)/Site Inspection (SI) conducted in 2007 by CH2MHill, MEC removal was necessary before the 2008/2009 soil remedial action could proceed.

Until 2008, the ordnance burn chamber and static rocket firing pad located in the north-central portion of the site were the only structures related to historical activities that remained at the site. The burn chamber was a rounded, steel, tank-like container approximately 10 feet in length and 4 feet in height. The static rocket-firing pad was an L-shaped concrete structure approximately 10 feet long by 4 feet wide by 6 feet high. The burn chamber and firing pad were removed in 2008 as part of remedial activities. Several concrete building foundations (remnants of buildings that supported skeet and trap range activities), located in the area surrounding the burn chamber and firing pad, were also removed in 2008.

The MEC removal included subdivision of Site 15 through a land survey into 100-foot by 100-foot grid cells and for those select grids associated with soil removal areas, vegetation reduction, MEC/MPPEH surface clearance, digital geophysical mapping (DGM) with EM61-MK2 time-domain metal detection, and identification of target anomalies, manual and mechanical-aided intrusive investigation of target anomalies identified through DGM, and detonation of MEC items were conducted. The munitions survey included 100-percent clearance (to 2 feet below ground surface [bgs]) and removal of MEC and MDAS from the grids included in the survey. Figure 10-3 depicts the grids with vegetation reduction and the results of munitions clearance for the grids where clearance was conducted. The munitions clearance included a geophysical prove-out (GPO) (yellow grid depicted on Figure 10-3) for testing of equipment and personnel and other appropriate QC as discussed further in the Remedial Action Completion Report - Soil Removal Action (AGVIQ-CH2MHill, 2009).

The table below provides MEC items identified and removed during the clearance. All of the MEC items were encountered in and around the former Ordnance Disposal Area (pink grids depicted on Figure 10-3). MDAS was found in and around the Ordnance Disposal Area, in the former skeet and trap range areas, and along access roads to the Ordnance Disposal Area (orange grids depicted on Figure 10-3).

Table 10-1 – MEC Items Identified During the 2008/2009 Soil Removal Action

Grid	MEC items found	Surface or Subsurface
A2J8	One 20mm Target Practice (TP) Projectile Full Up	Subsurface
A3H3	One 20mm TP Projectile Full Up	Surface
A3H4	One M204 Practice Mine Fuze	Subsurface
A3I3	Six M204 Practice Mine Fuzes	Subsurface
A3J3	Two M204 Practice Mine Fuzes	Subsurface
B2A7	Two M204 Practice Mine Fuzes and one M112 Photoflash Cartridge	Subsurface
B2A8	One M208 20mm TP	Surface
B2A9	Two 20mm TP Projectiles Full Up	Subsurface
B2C0	Three M204 Practice Mine Fuzes	Subsurface
B2C6	One 20mm Projectile High Explosive (HE)	Subsurface
B3A1	One Aircraft Launched Flare	Surface
B3B1	Two Mk4 Spotting Charges	Subsurface
B3B2	One M204 Practice Mine Fuze	Subsurface
B3B3	Two M204 Practice Mine Fuzes	Subsurface
B3C1	One BLU – 26/B Submunition Inert Bomblet	Subsurface
B3D3	One M204 Practice Mine Fuze	Subsurface

In 2010, a MEC RI was conducted practicing UXO avoidance (Tetra Tech, 2010b). Site 15 was divided into 100-foot grids building outwards from the grid system that was used previously during 2008 and 2009 soil removal activities. Both the ground surface and shallow subsurface (0 to 1 foot bgs) were investigated using detector-aided survey techniques. A summary of the MPPEH items (anticipated to be MDAS) found on the ground surface during the 2010 MEC RI is presented in Appendix B (in field form MRP FF.8). A summary of the number of subsurface anomalies found along each transect is presented in Appendix A. Figure 10-3 depicts the MEC RI grids, surface and shallow subsurface anomaly detections, and MPPEH items identified (Tetra Tech, 2010b).

Based on the detector-aided survey performed during the MEC RI, the density of surface MEC/material potentially presenting an explosive hazard (MPPEH) was characterized as low over the majority of the surface of the site, although still a concern. Thirteen MPPEH items (most suspected to be MDAS) were identified during the 2010 MEC RI and are expected to be located, inspected, treated, and certified during the Supplemental RI.

Approximately 1,600 subsurface anomalies were detected during the MEC RI. Subsurface anomaly density was greater nearest the Ordnance Disposal Area and generally decreased with distance away from this area. Based on the MEC/MPPEH findings identified during the 2008/2009 removal action, the source of the RI subsurface anomalies is expected to be largely MDAS or non-munitions related items like rebar, with decreasing number of MEC/MPPEH items present moving outward from the historical Ordnance Disposal Area. The MEC RI Report recommended an intrusive subsurface investigation of select anomalies to further assess the source of the anomalies in select areas in the shallow subsurface up to 1 foot bgs.

10.5 SITE 15 CONCEPTUAL SITE MODEL SUMMARY

This section provides the conceptual site model (CSM) summary based on the 2010 MEC RI and historical information (Tetra Tech, 2010b). As discussed in the 2010 MEC RI Report, chemical contamination at Site 15 has been addressed through the CERCLA remedy; therefore, the MEC RI and the Supplemental MEC RI is focused only on a MEC investigation, and so the following discussion of the CSM focuses on MEC-related information.

The CSM for Site 15 was developed based on historical information presented in documents associated with the 2008/2009 MEC and munitions constituents (MC) remedial actions, and information obtained during the MEC RI detector-aided survey. A visual CSM is presented as Figure 10-4, and a tabular CSM is presented as Table 10-2. The exposure pathways by which site receptors could be exposed to or contaminated by MEC/MPPEH are presented on Figure 10-5.

Table 10-2 – Conceptual Site Model Information Profile

Profile Type	Information Needs	Findings
Range/Site Profile	Installation Name	NAS Cecil Field
	Installation Location	Jacksonville, Florida Located 14 miles southwest of Jacksonville, Florida, with the majority of the facility located within Duval County, and the southernmost part of the facility is located in Clay County.
	Range/Site Name	OU 5, Site 15 - Blue 10 Ordnance Disposal Area
	Range/Site Location	Located in the southwestern section of the former Yellow Water Weapons Area of NAS Cecil Field.
	Range/Site History	The skeet and trap range complex operated at the site from the early 1940s to the mid-1950s. Site 15 was used for ordnance disposal from the 1960s to 1977. Remediation of soil based on chemical contamination conducted in 2008 and 2009 in accordance with the ROD and included soil excavation from 17 areas, on-site solidification/stabilization, and off-site treatment and disposal of contaminated soil to allow low-intensity recreational reuse of the site (AGVIQ-CH2MHill, 2009). Chemical contamination at Site 15 has been addressed through the remedial action (Tetra Tech, 2009). In support of the soil excavation effort, MEC/MDEH and MDAS [formerly MD] were first addressed during the 2008/2009 soil remediation effort and were removed from the excavation areas before soil excavation operations commenced. The munitions work occurred only in support of the contaminated soil removal effort and did not extend to other areas of the site.
	Range/Site Area and Layout	The former skeet and trap range complex was approximately 1,000 feet by 2,400 feet in size, with the long axis of the ranges being parallel to and east of the existing access road. Ordnance disposal consisted of burning ordnance materials in a large metal burn chamber and static firing rockets. The ordnance disposal structures were later located within the footprint on the western side of the skeet and trap ranges.
	Range/Site Structures	There are no structures associated with OU 5, Site 15 - Blue 10 Ordnance Disposal Area activities remaining on site, except for some concrete foundation rubble.
	Range/Site Boundaries	See Figure 10-2
	Range/Site Security	Site 15 is in a controlled area accessible only through access gates. Site 15 -Blue 10 is a semi-secured area with gates in place to limit vehicle entry but with relatively open access to bike and pedestrian traffic.

Profile Type	Information Needs	Findings
Munitions/ Release Profile	Munitions Types	The majority of ordnance disposed of at the site was burned and included small arms munitions up to 20 mm in size, parachute and distress flares, Mark IV signal cartridges, rocket igniters, cartridge activated devices, and 2.75-inch and 5-inch rockets. Additionally, rocket propellant was reportedly ignited in the area of the burn chamber directly on the ground surface. Rocket motors were disposed of by static firing of both 2.75-inch and 5-inch rockets from a firing pad located south of the burn chamber. An estimated 2.5 tons of ordnance were disposed of at the site each month. Overall, an estimated 350 tons of ordnance were disposed of at the site while it was in operation.
	Maximum Probability Penetration Depth	This is not applicable because munitions items were never fired at this site. NOTE: In 2008/2009, buried MEC/MPPEH were typically encountered at depths up to 2 feet bgs, and in some instances up to 3.5 feet bgs, within the Ordnance Disposal Area.
	MEC Density	Surface MEC was moderate to low – A few MEC/MDEH items were encountered during the 2008/2009 remediation. No MEC were observed on this surface during the MEC RI detector-aided survey; however, only a broad-based approach to determine the general extent was completed (i.e., widely spaced transects) and some remaining MEC/MPPEH items are still suspected in and around the Ordnance Disposal Area. All MEC/MDEH observed in the past at Site 15 were in and around the former Ordnance Disposal Area. Higher subsurface anomaly density is present nearest the Ordnance Disposal Area and generally decreases with distance from the Ordnance Disposal Area. This is supported by the MEC RI by the transect segments (high density of detected subsurface anomalies shown in red) on Figure 10-3. The source of anomalies is unknown. A summary of anomaly observations are presented in Appendix A.
	Munitions Scrap/ Fragments/ MPPEH	Based on the detector-aided survey performed during the MEC RI, remaining surface MEC/MPPEH is characterized as low over the majority of the surface of the site. MDAS was found in and around the Ordnance Disposal Area, in the former skeet and trap range areas, and along access roads to the Ordnance Disposal Area. Higher subsurface anomaly density is present nearest the Ordnance Disposal Area and near roadways and generally decreases moving outward. Approximately 1,600 subsurface anomalies were detected during the MEC RI particularly in and near the Ordnance Disposal Area and so the subsurface anomaly density would be expected to be high in areas not previously addressed close to the Ordnance Disposal Area. A summary of the anomaly observations are presented in Appendix A and a summary of MPPEH items (anticipated to be MDAS) identified during the 2010 MEC RI at the ground surface is presented in Appendix B (in field form MRP FF.8)

Profile Type	Information Needs	Findings
Munitions/ Release Profile (continued)	Associated MC	A remedial action was conducted in 2008 and 2009 and included removal of soil contaminated with PAHs, metals, and TRPH from 17 excavation areas (A to Q) (Figure 10-3). PAH and lead contamination, respectively, are likely the result of clay pigeons/forest burning and lead shot from skeet and trap and Ordnance Disposal Area operations. The extent of lead- and PAH-contaminated soil was delineated and contaminated soil excavated to meet cleanup requirements. Similarly, the extent of TRPH-contaminated soil has been delineated and excavated. Previous environmental investigations show that other organic compounds, dioxins, perchlorate, and nitroaromatics, and other Target Analyte List metals are not contaminants of concern (COCs) (ABB-ES, 1997). Although nitroglycerin (propellant) has not been investigated, soil near the burn chamber where propellant would be expected was removed during the 2008/2009 soil removal effort (reportedly, rocket propellant was placed on the ground, ignited, and presumed to be consumed). Groundwater concentrations of COCs were not at levels of concern (ABB-ES, 1997), although only one monitoring well remains on site to further assess arsenic (see Figure 10-2). Two consecutive rounds of sampling in August and September 2010 indicate that arsenic concentrations are less than the site screening criterion and a recommendation of no further action with regard to chemical constituents is pending.
	Migration Routes/Release Mechanisms	MEC/MPPEH have been detected in surface and subsurface soil. Migration of MEC/MPPEH is expected to be negligible because these items would not be expected to move significantly within soil. Human exposure would only occur at a given location where MEC/MPPEH is present (e.g., picking up an item, inadvertently kicking an item). MEC/MDEH is only anticipated in surface and subsurface soil to be in and around unremediated areas of the Ordnance Disposal Area. MDAS is anticipated in surface and shallow subsurface soil in the formerly open skeet and trap range areas, munitions disposal area and adjacent areas, and along access roads to the disposal area.
Physical Profile	Climate	The climate in Jacksonville, Florida, is humid subtropical. From 1971 through 2000, the mean annual rainfall was approximately 52 inches, and the mean annual temperature was 68 degrees Fahrenheit. Most of the annual rainfall occurs in the late spring/early summer, and winters are generally mild and dry.
	Topography	Overall, Site 15 is flat (ABB-ES, 1997). Much of the Site 15 area is swampy throughout the year, with sections of the area under water for parts of the year. Land surface elevations at Site 15 range from approximately 72 to 80 feet above mean sea level (relative to the National Geodetic Vertical Datum).
	Geology	Site 15 is underlain by undifferentiated fine-grained sand, and lenses and stringers of silty or clayey material may be encountered intermittently. The stringers are generally less than 1 inch thick and are not continuous. Lithologic descriptions recorded during monitoring well installation at Site 15 indicate that sand is present from the ground surface to at least 14 feet bgs (ABB-ES, 1997).

Profile Type	Information Needs	Findings
	Soil	Three soil types cover Site 15 in nearly equal percentages, Olustee Fine Sand, Leon Fine Sand, and Ridgeland Fine Sand. These three soil types are described as a nearly level poorly drained soil found in broad flatwood areas.
	Hydrogeology	Depth to groundwater is very shallow in these soil types, and permeability through the upper 6 inches is moderate to rapid (Tetra Tech, 2008).
	Hydrology	Drainage is limited because only two drainage pathways (ditches) intersect the general area of the site. Flow through the drainage ditches is intermittent, depending on rainfall, and the ditches ultimately drain into Yellow Water Creek located southwest of Site 15.
	Vegetation	Natural vegetation types consist predominantly of oak, pine, and saw palmetto. Six wetland areas are present that cover a combined area of approximately 4.6 acres (Tetra Tech, 2008). Currently, outside of the area where vegetation was removed as part of the 2008/2009 remedial action, the site remains heavily forested, primarily with slash pine and understory vegetation. The site also now includes low shrub and brushland vegetation, particularly in areas where vegetation was removed in 2008.
Land Use and Exposure Profile	Current Land Use	Site 15 is currently not used and is in a semi-secure controlled area accessible to vehicles only through access gates.
	Current Human Receptors	Potential receptors include military personnel and civilian personnel, contractors/visitors, and trespassers, although property transfer is pending.
	Current Activities	This area is currently not used.
	Potential Future Land Use	JEDC Reuse Plan provides for future use of the site as a natural and recreational corridor.
	Potential Future Human Receptors	Potential future receptors until final property transfer include military and civilian personnel, contractors, visitors, trespassers, and after property transfer, maintenance workers and recreational users of the site (including children). Because Site 15 will be accessible by the public and limited recreational activities (running and hiking along trails) may occur, Site 15 is considered accessible to potential future human receptors.
	Potential Future Land Use-Related Activities	In accordance with the ROD, the LUC RD, prepared by Tetra Tech in 2009, allows for low-intensity recreational uses including activities such as hiking, biking, horseback riding, birding, and hunting.
	Zoning/Land Use Restrictions	Site 15 is currently in a semi-secure controlled area accessible to vehicles only through access gates. In accordance with implemented LUCs, no man-made attractions can be provided that would entice people, particularly small children, to frequently visit the site, which is consistent with the property's proposed reuse as a natural resource corridor. Medium- (e.g., picnicking and camping) and high-intensity (e.g., children's playgrounds and contact sports) recreational uses are

Profile Type	Information Needs	Findings
		not permitted. LUCs also prohibit excavation of soil from Site 15 without prior written approval from the Navy, USEPA, and FDEP (Tetra Tech, 2009). Surface soil to a depth of 6 inches bgs is the expected vertical depth for exposure based on permitted land use (low-intensity recreational activities); however, because of potential erosion or other changes to the ground surface, a buffer of an additional 6 inches is warranted, resulting in a total vertical depth of 1 foot bgs of concern for conservative purposes.
	Demographics/ Zoning	The Duval County population is approximately 857,040 according to the 2009 United States Census Bureau estimate.
	Beneficial Resources	There are no known site-specific beneficial resources.
Ecological Profile	Habitat Type	This site is covered by a mixed deciduous and conifer forest, wetlands, low shrub, and brushland vegetation.
	Degree of Disturbance	Moderate – activities at the site will include development of trails and paths to be used for low-intensity recreational uses including hiking, biking, horseback riding, birding, and hunting. In addition, animals on site such as the gopher tortoise burrow into the soil.
	Ecological Receptors and Species of Special Concern	The gopher tortoise, considered threatened by the Florida Committee on Rare and Endangered Plants and Animals (FCREPA), was identified at Site 15. As part of the Site 15 2008/2009 remedial action for soil contamination, gopher tortoise burrows were identified in the planned soil excavation areas, and the gopher tortoises were relocated to an area west of the main area cleared of vegetation (AGVIQ-CH2MHill, 2009). Additionally, the indigo snake is considered a special status species (protected as threatened under the Endangered Species Act and by the State of Florida), and a protection plan was put in place.
General Exposure Profile	Relationship of MEC/MC Sources to Habitat and Potential Receptors	Exposure to surface MEC/MPPEH is a potentially complete pathway because, although no MEC were identified during the RI (Figure 10-5), MEC/MDEH have been identified in the past on the surface in the Ordnance Disposal Area, and MPPEH (anticipated to be MDAS but not yet certified) (Figure 10-3). MEC/MPPEH, which is likely present in the subsurface in the Ordnance Disposal Area, would present an explosive hazard to human receptors if brought to the surface. However, this hazard is low because most of the primary area of munitions disposal has been remediated to 1.5 to 3.5 feet bgs the site was extensively traversed historically for sample collection purposes, and current LUCs for the site limit development to low-intensity recreational activities. The MC pathway is potentially complete for human and ecological receptors; however, residual MC is considered an acceptable risk because the 2008/2009 remedial action removed contaminated soil from within the existing RI grid boundary.

10.5.1 Physical and Environmental Characteristics

The following section provides information that was presented in documents prepared to support previous site investigations, including climate, topography, geology, soil and vegetation types, hydrology, hydrogeology, cultural and natural resources, and threatened, endangered, and protected species. Supporting information for the physical and environmental characteristics of the site can be found in the MEC RI Report (Tetra Tech, 2010).

Climate

The climate in Jacksonville, Florida, is humid subtropical. From 1971 through 2000, the mean annual rainfall was approximately 52 inches, and the mean annual temperature was 68 degrees Fahrenheit. Most of the annual rainfall occurs in the late spring/early summer, and winters are generally mild and dry.

Topography

Overall, Site 15 is flat (ABB-ES, 1997). Much of Site 15 is swampy throughout the year, with sections of the area under water for parts of the year. Land surface elevations at Site 15 range from approximately 72 to 80 feet above mean sea level (relative to the National Geodetic Vertical Datum).

Geology

Site 15 is underlain by undifferentiated fine-grained sand and lenses and stringers of silty or clayey material may be encountered intermittently. The stringers are generally less than 1 inch thick and are not continuous. Lithologic descriptions recorded during monitoring well installation at Site 15 indicate that sand is present at each monitoring well location from the ground surface to the total depth, a maximum of 14 feet bgs (ABB-ES, 1997).

Cross sections showing Site 15 lithology were not generated during the RI and were not prepared as part of this SAP because of the homogeneous lithology and shallow depth to groundwater identified during previous investigations and because groundwater is not included in the subject investigation.

Soil and Vegetation Types

Three soil types cover Site 15 in nearly equal percentages, the Olustee Fine Sand, Leon Fine Sand, and Ridgeland Fine Sand. Each of the three soil types is described as a nearly level poorly drained soil found in broad flatwood areas. Natural vegetation on these soil types consists predominantly of oak, pine, and saw palmetto. Depth to groundwater is very shallow in these soil types, and permeability through the

upper 6 inches is moderate to rapid (Tetra Tech, 2008). Six wetland areas are present at Site 15 that cover a combined area of approximately 4.6 acres (Tetra Tech, 2008).

Several forest fires have occurred in an area of stressed vegetation, referred to as the forest burn area, in the southwestern portion of the site (see Figure 10-2). Several slash pines are partially burned in this area. Controlled burns were commonly undertaken in this area to manage understory growth in the planted pine forest. The latest burning event took place in spring 1999 (AGVIQ-CH2MHill, 2009).

Current-day soil and vegetation types are depicted on the CSM, Figure 10-4. Before 2008-2009 remedial activities to remove contaminated soil, which necessitated vegetation clearance over a large portion of the site, the entire area was heavily forested. Currently, outside of the area where vegetation was removed as part of the 2008/2009 remedial action, the site remains heavily forested, primarily with slash pine and understory vegetation. The site also now includes low shrub and brushland vegetation; particularly in areas where vegetation was removed areas of previously contaminated soil removal are now readily visible as unvegetated sandy areas due to backfill with clean sandy soil. Some minor stands of trees were identified between the areas cleared of vegetation. Trees are also sparser in the areas where controlled forest burns were formerly conducted.

Hydrology

Drainage is limited because only two drainage pathways (ditches) intersect the general area of the site. Flow through the drainage ditches is intermittent, depending on rainfall, and the ditches ultimately drain into Yellow Water Creek located southwest of Site 15.

Hydrogeology

Three water-bearing systems are present beneath Site 15, including in descending order, the surficial aquifer system, intermediate aquifer and confining units, and Floridian Aquifer system. Only the surficial aquifer was investigated at Site 15 during the RI of chemical contamination. The surficial aquifer at Site 15 is composed predominantly of sand from the ground surface to an approximate depth of 66 feet bgs. The water table is unconfined beneath the site and ranges between 1 and 4 feet bgs during the year, depending on rainfall events.

Cultural and Natural Resources

No existing cultural resources were identified for Site 15. As provided in the ROD, the Jacksonville Economic Development Commission (JEDC) Reuse Plan provides for future use of Site 15 as a natural

and recreation corridor. The remedy for Site 15 was selected to allow for the planned future use (Tetra Tech, 2008).

Threatened, Endangered and Special Status Species

The gopher tortoise, considered as threatened by the Florida Committee on Rare and Endangered Plants and Animals, was identified at Site 15. As part of the 2008/2009 Site 15 remedial action for soil contamination, gopher tortoise burrows identified in the planned soil excavation areas were relocated to an area west of the main area cleared of vegetation (AGVIQ-CH2MHill, 2009). In addition, the indigo snake is considered a special status species under the Endangered Species Act and by the State of Florida), and a protection plan was put in place.

Access/Controls/Restrictions

Site 15 is currently not used and is in a controlled area accessible only through access gates. Site 15 - Blue 10 is a semi-secured area with gates in place to limit vehicle entry but with relatively open access to bike and pedestrian traffic. In accordance with the ROD, the LUC RD allows for low-intensity recreational uses including activities such as hiking, biking, horseback riding, birding, and hunting. No man-made attractions can be provided that would entice people, particularly small children, to frequently visit the site, which is consistent with the property's proposed reuse as a natural resource corridor. Medium- (e.g., picnicking and camping) and high-intensity (e.g., children's playgrounds and contact sports) recreational uses are not permitted. Residential and industrial/commercial uses are also prohibited.

10.5.2 Potential or Known Sources of MEC

It appears that the areas containing MEC/MDEH at Site 15 are associated with the Ordnance Disposal Area where ordnance burning operations occurred. Table 10-3 below provides a summary of the areas of concern for MEC/MPPEH based on the current-day CSM, and discussion of each area is provided herein. Additional details on MEC/MDEH encountered during the 2008/2009 soil excavations are provided in Appendix A-2 of the MEC RI Report (Tetra Tech, 2010b).

Table 10-3 – Site 15 MEC Summary of Concerns

MEC Area of Concern	Munitions Items			Estimated Dates of Operation and Notes
	Type	Observed[1]	Potential	
Skeet and Trap Range Areas	MDAS[2]	√	√	- 1940s to 1950s. - Area 1,000 feet by 2,400 feet. - MDAS likely associated with reuse as the Ordnance Disposal Area operations and present because the area was formerly an open area when used as a range.
Ordnance Disposal Area - Burn Chamber - Static Firing Pad - Historical operational area outline (and adjacent grids)	MEC/MDEH items/MDAS[2]	√	√	- Mid-1960s to 1977. - MEC and MDAS were found in and adjacent to the area identified as the Ordnance Disposal Area.
Miscellaneous Disposal along Access Roads	MDAS[2]	√	√	- Unknown dates; assumed to be mid-1960s to 1977 as for Ordnance Disposal Area. - MDAS likely present due to easy accessibility.
High-Density Subsurface Anomaly areas outside of the Ordnance Disposal Area	MDAS[3]	--	√	- Unknown dates, assumed to be mid-1960s to 1977 as for Ordnance Disposal Area - Areas identified during the MEC RI with high (greater than 20 anomalies per transect) and unexplained source - MDAS likely present based on close proximity to Ordnance disposal area (northeast) and collocation with former Skeet Range (southeast)
Moderate to low-density anomaly transects at the Existing RI Grid Boundary	MDAS[4]	--	√	- Unknown dates, assumed to be mid-1940s to 1977 as for the Skeet Range and Ordnance Disposal Area - MDAS possible but unlikely due to distance from Ordnance Disposal Area

1 MEC/MPPEH were observed and removed as a safety measure from those areas that were included in the 2008/2009 munitions survey, prior to contaminated soil excavation: Figure 10-3 indicates the results of the munitions survey and areas where MEC/MPPEH were found and removed or where no MEC/MPPEH were found.

2 MEC found included practice mine fuzes, TP projectiles, and photoflash cartridges. MDAS found included cartridge and flare cases, banding pieces, flare canisters, small arms, and shotgun primer (see table in Appendix A-2 of the MEC RI Report).

3 MPPEH (anticipated to be MDAS) observed on the ground surface in these areas includes fuze parts, base plate, flare casings, and missile components.
4 No munitions-related items have been found on the ground surface at the RI grid boundary.

10.5.3 MEC Migration Pathways and Receptors

MEC/MPPEH from ordnance disposal activities were found in surface and subsurface soil in portions of Site 15 where munitions clearance was conducted as part of remedial activities in 2008/2009 (MEC/MDEH pink grids, MDAS Orange grids depicted in Figure 10-3). Additional items believed to be MDAS but not certified, were encountered on the ground surface during the 2010 RI. Migration of MEC is expected to be negligible because MEC items would not be expected to move within soil and the topography is flat. Human exposure to MEC would only occur at a given location where MEC are present (e.g., picking up an item, inadvertently kicking an item). MEC are anticipated in areas used for ordnance disposal and immediately adjacent areas. MDAS is anticipated in surface soil in the formerly open skeet and trap range areas, Ordnance Disposal Area and adjacent areas, and along access roads to the disposal area.

Based on the LUC RD, potential human receptors at this site are low-intensity recreational users (e.g., bikers, hikers, and bird watchers). The site is currently not used and access is restricted while the investigation proceeds. Therefore, these recreational users are considered future potential users who could be exposed to MEC/MPPEH, if present, at the ground surface, and in the top few inches of shallow subsurface soil (generally the top 1 foot of soil that includes a 6-inch buffer zone as a conservative measure) particularly in and around the Ordnance Disposal Area.

The Site 15 area is considered a natural resource corridor, and birds, mammals, and reptiles are present at the site. In particular, gopher tortoises are known to be present at the site. As part of remedial activities in 2008/2009, gopher tortoises, classified as threatened by Florida, in the vegetation removal area were relocated to the west of the vegetation removal area.

10.6 PROBLEM STATEMENT

The munitions survey conducted in 2008 only included areas where MC soil remedial activities were required. The transect detector-aided surface survey conducted in 2010 as part of the RI encountered 13 munitions-related items on the ground surface and defined the subsurface anomaly distribution but could not determine the sources/types of the anomalies since intrusive investigation was not included in the scope of work. Figure 10-3 shows the general distribution of anomalies per transect.

Data gaps remaining after the MEC RI are related to three general areas containing subsurface anomalies that are not consistent with the current understanding of CSM. The current CSM indicates that MEC/MPPEH in the subsurface should be located in and around the former Ordnance Disposal Area; and supported by the fact that all previously identified MEC/MDEH (surface or subsurface) items were in and around the Ordnance Disposal Area. MEC/MPPEH may be found outside of the Ordnance Disposal Area because of kick outs during disposal; however, these items are expected to be present at the ground surface and not the subsurface. For former staging areas located along access roads, only MDAS is expected. The extent of MEC/MPPEH on the ground surface appears to be adequately delineated based on the results of the MEC RI for the purposes of developing an FS. However, the subsurface has not been adequately investigated outside of the Ordnance Disposal Area; if MEC and MDEH (which will be treated at MEC) is present in the shallow subsurface (0 to 1 foot bgs) it could pose significant hazard to future land users, even during low-intensity recreational activities and so warrants additional investigation to confirm the CSM. MDAS does not present a safety hazard concern and therefore is not the primary concern of this supplemental MEC RI but if present may provide information as to the extent of historical operations. Intrusive anomaly source investigations are needed in the three general areas described below to confirm the absence of MEC/MDEH in the subsurface outside of the former Ordnance Disposal Area.

The remaining data gap areas of concern based on the MEC RI are as follows:

- **Bike Path/Asphalt Access Road** - The areas within approximately 100 feet of the paved bike path and asphalt access road have a high density of subsurface anomalies (depicted by red transects on Figure 10-3) based on the CSM, that may be the result of using this area for staging munitions-related material prior to or after disposal operations. In addition, this area is expected to be a high traffic area based on the planned future land use. Therefore, confirmation of the source of the anomalies was recommended.

- **High-Density Anomaly Areas Outside of the Ordnance Disposal Area** - The high-density subsurface anomaly areas located in the northeastern and southeastern portions of the site depicted by red transects on Figure 10-3, located outside of the Ordnance Disposal Area. These areas are near MPPEH (anticipated to be MDAS) found on the ground surface and may indicate currently unidentified subsurface source areas such as pits or disposal areas. Therefore, confirmation of the source of anomalies was recommended.

- **Existing RI Grid Boundary**- Based on the CSM, anomalies located along the 2010 RI extent of the transect investigation (depicted largely by blue and green transects on Figure 10-3) are expected to

be non-MEC/MDEH related because of the distance from the Ordnance Disposal Area where MEC/MDEH was historically encountered. Therefore, confirmation of the absence of MEC/MDEH was recommended.

MEC found during the 2008-2009 remedial areas was within and adjacent to the Ordnance Disposal Area; therefore this primary area of concern will be included in the FS to evaluate remedial alternatives. MDAS found on the ground surface during the 2008-2009 remediation activities and 2010 RI provides adequate information for the FS to evaluate remedial alternatives. MEC and MDEH in the areas between transects investigated during the RI are presumed to be a concern for recreational users at the site on the ground surface; the density in these areas will be estimated based on the information gathered to date. This supplemental investigation then is primarily to determine for the subsurface the need to include the three general data gap areas during the FS.

Chemical contamination has been adequately investigated and remediated and further investigation of chemical contamination as part of the RI and subject supplemental RI is not required at this time. Based on the extensive investigation of chemical contamination that was previously conducted, MEC/MPPEH are not expected to be present beyond the area of chemical contamination investigation at Site 15.

SAP Worksheet No. 11 - Project Quality Objectives/Systematic Planning Process Statements for Supplemental MEC Investigation at Site 15

(UFP-QAPP Manual Section 2.6.1)

11.1 IDENTIFY THE GOAL OF THE STUDY

The primary goal of the Supplemental MEC RI is to fill remaining data gaps regarding the source material for subsurface anomalies located in three general areas outside of the known remaining problem at the former Ordnance Disposal Area. The investigation will focus on determining if MEC/MDEH are present in the selected areas of high, medium, and low anomaly density identified in the MEC RI (see Figure 10-3). UXO Technicians will use hand-digging techniques to unearth and examine items that are the sources of the anomalies. The presence of MEC/MDEH in the three general data gap areas will also support development of the FS for these areas. The Ordnance Disposal Area will be included in the FS evaluation of remedial alternatives because it is a known area of concern in regards to MEC/MDEH; information collected to date is adequate for this area.

11.2 IDENTIFY INFORMATION INPUTS

Data and information gathered from portions of the site identified during the previous MEC RI and used for decision making include the following:

Bike Path and Asphalt Access Road: Results of the investigation of 55 randomly selected shallow subsurface anomalies using manual hand-digging techniques from the area at and near the intersection of the Bike Path and Asphalt Access Road.

High-Density Anomaly Areas: Results of the investigation of 28 randomly selected shallow subsurface anomalies using manual hand-digging techniques from high-density anomaly areas outside of the Ordnance Disposal Area.

Existing RI Grid Boundary: Results of the investigation of 54 randomly selected shallow subsurface anomalies using manual hand-digging techniques from transects along the existing RI grid boundary.

11.3 DEFINE BOUNDARIES OF THE STUDY

The initial horizontal boundary for this Supplemental RI was determined based on the results of the MEC RI and is presented on Figure 10-3, although the horizontal boundary may be expanded via step outs

based on the results of hand digging if MEC/MDEH is unexpectedly encountered. For the vertical boundary, the investigation will continue until the excavation is clear of all detectable anomalies or until the hand excavation reaches a maximum depth of 1 foot bgs and a maximum radius of 2 feet from the pin flag used to identify the center of each randomly acquired anomaly. Surface soil to a depth of 6 inches bgs is the expected vertical depth for exposure based on permitted land use (low-intensity recreational activities); however, because of potential erosion or other changes to the ground surface, a conservative buffer of an additional 6 inches is warranted, resulting in a total vertical depth of concern of 1 foot bgs.

If anomalies are determined in the field to be deeper than the maximum 1-foot-deep excavation, that information will be recorded in the logbook. MEC/MPPEH identified on site will be treated. MDAS will be removed. Most of the anomalies are anticipated to be located in the shallow subsurface (less than 12 inches bgs) because this depth generally corresponds to the depth restrictions of the detection instrumentation used to identify anomalies during the MEC RI.

Areas previously investigated/cleared of munitions during the 2008/2009 soil remediation effort do not require further investigation and are not included in the planned survey area. As shown on Figure 10-3, these areas include areas cleared of vegetation where no MEC/MDEH or MDAS (depicted as blue grid squares) was found and areas where MEC/MDEH and/or MDAS (depicted as pink and orange grid squares) were found and removed.

The Ordnance Disposal Area and the area within approximately 200 feet of the disposal area is not included in this Supplemental RI because it is already assumed to contain MEC/MPPEH and will be included in the FS for evaluation of remedial alternatives.

11.4 DEVELOP THE ANALYTICAL APPROACH

The three data gap areas need to be confirmed for the absence of MEC/MDEH. The decision rules for the three data gap areas are based on gaining information during the MEC/MDEH (MDEH will be treated as MEC) intrusive investigation that further confirms/develops the current CSM and aids in developing the next phase of the process. The decision rules are as follows:

- If the results of the Supplemental MEC RI indicate that no MEC/MDEH are present in the shallow subsurface for any of the three data gap areas, then proceed with an FS to address the remaining potential MEC/MPPEH exposure pathways associated with planned future low-intensity recreational land use.

Otherwise:

- **Bike Path/Asphalt Access Road:** If the results of the Supplemental MEC RI indicate that MEC/MDEH are present in the shallow subsurface, then the Project Team will proceed to a FS, if the Project Team agrees that adequate data have been collected. If adequate data have not been collected, the Project Team will evaluate the need for further focused investigation.

- **High-Density Anomaly Areas:** If the results of the Supplemental MEC RI indicate that MEC/MDEH are present in the shallow subsurface, then the Project Team will proceed to a FS, if the Project Team agrees that adequate data have been collected. If adequate data have not been collected, the Project Team will evaluate the need for further investigation.

- **Existing RI Grid Boundary:** If anomalies located along the grid boundary of the 2010 RI transect investigation are MEC/MDEH, then the UXO Team (including the Technical Lead) will make a field determination for the need to step out the investigation boundary with a transect parallel to and 200 feet from of any found MEC/MDEH. Up to 10 step-out transects may be completed across the site. When a step out is determined to be necessary, then a detector-aided survey and hand tool excavations will be completed using the same hand-digging strategy used in other data gap areas (described in Worksheet No. 17). If MEC/MDEH are found along a step-out transect, then the Project Team will evaluate the current CSM to determine the possibility of a separate source area for MEC-related items outside of the known problem at the former Ordnance Disposal Area. If the evaluation of the CSM results in no new source area, the Project Team will evaluate the available data to determine if they are sufficient to proceed to the FS.

Up to an additional 20 hand digging locations may be completed across the site to address remaining data gaps if any are identified by the UXO Team.

Figure 11-1 presents the project decision rules in a logic chart for the Bike Path/Asphalt Access Road and High-Density Anomaly Areas. Figure 11-2 presents the project decision rules in a logic chart for the existing RI grid boundary.

11.5 SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA

Data gap subsurface anomaly areas (Bike Path/Asphalt Access Road, High-Density Anomaly Areas outside of the Ordnance Disposal Area, and existing RI grid boundary) have been identified for further investigation based on detector-aided survey data collected during MEC RI field activities concerning

subsurface anomalies. The manual investigation using hand excavation methods will occur within these target locations to determine the absence or presence of MEC/MPPEH or the types of non-munitions-related debris in shallow subsurface soil, and to provide a general delineation of the extent of potential MEC/MPPEH in the shallow subsurface.

To make sure adequate data is being collected for decision making purposes Visual Sample Plan (VSP) Software Version 6.0 was used to determine the minimum number of anomalies to be investigated from the existing RI grid boundary and the transects located near the Bike Path/Asphalt Access Road (Appendix A). Additional hand excavation locations were added to allow a minimum of one excavation location per transect that contained shallow subsurface anomalies in each area of concern. VSP software was not used to determine the minimum number of hand excavation locations in the High-Density Anomaly Areas outside the Ordnance Disposal Area, as it did not lend itself to VSP Software. However, the same color coded strategy will be used to determine how many anomalies to investigate per transect (i.e. red equals three, yellow equal 2, and green equals 1). The Project Team will use the results of the investigation to verify that all proposed data were collected and that the data meet the quality specifications of this SAP, especially adherence to method-specific quality specifications identified in Worksheet Nos. 35 and 36.

The Project Team will review the investigation results and ensure that all Stakeholder viewpoints are included in decision-making. Worksheet No. 37 describes the data usability assessment process, which goes beyond an evaluation of method-specific quality evaluations to include evaluations of planning assumptions and other factors. This will involve a review of survey coverage and anomaly patterns by the Project Team to determine if adequate data were collected to progress to a FS.

11.6 DEVELOP THE PLAN FOR OBTAINING DATA

The proposed Supplemental RI field data collection program for Site 15 is described in detail in Worksheet No. 17 of this SAP.

SAP Worksheet No. 12 – Measurement Performance Criteria Table

(UFP-QAPP Manual Section 2.6.2)

Definable Feature of Work/ Data Type	Geophysical Anomaly Measurement/ Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Site Preparation (including mobilization)	Completeness	Verify that approved project plans are reviewed and signed.	Approved project plans reviewed and signed.	Once
		Verify that equipment needed is on site.	All equipment needed is on site.	
		Verify that communications needed are on site and working.	Communications checked.	
		Verify emergency services.	Emergency services checked.	
		Verify site-specific training.	Site-specific training completed.	
		Verify appropriate UXO personnel designated in writing by NAVFAC CO as qualified and authorized to inspect MPPEH and document as MDAS or MDEH.	Personnel designated in writing by NAVFAC CO as qualified and authorized to sort and document MPPEH.	
		Verify UXO personnel designated in writing are qualified to operate an explosive-laden vehicle and medically certified to transport ammunition and explosives.	Personnel designated in writing as qualified to operate an explosive-laden vehicle and medically certified to transport ammunition and explosives.	

Definable Feature of Work/ Data Type	Geophysical Anomaly Measurement/ Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Site Surveying	Accuracy	Verify that site boundaries have been established and are consistent with the 2010 MEC RI grid. Inspect area for visual evidence of 2010 transect. Verify that survey transects have been established in accordance with MRP SOP 05. For step-out transects, verify step-out transects are established 200 feet from the last parallel transect	Site boundaries have been established and are consistent with the 2010 MEC RI grid. Survey transects have been established in accordance with MRP SOP 05. Step-out transects have been established 200 feet from the last parallel transect	Once Transect ends will be marked using RI coordinates and recollected using the GPS.
Instrument Verification Strip (IVS)	Sensitivity	Detection capabilities test of representative seed items.	Vertical detection of industry standard objects (ISO) at specified depth.	Daily
Vegetation Management	Completeness	Verify that vegetation has been removed from working areas of the site (transects, excavation areas, equipment laydown areas, and access pathways) in accordance with MRP SOP 06.	Vegetation cut to between 6 to 12 inches above the ground surface.	As needed
GPS Positional Data Collection	Real-Time Accuracy	Horizontal Dilution of Precision (HDOP) and number of satellites.	HDOP less than 3, number of satellites at least 6.	Ongoing
	Accuracy	GPS positioning - comparison with two known locations.	Sub-meter.	Once at the beginning and at one other time during the latter part of the workday.

Definable Feature of Work/ Data Type	Geophysical Anomaly Measurement/ Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Detector-Aided Survey – Step-Out Transects	Precision	Resurvey completed transect to perform a direct comparison to field data collected during detector-aided surface survey.	Detect all metallic items (both ferrous and non-ferrous) 20mm or larger on the ground surface.	Resurvey 25% of first four transects and after any failure, then 10% of remaining transects after four transects in a row pass QC. If any transects does not pass QC, UXO Team will resurvey entire transects, and another QC check will be performed.
		Blind seeds items.	Discover and record all blind seeds placed in transect.	Blind seed items will be placed on the surface into the duff, or if duff is not present, covered with duff from another location, at locations within each transect prior to surface survey operations. At least one blind seed item, and no more than six, will be placed in each transect (daily lot of work). If any transect does not pass QC, UXO team will resurvey entire transect, and another QC check will be performed.

Definable Feature of Work/ Data Type	Geophysical Anomaly Measurement/ Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Anomaly Intrusive Investigations	Accuracy	QC identification of munitions-related anomaly sources.	Type, condition, and fuzing state (of munitions-related items correctly identified). Type of non-munitions-related items. Detect all MEC/MPPEH 20 mm or larger.	Each occurrence Each dig location will be surveyed by the UXOQCS. Any failed locations will be cleared again by the UXO Team, and the UXOQCS will then perform another resurvey of each failed target location. Process will repeat until all targets pass QC.
		QC audit of anomaly identification forms.	Anomaly identification forms completely and correctly filled out for each anomaly.	Daily
Donor Explosives Handling	Accuracy	Proper placarding, warning signs, flagging, and firefighting equipment present and correctly posted. Receipt, usage, and inventory control completed per Operations Pamphlet (OP) 5/Bureau of Alcohol, Tobacco, and Firearms and Explosives (BATFE) requirements. Compliance with explosive handling and transportation requirements.	Explosives handling performed in compliance with OP 5 and BATFE regulations.	Daily/weekly/each occurrence
MEC Management - Treatment	Completeness	Verify that treatment is conducted per MRP SOP 07.	Treatment conducted per MRP SOP 07.	Each occurrence
MPPEH Management - Inspection	Accuracy	Verify that inspection is per MRP SOP 02 and OP 5.	Each MPPEH item inspected and segregated as MDAS or MDEH.	Daily/each occurrence

Definable Feature of Work/ Data Type	Geophysical Anomaly Measurement/ Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
MPPEH Management - Certification	Accuracy	Verify that certification is per MRP SOP 02 and OP 5.	MPPEH is certified as MDAS or MDEH.	Daily/each occurrence
MPPEH Management - Disposal	Completeness	Verify that disposal is conducted per MRP SOPs 02 and 07.	Disposal is conducted per MRP SOPs 02 and 07.	Daily/each occurrence
Demobilization	Completeness	Verify that sites have been restored and that all equipment is inspected, packaged, and shipped to appropriate locations.	Temporary markers removed and instrument IVS seed holes are filled. All equipment is off site and has arrived at appropriate location.	Once at the end of field operations

Definable Feature of Work/ Data Type	Geophysical Anomaly Measurement/ Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Site-Specific Final Report Preparation and Approval	Completeness	QC of MEC Tracking Log and Daily Field Reports.	Ground Surface (as applicable): Quantitative tabulation of MEC items discovered during the 2010 RI and any new items found during the Supplemental RI, including step-out transects, is included in the MEC Tracking Log. Shallow Subsurface: Tabulation of MEC items discovered during the investigation are included in the MEC Tracking Log Shallow Subsurface: Semi-quantitative tabulation of anomalies for each step-out transect segment. Daily Field Reports are complete and accurate. MEC Hazard Assessment complete.	Once at the end of field operations prior to demobilization

Explanations for criteria listed above explained in Worksheet No. 22. Field forms are included in Appendix B.

SAP Worksheet No. 13 – Secondary Use of Data Criteria and Limitations Table

(UFP-QAPP Manual Section 2.7)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/collection dates)	How Data Will Be Used	Limitations on Data Use
Remedial Action Completion Report	Remedial Action Completion Report – Soil Removal Action for Operable Unit 5, Site 15 - Blue 10 Ordnance Disposal Area, Naval Air Station Cecil Field, Jacksonville, Florida. August 2009	AGVIQ-CH2MHill	Basis of SAP for 2010 RI and subject Supplemental RI	The information is quantitative and site specific. The information was used to establish data gaps to be addressed during the field work program for the RI and Supplemental RI.
MEC RI Report	MEC Remedial Investigation Report for Munitions Response Program at Operable Unit 5, Site 15 - Blue 10 Ordnance Disposal Area, August 2010 (draft)	Tetra Tech	Basis of SAP for Supplemental MEC RI	The information is quantitative and site specific. The information was used to establish the field work program and identify data gaps.
ESS	ESS Approval from NOSSA and DDESB	Tetra Tech	Basis for UFP-SAP for Site 15 supplemental RI.	The information is site specific for Site 15 and defines requirements for addressing what MEC/MPPEH-related material could be expected to remain on site.

SAP Worksheet No. 14 – Summary of Project Tasks

(UFP-QAPP Manual Section 2.8.1)

Implementation of the Supplemental MEC RI has been divided into definable features of work and the tasks required to be completed for the work identified. Procedures for these tasks, including recording data, forms and checklists (Appendix B), data generation, QC checks, data management, and information management, are defined in the SOPs for the project, which are provided in Appendix C and indexed in Worksheet No. 21.

Definable Feature of Work	Tasks
Site Preparation (including mobilization)	• Project Plan Preparation (SAP, ESS, and HASP/Accident Prevention Plan [APP] review, geographic information system [GIS] setup, document and data management procedures, approved SAP and subcontractors, and schedule is confirmed) • Verify personnel qualifications • Coordination with local authorities and establish communication logistics • Setup administrative offices • Conduct initial orientation and training (including safety and emergency response) • Equipment setup and checkout • Remove surface non-munitions related debris, as applicable • Verify certification from NAVFAC Commanding Officer of UXO Technician to certify MDEH/MDAS • Verify rental truck vendor authorization to use vehicle for transport of explosives
Site Surveying	• Survey site boundaries with GPS or conventional means • Survey transect ends with GPS or conventional means • Flag each end of reacquired transects
IVS	• Install IVS • Perform IVS • Report results of IVS • Obtain approval of initial IVS results
Vegetation Management	• Inspect equipment • Set cutting height to between 6 and 12 inches above ground surface, as needed for reacquired transects and step-out transects

Definable Feature of Work	Tasks
GPS Positional Data Collection	• Load GPS with site boundaries, transect end points, 13 MPPEH items from 2010 RI, etc. • Twice daily (one at the beginning and at one other time during the latter part of the workday) comparison with two known reference locations • Continually monitor HDOP parameters • Collect hand dig and MEC/MPPEH location GPS data, use alternative means if GPS is not effective due to tree canopy • Backup GPS data • Transfer GPS data to Tetra Tech GIS website
Detector-Aided Survey – Step-Out Transects	• Installation of blind seeds • Survey transects to locate subsurface anomalies • Record locations (GPS and photograph) of MEC/MPPEH found on surface and in subsurface hand dig locations then treat or remove as appropriate • Conduct UXO escort duties • On step-out transects count subsurface anomalies to determine density and establish color coding system (i.e., low - zero to five, medium - six to 20, or high - more than 20).
Anomaly Intrusive Investigation	• Remove non-munitions-related debris entirely on the surface, as applicable • Locate, flag, record random number of subsurface hand dig locations in accordance with Worksheet No. 17 • Excavate and investigate randomly selected targeted subsurface anomalies to a maximum depth of 1 foot and a maximum radius of 2 feet around the location of the subsurface anomaly • Record location (GPS and photograph) of each MEC or MPPEH item discovered, then treat or remove as appropriate • Report MEC in accordance with Worksheet #6 • Leave excavation open for QC confirmation of excavation dimensions and presence/absence of items at sidewalls and floor of the excavation • Refill excavation after QC complete
Donor Explosives Handling	• Post proper placarding, warning signs, flagging, and firefighting equipment present and correctly • Complete receipt, usage, and inventory control per Naval Sea System Command (NAVSEA) OP 5/BATFE requirements • Compliance with explosive handling and transportation requirements.
MEC Management - Treatment	• Establish EZ per ESS requirements • Prepare site for treatment • Prepare and apply donor charge • Check results of treatment • Locate and treat MEC/MPPEH found during 2010 MEC RI

Definable Feature of Work	Tasks
MPPEH Management - Inspection	• Inspect MPPEH • Separate MPPEH into MDEH and MDAS • Secure MDEH items and treated as MEC
MPPEH Management - Certification	• Secure MDAS secured in a secure locked container and certify to ensure that no energetic material remains • Update MDAS form and attach to container • Certify MDEH
MPPEH Management - Disposal	• Dispose of MDAS as per OP 5 • Treat MDEH with donor change as MEC • Maintain custody of MDEH through treatment until MDAS custody is transferred to an authorized disposal contractor
Demobilization	• Remove IVS • Remove temporary survey markers and verify site restoration • Complete all field forms • Close out field logbooks • Return equipment • Provide all field documentation to Technical Lead (verify requirements established in the SAP)
Site-Specific Final Report Preparation and Approval	• Close out MEC tracking log • Collect all documentation from the field activities • Prepare Site Specific final report • Address comments • Receive approval of final report

SAP Worksheet No. 15 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

☑ **Worksheet Not Applicable**

This worksheet applies to chemical analysis and reporting and is not applicable to this UFP-SAP for MEC /investigation.

SAP Worksheet No. 16 – Project Schedule/Timeline Table

(UFP-QAPP Manual Section 2.8.2)

Activity	Organization	Dates (MM/YYYY)	
		Anticipated Date(s) of Initiation	Anticipated Date of Completion
Prepare Draft Supplemental MEC RI SAP	Tetra Tech	---	1/10//2011
Submit Draft Supplemental MEC RI SAP	Tetra Tech	1/10/11	1/10/2011
Review	Navy, FDEP, USEPA	1/10/2011	3/18/2011
Receive Comments/Comment Resolution	Tetra Tech, Navy, FDEP, USEPA	3/18/2011	3/25/2011
Prepare Final Supplemental MEC RI SAP	Tetra Tech	3/25/2011	4/1/2011
Submit Final Supplemental MEC RI SAP	Tetra Tech	4/1/2011	4/1/2011
Field Investigation	Tetra Tech	4/11/2011	5/2/2011
Prepare Draft Supplemental RI Report	Tetra Tech	5/7/2011	6/14/2011
Submit Draft Supplemental RI Report	Tetra Tech	6/14/2011	6/14/2011
Review	Navy	6/14/2011	6/28/2011
Receive Comments/Comment Resolution	Tetra Tech, Navy	6/28/2011	7/5/2011
Prepare Draft Final Supplemental RI Report	Tetra Tech	7/5/2011	7/13/2011
Submit Draft Final Supplemental RI Report	Tetra Tech	7/13/2011	7/13/2011
Review	FDEP, USEPA	7/13/2011	8/24/2011
Receive Comments/Comment Resolution	Tetra Tech, Navy, FDEP, USEPA	8/24/2011	9/7/2011

Activity	Organization	Dates (MM/YYYY)	
		Anticipated Date(s) of Initiation	Anticipated Date of Completion
Prepare Final Supplemental RI Report	Tetra Tech	9/7//2011	9/14/2011
Submit Final Supplemental RI Report	Tetra Tech	9/14/2011	9/14/2011

1) Submittal of the Draft SAP was delayed pending the receipt of FDEP/USEPA comments/comment resolution on the 2010 RI Report, which was received in December 2010.

SAP Worksheet No. 17 – Project Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

17.1 PROJECT DESIGN AND RATIONALE

This section describes in detail the approach, methods, and operational procedures Tetra Tech will use to conduct detector-aided surveys, investigate anomalies for potential MEC/MPPEH, and manage/treat MEC/MPPEH. The data will be used to evaluate suspected anomalies in the accessible portions of the survey areas by developing hand excavation locations for target anomalies. Associated equipment and personnel, which will be used to meet the site-specific project performance goals as presented in Worksheet No. 11 of this SAP. Currently, data gaps are too significant to determine a path forward for the site.

Definable Feature of Work	SOP	Supporting Document(s)
Site Preparation (including mobilization)	MRP SOP 01 MRP SOP 03 MRP SOP 08	UFP-SAP
Site Surveying	MRP SOP 05	UFP-SAP
IVS	MRP SOP 03 MRP SOP 05	UFP-SAP
Vegetation Management	MRP SOP 06	UFP-SAP
GPS Positional Data Collection	MRP SOP 05	UFP-SAP
Detector-Aided Survey – Step-Out Transects	MRP SOP 01 MRP SOP 02 MRP SOP 05	UFP-SAP
Anomaly Intrusive Investigation	MRP SOP 01 MRP SOP 02 MRP SOP 05 MRP SOP 07	UFP-SAP
Donor Explosives Handling	MRP SOP 07	UFP-SAP
MEC Management - Treatment	MRP SOP 07	UFP-SAP
MPPEH Management - Inspection	MRP SOP 02	UFP-SAP
MPPEH Management - Certification	MRP SOP 07	UFP-SAP
MPPEH Management - Disposal	MRP SOP 07	UFP-SAP
Demobilization	NA	UFP-SAP
Site-Specific Final Report Preparation and Approval	NA	UFP-SAP

Field Forms are contained in Appendix B; and SOPs are provided in Appendix C.

17.2 SITE PREPARATION INCLUDING MOBILIZATION

17.2.1 Mobilization, Set-Up, and Preliminary Activities

Tetra Tech will schedule the arrival of the workforce in a manner that is most effective and designed to allow for immediate productivity. All personnel mobilized to the site will meet the OSHA training and medical surveillance requirements specified in the HASP. The UXO Technicians will have the appropriate level of training and experience as stated in DDESB TP-18 and NAVSEA OP-5. As part of the mobilization process, site-specific training for all on-site personnel will be performed, and each person will sign Worksheet No. 4. The purpose of this training is to ensure that personnel fully understand the operational procedures and methods to be used at NAS Cecil Field to include individual duties and responsibilities, and all safety and environmental concerns associated with these operations. The training will include, but is not limited to, a review of this MEC SAP and the HASP/APP (separate document). Any personnel arriving at the site after this initial training session will be trained when they arrive and will sign Worksheet No. 4. A UXO Technician III will conduct training.

Project equipment for the hand digging and detector-aided survey and investigation will come from Tetra Tech sources and local leases/purchases. All equipment, regardless of source, will be checked to ensure its completeness and operational readiness. Any equipment found damaged or defective will be returned to the point of origin, and a replacement will be secured. All instruments and equipment that require routine maintenance and/or calibration will be checked initially upon arrival and then prior to use each day. This system of checks ensures that the equipment is functioning properly. If an equipment check indicates that any piece of equipment is not operating correctly and field repair cannot be made, the equipment will be tagged and removed from service, and a request for replacement equipment will be placed immediately. Replacement equipment will meet the same specifications for accuracy and precision as the equipment removed from service.

17.2.2 Site Accessibility and Traffic Control

OU 5, Site 15, is a controlled area accessible to vehicles only through access gates for vehicle access only. For Site 15 access, the following two entities must be contacted:

- Florida Forestry: 904-573-4902
- Florida State College at Jacksonville, Cecil Center North: 904-779-4177

Trespassers may still access the site without authorization.

Safety requires that an active EZ be established at the site and maintained before any MEC activities occur due to the potential of encountering explosively configured/fuzed munitions. For this project, the EZ is listed in Table 17-1 (from Table 6-2 of the ESS). If non-site personnel or non-essential non-UXO personnel enter the EZ, all MEC operations will cease until the EZ is re-established. EZs are intended to keep non-essential personnel from being exposed to hazardous blast overpressure and fragments resulting from an unintentional detonation.

The EZ listed in Table 17-1 (from Table 6-2 of the ESS) is required to be established and maintained for the Supplemental RI area. The active EZ must be established before any survey activities or intrusive activities using hand tools occur because of the potential for encountering live explosively configured munitions. The EZ is based on the hazardous fragmentation distance (HFD) for a M54A4 20mm projectile, in accordance with the Fragmentation Data Review Form dated September 30, 2010 (see Appendix B of the ESS).

The M54A4 20mm projectile is the only approved munition with the greatest fragmentation distance (MGFD) for the site. If any member of the UXO Team or any other person on the project encounters an MEC item that has a greater HFD than the 65 feet associated with the M54A4 20mm projectile, the person discovering the item will: (1) immediately direct all operations within the hazardous fragmentation distance to stop, and (2) notify the SUXOS who will then notify the Tetra Tech Technical Lead. In turn, the Tetra Tech Technical Lead will consult with the Navy regarding the selection of a new MGFD. Operations will resume only when the ESS and project documents are updated to reflect the selected MGFD, and when all safeguards associated with the new MFGD are in place.

Table 17-1 (Table 6-2 from the ESS) Controlling EZs for Site 15 Primary MGFD

Operation	Sited As	ES	Basis [1]	ESQD (ft)
Manual Operations Site 15 - Blue 10[2]	Unintentional detonation	UXO Teams	K40 of the MGFD	14[3]
Manual Operations Site 15 - Blue 10[2]	Unintentional detonation	Public and non-essential personnel	HFD of the MGFD	65[3]
MEC treatment of MGFD 20mm projectile, M56A4	Intentional detonation	Public and all personnel	MFD of the MGFD	535[3]

ES – Exposed Sites
ESQD - Explosive Safety Quantity Distance
MFD – Maximum Fragmentation Distance
MGFD - Munitions with the Greatest Fragmentation Distance

1 MGFD is the 20mm projectile, M56A4 with 0.0264 lbs NEW of H-764 (RDX).
2 Manual operations involve excavating anomalies with hand tools.
3 From Fragmentation Data Review Forms, Updated 30 September 2010 (see Appendix B).

Both routine and emergency response actions dictate the need for prevention of unauthorized site access and for the protection of vital records and equipment. All equipment will be brought to a designated secure location each day. All excavations will be backfilled prior to leaving the excavation, such that no open excavations will be present after duty hours.

17.2.3 Site Security

Site security will be maintained to ensure that non-essential personnel do not access the EZ during detector-aided surveys or other UXO avoidance operations at the site. Site 15 - Blue 10 is a semi-secured area with gates in place to limit vehicle entry but with relatively open access to bike and pedestrian traffic. Barricades will be positioned with a red (BRAVO) flag on access routes a minimum of 65 feet from the edge of the investigation site. Notification procedures will be posted on the barricades to ensure that non-essential personnel notify the team working in the area prior to entering the area during active operations. Barricades and red (Bravo) flags will be removed when operations stop for the day. The site has signs posted warning that the area is a UXO area, do not enter.

Refer to MRP SOPs 01 and 03 for more detail on set-up and preliminary activities.

17.2.4 Out-of-Box Tests

The following out-of-box tests will be conducted before the detector-aided survey of the IVS area begins and at the start of each day of surveying:

- Inventory and inspect all equipment to confirm that all components are present and in good condition
- Assemble the equipment and power up

Refer to MRP SOPs 01, 03, and 05 for more detail on equipment out-of-box and start-up procedures.

17.2.5 Governing Regulations/Guidance and ESS

An ESS for MEC Operations was previously prepared by CH2MHILL but at NOSSA's request, a new ESS was prepared by Tetra Tech for the Supplemental MEC RI, and submitted through NOSSA to DDESB for approval (Tetra Tech, 2011). All MEC/MPPEH-related work at NAS Cecil Field will be conducted in full compliance with the approved ESS, provided as a separate document. Additionally, MEC/MPPEH activities will be performed in accordance with all local, state, and federal regulations and will include all applicable DoD requirements including those in Engineer Manual (EM)-1110-1-4009 (USACE, 2007) and data item description (DID) MMRP-09-005 (USACE, 2009). Activities involving work in areas potentially containing MEC/MPPEH hazards will be conducted in full compliance with Military Munitions Division (CEHNC-CX-MM) of the Environmental and Munitions Center of Expertise (EM CX), Department of the Navy, and DoD requirements regarding personnel, equipment, and procedures. Navy requirements include OP-5 and NOSSAINST.8020.15B.

The Supplemental MEC RI is being conducted as part of the Defense Environmental Restoration Program (DERP) MRP and will be performed in accordance with CERCLA Sections 104 and 121.

The site where surveys that will be conducted may contain live munitions, and caution should always be exercised while working in the area.

17.3 SITE SURVEYING

Information for the survey transect end points for those transects where anomaly hand digging will occur will be preloaded into the GPS unit by the GIS staff at the Tetra Tech office in Pittsburgh, PA. This information will be used to mark the transects using stakes and flagging tape in the field. Figures 17-1, 17-2, and 17-3 depict the survey transect to be investigated as described in this SAP. The UXO Team will establish a coordinate system for the detector-aided surface surveys by creating a labeled system of

survey stakes. Each transect will be aligned with the grid system developed during the 2008/2009 soil removal effort (Figure 10-3) and used during the 2010 MEC RI field work. The same transect labels that were used during the 2010 MEC RI activities will be used during the Supplemental MEC RI field work to provide continuity in the data. Step-out transects, if required, may be located in the field, and the end point location data will be collected using the GPS unit, or if time allows, the coordinates will be provided to the UXO Team by Tetra Tech GIS personnel.

In addition, GIS Staff at the Pittsburgh, Pennsylvania office will preload GPS coordinates for the 13 MPPEH items (anticipated to be MDAS) previously found on the ground surface during the 2010 MEC RI onto the GPS unit. If the GPS signal reception is inadequate, then a compass, tape measure, or survey wheel will be used to locate transects from a known location. For step-out transects and existing transects where additional vegetation management is necessary, easy-to-see temporary markings will be used to identify transect locations, and fiducial surveying will be set at 50-foot intervals using wooden survey stakes.

Refer to MRP SOP 05 for more detail on GPS survey procedure.

17.4 INSTRUMENT VERIFICATION STRIP

To test the capabilities of the Schonstedt GA-52Cx and Whites XLT, the UXOQCS will use a Geophysical System Verification (GSV) to provide rigorous QA/QC of MEC survey performance. The Environmental Security Technology Certification Program (ESTCP) developed the GSV specifically for UXO work. The GSV generally includes two main processes: an IVS and a production area blind seeding program. Blind seeding will not be used for reacquired transect but will be used if step-out transects are required, because the detector-aided surface survey was completed during the 2010 MEC RI and the focus of the Supplemental RI is on the subsurface. However, for step-out transects blind seeding will be employed because surface MEC/MPPEH may be present.

The specific objectives of the IVS are as follows:

- Demonstrate that the detector-aided survey equipment in use is operating properly.
- Provide a safe area with a known set of isolated objects for testing detection with the survey equipment.
- Assess operator performance.

- Evaluate detection of seed items. The UXOQCS, SUXOS, and Tetra Tech Technical Lead will determine whether the IVS performance is acceptable, and consequently when survey work may begin.

The grid square used for the original GPO for the 2008/2009 remedial activities and 2010 MEC RI will be used to establish an IVS (Figure 10-3). The IVS location is in an area suitable to remain seeded for the duration of the project in the event that different equipment or operators need to be tested. A utility clearance and/or dig permit will not be required from the local authority prior to establishing the IVS because the area was previously cleared.

IVS Seeding

Tetra Tech will seed the IVS using ISOs. Each seed item will be labeled with a unique identifier, photographed (open hole), and located via GPS in relation to the IVS survey ends, which will also be located using a GPS unit.

Prior to seeding the area with ISO items, the UXO team will conduct a detector-aided surface survey of the selected IVS location to ensure that the area is free of anomalies and to evaluate instrument response to site background conditions. Prior to surveying activities at Site 15, data will be collected along several survey lines across the seeded verification strip. An initial survey line will be conducted directly over the seed items (which will be arranged in a straight line).

To ensure that detection instruments are operating properly to assess the shallow subsurface of Site 15, the following seed items will be buried 10 feet apart in a horizontal orientation at the following depths.

Item and Burial Depth	Burial Depth
Small ISO (1-inch-diameter 4-inch-long pipe)	3 inches
Small ISO (1-inch-diameter 4-inch-long pipe)	6 inches
Medium ISO (2-inch-diameter 8-inch-long pipe)	12 inches

IVS Disassembly

The IVS will be seeded for the duration of the project. After project work is complete, the IVS items will be removed from the verification strip area, and the holes will be backfilled and restored.

17.5 VEGETATION MANAGEMENT

It is anticipated that some vegetation management will be required for access to the investigation areas. Brush cutting/vegetation management was completed during the 2010 MEC RI; however, due to the time between field activities, some minor vegetation management is anticipated prior to reacquiring subsurface anomaly locations at the site. Also if step-out transect are required, vegetation management will be necessary.

Brush and grass can present impediments to positioning the metal detectors in close proximity to the ground surface. The degree of brush/vegetation management will be determined by site conditions at the time of fieldwork and will be accomplished in accordance with Tetra Tech MRP SOP 06 (Vegetation Management at MEC Sites). Vegetation and trees two inches in diameter or less will be cut to a height between 6 to 12 inches above ground level. The following are the types of equipment/techniques that may be used:

- Hand-held brush cutters (string or blade) will be used to cut light vegetation and small grassy areas.
- Chain saws will be used in heavier brush areas and to cut small trees up to 2 inches in diameter.
- Mechanized equipment will be used to remove brush and grasses.
- Brush/vegetation debris will be left on site at the edge of the area cleared.

The UXO team will conduct brush cutting/vegetation management operations.

17.6 GPS POSITIONAL DATA COLLECTION

A sub-meter-accuracy GPS (e.g., Trimble GeoXM or GeoXH) unit will be used to collect positional data during the Supplemental RI. The GPS survey will utilize third-order monumentation, if available. Positional data from select monuments or markers (such as the surveyed monitoring wells or the northings and eastings of the corners of the Site 15 LUC parcel) will be collected at the start of each day and at midday of each day. The GPS data will be used to accurately record the positions of surface and subsurface suspect MEC, MPPEH, and munitions-related debris. Additionally, the GPS will be used to establish detector-aided survey transect end points and to locate the 13 MPPEH items previously found on the ground surface during the 2010 MEC RI. Tetra Tech will load site boundaries, transect end point locations, known cultural/terrain features that may affect surveys, and the background maps into the GPS prior to deployment. GPS data collected during the investigation will be stored in the GPS and downloaded to a personal computer daily or as soon as possible. Data will also be manually entered into a field log as it is collected. Once downloaded from the GPS unit, the data will then be uploaded to the

MRP Data Repository website located at http://www.ttnus.com/MrpRepository/Login.aspx for processing by Tetra Tech GIS personnel.

If GPS accuracy is not sub-meter for detector-aided surveys, data will not be collected until more satellites are available and the accuracy criteria specified in Worksheet No. 12 are met, or an alternative positioning technique will be employed (e.g., compass and tape measure, fiducials, or total stationing).

GPS positional data will be collected in accordance with Tetra Tech MRP SOP 05 (Global Positioning System).

17.7 DETECTOR-AIDED SURVEYING

The UXO Team will survey the surface, to the extent necessary, during the initial setup of the site associated with hand dig excavations, reacquired transect end points, step-out transects, and prior to bringing non-UXO personnel or mechanized equipment for vegetation management on site. The UXO Team will locate the appropriate anomalies on each transect and locate the 13 surface MPPEH items from the 2010 MEC RI. The UXO Team will treat/dispose of or flag all suspect MEC/MPPEH. After all surface non-munitions-related metallic debris has been removed and all MDAS and suspect MEC/MPPEH have been treated/disposed of or flagged for UXO avoidance, the SUXOS will allow non-UXO personnel and mechanized equipment for vegetation management on site in cleared areas.

The detector-aided surface survey will be conducted in the data gap anomaly areas known as the Bike Path/Asphalt Access Road, the High-Density Anomaly Areas located outside of the ordnance disposal area, and the Existing RI Grid Boundary. The Existing RI Grid Boundary will be addressed first to allow adequate time to assess the need for step-out transects. Figures 17-1 through 17-3 illustrate transects chosen for review during the Supplemental MEC RI. Detector-aided surface surveys will be conducted along orthogonal survey transects spaced 100 feet apart. Figure 10-3 shows the system used during the 2010 MEC RI by Tetra Tech. The same system will be used for the Supplemental MEC RI. The UXO Team established a coordinate system for the detector-aided surface surveys by creating a labeled system of survey stakes. Transects were aligned with the grid system developed during the CH2MHill 2008 soil removal effort. Detector-aided surveys will be performed along the survey transects to establish approximately 5-foot-wide lanes, acquire random anomalies along designated transects or along step-out transects, to determine the presence of subsurface anomalies. Detector-aided survey operations will be conducted in accordance with MRP SOP 01. MEC/MPPEH will be managed in accordance with MRP SOP 02.

Surface items discovered during the detector-aided surveys, and the 13 known MPPEH surface items from the 2010 MEC RI will be investigated. If a UXO team member discovers a suspect MEC/MPPEH item, he/she will: (1) call for a temporary work stoppage within the team work area. (2) request that the SUXOS identify and/or verify the identity of the item and the hazards associated with it. The SUXOS will have ultimate responsibility for proper identification of the item and its condition, and only the SUXOS can declare that an item is safe to move. Suspect MEC/MPPEH items that are not safe to move will be secured in place, and the SUXOS will coordinate for treatment of the item with a donor charge using blow-in-place (BIP) procedures. The SUXOS may designate collection points to organize and track items found during the Supplemental MEC RI. This area will be under the control of the SUXOS until the item has been treated with donor charges.

Upon finding a MEC/MPPEH item, the UXO team will assign a unique name to each MEC/MPPEH item found, take a digital photograph of the item, and record the items location with a GPS. This information will be recorded in the UXO Team leader's logbook.

17.7.1 Step-Out Transects

Step-out transects will be used to determine if MEC/MPPEH is located outside the current extend of the 2010 MEC RI Grid Boundary. When time permits, the Tetra Tech Technical Lead with input from UXO field personnel, will designate the location of up to 10 step-out transects site wide. If time permits the step-out transect end points will be determined using the GIS system and GPS coordinates will be provided to the UXO Team otherwise manual measurement techniques will be used to located the transect end points and the GPS location data will be collected and provided to the Tetra Tech GIS personnel. If a MEC/MDEH item is found on a transect located on the edge of the investigation area, a step-out transect will be established 200 feet in the direction away from the investigation area and parallel to the subject transect.

If step-out transects are required, these transects will have a count taken of the number of anomalies found during the detector aided surface survey. This information will be used to determine the number of subsurface anomalies that will be investigated.

17.7.2 UXO Escort Operations

A UXO escort will be provided for each visitor and non-UXO qualified team or individual on site. The UXOSO will perform an operational risk assessment using Naval Operations Instruction (OPNAVINST) 5900.39C (2010) as a guide to determine the hazard visitors would pose on that day's activities. All

activities involving work in areas potentially containing MEC hazards will be conducted in full compliance with the SAP regarding personnel, equipment, and procedures as follows:

1. If any MEC/MPPEH is encountered by non-UXO personnel, the item will be avoided. The UXO escort will not attempt to identify the type or condition of the ordnance. Its location will be reported to the UXO Team Leader, and the item will be flagged for avoidance and addressed after the conclusion of UXO Escort operations in the area. Potential exposure to chemical warfare material (CWM) at the site is not anticipated. In the event that hazardous, toxic, and radiological waste (HTRW) is encountered on site, the work site will be evacuated until the Project HSM and the Navy RPM identify and implement appropriate protective measures.

2. The UXO escort will clearly mark any area with visible ordnance or MEC, and the area will be avoided. The visible ordnance or MEC/MPPEH will be noted on field log sheets or in the field logbook. The UXO escort will report the MEC to the UXO team leader.

3. No ordnance, munitions, explosives, or ordnance-related materials will be moved, removed, or disposed of during UXO escort duties.

4. The UXO Escort will conduct UXO avoidance surveys for all proposed survey stake locations using a metal detector to check for possible MEC/MPPEH. If an anomaly is encountered or if the UXO Escort suspects the presence of MEC, the proposed stake location will be relocated to an area free of concerns/anomalies.

17.7.3 Detector-Aided Survey Instrumentation, Methods and Standards

The Schonstedt GA-52Cx or equivalent will be used as the primary survey instrument to conduct the detector-aided surveys at Site 15. In addition to the Schonstedt, a White's Spectrum XLT all-metals detector, or equivalent, will be used during the IVS setup and in survey areas. The White's Spectrum XLT has reduced depth detection capabilities but has the added capability of detection of nonferrous metals. Because ferrous and non-ferrous ordnance may be present at the site, this is the best combination of technologies for the operation based on industry standards.

The Schonstedt GA-52Cx is expected to detect munitions with required depth of 1 foot bgs (approximately 6 inches, with a buffer of an additional 6 inches). To test the detector-aided survey instruments, the UXO Team will verify instrument response using the newly installed IVS established by the UXOQCS. If step-out transects are required, blind seeding will occur within those specific survey

areas only. The blind seed items in the IVS will be placed on the ground surface in locations free from anomalies. The blind seed items will be ISOs of similar size and material as the defined targets for the site identified in the ESS.

The detection depth capabilities of the Schonstedt GA-52Cx and White's Spectrum XLT are limited by the size and orientation of the target and soil characteristics of the work area. These instruments provide an audio signal for response but do not store data (analog). The Schonstedt GA-52Cx magnetic locator (magnetic gradiometer) does not need to be calibrated. The White's Spectrum XLT all-metals detector requires setup to establish the sensitivity setting for UXO detection see MRP SOP 1 Table 1 for settings. To ensure that each detector is operating properly, the operator turns on the instrument and slowly moves the locator towards metal. As the probe advances toward the target, the audio signal will increase. Failure to detect the object is reason to reject the instrument. The detector will be checked at the start and end of each day during MEC activities and after any battery change. UXO Technicians will also conduct random checks during daily operations.

17.7.4 Discovery of Chemical Warfare Material

Potential exposure to CWM on this site is not anticipated. In the event that CWM is located or suspected, Tetra Tech personnel will evacuate the area immediately in an upwind direction from the CWM, secure the site, and request assistance from the Navy RPM.

Upon discovery of suspect CWM, the responsible UXO Technician III will:

- Ensure that all personnel are clear of the area
- Maintain security of the area until relieved

After the area is clear and secured, the responsible UXO Technician III will:

- Notify the Tetra Tech UXO Program Manager
- Notify the Tetra Tech Technical Lead
- Notify the Navy RPM
- Stop all field operations
- Assemble the crew at a designated assembly point
- Stand by to provide assistance as required

If directed, UXO personnel will take emergency non-invasive actions such as covering the item with plastic sheeting or placing sandbags around the item. In the event that HTRW is encountered on site, the work site will be evacuated until the Project HSM, with concurrence of the Navy RPM, identifies and implements appropriate protective measures.

Refer to MRP SOP 01 for more detail on detector-aided survey procedures.

17.8 ANOMALY INTRUSIVE INVESTIGATION

Figures 17-1 through 17-3 show all transects to be investigated during the Supplemental RI. The number of subsurface anomalies designated for investigation is based on the results of the MEC RI detector-aided survey and the results of statistical analysis of the anomalies in each area of concern using VSP Software. Each transect investigated during the MEC RI was classified as having no, low (1 to 5), medium (6 to 20), or high (greater than 20) anomalies. Hand excavations will be conducted for each transect classification in each area of concern in the following manner:

- No hand excavations will be performed in transects containing no anomalies (blue transects).
- One randomly selected hand excavation will be performed on transects with a low number of anomalies (1 to 5) (green transects).
- Two randomly selected hand excavations will be performed on transects with a medium number of anomalies (6 to 20) (yellow transects).
- Three randomly selected hand excavations will be performed on transects with a high number of anomalies (greater than 20) (red transects).

Anomaly excavation locations are to be randomly selected from the entire length of each transect, if possible (e.g., all anomalies should not all be located in the center or near the beginning or end of a given transect). Also in transects containing more than one hand dig location the locations should be distributed along the full length of the transect if possible. This distribution will be applied to the step-out transects as well following a detector-aided survey to determine the number of anomalies along each transect.

17.8.1 Hand Excavation Rationale

After selecting the areas of concern, VSP Software was used to calculate the minimum number of anomalies required to be evaluated to achieve a 95-percent confidence level that 95-percent of the remaining anomalies in the Bike Path/Asphalt Access Road and at the Existing RI Grid Boundary areas are not related to MEC/MDEH. This calculation resulted in 49 and 46 required anomaly excavations,

respectively (Appendix A). Additional hand excavation locations were added to allow a minimum of one excavation location per transect that contained shallow subsurface anomalies for each area of concern (Figures 17-1 through 17-3). The additional hand excavation locations in the Bike Path/Asphalt Access Road (55 total) will raise the confidence level to approximately 96.5-percent, if no MEC are located within the associated transects. The additional hand excavation locations in the existing RI grid boundary (54 total) will raise the confidence level to approximately 98-percent if no MEC/MDEH are located within the associated transects.

VSP Software was not used to determine the minimum number of hand excavation locations in the high-density areas outside of the Ordnance Disposal Area. However, the same strategy will be used to determine how many anomalies to investigate per transect (three for a high number of anomalies, two for a medium number of anomalies, and one for a low number of anomalies). These areas are comprised of high-density anomaly areas that are inconsistent with the current CSM because they indicate a potential for subsurface MEC/MDEH outside of the Ordnance Disposal Area.

If MEC/MDEH are found in areas not in and around the Ordnance Disposal Area the CSM will be revised accordingly. The information will be useful to determine distribution and estimation of remaining risk and/or is additional investigation is necessary.

Excavations will be conducted using manual digging procedures until the sidewalls and bottom of each small excavation are clear of anomalies, not to exceed 1 foot bgs and a radius of 2 feet from pin flags identifying the subsurface anomalies. Each intrusive “dig team” will consist of two qualified UXO personnel including at least one UXO Technician II or higher. Dig teams will be supervised by a UXO Team Leader (UXO Technician III) who will be able to supervise up to three dig teams at one time as long as visual and verbal communications can be maintained between the UXO Team Leader and his assigned dig teams. Intrusive activities will not begin until the UXOSO has given a safety briefing, the SUXOS has given a site-specific operations briefing, communications are established, and all non-essential personnel are evacuated outside the EZ. Authorized visitors will be allowed to enter the EZ during intrusive operations in accordance with requirements in NOSSA guidance, OP-5, and the NOSSA-approved ESS.

If a UXO team member discovers a suspect MEC/MPPEH item, he/she will: (1) call for a temporary work stoppage within the team’s work area and (2) request that the SUXOS identify and/or verify the identity of the item and the hazards associated with it. The SUXOS will have ultimate responsibility for proper identification of the item and its condition, and only the SUXOS can declare that an item is safe to move. Suspect MEC items that are not safe to move will be secured in place, and the SUXOS will coordinate for

treatment of the item with a donor charge using blow-in-place (BIP) procedures. If MEC/MPPEH are deemed safe to move, the UXO Team may transport the item(s) to collection points established at the site by the SUXOS for recovered MEC/MPPEH that are determined safe to move and awaiting disposal. These points will be under the control of the SUXOS until the item has been thermally treated. The purpose of collection point is to facilitate tracking of smaller items that are not easily seen if left in place. The ESQD arc created by the net explosive weight (NEW) for each collection point will not extend beyond that established for the site, which allows site operations to continue.

Upon finding a MEC/MPPEH item, the UXO Team will assign a unique name to each MEC/MPPEH item found, take a digital photograph of the item, and record the items location with a GPS. The MEC/MPPEH Tracking Logs provided in Appendix B will be completed daily by the SUXOS. The UXO Team Leader will document all information in a logbook and report to the SUXOS for inclusion in the daily report. Information documented by the UXO Team Leader will include, at a minimum, the length, width, and depth of each excavation, the location(s) excavated, and a description of each MEC/MPPEH removed along with general descriptions and weight. Non-munitions items removed will likewise be recorded.

Upon completion of each excavation, the cleared soil will be backfilled and compacted within the excavation before the next anomaly excavation begins.

17.9 DONOR EXPLOSIVES HANDLING

17.9.1 General Requirements and Licensing for Explosive Acquisition

The explosives used for this project will be managed in accordance with Federal Acquisition Regulation 45.5, local and state laws and regulations, BATFE Pamphlet 5400.7, DoD 6055.9-STD, Department of Transportation regulations, OP 5, and applicable Florida guidance documents. Tetra Tech shall have and, upon request, make available to any local, state, or federal authority, a copy of the ATF license or permit authorizing the purchase, storage, transport, and use of explosives.

17.9.2 Explosives Acquisition

Detonation explosives (donor charges) will be obtained from a local vendor on an as-needed basis. No magazine is available at the station for storage of explosives. Transportation and delivery of explosives will be coordinated to ensure that explosive laden routes are followed and that an escort meets and guides the delivery truck along the correct route.

Explosives will be purchased from a licensed vender such as:

Austin Powder Company
(904) 270-5412
5299 Ne 97th Street Rd, Anthony, FL 32617

17.9.3 Initial Receipt of Explosives

The SUXOS and UXOSO/UXOQCS will be responsible for receipt of explosives from the commercial vendor. The SUXOS will coordinate all receipt and management of explosives.

Explosives delivered to the site will be inspected to confirm the content and quantity of the delivery by the Tetra Tech SUXOS and UXOQCS, when received. Discrepancies will be reconciled at the time of receipt with the Tetra Tech SUXOS, vendor, Tetra Tech UXO Program Manager and Tetra Tech Technical Lead. Documentation will address the discrepancy and the resolution.

17.9.4 Explosives Storage

No BATFE approved magazines will be available for this Supplemental MEC RI. Explosives will be ordered as needed and consumed that same day. Once onsite, explosives packages will be marked "LIGHT BOX" in accordance with OP5 paragraph 11-2.6.4. Recovered MEC/MDEH will be managed as hazard C/D 1.1, Storage Compatibility Group (SCG) L unless assigned differently by NOSSA (N82).

Discovered MEC/MPPEH items that are safe to move and cannot be treated the same day will be stored on site until they can be treated. The MEC/MPPEH will be left where found or moved to a collection point in order to keep better track of small items. Collection points will be flagged and its location will be recorded with a GPS and in the SUXOS logbook. Security of MEC/MPPEH items will be the responsibility of the SUXOS until the items are treated.

17.9.5 Explosives Transportation

Explosives to be used for treatment of MEC/MPPEH items will be transported to the treatment area by the explosive vender providing the explosives. Explosives will be inventoried prior to being issued by the SUXOS and transported from the issue point to disposal locations at the project site in accordance with BATFE licensing requirements. The use of rental vehicles for the transport of hazardous material (explosives) requires written approval from the rental vehicle agency corporate headquarters, and Navy headquarters. If a vehicle is used to transport explosives, that vehicle will have a wooden bed liner and

will be equipped to secure the containers in the vehicle. During the transportation of explosives from the issue point to the detonation area, blasting caps will be stored separately from main charges in a BATFE-approved day box or by keeping a safe separation distance between the person carrying the explosives and the person carrying the blasting caps.

Transportation of donor explosives or MEC will be coordinated to ensure that the existing explosive-laden routes are followed for delivery or removal of the explosives and that an escort meets and guides the delivery truck along the correct route. If a vehicle for transporting explosives is not available, UXO technicians transporting explosives by hand will observe safe separation between explosives and blasting caps.

Only Tetra Tech UXO Technicians who are certified as being fully qualified to operate an explosive-laden vehicle and are medically certified to transport ammunition and explosives will transport donor explosives or MEC on site.

17.9.6 Explosives Receipt Procedures

Each item of explosives will be receipted from initial delivery to NAS Cecil Field until the item is expended. Tetra Tech will maintain a list of individuals authorized to receive, issue, transport, and use explosives by position and title, and those individuals will assume accountability by signing the receipt documents. The end user of explosives will certify in writing that the explosives were used for their intended purpose. Receipt documents will be reconciled at the time of delivery, issue, disposal, and during each week's inventory. The Tetra Tech SUXOS will document any discrepancies and reported to the Tetra Tech UXO Program Manager, Tetra Tech Technical Lead, Navy RPM, and others as required by law.

17.9.7 Explosives Inventory

The Tetra Tech SUXOS and Tetra Tech UXOSO/UXOQCS will be physically inventoried all explosives when received. The Tetra Tech SUXOS will document any discrepancies and reported to the Tetra Tech UXO Program Manager, Tetra Tech Technical Lead, Navy RPM, and others as required by law.

The following procedures will be followed upon discovery of lost, stolen, or unauthorized use of explosives:

- The Tetra Tech UXO Program Manager, Tetra Tech Technical Lead, and Navy RPM will be notified immediately by telephone and with a written report within 24 hours.

- Proper authorities (BATFE and State Fire Marshall) will be notified in writing within 24 hours of the event.

All explosives will be expended during that day's treatment operation. No explosives will be stored on site. Documents will be completed showing final disposition of all explosives.

17.10 MEC MANAGEMENT – TREATMENT

17.10.1 MEC Management

If a UXO Team member discovers a suspect MEC/MPPEH item, he/she will: (1) call for a temporary work stoppage of the team discovering the item and (2) request that the SUXOS identify and/or verify the identity of the item and the hazards associated with it. The SUXOS will have ultimate responsibility for proper identification of the item and its condition, and only the SUXOS can declare that an item is safe to move. MEC will not be moved until a positive identification is made by a UXO Technician III or higher and the SUXOS concurs that the item(s) can be safely moved.

Detonation operations will be performed on the day the MEC item is discovered, or when donor explosives are received; treatment operations may be delayed due to availability from the explosive vendor, or requirements for advance notification of the Navy. Treatment/disposal of MEC will be performed in accordance with MRP SOP 07. No consolidated shots are allowed. Suspect MEC items determined by the SUXOS to be safe to move can be moved to a collection point, and the SUXOS will coordinate treatment of the item at that location or when donor explosives are received. If MEC/MPPEH are deemed safe to move, the item may be left in place, or the UXO team may transport the smaller item(s) in a sand-filled wood container to a collection point established to keep better track of small items. Larger MEC/MPPEH items will be secured by sand bags for transport in a vehicle with a wooden bed liner. The collection points will be under the control of the SUXOS until the item has been treated by donor charge. The ESQD arc created by the NEW for each collection point will not extend beyond that established for the site to allow site operations to continue. Suspect MEC items that are not safe to move will be secured in place, and the SUXOS will coordinate for treatment of the item with a donor charge using BIP procedures.

Any item that is not safe to move and cannot be treated the day that it is discovered will be flagged and its location marked for treatment by donor charge for the following day. Security for treatment and BIP

operations will be set outside the EZ, and the area will be checked for the presence of staff and intruders. The EZ for intentional detonation of the primary MGFD is listed in Table 17-1 (from Table 6-2 of the ESS). Engineering controls may be employed to reduce the EZ associated with intentional detonation of the MGFD prior to treatment. Approved engineering controls are detailed in the Fragmentation Data Sheet in Appendix B of the ESS. Engineering controls authorized by DDESB TP 16 may also be implemented. Deviations from approved engineering controls will require NOSSA approval prior to implementation.

The collection point will be cleared of vegetation to minimize the change of a fire during detonation with a donor charge. The collection point will also be cleared of all metal debris to eliminate the chance of having fragments from an unknown source remaining after the treatment.

The SUXOS will maintain security of any MEC item and report its location and other information, in accordance with MRP SOP 03, to the Tetra Tech UXO Manager and Tetra Tech Technical Lead. Security of the item will be maintained until it is treated. To ensure complete clearance, non-MEC debris will be moved off a transect, and a detector-aided surface survey will be performed over areas containing non-MEC debris to determine the extent to which underlying anomalies are present.

Figure 17-4 depicts the decision flow path described below for MEC. Each item will be marked with flagging tape and assigned a unique number starting with the abbreviated site ID followed by the transect number and item number (e.g., for north-south transects S15-F-T23T24-01 or east-west transects S15-T1-DE). All available information about the item will be recorded in the logbook, including location using GPS coordinates, tape measure, or other grid coordinate location system, identification, item number, and whether the item is suspect MEC or MPPEH. A digital photograph will be taken of each item.

If the UXO Team is unable to identify a MEC item, Tetra Tech personnel will notify the Navy RPM, who will request assistance from the nearest military EOD Detachment in Naval Station Mayport, FL.

The UXO Team will identify all MEC items, and their original locations will be recorded by GPS or other means. This information will be recorded on the MEC Tracking Log (provided in Appendix B) in accordance with MRP SOP 02 and all MEC items will be photographed. This information will be added to the data collected for the site. The MEC Tracking Log will be reviewed for accuracy by the SUXOS, UXOQCS, and UXO Manager on days when MEC is discovered, or disposition of MEC recorded on the tracking log has changed.

Blow-In-Place Operations

If BIP operations become necessary, the maximum fragmentation distance will be used to establish an EZ for intentional detonations. The intentional detonation for the site listed in Table 17-1 (from Table 6-2 of the ESS). The procedures to be followed should BIP become necessary are presented in MRP SOP-07, UXO Demolition/Disposal Operations, and MRP SOP-04, MEC Management and Accountability.

17.11 MPPEH MANAGEMENT - INSPECTION

If MPPEH are encountered during the operation, the SUXOS and the UXOQCS will independently inspect and separate the MPPEH into MDEH or MDAS in accordance with MRP SOPs 02 and 07. Items will then be segregated into items that require demilitarization from those ready for certification. If any items are suspected to or found to contain HTRW, procedures described in Section 17.7.4 will be followed.

17.12 MPPEH MANAGEMENT – CERTIFICATION

The Tetra Tech Technical Lead must designate the personnel authorized and qualified to inspect MPPEH and document its explosives safety status as either MDAS or MDEH in writing by the BRAC PMO SE Director. The designation letter will include personnel signatures.

Persons certifying and verifying MDAS or MDEH will be designated in writing by the BRAC PMO SE Director as qualified and certified to do so. In the event that HTRW is encountered on site, the work site will be evacuated until the Tetra Tech CLEAN HSM, with the concurrence of the Navy RPM, identifies and implements appropriate protective measures.

A UXO Technician III (Team Leader) will then:

- Reinspect 100 percent of all recovered items to determine if each item is free of explosive hazards and other visible liquid HTRW materials.

- Record the information that each recovered item is free of explosive hazards and other visible HTRW materials.

- Certify the recovered items as MDAS.
  - Following the inspection and reinspection, MDAS will be certified and verified and transported offsite by an approved subcontractor in accordance with Section 17.14.

- Coordinate transfer of MDEH to the treatment area for treatment/disposal.

The Tetra Tech UXOQCS will:

- Conduct daily audits of the procedures used by UXO teams and individuals for processing MPPEH.
- Perform and document random sampling of all MPPEH collected from the various teams to ensure that no items with explosive hazards and other visible liquid HTRW material are identified as MDAS.
- Ensure that specific procedures and responsibilities are followed while processing MPPEH for certification as MDAS.
- Conduct a final 100-percent inspection of all MDAS prior to certification and transport off site.

The UXOSO will ensure that all procedures for processing MPPEH are being performed safely and consistently.

The Tetra Tech SUXOS will:

- Ensure that all documentation is completed for all MDAS.
- Perform random checks to verify that the MDAS are free from explosive hazards.
- Conduct a final 100-percent inspection of all MDAS prior to certification and transport off site.
- Maintain custody of the seal/key for all certified MDAS. If custody of the sealed container is lost, the Tetra Tech SUXOS and UXOQCS will conduct another 100-percent inspection of all MDAS.
- Certify all MDAS as free of explosive hazards and other visible liquid HTRW materials.

- Be responsible for ensuring that MDAS are secured in a locked, labeled, and sealed container.
  - The container will be closed and clearly labeled on the outside with a unique identification.
  - The container will be closed in such a manner that a seal must be broken to open the container. The seal will have the same unique identification number as the container, or the container will be clearly marked with the seal's identification if different from the container.
  - A documented description of the container will be provided with the following information for each container: contents, approximate weight of container, location where contents were obtained, contractor name, names of certifying and verifying individuals, unique container identification, and seal identification.

All certification/verification documentation will clearly show the printed names of the Tetra Tech SUXOS and UXOQCS, signature, and phone numbers, which will be posted on the outside of the container in a waterproof bag.

The following certification/verification will be entered on each form for turnover of MDAS to a disposal/recycling company and will be signed by the Tetra Tech SUXOS and UXOQCS:

> "This certifies that the material potentially presenting an explosive hazard listed has been 100 percent properly inspected and, to the best of our knowledge and belief, is inert and/or free of explosives or related materials."

17.13 MPPEH MANAGEMENT - DISPOSAL

MDEH will be treated with donor charges then addressed as MDAS. The locked and sealed containers containing items classified as MDAS will remain at the site until custody of the treated material is assumed by a certified subcontractor [in accordance with DoD 4160-21-M-1 (1995)]. This certified contractor will be responsible for transportation of the material to an off-site facility for disposal or demilitarization.

MDAS will be managed at all times in such a manner as to prevent it from being:

- Commingled with MPPEH or MDEH
- Misidentified as MPPEH or MDEH after it has been determined to be safe

MDAS will be secured in a locked/sealed container, with the key/seal number held only by the SUXOS. An MDAS Certification From will be attached to the outside of the container in a waterproof holder and updated every time an item is added to the container (e.g., drum). The locked sealed container will remain at the site until released. A chain-of-custody form will be maintained for MDAS, and the proper documentation will be completed and signed by the responsible personnel (SUXOS and UXOQCS) before custody of MDAS is assumed by a certified contractor (in accordance with DoD 4160-21-M-1) for disposal or disposition. Detailed guidance on the policy and responsibilities for the management and disposition of MPPEH is provided in OP 5 Change 8 (Navy, 2009), EM 1110-1-4009, Chapter 14 (USACE, 2007) and DoD Instruction 4140.62 (2008).

The certified and verified MDAS will be released to the certified subcontractor, who will:

- 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 agreeing with the provided documentation that the sealed containers contained no explosives when received.

- Perform shredding/cutting process capable of demilitarizing MDAS resembling military munitions.

- Perform a 100-percent inspection of the shredded/cut scrap to ensure no resemblance to military munitions. Once this has been determined, the scrap will be transported to a qualified recycler and recycled.

- Provide an “End Use” certification confirming that the material has been recycled. End Use certifications will be included in the After Action Report.

If any organization breaks the MPPEH chain of custody, the affected MPPEH must undergo a second 100-percent inspection, a second 100-percent reinspection, and be documented to verify its explosive safety status as described above.

17.14 DEMOBILIZATION

When fieldwork is complete, the site will be restored and temporary survey markers will be removed. All field forms and field logbooks will be completed, field documentation will be provided to recipients, and equipment will be returned to providers. Personnel will demobilize with approval of the Tetra Tech UXO Manager and Technical Lead.

17.15 SITE-SPECIFIC FINAL REPORT PREPARATION AND APPROVAL

17.15.1 Team Decision Points

The Supplemental RI intrusive investigation will be used in conjunction with the 2008/2009 soil remediation results and 2010 MEC RI results to develop a FS. The Supplemental MEC RI SAP is being written to allow field flexibility in establishing hand digging locations based on data from the previous detector-aided surface surveys.

Any MEC/MPPEH or suspect MEC/MPPEH discovered on site will be brought to the attention of the Navy, and Tetra Tech UXO Program Manager and Technical Lead. If MEC items are identified at the existing RI grid boundary, the UXO Team and Tetra Tech Technical Lead will determine the need for step-out transects 200 feet from the transect containing an MEC/MDEH item. Vegetation management and a detector-aided survey will be completed for each step-out transect. After determining the number of subsurface anomalies, hand excavations will be completed following the hand digging distribution discussed in Section 17.8.

Any unanticipated findings that warrant modification of the SAP will be brought to the attention of the Navy, regulatory agencies, and the stakeholders.

17.15.2 Report

A report will be prepared summarizing the investigation and containing summaries of site background information, personnel utilized, objectives and scope, equipment, description of survey activities, results, discussion of project data, and recommendations. Provided data will consist of tables reporting the UXO survey results in North American Datum (NAD) 1983 Florida State Plane East coordinates in feet, and plots of the results on plans or aerial maps for the MRP area. The report will contain noted munitions-related discoveries, site photographs, field notes, checklists, QC data, and any other relevant information to aid in refinement of the CSM.

SAP Worksheet No. 18 – Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sampling Location/ ID Number	Exclusion Area	Matrix	Approximate Depth (feet bgs)	Survey Methodology	Degree of Investigation	SOP Name[1]
OU 5, Site 15 - Blue 10 Ordnance Disposal Area	Any area outside of targeted anomaly locations	Soil	From surface to a maximum of 1 foot bgs If anomalies are determined (via detector-aided surveying instruments) in the field to be deeper than maximum depth specified above, that information will simply be recorded in the logbook	Schonstedt GA-52Cx White's Spectrum XLT	Hand-Digging/Manual Excavation Techniques Step-Out Transects [5-foot-wide survey transect lines at 200-feet and parallel from the transect with the MEC/MDEH find (location to be field determined)]	MRP SOP 01 MRP SOP 02 MRP SOP 03 MRP SOP 05 MRP SOP 06 MRP SOP 07 MRP SOP 08 and in accordance with the ESS

1 SOP or worksheet that describes geophysical surveying procedures (see Appendix C of this MEC UFP-SAP).

SAP Worksheet No. 19 – Analytical SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

☑ **Worksheet Not Applicable**

No laboratory samples are proposed for collection/analysis during this MEC investigation.

SAP Worksheet No. 20 – Field Quality Control Sample Summary Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	QC Survey Requirements	Field Duplicates/Repeat Data Collection	Sample	Quality Control
Soil	Detector-aided surface survey – step-out transects	Resurvey 25% of first four transects/lots and after any failure, then 10% of remaining transects/lots after four grids/lots in a row pass QC. If any transect/lot does not pass QC, UXO team will resurvey transect/lot and another QC check will be performed. Blind seed items will be used during the detector-aided surface survey process as an additional QC check. Blind seed items will be placed at the surface into the duff, or if duff is not present, covered with duff from another location, at locations along transects prior to the start of the detector-aided surface survey. At least one blind seed item will be placed on each step-out transect to verify operator and instrument performance.	Not applicable	Detect, recover, and record all blind seed items; non-detection of a blind seed item would result in failure of QC.	Resurvey transect/lots to perform a direct comparison to field data collected during detector-aided surface survey If a blind seed item is missed, that lot of work will be rejected and reworked.

Matrix	Analytical Group	QC Survey Requirements	Field Duplicates/Repeat Data Collection	Sample	Quality Control
Anomaly Locations/ Excavated Soil	Anomaly intrusive investigations	The UXOQCS will screen 100% of the excavation sites, excavated material, and any metallic material removed from the location to ensure that all anomaly source material is properly classified. UXOQCS will examine the field forms to ensure that all information is being recorded for each hand excavation location. Ensure non-munitions debris being removed is free of MEC/MPPEH.	Not applicable	Detect, recover, and record all metallic material excavated; non-detection of an anomaly source would result in failure of QC.	Resurvey excavated hand dig location and excavated material to ensure that the anomaly source was located and correctly classified as MEC, MPPEH, or non-munitions related debris.
Soil	Anomaly intrusive investigation	Identify anomaly item and log results.	Not applicable	Not applicable	If no MEC/MPPEH are identified, log what is the source of anomaly or that the anomaly is deeper than 1 foot. If MEC/MPPEH are identified, record information on the field form and determine if treatment is required.

SAP Worksheet No. 21 – Project SOP References Table

(UFP-QAPP Manual Section 3.1.2)

Reference Number[1]	Title	Originating Organization of SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
MRP SOP 01	UXO Detector-Aided Surveys	Tetra Tech	Magnetic detector All-metals detector	Y	Describes detector-aided surface surveys
MRP SOP 02	MEC/MPPEH Management and Accountability	Tetra Tech	GPS Digital camera	Y	Describes actions to be taken if suspect MEC are encountered
MRP SOP 03	Geophysical Survey	Tetra Tech	Magnetic detector All-metals detector	N	Describes IVS requirements
MRP SOP 05	Global Positioning System	Tetra Tech	GPS	N	Describes usage of hand-held GPS units
MRP SOP 06	Vegetation Management at MEC/MPPEH Sites	Tetra Tech	Hand-held brush cutters, mowers, chain saws, brush hog, wood chipper	N	Describes brush cutting and vegetation clearance activities at MEC sites
MRP SOP 07	UXO Demolition Disposal Operations	Tetra Tech	Detonation and disposal materials	Y	Describes UXO detonation disposal operations
MRP SOP 08	UXO Documentation	Tetra Tech	None	N	Describes documentation of field activities at MEC Sites

Field Forms are contained in Appendix B; and SOPs are contained in Appendix C of this supplemental MEC RI SAP.

SAP Worksheet No. 22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity[1]	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[2]	Comments
GPS	Positioning	Daily	Accuracy: sub-meter according to post-processed accuracy estimates. HDOP <3, number of satellites at least six	Wait for better signal, replace unit, or choose alternate location technique	UXO Technician	MRP SOP 05	None
Magnetic Locator Schonstedt GA-52Cx	Operational	Beginning and end of day and after battery change	Operating properly	Replace battery, replace instrument	UXO Technician	MRP SOP 01 MRP SOP 03	None
All-Metals Detector White's Spectrum XLT	Calibration	Beginning and end of day	Detect non-ferrous ISO	Recalibrate, replace instrument	UXO Technician	MRP SOP 01 MRP SOP 03	None

1 Activities may include calibration, verification, testing, and maintenance.
2 Field Forms are provided in Appendix B; and SOPs are contained in Appendix C of this Supplemental MEC RI SAP.

22.1 REGULAR TESTS FOR GEOPHYSICAL SURVEYING EQUIPMENT

No digital geophysical survey operations are currently planned at Site 15 during MEC/MPPEH hand-digging and exploratory investigations.

22.2 DATA COLLECTION VARIABLES FOR GEOPHYSICAL SURVEYING EQUIPMENT

The same equipment (Schonstedt GA-52Cx and White's Spectrum XLT) and procedures will be used for the IVS (Worksheet No. 12) and MEC/MPPEH detector-aided surveys. In addition, only personnel who have been tested on the IVS will perform MEC/MPPEH detector-aided surveys.

22.3 GEOPHYSICAL AND POSITIONING INSTRUMENTS

During the MEC/MPPEH surveys and anomaly reacquisition a magnetic locator such as the Schonstedt XLT (or equivalent) and an all-metals detector such as the White's Spectrum XLT (or equivalent) will be used. The sizes and orientations of the targets and the characteristics of the soil in the work area limit the detection depths of the metal detectors to be used by the UXO team during detector-aided surveys. These instruments provide an audio signal for response but do not store data. The magnetic locator (magnetic gradiometer) does not need to be calibrated, but the all-metal detector requires field calibration. The operator turns on the instrument and slowly moves the locator toward metal to ensure that each detector is operating properly. The audio signal will increase as the probe advances toward the target. Failure to detect the object is reason to reject the instrument. The detector will be checked at the beginning and end of each day and after any battery change. UXO Technicians will also conduct a minimum of two checks during daily operations.

The normal setting for the Schonstedt magnetic locator instrument is 2; setting the instrument to 3 or 4 will make it more sensitive, and setting the instrument to 1 will make it less sensitive. The Schonstedt magnetic locator instrument will not detect non-ferrous munitions such as ones made of copper, brass, or aluminum. The normal settings for the White's Spectrum XLT all-metals detector are presented in MRP SOP 01.

Tetra Tech will use a Trimble GeoXT or XH sub-meter accuracy GPS unit where possible during data collection to provide precise location coordinate for the data collected. If the GPS accuracy is not sub-meter according to post-processed accuracy estimates, data will not be collected until more satellites are available and the accuracy criteria are met, or surveying with an alternate positioning technique will be employed.

22.4 QUALITY ASSURANCE/QUALITY CONTROL

Operational and test procedures will conform to manufacturer standard instructions. QC of instrument data will be achieved daily by field testing consisting of checking the detectors and navigation system against a known target to ensure that they are operating properly. All instruments and equipment used to gather and generate field data will be operated in such a manner that accuracy and reproducibility of the results are consistent with manufacturer specifications. Repair or replacement records will be filed and maintained by the UXOQCS and may be subject to audit by the Tetra Tech QAM.

SAP Worksheet No. 23 – Analytical SOP Reference Table

(UFP-QAPP Manual Section 3.2.1)

☑ **Worksheet Not Applicable**

No project sampling is proposed for this MEC investigation (see Worksheet No. 21 for project SOPs).

SAP Worksheet No. 24 – Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

☑ **Worksheet Not Applicable**

No analytical instrument calibration data will be required to support this MEC investigation (see Worksheet No. 22 for equipment calibration information).

SAP Worksheet No. 25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.2.3)

☑ **Worksheet Not Applicable**

No analytical instrument equipment maintenance, testing, or inspections will be required to support this MEC investigation. Field instrumentation maintenance, testing, and inspection information is presented in Worksheet No. 22.

SAP Worksheet No. 26 – Sample Handling System

(UFP-QAPP Manual Appendix A)

☑ **Worksheet Not Applicable**

This worksheet is not applicable because will be an MEC investigation, and no samples will be handled.

SAP Worksheet No. 27 – Sample Custody Requirements Table

(UFP-QAPP Manual Section 3.3.3)

☑ **Worksheet Not Applicable**

No samples are proposed for collection/analysis during this MEC investigation.

SAP Worksheet No. 28 – QC Samples Table

(UFP-QAPP Manual Section 3.4)

☑ **Worksheet Not Applicable**

No analytical laboratory QC sampling will be required for this MEC investigation.

SAP Worksheet No. 29 – Project Documents and Records Table

(UFP-QAPP Manual Section 3.5.1)

Document, Report, or Form	Generator	Definable Feature of Work	Frequency of Completion	Location/Where Maintained(1)
Project Personnel Sign-Off Record	Technical Lead	Mobilization/Site Preparation	One time	SAP/RI Report, Project File
ESS	UXO Program Manager	Mobilization	One time	SAP/Project File
Field Checklist	Field UXO Personnel	Detector-Aided Surface Surveys Intrusive Operations	Field collection days	SAP/RI Report, Project File
MEC Accountability Log	SUXOS	Detector-Aided Surface Surveys Intrusive Operations, MEC Treatment	As needed	SAP, MRP SOP 01, MRP SOP 02, MRP SOP 07/ RI Report, Project File
MDAS Addition Form	SUXOS	MPPEH Management	Every time MDAS is added to container	Outside of Container
Demolition Explosives Accountability Log	SUXOS/UXOQCS	MEC Treatment	As needed/weekly	SAP, MRP SOP 07/RI Report, Project File
Daily Report	SUXOS	All	Field collection days	SAP, MRP SOP 08/RI Report, Project File
Medical and OSHA Clearance Letter	HSM and Technical Lead	All	As needed	HASP/Project File
Daily Safety Meeting Sign-In Sheet	SSO	All	Daily	HASP/RI Report, Project File
Medical Data Sheet	SUXOS	All	As needed	HASP/Project File
Target Survey Grid Map	Tetra Tech GIS Personnel	Intrusive Operations	Field collection days	SAP/RI Report, Project File
Dig Sheet	UXO Personnel	Intrusive Operations	Field collection days	SAP/RI Report, Project File
Intrusive Operation Survey Data	UXO Personnel	Intrusive Operations	Field collection days	SUXOS Logbook/Project File, RI Report, NIRIS

Document, Report, or Form	Generator	Definable Feature of Work	Frequency of Completion	Location/Where Maintained(1)
Field Notes (detailing equipment and procedures)	Field UXO Personnel	All	Field collection days	SUXOS Logbook, QC Logbook, MRP SOP 08/RI Report, Project File
Assessment Findings and Corrective Actions	Various (see Worksheet No. 31)	All	As needed	SAP/RI Report, Project File
QC Surveillance Report	UXOQCS	All	UXOQCS - Minimum of once for each definable feature of work	SAP, QC Logbook, MRP SOP 08/RI Report, Project File
Non-Conformance Report	UXOQCS	All	After any failure of QC/QA	QC Logbook/RI Report, Project File
Daily QC Report	UXOQCS	All	Daily	SAP, QC Logbook/RI Report, Project File
Photographs (may be included in report)	Field UXO Personnel	All	As needed	MRP SOP 01, MRP SOP 02, MRP SOP 08/RI Report, Project File
FTMR Forms	SUXOS	All	As needed	SAP/RI Report, Project File
Field Audit Checklist (if an audit is conducted)	Technical Lead	All	As needed	RI Report, Project File
Supplemental RI Report	Tetra Tech Personnel	Investigation Project Work	One time	SAP/Project File, Long-Term Third-Party Professional Document Storage Firm

NIRIS – Naval Installation Restoration Information Solution.

1 – Field Forms are provided in Appendix B; and SOPs are contained in Appendix C of this supplemental MEC RI SAP.

Project documentation will be maintained in the Tetra Tech project file. Processed final format files (maps) compatible with Arcview Version 8 or another specified GIS platform will be maintained on the Tetra Tech GIS server and in Naval Installation Restoration Information Solution (NIRIS).

SAP Worksheet No. 30 – Analytical Services Table

(UFP-QAPP Manual Section 3.5.2.3)

☑ **Worksheet Not Applicable**

No analytical services will be required to support this MEC investigation.

SAP Worksheet No. 31 – Planned Project Assessments Table

(UFP-QAPP Manual Section 4.1.1)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment[1] (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings[1] (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions[1] (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions[1] (title and organizational affiliation)
Personnel Qualifications	One time for all field personnel	Internal	Tetra Tech	UXOQCS	SUXOS	UXO Program Manager	QAM Technical Lead
Site-Specific Training	Once at start of fieldwork and at start of each definable feature of work	Internal	Tetra Tech	SUXOS UXO Program Manager Technical Lead	As designated by Technical Lead	As designated by Technical Lead	Technical Lead
Accident/Incident Reporting	Per event	Internal	Tetra Tech	SSO/UXOSO	Project Safety Officer	HSM Technical Lead	HSM
Preventive Maintenance	Daily	Internal	Tetra Tech	UXOQCS	SUXOS	UXO Program Manager	Technical Lead
Communications Equipment Inspection	Daily	Internal	Tetra Tech	UXO Team Leader	SUXOS	SUXOS	UXO Program Manager Technical Lead

Assessment Type	**Frequency**	**Internal or External**	**Organization Performing Assessment**	**Person(s) Responsible for Performing Assessment(1)** (title and organizational affiliation)	**Person(s) Responsible for Responding to Assessment Findings(1)** (title and organizational affiliation)	**Person(s) Responsible for Identifying and Implementing Corrective Actions(1)** (title and organizational affiliation)	**Person(s) Responsible for Monitoring Effectiveness of Corrective Actions(1)** (title and organizational affiliation)
Safety Inspections	Daily (inspection); Weekly (formal surveillance)	Internal	Tetra Tech	SSO/UXOSO	SUXOS	SUXOS	UXO Program Manager Technical Lead
Site Surveying	Initial, then weekly	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Program Manager
IVS - Assessment	Twice daily	Internal	Tetra Tech	SUXOS	UXO Team Leader	UXO Team Leader	Technical Lead
Vegetation Management	As needed to support operations	Internal	Tetra Tech	SUXOS	UXO Team Leader	UXO Team Leader	Technical Lead
GPS Positional Data Collection	Twice daily	Internal	Tetra Tech	SUXOS	SUXOS	SUXOS	UXO Program Manager Technical Lead
Detector-Aided Surface Survey - step-out transect	25% of first four transects/ lots or after any failure; 10% thereafter	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Program Manager Technical Lead

Assessment Type	**Frequency**	**Internal or External**	**Organization Performing Assessment**	**Person(s) Responsible for Performing Assessment(1)** (title and organizational affiliation)	**Person(s) Responsible for Responding to Assessment Findings(1)** (title and organizational affiliation)	**Person(s) Responsible for Identifying and Implementing Corrective Actions(1)** (title and organizational affiliation)	**Person(s) Responsible for Monitoring Effectiveness of Corrective Actions(1)** (title and organizational affiliation)
Anomaly Intrusive Investigation	100% of excavation sites; field forms	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Program Manager Technical Lead
Donor Explosives Handling	Daily, as needed when explosives are on site	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Program Manager Technical Lead
UXO/MEC Accountability and MPPEH Management	Daily	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Program Manager Technical Lead
Visitor Briefing/ Operational Assessment	Initial, then as needed to support operations	Internal	Tetra Tech	UXOSO	SUXOS	SUXOS	HSM
Hazard Assessment – Risk Analysis	Once at start of each definable feature of work, then as needed to support operations	Internal	Tetra Tech	UXOSO	UXOSO SUXOS	UXOSO SUXOS	HSM

Assessment Type	**Frequency**	**Internal or External**	**Organization Performing Assessment**	**Person(s) Responsible for Performing Assessment[1]** (title and organizational affiliation)	**Person(s) Responsible for Responding to Assessment Findings[1]** (title and organizational affiliation)	**Person(s) Responsible for Identifying and Implementing Corrective Actions[1]** (title and organizational affiliation)	**Person(s) Responsible for Monitoring Effectiveness of Corrective Actions[1]** (title and organizational affiliation)
Field Work Systems Audit	Once per contract year	Internal	Tetra Tech	QAM	UXO Program Manager Technical Lead	QAM UXO Program Manager	QAM Technical Lead

1 Tetra Tech personnel unless otherwise noted.

SAP Worksheet No. 32 – Assessment Findings and Corrective Action Responses

(UFP-QAPP Manual Section 4.1.2)

Assessment Type	**Nature of Deficiencies Documentation**	**Individual(s) Notified of Findings** (name, title, organization)	**Time Frame of Notification**	**Nature of Corrective Action Response Documentation**	**Individual(s) Receiving Corrective Action Response** (name, title, organization)	**Time Frame for Response**
Personnel Qualifications	E-mail	Ralph Brooks – UXO Program Manager, Tetra Tech	Immediately upon discovery	E-mail	Linda Klink – Technical Lead, Tetra Tech	Prior to initiation of task
Site-Specific Training	E-mail	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Upon completion of training	Updated e-mail	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours
Accident/Incident Reporting	Accident/Incident Report Form	Matt Soltis – HSM, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Immediately	Dependant on accident/incident	Linda Klink – Technical Lead, Tetra Tech Ralph Brooks – UXO Program Manager, Tetra Tech Matt Soltis – HSM, Tetra Tech	Within 24 hours
Preventive Maintenance	Field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours	Field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours

Assessment Type	**Nature of Deficiencies Documentation**	**Individual(s) Notified of Findings** (name, title, organization)	**Time Frame of Notification**	**Nature of Corrective Action Response Documentation**	**Individual(s) Receiving Corrective Action Response** (name, title, organization)	**Time Frame for Response**
Communications Equipment Inspection	Field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours	Field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink Technical Lead, Tetra Tech	Within 24 hours
Safety Inspections	Field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours	Field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours
Site Surveying	E-mail	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours	Updated e-mail	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours

Assessment Type	**Nature of Deficiencies Documentation**	**Individual(s) Notified of Findings** (name, title, organization)	**Time Frame of Notification**	**Nature of Corrective Action Response Documentation**	**Individual(s) Receiving Corrective Action Response** (name, title, organization)	**Time Frame for Response**
IVS - Assessment	Oral	SUXOS – TBD Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours	E-mail	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours
Vegetation Management	Field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours	E-mail	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours
GPS Positional Data Collection	Field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours	E-mail	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours
Detector-Aided Surface Survey - step-out transects	QC Checklist	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 1 business day of assessment	Updated QC checklist	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours

Assessment Type	**Nature of Deficiencies Documentation**	**Individual(s) Notified of Findings** (name, title, organization)	**Time Frame of Notification**	**Nature of Corrective Action Response Documentation**	**Individual(s) Receiving Corrective Action Response** (name, title, organization)	**Time Frame for Response**
Anomaly Intrusive Investigations	Field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours	Updated field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours
Donor Explosives Handling	Field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours	Updated field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours
UXO/MEC Accountability and MPPEH Management	Field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours	Updated field forms	Ralph Brooks – UXO Program Manager, Tetra Tech Linda Klink – Technical Lead, Tetra Tech	Within 24 hours
Visitor Briefing/ Operational Risk Assessment	E-mail	SUXOS – TBD Linda Klink – Technical Lead, Tetra Tech	Within 24 hours	Updated e-mail	SUXOS – TBD Linda Klink – Technical Lead, Tetra Tech	Within 24 hours

Assessment Type	**Nature of Deficiencies Documentation**	**Individual(s) Notified of Findings** (name, title, organization)	**Time Frame of Notification**	**Nature of Corrective Action Response Documentation**	**Individual(s) Receiving Corrective Action Response** (name, title, organization)	**Time Frame for Response**
Hazard Assessment – Risk Analysis	E-mail	Linda Klink – Technical Lead, Tetra Tech Matt Soltis – HSM, Tetra Tech	Within 24 hours	Updated e-mail	Linda Klink – Technical Lead, Tetra Tech Matt Soltis – HSM, Tetra Tech	Within 24 hours
Field Work Systems Audit	Letter Report	Linda Klink – Technical Lead, Tetra Tech Tom Johnston – QAM, Tetra Tech	Within 5 business days of assessment	Letter report	Linda Klink – Technical Lead, Tetra Tech Tom Johnston – QAM, Tetra Tech	Within 10 business days of receipt

SAP Worksheet No. 33 – QA Management Reports Table

(UFP QAPP Manual Section 4.2)

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)[1]	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Project Monthly Progress Report	Monthly (written) for duration of the project	Monthly	Technical Lead Tetra Tech	Navy RPM BEC BRAC PMO SE
Field Status Report	Daily (oral or e-mail) during the course of fieldwork	TBD	SUXOS Tetra Tech	Technical Lead Tetra Tech UXO Program Manager Tetra Tech
Daily QC Report	Daily (e-mail)	TBD	UXOQCS Tetra Tech	Technical Lead Tetra Tech UXO Program Manager Tetra Tech
QC Meeting Minutes	Twice per month during project performance	TBD	UXO Program Manager Tetra Tech	Technical Lead Tetra Tech
Rework Items List	Twice per month during project performance Daily for UXO work	TBD	UXOQCS Tetra Tech	Technical Lead Tetra Tech
Project QC Report	Internal draft, draft, and final (appendix to report)	TBD	Technical Lead Tetra Tech	Navy RPM BEC BRAC PMO SE

1. This worksheet will be modified to include the project delivery dates after fieldwork is scheduled.

SAP Worksheet No. 34 – Verification (Step I) Process Table

(UFP-QAPP Manual Section 5.2.1)

A preparatory-phase inspection will be performed prior to beginning each definable feature of work to review applicable specifications and verify that the necessary resources, conditions, and controls are in place and compliant with the SAP before the start of work activities. An initial-phase inspection will be performed at the beginning of each definable feature of work to observe/review the application of procedures to ensure their adequacy, to ensure that adequate resources are applied to the activity, and to ensure that a clear understanding exists as to the quality control requirements of the definable feature of work. The responsible person will inspect the relevant items from the checklist in the appropriate SOP. All preparatory-phase and initial-phase inspection reports will be submitted the day the inspections occur to the SUXOS and UXO Program Manager for review.

Definable Feature of Work	**Description**	**Responsible for Verification** (name, organization)
Site Preparation (including mobilization)	Project readiness review to be performed by Tetra Tech Technical Lead and Navy RPM, including SAP review.	Linda Klink – Technical Lead, Tetra Tech Art Sanford – Navy RPM Stacin Martin – NTR Mark Davidson - BEC BRAC PMO SE
	Prior to the field crew mobilizing to the field for on-site data collection, the Tetra Tech UXO Program Manager will review resumes and training records, including those for UXO field personnel, to ensure that all required training and experience requirements identified in Worksheet No. 7 have been completed for each crew member. Certifications will also be obtained prior to conducting the task requiring certification.	Ralph Brooks – UXO Program Manager, Tetra Tech
	Review of mobilization and site preparation activities such as equipment setup and checkout, installation of IVS, and investigation area survey and layout.	Linda Klink – Technical Lead, Tetra Tech Ralph Brooks – UXO Program Manager, Tetra Tech

Definable Feature of Work	Description	Responsible for Verification (name, organization)
Site Preparation (including mobilization) (continued)	Review of MRP SOP 01 (UXO Detector-Aided Surface Surveys) and MRP SOP 02 (MEC Management and Accountability), which document methodology to be used during surveys and QC procedures. Review of MRP SOP 08 (UXO Documentation), which describes documentation methodology to be used during performance of site work.	Ralph Brooks, – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech TBD – UXOQCS, Tetra Tech
	Prior to surface survey crews initiating on-site investigations, the UXO Program Manager will review the results of the IVS to verify that performance criteria have been satisfactorily attained per Worksheet No. 12. The Tetra Tech Technical Lead will review the recommendations of the UXO Program Manager and provide final approval.	Linda Klink – Technical Lead, Tetra Tech Ralph Brooks – UXO Program Manager, Tetra Tech
Site Surveying	Prior to the start of field work, the site boundaries (regarding work areas, equipment laydown areas, and access ways) will be established.	TBD – SUXOS, Tetra Tech
IVS	Prior to collection of data at IVS, review MRP SOP 3.	Ralph Brooks – UXO Program Manager, Tetra Tech
Vegetation Management	Brush clearing and vegetation management (regarding work areas, equipment laydown areas, and access ways) will be conducted in accordance with MRP SOP 06.	Preparatory Inspections: Ralph Brooks – UXO Program Manager, Tetra Tech Initial Inspections: TBD – UXOQCS, Tetra Tech
GPS Positional Data Collection	Review or MRP SOP 05 (Global Positioning System), which documents procedures to be utilized in the collection of GPS positional data. Ensure that real-time accuracy is being achieved by confirming that data are only collected when Horizontal Dilution of Precision (HDOP) is <3 and when at least six satellites are available. Ensure that sub-meter post processing accuracy estimate is being achieved by checking that GPS positioning is compared to two known locations at least twice daily.	TBD – SUXOS, Tetra Tech

Definable Feature of Work	Description	Responsible for Verification (name, organization)
Detector-Aided Survey – Step-Out Transects	Review of MRP SOP 01 (UXO Detector-Aided Surface Surveys) and MRP SOP 02 (MEC Management and Accountability), which include procedures for data collection and transcription. The SUXOS will verify that the data collected during the first lot of field work contain all the elements required by the scope of work and do not contain questionable data or error points.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech
	Review of MRP SOP 05 (Global Positioning System), which documents procedures to be used in the collection of GPS positional data. The SUXOS will verify that the detector-aided data collected during the first lot of field work contain all the elements required by the scope of work and do not contain questionable data or error points.	Ralph Brooks – UXO Program Manager, Tetra Tech
Target Reacquisition	Review MRP SOP 05 (GPS), which documents procedures to be used during GPS data collection and use and includes checklists and field forms.	TBD – SUXOS/UXOQCS, Tetra Tech
Anomaly Intrusive Investigation	Review MRP SOP 01 (UXO Detector-Aided Surface Surveys) and MRP SOP 02 (MEC Management and Accountability), which document methodology to be used during detector-aided survey and QC procedures. The SUXOS will verify that the data collected during the first lot of field work contain all the elements required by the scope of work and do not contain questionable data or error points.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech
Donor Explosives Handling)	Review MRP SOP 07 (UXO Demolition/Disposal Operations), which documents procedures to be used during UXO detonation operation and includes checklists and field forms.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech
MEC Management - Treatment	Review MRP SOP 07 (UXO Demolition/Disposal Operations), which documents procedures to be used during UXO detonation operations and includes checklists and field forms.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech
MPPEH Management - Inspection	Review MRP SOP 02 (MEC Management and Accounting), which documents procedures to be used during MPPEH management operations and includes checklists and field forms.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech
MPPEH Management - Certification	Review MRP SOP 02 (MEC Management and Accounting), which documents procedures to be used during MPPEH certification operations and includes checklists and field forms.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS

Definable Feature of Work	**Description**	**Responsible for Verification** (name, organization)
MPPEH Management - Disposal	Review MRP SOP 02 (MEC Management and Accounting), which documents procedures to be used during MPPEH disposal operations and includes checklists and field forms.	Linda Klink – Technical Lead, Tetra Tech Ralph Brooks – UXO Program Manager, Tetra Tech
Demobilization	Review of demobilization activities such as completion of field forms, return or equipment, and forwarding of all field documentation to Technical Lead.	Linda Klink – Technical Lead, Tetra Tech Ralph Brooks – UXO Program Manager, Tetra Tech
Site-Specific Final Report Preparation and Approval	Verify that all data and documentation have been acquired for report preparation	Linda Klink – Technical Lead, Tetra Tech Ralph Brooks – UXO Program Manager, Tetra Tech

SAP Worksheet No. 35 – Validation (Steps IIa and IIb) Process Table

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

Follow-up QC inspections are conducted to ensure that procedures are being correctly performed, that no changed conditions exist that may affect the quality of work, and that lessons learned are being applied as identified. The responsible individual will inspect the relevant follow-up items from the checklist in the appropriate SOP at least as often as specified in this worksheet. Worksheet No. 32 describes actions to be taken in the event that non-conforming conditions are observed during the QC inspections.

Definable Feature of Work	Frequency of Inspection	Supporting QC Document(s)	Responsible for Validation (name, organization)
Site Preparation (including mobilization)	Once	No follow-up required for project readiness. Verify that the SAP can be implemented and carried out as written and that any deviations are documented.	Linda Klink – Technical Lead, Tetra Tech Art Sanford – Navy RPM Stacin Martin – NTR Mark Davidson - BEC BRAC PMO SE
Site Surveying	Daily	Checklist and field logbooks, which document equipment utilization and progress.	TBD – SUXOS, Tetra Tech
IVS	Once by each team	Review results of IVS.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech TBD – UXOQCS, Tetra Tech
Vegetation Management	Daily	Checklists and field logbooks, which document equipment utilized and progress.	TBD – SUXOS, Tetra Tech Ralph Brooks – UXO Program Manager, Tetra Tech

Definable Feature of Work	Frequency of Inspection	Supporting QC Document(s)	Responsible for Validation (name, organization)
GPS Positional Data Collection	Daily	See MRP SOP 05 (GPS) and QC Follow-Up Report.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech
Detector-Aided Survey – Step-OutTransects	Once per week activity is conducted	Checklists and field logbooks, which document equipment utilized and progress.	Linda Klink – Technical Lead, Tetra Tech
	Minimum of once per day surveys are conducted or more frequently as necessary	Checklists and field forms, which document equipment utilized, grids/transects surveyed, and grids/transects checked for QC purposes.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech TBD – UXOQCS, Tetra Tech
	As needed, prior to data entry	Prior to entering data (field forms and electronic data) from the detector-aided surface surveys into the permanent project database, the UXO Program Manager or designated representative will review the field forms to ensure that all required information is provided as required by MRP SOP 01 (Detector-Aided Surface Survey) and MRP SOP 02 (MEC Management and Accountability). Verify that all data have been transferred correctly and completely during collection. Ensure that data are downloaded and backed up at least once per day to prevent accidental loss of data/field efforts.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech
Target Reacquisition	Daily	See MRP SOP 05 and QC Follow-Up Report.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech TBD – UXOQCS, Tetra Tech

Definable Feature of Work	**Frequency of Inspection**	**Supporting QC Document(s)**	**Responsible for Validation** (name, organization)
Anomaly Intrusive Operations	Daily	See MRP SOP 01 (UXO Detector-Aided Surface Surveys), MRP SOP 02 (MEC Management and Accountability), and QC Follow-Up Report.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech TBD – UXOQCS, Tetra Tech
Donor Explosives Handling	Before first event and any time a new procedure is introduced	See MRP SOP 07 (UXO Demolition/Disposal Operations) and QC Follow-Up Report.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech TBD – UXOQCS, Tetra Tech
MEC Management - Treatment	Before first event and any time a new procedure is introduced	See MRP SOP 07 (UXO Demolition/Disposal Operations) and QC Follow-Up Report.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech TBD – UXOQCS, Tetra Tech
MPPEH Management - Inspection	Daily	See MRP SOP 02 (MEC Management and Accounting) and QC Follow-Up Report.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech TBD – UXOQCS, Tetra Tech
MPPEH Management - Certification	Daily	See MRP SOP 02 (MEC Management and Accounting) and QC Follow-Up Report.	Ralph Brooks - UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech TBD – UXOQCS, Tetra Tech

Definable Feature of Work	**Frequency of Inspection**	**Supporting QC Document(s)**	**Responsible for Validation** (name, organization)
MPPEH Management - Disposal	Daily	See MRP SOP 02 (MEC Management and Accounting) and QC Follow-Up report.	Ralph Brooks – UXO Program Manager, Tetra Tech TBD – SUXOS, Tetra Tech TBD – UXOQCS, Tetra Tech
Demobilization	Once upon completion of Supplemental MEC RI project	Verify that all demobilization activities have been completed.	Linda Klink – Technical Lead, Tetra Tech Ralph Brooks – UXO Program Manager, Tetra Tech
Site-Specific Final Report Preparation and Approval	Once upon completion of the Supplemental MEC RI project.	Verify that all activities have been documented and reported and have been included in the report.	Linda Klink – Technical Lead, Tetra Tech Art Sanford – Navy RPM Stacin Martin – NTR Mark Davidson - BEC BRAC PMO SE

SAP Worksheet No. 36 –Analytical Data Validation (Steps IIa and IIb) Summary Table

(UFP-QAPP Manual Section 5.2.2.1)

Step IIa/IIb(1)	Matrix	Analytical Group	Validation Criteria	Data Validator (Title and organization)
IIa	Surface Soil	Detector-Aided Surface Survey	a) Satisfactory rechecks of 25% of first four grids/transects by the UXOQCS, or SUXOS if no UXOQCS. b) Satisfactory rechecks of 10% of the grids/ transects by the UXOQCS, or SUXOS if no UXOQCS, after achievement of satisfactory rechecks on four grids/transects in a row c) Detection and Location of blind seed items, for step-out transects	TBD - SUXOS Tetra Tech TBD - UXOQCS Tetra Tech
IIa	Subsurface Soil	Detector-aided subsurface surface survey with manual MEC/MPPEH and non-munitions-related debris removal Intrusive investigation to maximum of 1 foot bgs within 2 feet of anomaly location	a) Satisfactory rechecks of 100% of intrusive investigation of anomalies. b) All anomalies detected and investigated within 1 foot bgs and 2 feet of detected anomaly location. No MEC 20mm or larger remains in the excavation.	TBD - SUXOS Tetra Tech TBD - UXOQCS Tetra Tech

1 IIa = compliance with methods, procedures, and contracts (see Table 10, page 117, UFP-QAPP manual, V.1 March 2005).
IIb not applicable for MEC investigation.

SAP Worksheet No. 37 – Usability Assessment

(UFP-QAPP Manual Section 5.2.3)

Data Usability Assessment

The usability of the data directly affects whether project objectives can be achieved. The following characteristics will be evaluated at a minimum. The results of these evaluations will be included in the project report. To the extent required by the type of data being reviewed, the assessors will consult with other technically competent individuals to render sound technical assessments of these data characteristics.

Certification of Proper Operation of Detection and Positioning Systems

The Tetra Tech UXO Program Manager, or designee, acting on behalf of the Project Team, will prepare a table listing planned calibration and QC checks, their occurrence, and the results (acceptable or not acceptable) for each type of metal detector and positioning system equipment to be used on the project. Data collected by any improperly operating equipment will be identified. A determination will be made as to whether the affected data adversely impacted the ability to meet project objectives. If the project objectives have been adversely impacted, the Tetra Tech Technical Lead will consult with the Navy RPM and other Project Team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions.

Qualification/Certification of Survey Team

The Tetra Tech UXO Program Manager, or designee, acting on behalf of the Project Team, will prepare a table listing each member of the MEC investigation UXO team and required certifications, training, and demonstrations of competency. Any deviations from this SAP will be identified. Data collected by team members not meeting the required training and demonstrations of competency will be identified. A determination will be made as to whether affected data impacted the ability to meet project objectives. If the project objectives have been adversely impacted, the Tetra Tech Technical Lead will consult with the Navy RPM/NTR/BEC and other Project Team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions.

Coverage of Areas to be Investigated

The UXO Program Manager, or designee, acting on behalf of the Tetra Tech Technical Lead and Project Team, will determine whether data were collected in all areas planned to be investigated. Data gaps will be identified. The Tetra Tech Technical Lead will consult with the Project Team to determine the extent to which it is necessary to fill these data gaps during future investigations.

Identify the personnel responsible for performing the usability assessment:

The Tetra Tech Technical Lead will be responsible for conducting the listed data usability assessments. The data usability assessments will be reviewed with the Navy RPM/NTR/BEC, FDEP, and USEPA. The review will take place either in a face-to-face meeting or teleconference depending on the extent of identified deficiencies. If no significant deficiencies are identified, the data usability assessment will simply be documented in the project report and reviewed during the normal document review cycle.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented:

Written documentation will support non-compliance with this SAP. The project report will identify and describe the data usability limitations and suggest corrective actions, if necessary.

Usability Checklist Table			
Phase of Work	**Item to be checked/verified**	**Verified (Yes or No)**	**Comments or Deviations**
Pre-Survey	Qualifications of survey team evaluated.		
	Personnel reviewed and signed off on relevant SAP section(s).		
MDAS Inventory	MDAS recorded on MDAS Addition Form. MDAS reported in daily report.		
GPS Data	Prepare a table listing planned calibration and QC checks, their occurrence, and the results (acceptable or not acceptable) for position system equipment to be used on the project. Verify uploads of GPS data to Tetra Tech's munitions response website.		
MEC Tracking Log	Conformance with SAP requirements and procedures for recording MEC items discovered. Report MEC/MPPEH and related items on Daily Reports.		
Survey	QC evaluation of survey equipment (tests and checklists satisfactorily completed).		
	Conformance to SAP requirements and procedures for all survey work and rework (including documentation requirements), and all deficiencies documented.		
	Coverage of areas to be investigated fulfilled and transect endpoints and 2010 MEC RI MPPEH items located within accuracy levels required for the Supplemental MEC RI.		
	Interpretation and summary of data satisfies SAP requirements and conformance with Worksheet No. 17.		

REFERENCES

ABB-ES (ABB Environmental Services, Inc.), 1997. Remedial Investigation, Operable Unit 5, Sites 14 and 15, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Naval Facilities Engineering Command, Southern Division, North Charleston, South Carolina. October.

AGVIQ-CH2MHill (AGVIQ-CH2MHill Constructors, Inc., Joint Venture III), 2009. Remedial Action Completion Report – Soil Removal Action for Operable Unit 5, Site 15 - Blue 10 Ordnance Disposal Area, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Naval Facilities Engineering Command, Southern Division, North Charleston, South Carolina. August.

CH2MHill, 2007. Preliminary Assessment/Site Inspection Report for Past Use of Munitions and Explosives of Concern for Blue Ordnance Disposal Area (Site 15), Former Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Naval Facilities Engineering Command Southeast. February.

Department of Defense (DoD), 1995. Defense Demilitarization Manual DoD 4160-21-M-1. Revision 1, February.

DoD, 2008. Material Potentially Presenting an Explosive Hazard. DoD Instruction 4140.62. November.

Department of Defense Explosives Safety Board (DDESB), 2004. Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel, TP 18. December.

Navy, 2005. Naval Sea Systems Command, Ammunition and Explosives Safety Ashore, NAVSEA OP 5 VOLUME 1, 15 January 2001, W/Change 7 - 1 June.

Navy, 2009. Explosives Safety Review, Oversight, and Verification Of Munitions Responses, Naval Ordnance Safety And Security Activity Instruction, NOSSAINST 8020.15B. January

Navy, 2010. Operations Risk Management. Naval Operations Instruction (OPNAVINST) 5900.39C July.

Tetra Tech (Tetra Tech, NUS, Inc.), 2008. Record of Decision for Operable Unit 5, Site 15 - Blue 10 Ordnance Disposal Area, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Naval Facilities Engineering Command, Southern Division, North Charleston, South Carolina. June.

Tetra Tech, 2009. Land Use Control Remedial Design, Operable Unit 5, Site 15, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for Naval Facilities Engineering Command, Southern Division, North Charleston, South Carolina. May.

Tetra Tech, 2010a. Sampling and Analysis Plan for Munitions Response Program. MEC Remedial Investigation at Operable Unit 5, Site 15 - Blue 10 Ordnance Disposal Area. Naval Air Station Cecil Field. Jacksonville, Florida. April.

Tetra Tech, 2010b. MEC Remedial Investigation Report for Munitions Response Program at Operable Unit 5, Site 15 - Blue 10 Ordnance Disposal Area. Naval Air Station Cecil Field. Jacksonville, Florida. August.

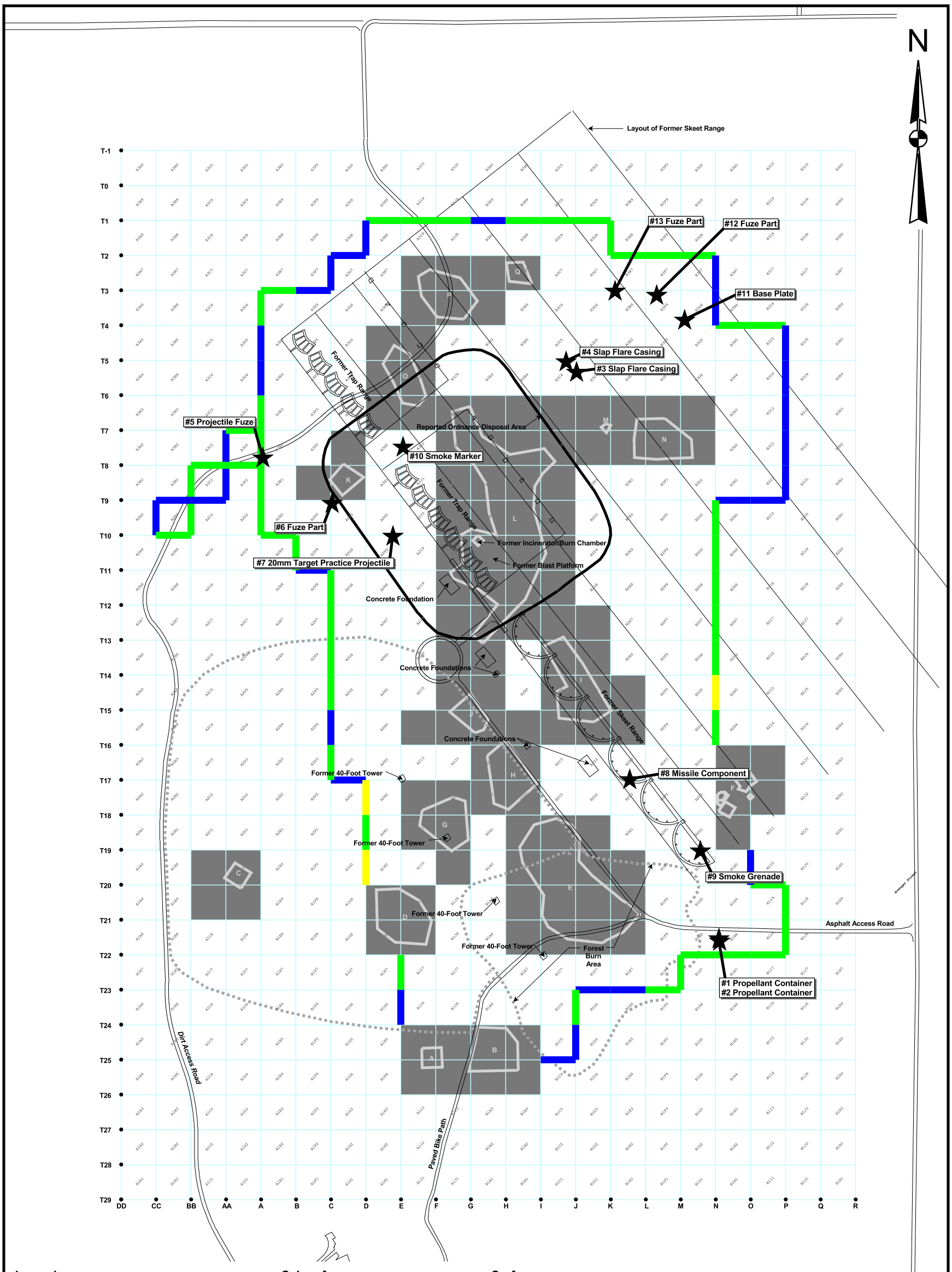
United States Army Corps of Engineers (USACE), 2007. Engineering and Design – Ordnance and Explosives Response EM 1110-1-4009. June.

USACE, 2009. Accident Prevention Plan Data Item Description MMRP-09-005. August.

USEPA (United States Environmental Protection Agency), 2002. Guidance for Quality Assurance Project Plans (EPA QA/G-5). USEPA/240/R-02/009. USEPA Office of Environmental Information, Washington DC. December.

USEPA, 2005. Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP), Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs (Final Version 1), EPA-505-B-04-900A. March.

:\GIS\NAS_CecilField\Site-15_20100607.apr 10Jan11 MJJ 10-03



Legend

- 2008 Soil Excavated Area (A through Q)
- UXO Grid Number

Subsurface

Transect Anomaly Density

- No anomalies
- Low (1 to 5) anomalies
- Medium (6 to 20) anomalies
- High (21 or more) anomalies

Surface

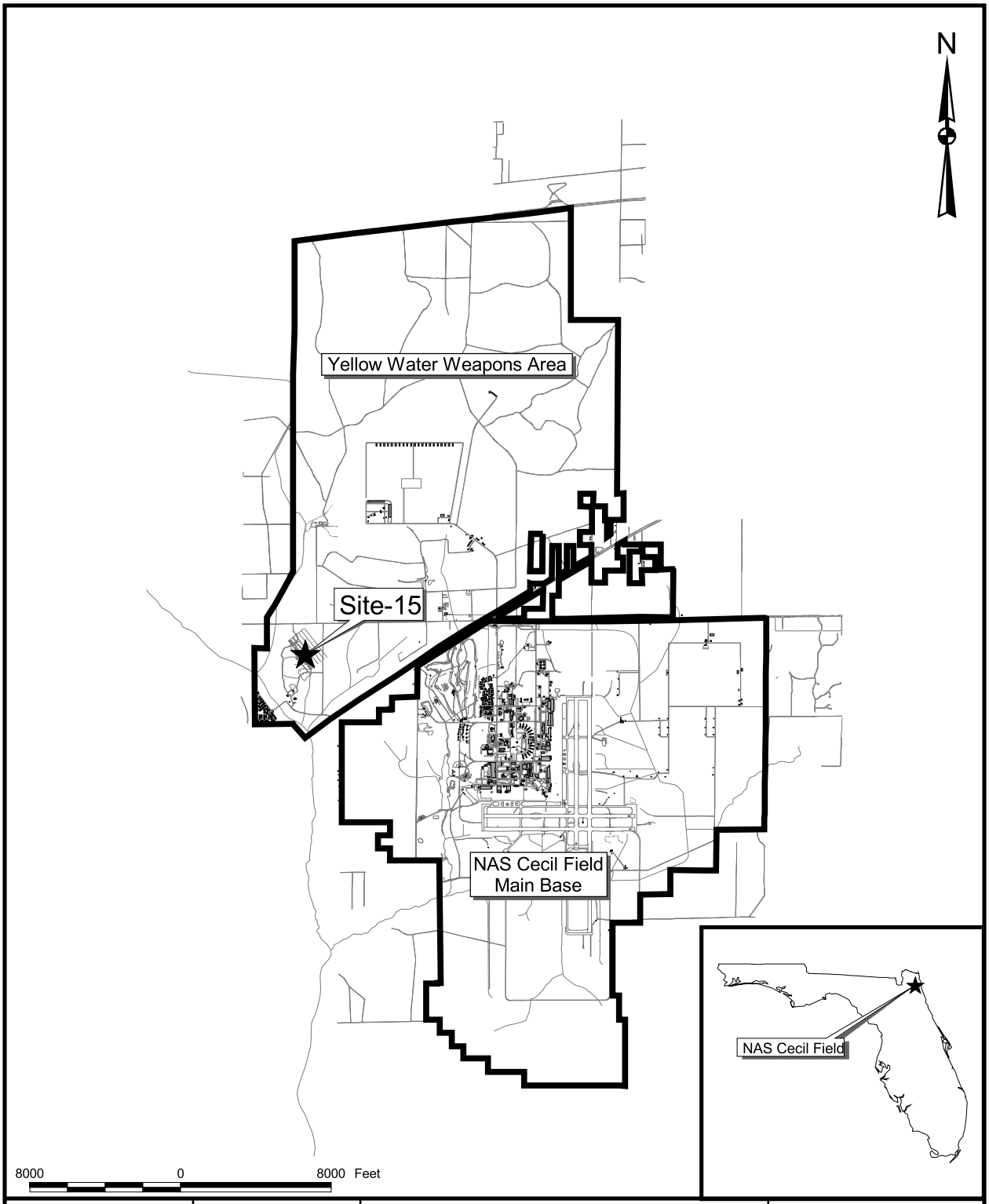
- ★ MPPEH Item

2008 Munitions Surface and Subsurface Clearance Areas:

- GPO from munitions support of 2008/2009 contaminated soil, reused area for 2010 MEC RI
- MEC or MEC/MDAS found and removed
- MDAS only found and removed
- No MEC or MDAS found although non-munitions related debris may have been present

300 0 300 Feet

DRAWN BY MJJ	DATE 20Oct10	DETECTOR-AIDED SURVEY TRANSECT RESULTS OPERABLE UNIT 5, SITE 15 MEC REMEDIAL INVESTIGATION NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 2267
CHECKED BY EIL	DATE		APPROVED BY L. Klink / DATE
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE AS NOTED	NAVFAC		DRAWING NO. FIGURE ES-1 / REV 0



DRAWN BY MJJ	DATE 27Dec10	GENERAL LOCATION MAP OPERABLE UNIT 5, SITE 15 NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 2267
CHECKED BY EIL	DATE		APPROVED BY L. Klink / DATE
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 10-1 / REV 0

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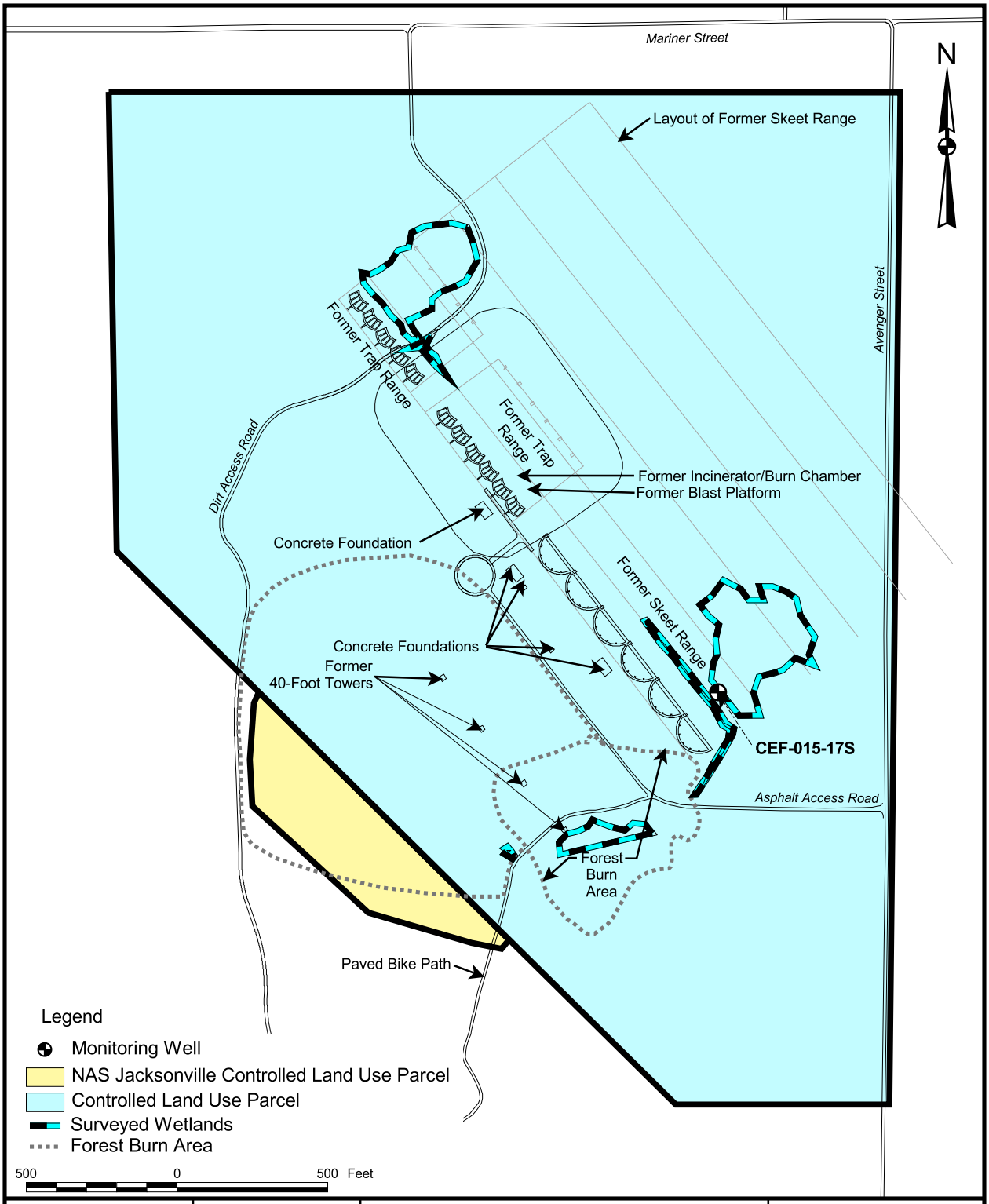

DRAWN BY MJJ DATE 20Jan10		GENERAL SITE ARRANGEMENT OPERABLE UNIT 5, SITE 15 NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 2267
CHECKED BY EIL DATE			APPROVED BY L. Klink DATE
COST/SCHEDULE-AREA			APPROVED BY DATE
SCALE AS NOTED	NAVFAC		DRAWING NO. FIGURE 10-2 REV 0

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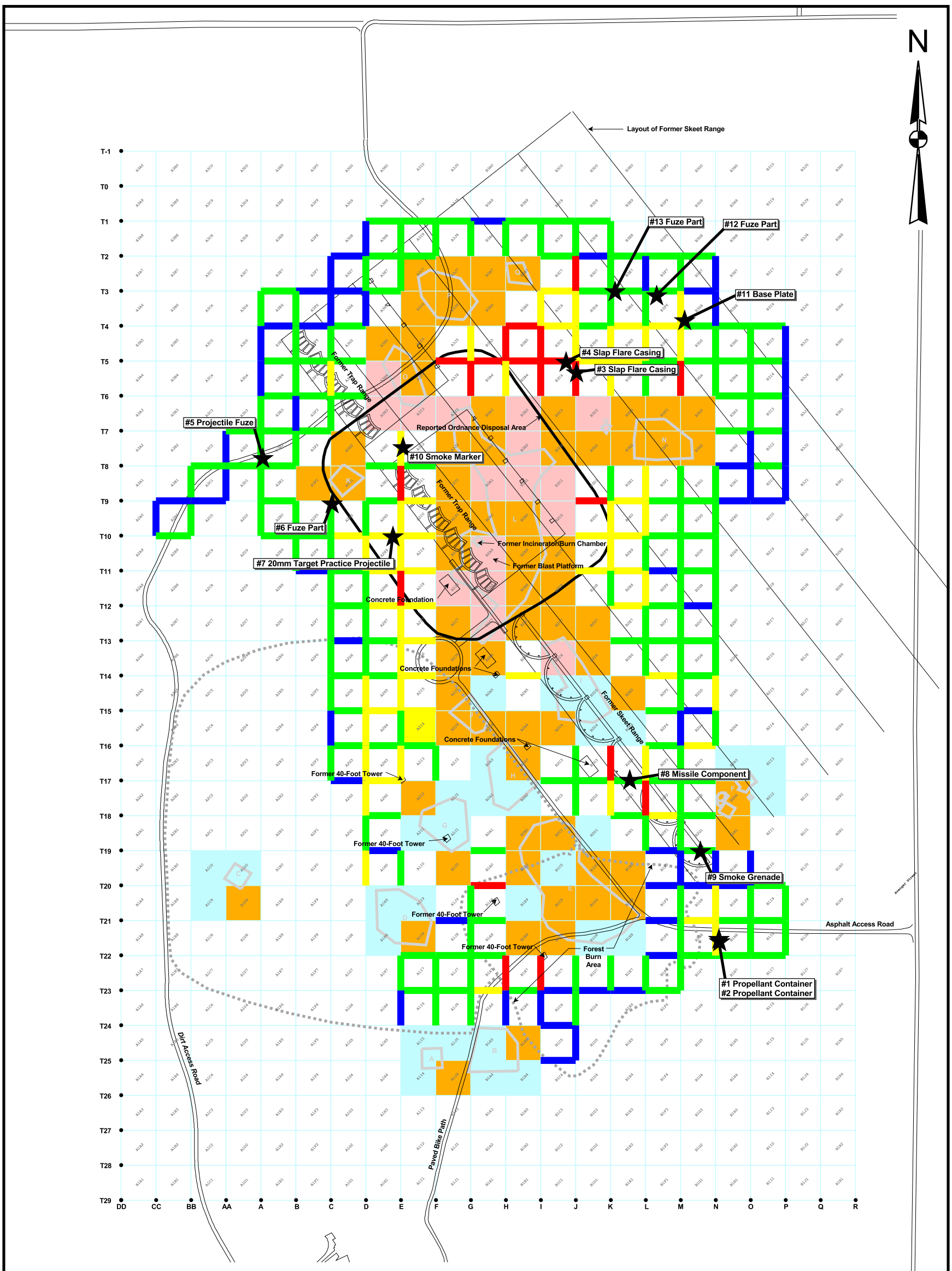


Legend

- 2008 Soil Excavated Area (A through Q)
- UXO Grid Number

Subsurface

Transect Anomaly Density

- No anomalies
- Low (1 to 5) anomalies
- Medium (6 to 20) anomalies
- High (21 or more) anomalies

Surface

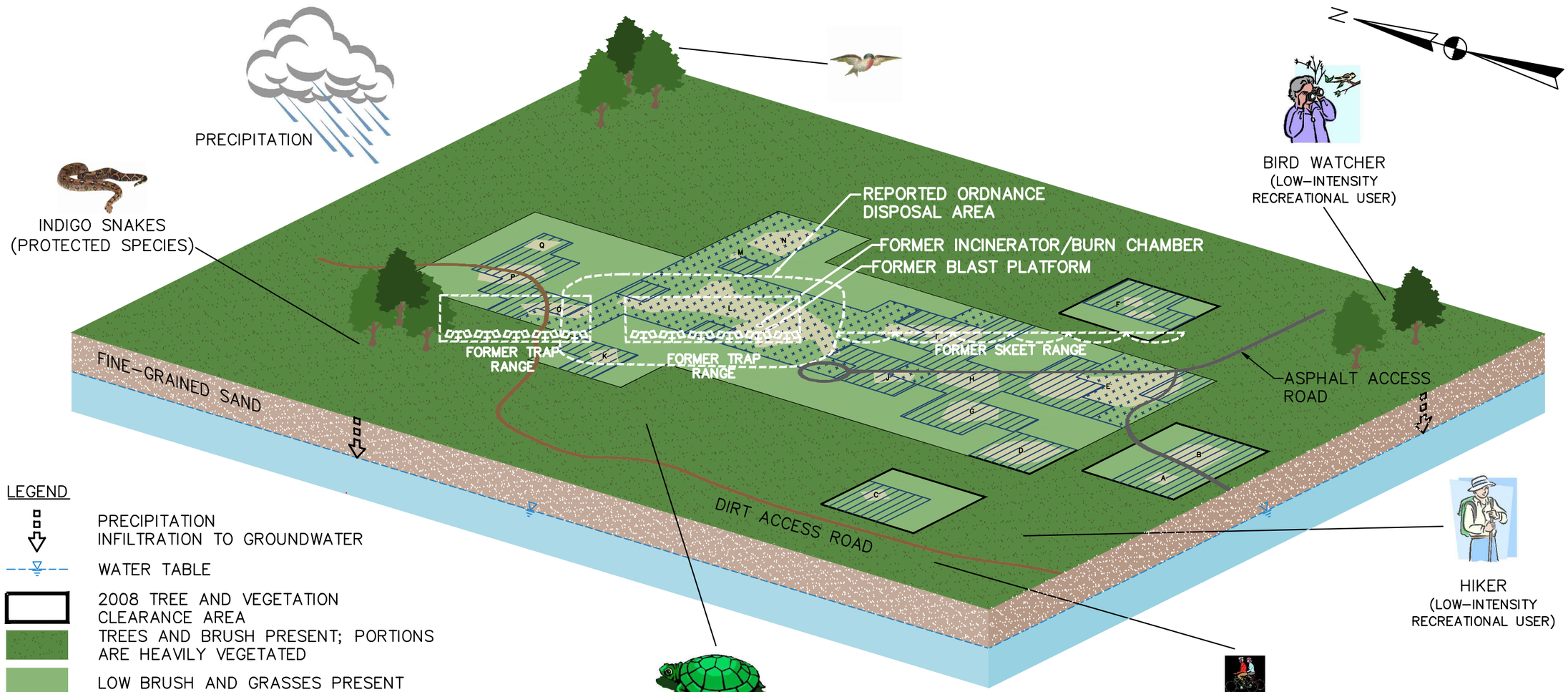
- ★ MPPEH Item

2008 Munitions Surface and Subsurface Clearance Areas:

- GPO from munitions support of 2008/2009 contaminated soil, reused area for 2010 MEC RI
- MEC or MEC/MDAS found and removed
- MDAS only found and removed
- No MEC or MDAS found although non-munitions related debris may have been present

300 0 300 Feet

DRAWN BY MJJ	DATE 20Oct10	DETECTOR-AIDED SURVEY TRANSECT RESULTS OPERABLE UNIT 5, SITE 15 MEC REMEDIAL INVESTIGATION NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 2267
CHECKED BY EIL	DATE		APPROVED BY L. Klink / DATE
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE AS NOTED	NAVFAC		DRAWING NO. FIGURE 10-3 / REV 0



LEGEND

- PRECIPITATION INFILTRATION TO GROUNDWATER
- WATER TABLE
- 2008 TREE AND VEGETATION CLEARANCE AREA
- TREES AND BRUSH PRESENT; PORTIONS ARE HEAVILY VEGETATED
- LOW BRUSH AND GRASSES PRESENT
- 2008 SOIL EXCAVATION AREAS A THROUGH Q
- NO MEC OR MDAS FOUND, ALTHOUGH NON-MUNITIONS DEBRIS MAY HAVE BEEN PRESENT
- MEC AND/OR MDAS FOUND

NOTES:

1.) MEC OR MDAS ARE MOST LIKELY STILL PRESENT IN AREAS NOT INCLUDED IN THE 2008 MUNITIONS CLEARANCE WITHIN AND ADJACENT TO THE ORDNANCE DISPOSAL AREA, ALONG ACCESS ROADS TO THE ORDNANCE DISPOSAL AREA, AND IN THE AREA USED AS FORMER SKEET AND TRAP RANGES.

2.) CURRENT ALLOWED LAND USE INCLUDES LOW-INTENSITY RECREATIONAL USE.

DRAWN BY CK	DATE 2/16/10	CONCEPTUAL SITE MODEL MEC REMEDIAL INVESTIGATION OPERABLE UNIT 5, SITE 15 NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NO. 2267
CHECKED BY	DATE		OWNER NO.
REVISED BY	DATE		APPROVED BY L. KLINK / DATE 8-2-10
SCALE NOT TO SCALE		NAVFAC	DRAWING NO. FIGURE 10-4 / REV. 0

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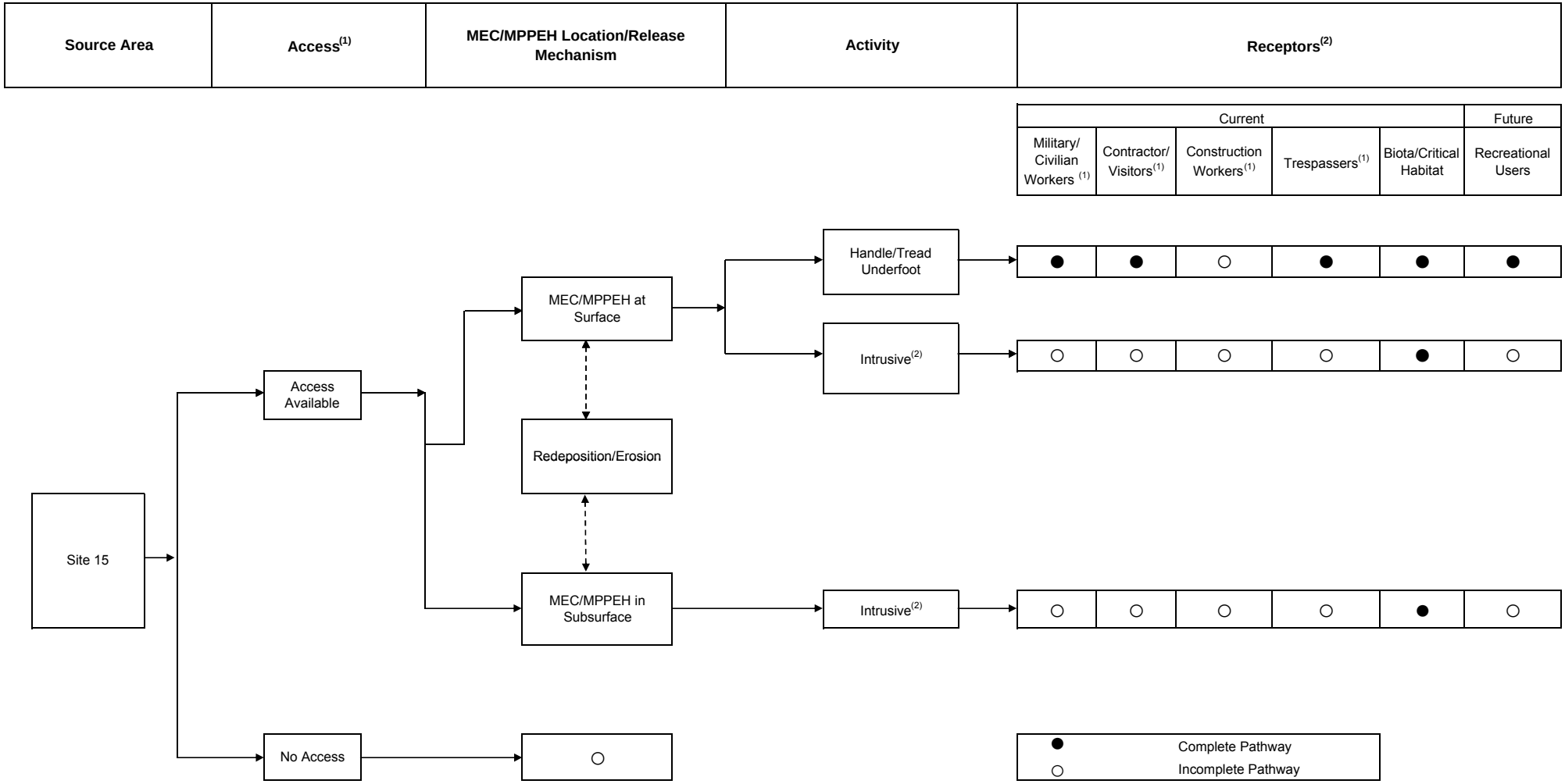
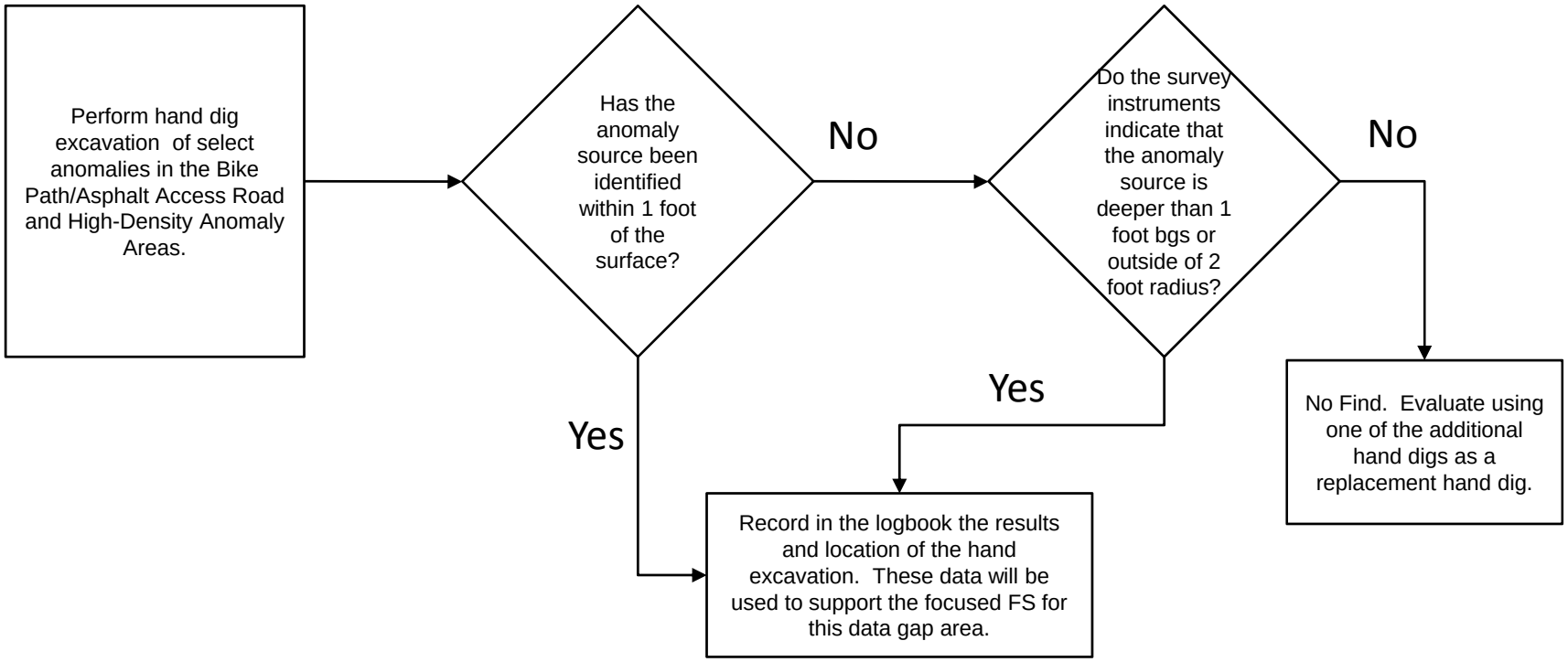
FIGURE 10-5
MEC/MPPEH EXPOSURE PATHWAY ANALYSIS
OPERABLE UNIT 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA



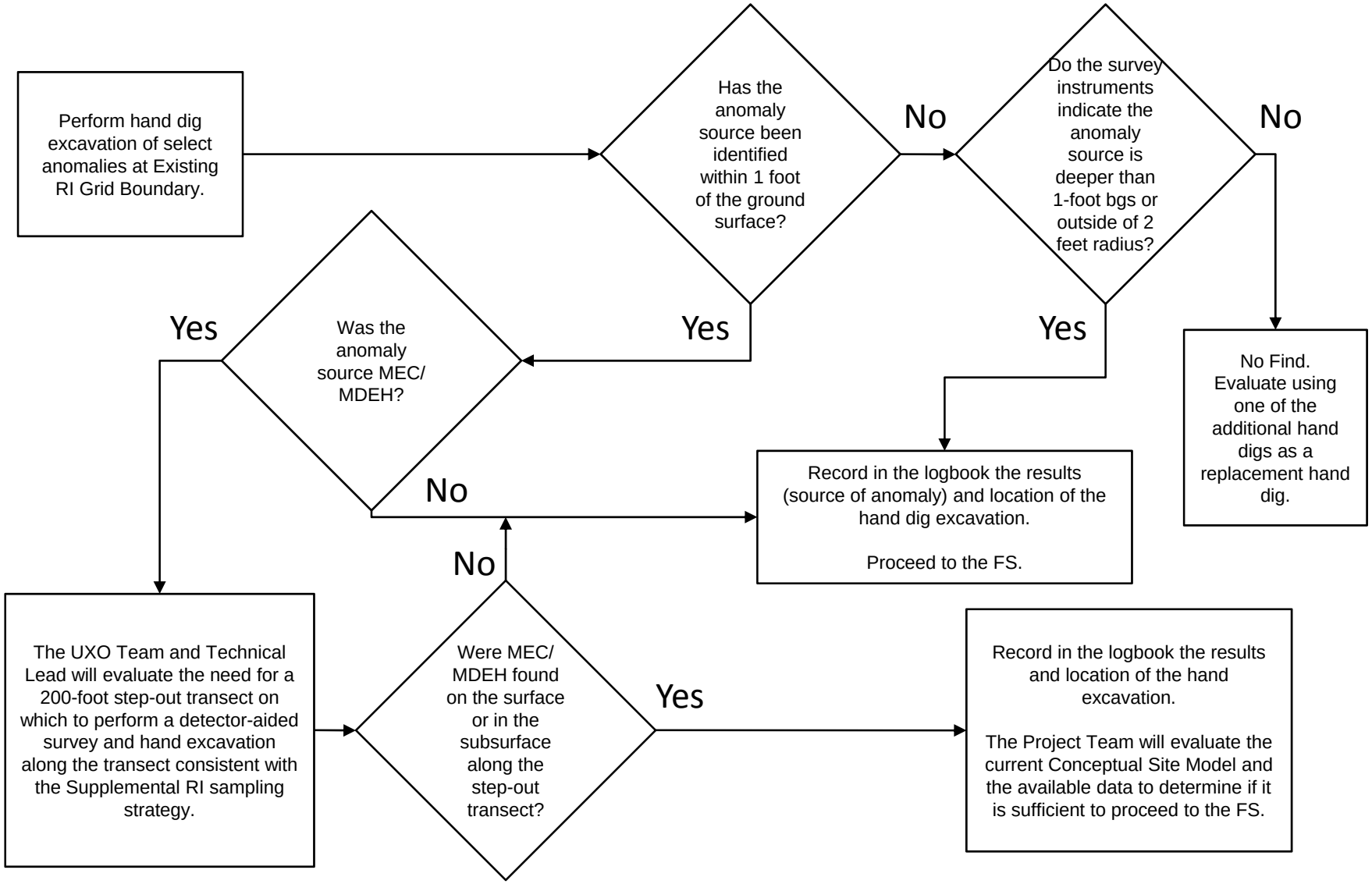
1 Property transfer is pending following completion of MEC RI, FS, and establishment of a MEC remedy.
2 Land Use Control (LUC) Remedial Design (RD) allows for low-intensity recreational uses including activities such as hiking, biking, horseback riding, birding, and hunting. No man-made attractions can be provided that would entice people, particularly small children, to frequently visit the site, which is consistent with the property's proposed reuse as a natural resource corridor. Medium-(e.g., picnicking and camping) and high-intensity (e.g., children's playgrounds and contact sports) recreational uses are not permitted. Residential and industrial/commercial uses are also prohibited.

Figure 11-1
Decision Rules for the Bike Path/Access Road and High-Density Anomaly Areas



Note: Up to 20 additional hand dig excavations may be completed over the site to address remaining data gaps if any are identified during the Supplemental RI.

Figure 11-2
Decision Rules for Existing RI Grid Boundary



Note: Up to 20 additional hand dig excavations may be completed over the site to address remaining data gaps if any are identified during the Supplemental RI. Up to 10 step-out transects may be completed across the site.

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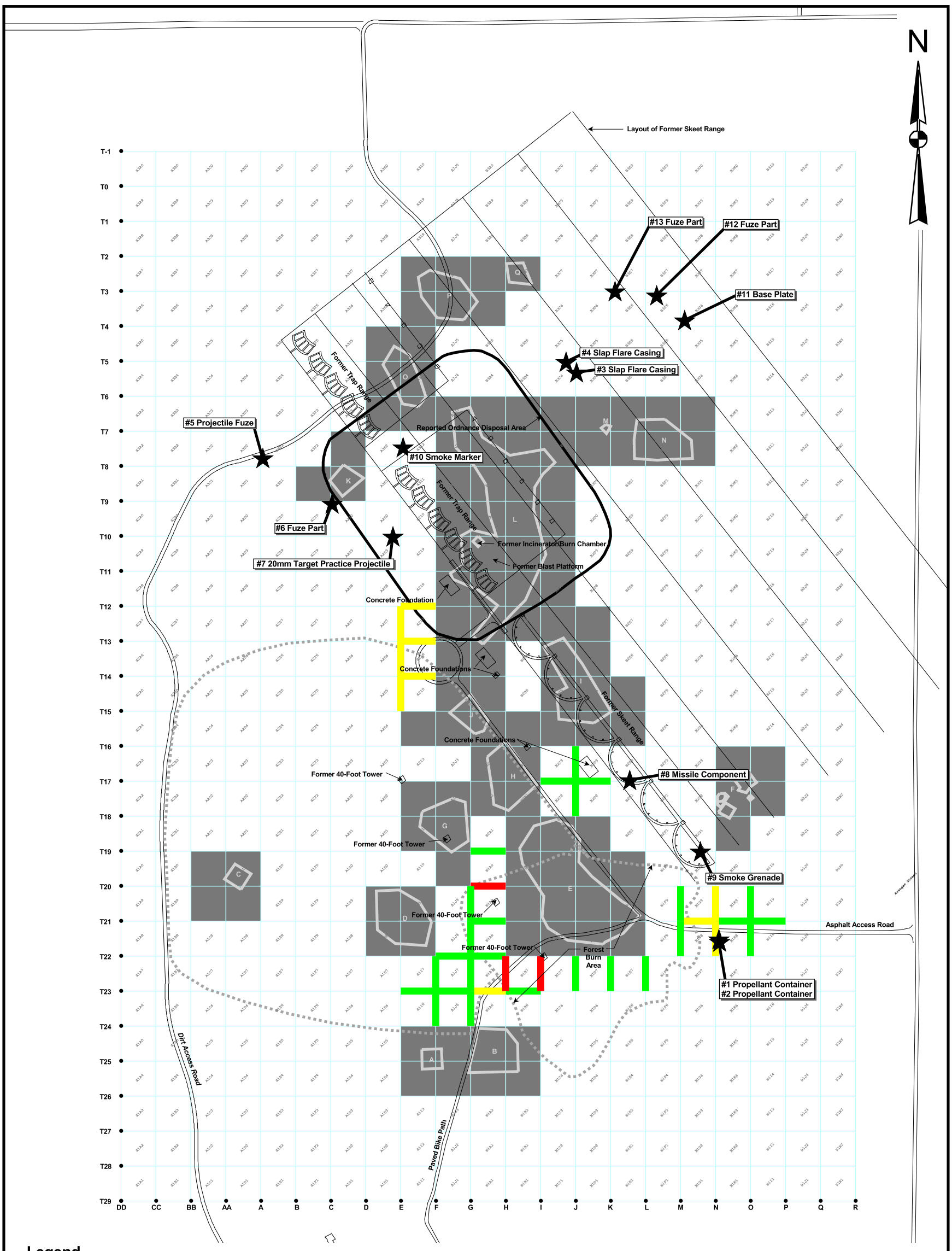

Legend

UXO Grid Number

2008 Soil Excavated Area (A through Q)

2008 Munitions Surface and Subsurface Clearance Area

Surface

★ MPPEH Item

Subsurface

Number Of Hand Excavation Locations/Transect	Transect Anomaly Density
0	No anomalies
1	Low (1 to 5) anomalies
2	Medium (6 to 20) anomalies
3	High (21 or more) anomalies

Notes: 1) Only transects for Supplemental RI work (along paved bike path and asphalt access road) are shown on this figure.

2) Up to 20 additional hand excavations for the site as a whole may be investigated if MEC/MDEH are identified on site.

300 0 300 Feet

DRAWN BY MJJ	DATE 27Dec10	PROPOSED EXCAVATION LOCATIONS PAVED BIKE PATH AND ASPHALT ACCESS ROAD OPERABLE UNIT 5, SITE 15 SUPPLEMENTAL MEC REMEDIAL INVESTIGATION NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 2267
CHECKED BY EIL	DATE		APPROVED BY L. Klink DATE
COST/SCHEDULE-AREA			APPROVED BY DATE
SCALE AS NOTED	NAVFAC		DRAWING NO. FIGURE 17-1 REV 0

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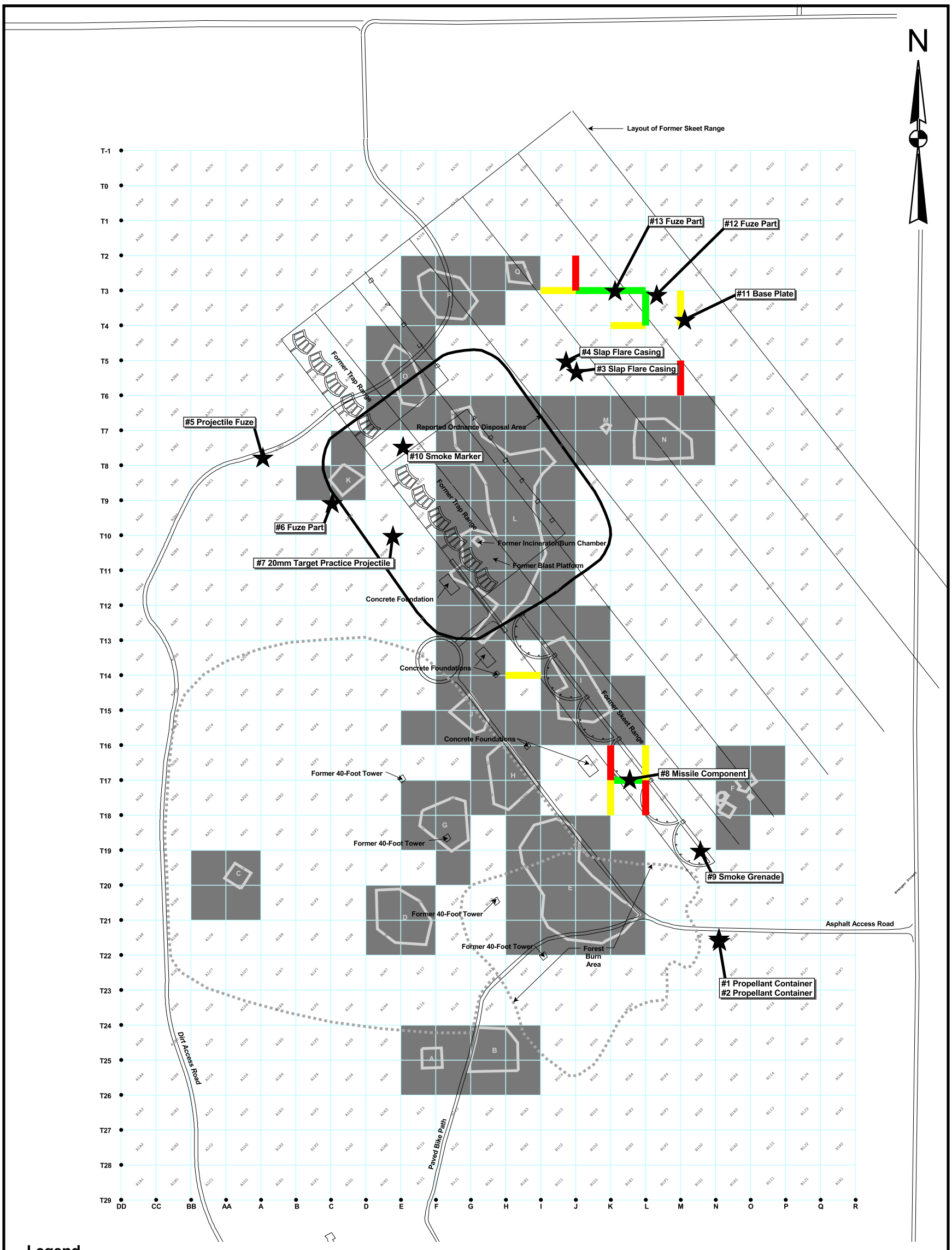

Legend

- UXO Grid Number
- 2008 Soil Excavated Area (A through Q)
- 2008 Munitions Surface and Subsurface Clearance Area

Surface

★ MPPEH Item

Subsurface

Number Of Hand Excavation Locations/Transect	Transect Anomaly Density
0	No anomalies
1	Low (1 to 5) anomalies
2	Medium (6 to 20) anomalies
3	High (21 or more) anomalies

Notes: 1) Only transects for Supplemental RI work (high density anomaly area) are shown on this figure.

2) Up to 20 additional hand excavations for the site as a whole may be investigated if MEC/MDEH are identified on site.

300 0 300 Feet

DRAWN BY MJJ	DATE 27Dec10	PROPOSED EXCAVATION LOCATIONS HIGH ANOMALY DENSITY AREAS OPERABLE UNIT 5, SITE 15 SUPPLEMENTAL MEC REMEDIAL INVESTIGATION NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 2267
CHECKED BY EIL	DATE		APPROVED BY L. Klink / DATE
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE AS NOTED	NAVFAC		DRAWING NO. FIGURE 17-2 / REV 0

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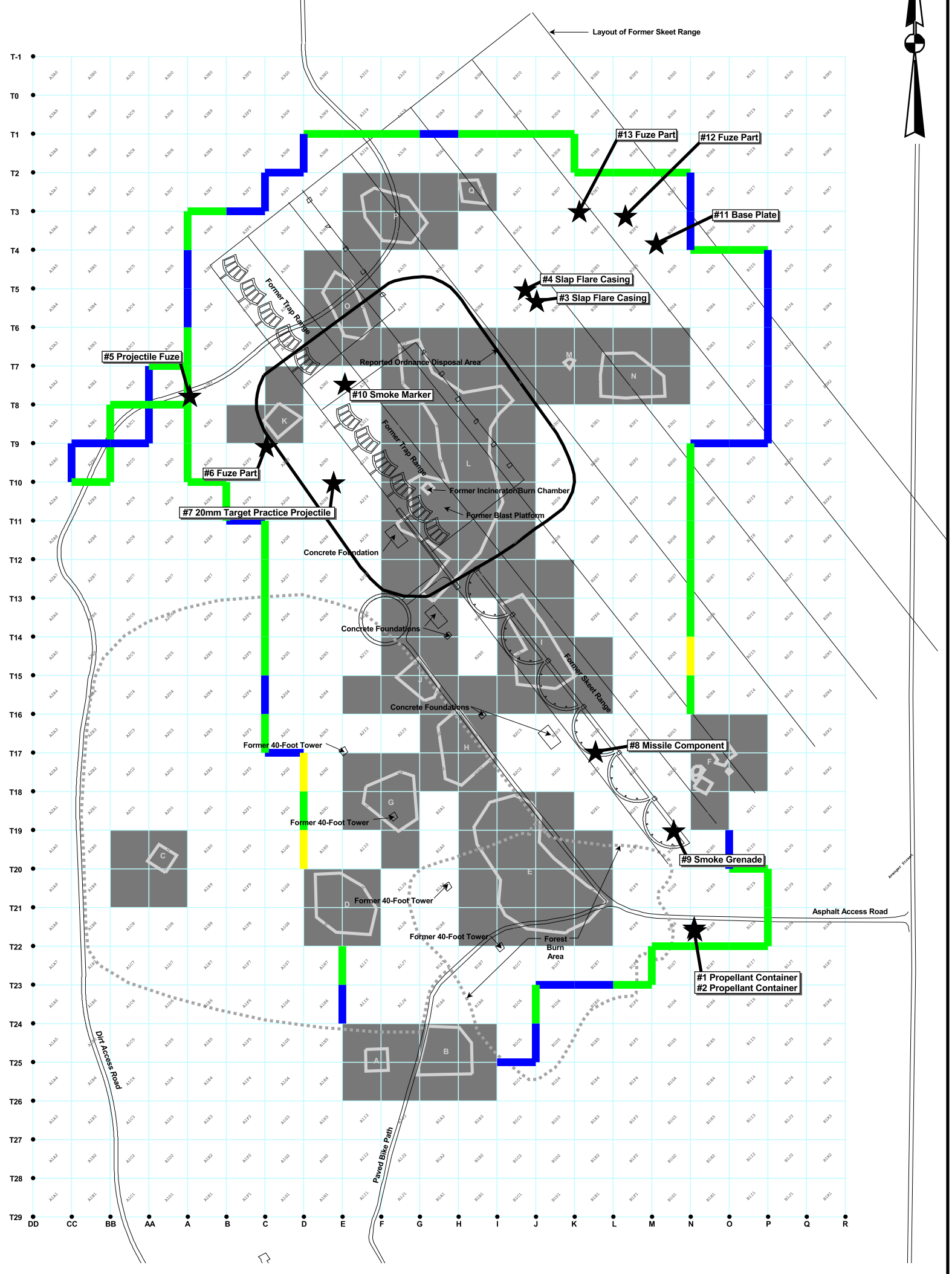


Legend

- UXO Grid Number
- 2008 Soil Excavated Area (A through Q)
- 2008 Munitions Surface and Subsurface Clearance Area

Surface

★ MPPEH Item

Subsurface

Number Of Hand Excavation Locations/Transect	Transect Anomaly Density
0	No anomalies
1	Low (1 to 5) anomalies
2	Medium (6 to 20) anomalies
3	High (21 or more) anomalies

Notes: 1) Only transects for Supplemental RI work (existing 2010 MEC RI grid boundary) are shown on this figure.

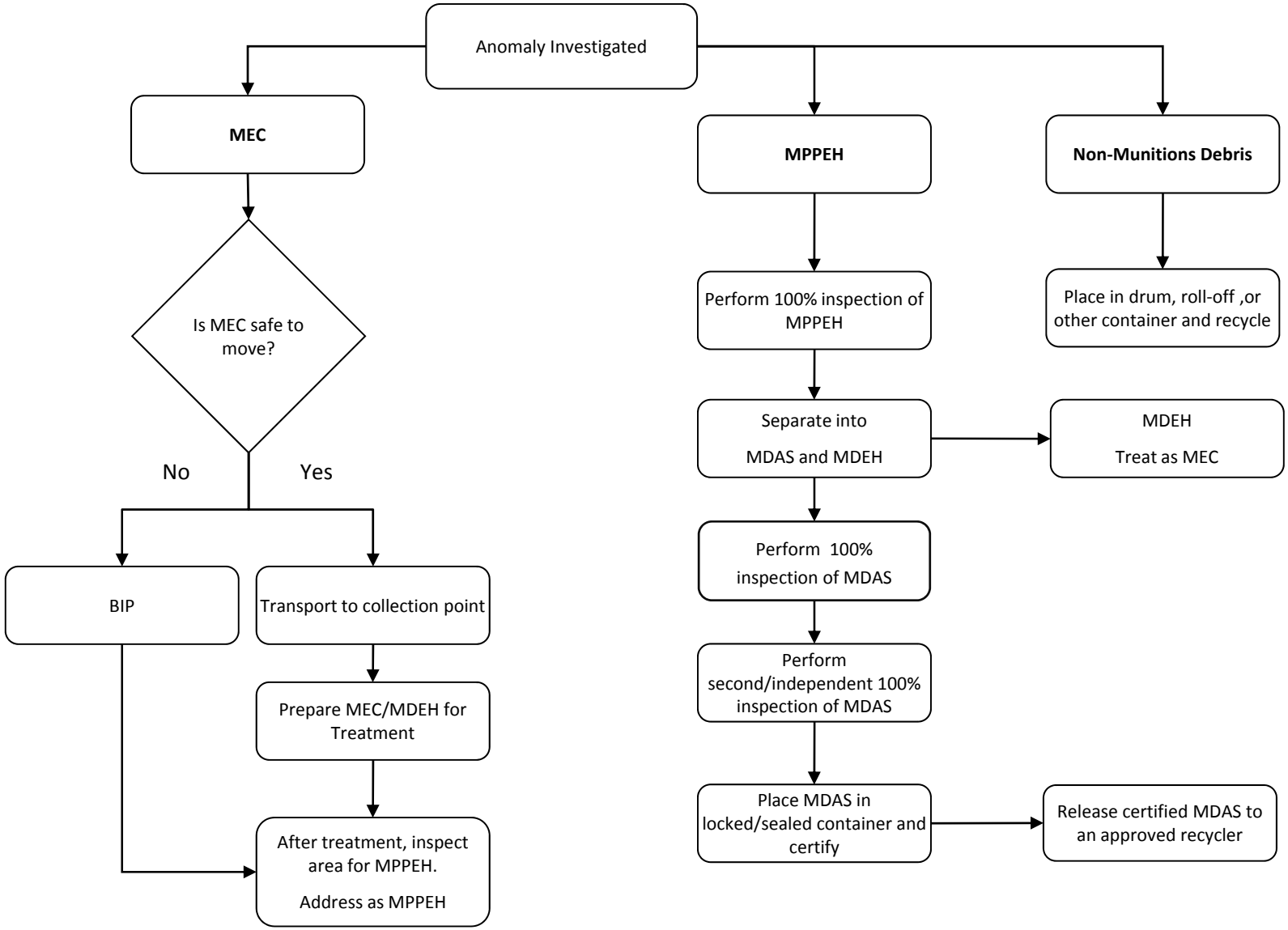
2) Up to 20 additional hand excavations for the site as a whole may be investigated if MEC/MDEH are identified on site.

3) Up to 10 step-out transects for the site as a whole may be investigated if MEC/MDEH are identified at the existing 2010 MEC RI grid boundary.

300 0 300 Feet

DRAWN BY MJJ	DATE 27Dec10	PROPOSED EXCAVATION LOCATIONS SITE BOUNDARY TRANSECTS OPERABLE UNIT 5, SITE 15 SUPPLEMENTAL MEC REMEDIAL INVESTIGATION NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 2267
CHECKED BY EIL	DATE		APPROVED BY L. Klink DATE
COST/SCHEDULE-AREA			APPROVED BY DATE
SCALE AS NOTED	NAVFAC		DRAWING NO. FIGURE 17-3 REV 0

Figure 17-4 MEC/MPPEH/Non-Munitions Debris Processing Flowchart



APPENDIX A

ANOMALY VERIFICATION SAMPLING

Attachment 1 **SUMMARY OF MEC RI DETECTOR-AIDED SURFACE AND SUBSURFACE ANOMALY SURVEY RESULTS**

Appendix A

Anomaly Verification Sampling

Soil locations at some large military bases in the United States are known to contain unexploded ordnance (UXO). Anomaly verification sampling is a statistical approach for establishing confidence that geophysical targets are not MEC.

For a given area, for which a geophysical survey is conducted over an entire area, (e.g., lot) and N anomaly locations are identified, the anomaly verification sampling module, in Visual Sample Plan (VSP) (version 6.0), can be used to determine the number of anomaly locations to be evaluated for a confidence level (Y%). That is, when *n* anomaly locations are evaluated and do not contain targets of interest (TOI) there is Y% confidence that X% of the remaining anomalies does not contain TOIs. Once the VSP *n* value is estimated, a subset of *n* anomaly locations are selected from the geological survey N anomaly locations based upon simple random sampling techniques.

If none of the *n* anomaly locations contain TOI, then there is Y% confidence that at least X% of the N anomaly locations in the lot do not contain TOI. If one or more of the *n* anomaly locations are found to contain TOI, then the lot is "rejected," that is, the required Y% confidence has not been achieved. For the latter case, some additional action is typically required, such as surveying additional anomaly locations and conducting further remediation as necessary to achieve the Y% and X% specifications.

The following assumptions are needed to assure the validity of anomaly verification sampling and the confidence statement:

- N anomalies have been detected in the lot by geophysical detectors.
- Simple random sampling is used to select the n anomalies that will be evaluated.
- The detected anomalies have not been inappropriately classified as TOI. That is, no non-TOI objects will be inappropriately classified as TOI.

The anomaly verification sampling uses the following formula for determining the number, *n*, of anomaly locations in the sample area that must be evaluated and found to be free of TOI in order to achieve a specified confidence that the fraction of anomaly locations in the specified areas that are TOI is less than a prescribed upper limit.

$$n \cong 0.5\left(1-\beta^{\frac{1}{N*P_d}}\right)\left(2N-N*P_d+1\right)$$

Where:

N is the total number of detected anomaly locations in the target population (set of anomaly locations in the sample areas for which a decision will be made).

n is the number of anomaly locations that are selected from the *N* detected anomaly locations using Simple Random Sampling to be surveyed ($n \leq N$).

P_d is the maximum fraction of the *N* detected anomaly locations that can contain TOI under the alternative hypothesis (H_a). P_d is typically a small fraction, e.g., 0.01 (1 percent).

β is the acceptable Type II decision error rate. That is, β is the probability that can be tolerated of falsely accepting the Null Hypothesis (H_o) based on the *n* evaluated anomaly locations.

H_o is the Null Hypothesis, which is believed and assumed to be true prior to evaluating any of the *n* anomaly locations. The Null Hypothesis assumes that none of the *N* anomaly locations contain TOI.

H_a is the Alternative Hypothesis, which is the percentage of anomaly locations that contain TOI is greater than P_d and is the basis for the confidence statement below.

Using the above notation, if none of the *n* anomaly locations contain TOI, then you can be $100(1 - \beta)$% confident that at least $100(1 - P_d)$% of the detected anomaly locations in the area of interest do not contain TOI.

VSP is a software tool that helps ensure that the right type, quality, and quantity of data are gathered to support confident decisions and provides statistical evaluations of the data with decision recommendations. VSP was developed with support from the Department of Energy (DOE), the United States Environmental Protection Agency (USEPA), the Department of Defense (DoD), the Department of Homeland Security (DHS), the Centers for Disease Control (CDC), and the United Kingdom, VSP version 6.0 was used to calculate the number of anomalies to investigate for TOI. The anomaly investigation module was used to determine the number of anomalies that would need to be investigated and found not to be TOI based on varying levels of confidence. Tables 1, 2, and 3 present the results of the number of anomalies that would need to be investigated and found free of TOI to be able to determine that 95%of the anomalies are not TOIs for various levels of confidence for the transects across the Total Site,

transects that are near the Site Bike Path and Paved Access Road, and the Current Extent of Investigation, respectively.

TABLE 1

Total Site (1654 anomalies)

Percent Confident	Number of Verification Samples (Hand Excavation Locations)
95%	58
96%	62
97%	67
98%	75
99%	88

TABLE 2

Site Bike Path and Paved Access Road (156 anomalies)

Percent Confident	Number of Verification Samples (Hand Excavation Locations)
95%	49
96%	52
97%	56
98%	61
99%	69

TABLE 3

Current Extent of Investigation (111 anomalies)

Percent Confident	Number of Verification Samples (Hand Excavation Locations)
95%	46
96%	48
97%	51
98%	55
99%	62

Attachment 1 **SUMMARY OF MEC RI DETECTOR-AIDED SURFACE AND SUBSURFACE ANOMALY SURVEY RESULTS**

ATTACHMENT 1

SUMMARY OF MEC RI DETECTOR-AIDED SURFACE AND SUBSURFACE ANOMALY SURVEY RESULTS
OU 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

TRANSECT SEGMENT[1]	NUMBER OF ANOMALIES	COLOR CODE[2]	DATE COLLECTED
EAST/WEST			
T1-DE	2	Green	5/15/2010
T1-EF	2	Green	5/15/2010
T1-FG	1	Green	5/15/2010
T1-GH	0	Blue	5/15/2010
T1-HI	1	Green	5/15/2010
T1-IJ	3	Green	5/15/2010
T1-JK	1	Green	5/19/2010
T2-KL	1	Green	5/22/2010
T2-LM	1	Green	5/22/2010
T2-MN	1	Green	5/22/2010
T2-CD	0	Blue	5/11/2010
T2-DE	1	Green	5/2/2010
T2-EF	2	Green	5/11/2010
T2-IJ	3	Green	5/3/2010
T2-JK	0	Blue	5/19/2010
T3-AB	2	Green	5/11/2010
T3-BC	0	Blue	5/11/2010
T3-CD	0	Blue	5/11/2010
T3-DE	1	Green	5/11/2010
T3-IJ	10	Yellow	5/3/2010
T3-JK	1	Green	5/19/2010
T3-KL	4	Green	5/19/2010
T3-LM	3	Green	5/19/2010
T3-MN	0	Blue	5/22/2010
T4-AB	0	Blue	5/11/2010
T4-BC	0	Blue	5/11/2010
T4-CD	2	Green	5/11/2010
T4-HI	30	Red	5/3/2010
T4-IJ	16	Yellow	5/3/2010
T4-JK	5	Green	5/3/2010
T4-KL	10	Yellow	5/3/2010
T4-LM	9	Yellow	5/3/2010
T4-MN	4	Green	5/3/2010
T4-NO	2	Green	5/3/2010
T4-OP	1	Green	5/3/2010
T5-AB	1	Green	5/11/2010
T5-BC	2	Green	5/11/2010

ATTACHMENT 1

SUMMARY OF MEC RI DETECTOR-AIDED SURFACE AND SUBSURFACE ANOMALY SURVEY RESULTS
OU 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

TRANSECT SEGMENT(1)	NUMBER OF ANOMALIES	COLOR CODE(2)	DATE COLLECTED
T5-CD	1	Green	5/11/2010
T5-FG	23	Red	5/3/2010
T5-GH	22	Red	5/5/2010
T5-HI	29	Red	5/5/2010
T5-IJ	21	Red	5/5/2010
T5-JK	18	Yellow	5/5/2010
T5-KL	9	Yellow	5/5/2010
T5-LM	5	Green	5/3/2010
T5-MN	2	Green	5/3/2010
T5-NO	1	Green	5/3/2010
T5-OP	1	Green	5/3/2010
T6-AB	1	Green	5/11/2010
T6-BC	1	Green	5/11/2010
T6-CD	4	Green	5/11/2010
T6-NO	5	Green	5/12/2010
T6-OP	2	Green	5/12/2010
T7-A AA	3	Green	5/21/2010
T7-AB	1	Green	5/11/2010
T7-BC	3	Green	5/11/2010
T7-NO	1	Green	5/12/2010
T7-OP	1	Green	5/12/2010
T8-AA BB	1	Green	5/21/2010
T8-A AA	2	Green	5/21/2010
T8-AB	2	Green	5/11/2010
T8-DE	5	Green	5/12/2010
T8-EF	5	Green	5/12/2010
T8-NO	0	Blue	5/12/2010
T8-OP	1	Green	5/12/2010
T9-BB CC	0	Blue	5/21/2010
T9-AA BB	0	Blue	5/21/2010
T9-AB	3	Green	5/11/2010
T9-DE	4	Green	5/12/2010
T9-EF	6	Yellow	5/12/2010
T9-JK	23	Red	5/12/2010
T9-KL	11	Yellow	5/12/2010
T9-LM	1	Green	5/12/2010
T9-MN	4	Green	5/12/2010
T9-NO	0	Blue	5/12/2010

ATTACHMENT 1

SUMMARY OF MEC RI DETECTOR-AIDED SURFACE AND SUBSURFACE ANOMALY SURVEY RESULTS
OU 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

TRANSECT SEGMENT(1)	NUMBER OF ANOMALIES	COLOR CODE(2)	DATE COLLECTED
T9-OP	0	Blue	5/12/2010
T10-BB CC	1	Green	5/21/2010
T10-BC	4	Green	5/15/2010
T10-AB	1	Green	5/11/2010
T10-CD	12	Yellow	5/15/2010
T10-DE	8	Yellow	5/15/2010
T10-EF	9	Yellow	5/12/2010
T10-JK	11	Yellow	5/12/2010
T10-KL	19	Yellow	5/12/2010
T10-LM	1	Green	5/12/2010
T10-MN	2	Green	5/12/2010
T11-BC	0	Blue	5/11/2010
T11-CD	3	Green	5/15/2010
T11-DE	11	Yellow	5/15/2010
T11-EF	9	Yellow	5/12/2010
T11-JK	8	Yellow	5/12/2010
T11-KL	13	Yellow	5/12/2010
T11-LM	0	Blue	5/12/2010
T11-MN	1	Green	5/12/2010
T12-CD	4	Green	5/15/2010
T12-DE	17	Yellow	5/15/2010
T12-EF	15	Yellow	5/12/2010
T12-KL	14	Yellow	5/12/2010
T12-LM	2	Green	5/12/2010
T12-MN	0	Blue	5/12/2010
T13-CD	0	Blue	5/15/2010
T13-DE	5	Green	5/15/2010
T13-EF	11	Yellow	5/12/2010
T13-KL	4	Green	5/12/2010
T13-LM	3	Green	5/12/2010
T13-MN	3	Green	5/12/2010
T14-CD	2	Green	5/11/2010
T14-DE	2	Green	5/15/2010
T14-EF	13	Yellow	5/12/2010
T14-HI	8	Yellow	5/14/2010
T14-LM	6	Yellow	5/12/2010
T14-MN	3	Green	5/12/2010
T15-CD	4	Green	5/22/2010

ATTACHMENT 1

SUMMARY OF MEC RI DETECTOR-AIDED SURFACE AND SUBSURFACE ANOMALY SURVEY RESULTS
OU 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

TRANSECT SEGMENT(1)	NUMBER OF ANOMALIES	COLOR CODE(2)	DATE COLLECTED
T15-DE	7	Yellow	5/13/2010
T15-EF	11	Yellow	5/13/2010
T15-LM	2	Green	5/12/2010
T15-MN	0	Blue	5/15/2010
T16-CD	2	Green	5/22/2010
T16-DE	2	Green	5/13/2010
T16-EF	3	Green	5/13/2010
T16-LM	1	Green	5/12/2010
T16-MN	7	Yellow	5/15/2010
T17-CD	0	Blue	5/22/2010
T17-DE	7	Yellow	5/13/2010
T17-IJ	4	Green	5/14/2010
T17-JK	5	Green	5/14/2010
T17-KL	5	Green	5/14/2010
T17-LM	1	Green	5/14/2010
T17-MN	1	Green	5/14/2010
T18-DE	2	Green	5/13/2010
T18-KL	3	Green	5/15/2010
T18-LM	11	Yellow	5/15/2010
T18-MN	4	Green	5/15/2010
T19-DE	0	Blue	5/13/2010
T19-GH	4	Green	5/13/2010
T19-LM	0	Blue	5/15/2010
T19-MN	1	Green	5/15/2010
T20-GH	25	Red	5/13/2010
T20-LM	0	Blue	5/15/2010
T20-MN	0	Blue	5/15/2010
T20-NO	0	Blue	5/15/2010
T20-OP	2	Green	5/20/2010
T21-FG	0	Blue	5/13/2010
T21-GH	4	Green	5/13/2010
T21-LM	0	Blue	5/15/2010
T21-MN	7	Yellow	5/15/2010
T21-NO	5	Green	5/20/2010
T21-OP	1	Green	5/20/2010
T22-EF	1	Green	5/14/2010
T22-FG	1	Green	5/14/2010
T22-GH	2	Green	5/14/2010

ATTACHMENT 1

SUMMARY OF MEC RI DETECTOR-AIDED SURFACE AND SUBSURFACE ANOMALY SURVEY RESULTS
OU 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

TRANSECT SEGMENT(1)	NUMBER OF ANOMALIES	COLOR CODE(2)	DATE COLLECTED
T22-LM	0	Blue	5/15/2010
T22-MN	3	Green	5/15/2010
T22-NO	1	Green	5/20/2010
T22-OP	1	Green	5/20/2010
T23-EF	1	Green	5/14/2010
T23-FG	2	Green	5/14/2010
T23-GH	9	Yellow	5/14/2010
T23-HI	1	Green	5/15/2010
T23-IJ	0	Blue	5/15/2010
T23-JK	0	Blue	5/15/2010
T23-KL	0	Blue	5/15/2010
T23-LM	2	Green	5/15/2010
T24-IJ	0	Blue	5/15/2010
T25-IJ	0	Blue	5/15/2010
North / South			
CC-T9T10	0	Blue	5/21/2010
BB-T8T9	2	Green	5/21/2010
BB-T9T10	2	Green	5/21/2010
AA-T7T8	0	Blue	5/21/2010
AA-T8T9	0	Blue	5/21/2010
A-T3T4	1	Green	5/11/2010
A-T4T5	0	Blue	5/11/2010
A-T5T6	0	Blue	5/11/2010
A-T6T7	1	Green	5/11/2010
A-T7T8	1	Green	5/11/2010
A-T8T9	2	Green	5/11/2010
A-T9T10	2	Green	5/11/2010
B-T3T4	1	Green	5/11/2010
B-T4T5	2	Green	5/11/2010
B-T5T6	2	Green	5/11/2010
B-T6T7	0	Blue	5/11/2010
B-T7T8	1	Green	5/11/2010
B-T9T10	2	Green	5/11/2010
B-T10T11	1	Green	5/11/2010
C-T2T3	0	Blue	5/11/2010
C-T3T4	0	Blue	5/11/2010
C-T4T5	2	Green	5/11/2010
C-T5T6	6	Yellow	5/11/2010

ATTACHMENT 1

SUMMARY OF MEC RI DETECTOR-AIDED SURFACE AND SUBSURFACE
ANOMALY SURVEY RESULTS
OU 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

TRANSECT SEGMENT(1)	NUMBER OF ANOMALIES	COLOR CODE(2)	DATE COLLECTED
C-T6T7	5	Green	5/11/2010
C-T9T10	4	Green	5/11/2010
C-T10T11	1	Green	5/11/2010
C-T11T12	2	Green	5/11/2010
C-T12T13	1	Green	5/11/2010
C-T13T14	1	Green	5/11/2010
C-T14T15	1	Green	5/22/2010
C-T15T16	0	Blue	5/22/2010
C-T16T17	3	Green	5/22/2010
D-T1T2	0	Blue	5/11/2010
D-T2T3	1	Green	5/15/2010
D-T3T4	0	Blue	5/11/2010
D-T9T10	5	Green	5/11/2010
D-T10T11	6	Yellow	5/11/2010
D-T11T12	2	Green	5/11/2010
D-T12T13	2	Green	5/11/2010
D-T13T14	2	Green	5/11/2010
D-T14T15	14	Yellow	5/13/2010
D-T15T16	9	Yellow	5/13/2010
D-T16T17	8	Yellow	5/13/2010
D-T17T18	6	Yellow	5/13/2010
D-T18T19	4	Green	5/13/2010
D-T19T20	6	Yellow	5/13/2010
E-T1T2	2	Green	5/15/2010
E-T2T3	1	Green	5/15/2010
E-T7T8	15	Yellow	5/12/2010
E-T8T9	24	Red	5/12/2010
E-T9T10	9	Yellow	5/12/2010
E-T10T11	11	Yellow	5/12/2010
E-T11T12	22	Red	5/12/2010
E-T12T13	9	Yellow	5/12/2010
E-T13T14	6	Yellow	5/12/2010
E-T14T15	8	Yellow	5/13/2010
E-T15T16	5	Green	5/13/2010
E-T16T17	20	Yellow	5/13/2010
E-T19T20	1	Green	5/13/2010
E-T22T23	2	Green	5/14/2010
E-T23T24	0	Blue	5/14/2010

ATTACHMENT 1

SUMMARY OF MEC RI DETECTOR-AIDED SURFACE AND SUBSURFACE
ANOMALY SURVEY RESULTS
OU 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

TRANSECT SEGMENT(1)	NUMBER OF ANOMALIES	COLOR CODE(2)	DATE COLLECTED
F-T1T2	2	Green	5/15/2010
F-T16T17	2	Green	5/13/2010
F-T22T23	2	Green	5/14/2010
F-T23T24	5	Green	5/14/2010
G-T1T2	2	Green	5/15/2010
G-T4T5	20	Yellow	5/5/2010
G-T5T6	28	Red	5/3/2010
G-T20T21	2	Green	5/13/2010
G-T21T22	1	Green	5/14/2010
G-T22T23	4	Green	5/14/2010
G-T23T24	4	Green	5/14/2010
H-T1T2	4	Green	5/15/2010
H-T4T5	24	Red	5/5/2010
H-T5T6	15	Yellow	5/5/2010
H-T22T23	31	Red	5/15/2010
H-T23T24	0	Blue	5/15/2010
I-T1T2	1	Green	5/2/2010
I-T3T4	11	Yellow	5/3/2010
I-T4T5	23	Red	5/3/2010
I-T5T6	25	Red	5/3/2010
I-T22T23	31	Red	5/15/2010
I-T23T24	0	Blue	5/15/2010
J-T1T2	2	Green	5/15/2010
J-T2T3	28	Red	5/3/2010
J-T3T4	14	Yellow	5/3/2010
J-T4T5	15	Yellow	5/3/2010
J-T5T6	27	Red	5/3/2010
J-T16T17	5	Green	5/15/2010
J-T17T18	4	Green	5/15/2010
J-T22T23	1	Green	5/15/2010
J-T23T24	3	Green	5/15/2010
J-T24T25	0	Blue	5/15/2010
K-T1T2	1	Green	5/19/2010
K-T2T3	1	Green	5/19/2010
K-T3T4	3	Green	5/19/2010
K-T4T5	19	Yellow	5/5/2010
K-T5T6	20	Yellow	5/4/2010
K-T8T9	2	Green	5/12/2010

ATTACHMENT 1

SUMMARY OF MEC RI DETECTOR-AIDED SURFACE AND SUBSURFACE
ANOMALY SURVEY RESULTS
OU 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

TRANSECT SEGMENT(1)	NUMBER OF ANOMALIES	COLOR CODE(2)	DATE COLLECTED
K-T9T10	7	Yellow	5/12/2010
K-T10T11	8	Yellow	5/12/2010
K-T11T12	3	Green	5/12/2010
K-T16T17	36	Red	5/15/2010
K-T17T18	12	Yellow	5/15/2010
K-T22T23	1	Green	5/15/2010
L-T2T3	0	Blue	5/22/2010
L-T3T4	1	Green	5/19/2010
L-T4T5	11	Yellow	5/5/2010
L-T5T6	5	Green	5/5/2010
L-T8T9	10	Yellow	5/12/2010
L-T9T10	7	Yellow	5/12/2010
L-T10T11	4	Green	5/12/2010
L-T11T12	6	Yellow	5/12/2010
L-T12T13	2	Green	5/12/2010
L-T13T14	1	Green	5/12/2010
L-T16T17	17	Yellow	5/15/2010
L-T17T18	30	Red	5/15/2010
L-T18T19	5	Green	5/15/2010
L-T22T23	2	Green	5/15/2010
M-T2T3	2	Green	5/22/2010
M-T3T4	6	Yellow	5/19/2010
M-T4T5	6	Yellow	5/5/2010
M-T5T6	23	Red	5/5/2010
M-T8T9	1	Green	5/12/2010
M-T9T10	1	Green	5/12/2010
M-T10T11	1	Green	5/12/2010
M-T11T12	1	Green	5/12/2010
M-T12T13	3	Green	5/12/2010
M-T13T14	2	Green	5/12/2010
M-T14T15	4	Green	5/12/2010
M-T15T16	0	Blue	5/12/2010
M-T16T17	5	Green	5/15/2010
M-T17T18	3	Green	5/15/2010
M-T18T19	2	Green	5/15/2010
M-T19T20	0	Blue	5/15/2010
M-T20T21	3	Green	5/15/2010
M-T21T22	2	Green	5/15/2010

ATTACHMENT 1

SUMMARY OF MEC RI DETECTOR-AIDED SURFACE AND SUBSURFACE ANOMALY SURVEY RESULTS
OU 5, SITE 15 - BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

TRANSECT SEGMENT(1)	NUMBER OF ANOMALIES	COLOR CODE(2)	DATE COLLECTED
M-T22T23	4	Green	5/15/2010
N-T2T3	0	Blue	5/22/2010
N-T3T4	0	Blue	5/22/2010
N-T4T5	1	Green	5/5/2010
N-T5T6	3	Green	5/5/2010
N-T8T9	3	Green	5/12/2010
N-T9T10	5	Green	5/12/2010
N-T10T11	2	Green	5/12/2010
N-T11T12	1	Green	5/12/2010
N-T12T13	4	Green	5/12/2010
N-T13T14	4	Green	5/12/2010
N-T14T15	10	Yellow	5/12/2010
N-T15T16	1	Green	5/12/2010
N-T19T20	0	Blue	5/15/2010
N-T20T21	6	Yellow	5/15/2010
N-T21T22	6	Yellow	5/15/2010
O-T4T5	2	Green	5/12/2010
O-T5T6	1	Green	5/12/2010
O-T6T7	1	Green	5/12/2010
O-T7T8	0	Blue	5/12/2010
O-T8T9	0	Blue	5/12/2010
O-T19T20	0	Blue	5/15/2010
O-T20T21	1	Green	5/20/2010
O-T21T22	1	Green	5/20/2010
P-T4T5	0	Blue	5/3/2010
P-T5T6	0	Blue	5/12/2010
P-T6T7	0	Blue	5/12/2010
P-T7T8	0	Blue	5/12/2010
P-T8T9	0	Blue	5/12/2010
P-T20T21	3	Green	5/20/2010
P-T21T22	1	Green	5/20/2010

APPENDIX B

FIELD FORMS

MRP FF.1 - SAP Worksheet No 4-Project sign-off
MRP FF.2 - Daily MEC Activity Log
MRP FF.3 - Daily Equipment Checklist
MRP FF.4 - Daily Visitors Log
MRP FF.5 - Daily Photographic Log
MRP FF.6 - IVS Installation Checklist
MRP FF.7 - Daily IVS Report
MRP FF.8 - Daily MEC_MPPEH Log for UXO Avoidance Activities
MRP FF.9 - MEC Cumulative Summary Log
MRP FF.10 - MEC Data and Accountability Form
MRP FF.11 - Dig Sheet - MANUAL Target Excavation Results
MRP FF.12 - Dig Sheet - MECHANICAL Target Excavation Results
MRP FF.13 - MDAS Addition Form
MRP FF.15 - Daily QC Report
MRP FF.16 - Preparatory Phase Inspection Report
MRP FF.17 - Initial Phase Inspection Report
MRP FF.18 - Follow Up Phase Inspection Report
MRP FF.19 - Non Conformance Report
MRP FF.20 - Lessons Learned
MRP FF.21 - Daily Safety Log
MRP FF.22 - Daily Tailgate Safety Briefing-Training Record Form
MRP FF.23 - Field Change Request
MRP FF.24 - Equipment Maintenance-Repair Form

TETRA TECH

MRP FF.1

SAP Worksheet #4 (Field Personnel)

Project Personnel Sign-off Sheet

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA_____

Site(s): ____SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA____

Date	Organization/Role	Name	Signature
	Tetra Tech/SUXOS		
	Tetra Tech/UXOQCS		
	Tetra Tech/UXOSO (if different than UXOQCS)		
	Tetra Tech/Technician		
	Tetra Tech/ Technician		
	Tetra Tech/ Technician		
	Tetra Tech/ Technician		
	Tetra Tech/ Technician		
	Tetra Tech/ Technician		
	Tetra Tech/ Technician		
	Tetra Tech/ Technician		
	Site Geophysicist		
	Staff Geophysicist		
	Staff Geophysicist		
	Staff Geophysicist		

I have read and understood the SAP relative to assigned roles, per SAP Worksheet No. 3.

TETRA TECH

MRP FF.2

DAILY MEC ACTIVITY LOG

Facility/Location: __NAS CECIL FIELD, JACKSONVILLE, FLORIDA____

Site(s): __SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA__

FIELD ACTIVITY SUBJECT:	**Date:**
PROJECT NO:	**TASK CODES**:

SUMMARY OF DAILY PROGRESS: (Update Definable Feature of Work - Worksheet 12)

Mobilization/Set Preparation:

Site Survey:

Vegetation Management:

GPS Positional Data

IVS:

Detector-Aided Survey (inc. Step-Out Transects):

Intrusive Operation:

Donor Explosives Handling/Storage:

MEC Management (Treatment):

MPPEH Management (Inspections):

MPPEH Management (Certification):

MPPEH Management (Disposal):

Demobilization:

Other:

LIST OF MEC ITEMS ID, MPPEH ITEM ID, MDAS, OR NONE
(for documentation see MEC/MPPEH/MDAS Tracking Logs for added details)**:**

Item ID	Description	Item ID	Description

TETRA TECH

MRP FF.2

DAILY MEC ACTIVITY LOG

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

FIELD ACTIVITY SUBJECT:	**Date:**
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	
IMPORTANT PHONE CALLS/DECISIONS:	
FIELD TASK MODIFICATIONS:	
WEATHER CONDITIONS:	
VISITORS ON SITE:	
PERSONNEL ON SITE:	
SIGNATURE:	**DATE:**

TETRA TECH

MRP FF.3
DAILY EQUIPMENT CHECKLIST

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

Equipment:					**Initial Condition Out of the Box Acceptable (Y/N/NA)**				
Serial Number:					**Inspection**		**Spare parts**		**Cable Shake Test**
Description:									
Date Out	**Time Out**	**Daily Cond. & Comments Out**	**Monument Check (1)**	**Checked Out By**	**Date In**	**Time In**	**Daily Cond. & Comments In**	**Checked In By**	**Monument Check (1)**

(1) For GPS Units, confirm accuracy correlation to referenced monument locations. Please record general description of monument locations in the Daily Activity Log, once established. (Example – GPS QC Location – Well MW-3 or northwest corner of intersection of Perimeter Road and Munitions Street)

Last Revised: 3/31/2011

TETRA TECH

MRP FF.4
VISITOR'S LOG

Facility/Location: __NAS CECIL FIELD, JACKSONVILLE, FLORIDA_

Site(s): ____SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA _

DATE	Time		PRINT NAME	SIGNATURE	ORGANIZATION	PHONE #	RAC
	In	Out					

Last Revised: 3/31/2011

TETRA TECH

MRP FF.5
Photographic Log

Facility/Location: __NAS CECIL FIELD, JACKSONVILLE, FLORIDA___

Site(s): __SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

Photograph Number	Date	Taken By (initials)	Subject/Description	Anomaly ID (if applicable)	Remarks/Comments

Last Revised: 3/31/2011

TETRA TECH
MRP FF.6
INSTRUMENT VERIFICATION STRIP (IVS)
INSTALLATION CHECKLIST

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

Project No:	**Date**:

I. Test Plot Information

Location:

Have survey objectives been determined, clarified, and documented?	Y	N	NA
Will the IVS be available during the project for the evaluation of suspected instrument malfunctions or evaluation of new equipment and operators?	Y	N	NA
Has surface clearance been performed?	Y	N	NA
Has background geophysical survey been performed before burial?	Y	N	NA
Measure depth to top and center of mass of each object?	Y	N	NA

Item No.	Inert Item/Surrogate Description	Depth (inches)	Azimuth/ Inclination Angle(Degrees)	GPSed (Y/N)	Comments
1					
2					
3					
4					
5					
6					
7					

II. Instrument Information

Instrument Type/Manufacture	Instrument Serial Number	Test Plot Items Instrument Tested on (List Item Numbers)	Test Results - Personnel Testing Equipment ☒ indicates good for operation				Comments (pass/fail) Explain below
			AM	AM	PM	PM	
			☐		☐		
			☐		☐		
			☐		☐		
			☐		☐		
			☐		☐		
			☐		☐		
			☐		☐		

III. Problems Encountered / Corrective Actions Taken.

explain in space below:

IV. Supervisor

Name and Signature:	**Title/Company**:	**Date**:

TETRA TECH
MRP FF.7
DAILY IVS REPORT

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

Project No:	**Date**:

I. Test Plot Information

Location: (See IVS Installation Checklist)

Item No.	Inert Item/Surrogate Description	Depth (inches)	Comments
1			
2			
3			
4			
5			
6			
7			

II. Instrument Information

Instrument Type/Manufacture	Instrument Serial Number	Test Plot Items Instrument Tested on (List Item Numbers)	Test Results - Initials of personnel Testing Equipment ☒ indicates good for operation				Comments (pass/fail) Explain below
			AM	AM	PM	PM	
			☐		☐		
			☐		☐		
			☐		☐		
			☐		☐		
			☐		☐		
			☐		☐		
			☐		☐		
			☐		☐		
			☐		☐		
			☐		☐		

III. Problems Encountered / Corrective Actions Taken.

explain in space below:

IV. Supervisor

Name and Signature:	**Title/Company**:	**Date**:

TETRA TECH
MRP FF.8
MEC/MPPEH LOG FOR UXO AVOIDANCE ACTIVITIES

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

ID #	Item	Date Identified	GPS Location* US Survey Feet		Physical Condition/ Appearance	Classification (MEC/MPPEH)	Resolution (EOD Called, Left in Place, etc)	Resolution/ Disposition Date
			Northing (feet)	Easting (feet)				
1	Propellant Can	4/28/10	2147746125	365412.93	Rusted/Open	MDAS	Left in Place	
2	Two Propellant Cans	4/28/10	2147752.62	365408.05	Rusted/Open Intact	1-MDAS 1-MPPEH	Left in Place	
3	Slap Flare Case	5/3/10	2149369.30	365001.10	Crushed/Corroded	MPPEH	Left in Place	
4	Slap Flare Case	5/3/10	2149402.86	364973.56	Crushed/Corroded	MPPEH	Left in Place	
5	Projectile Fuze	5/11/10	2148124.03	364104.19	Burned/Corroded	MDAS	Left in Place	
6	Fuze Part	5/11/10	2148994.82	364300.49	Burned/Corroded	MDAS	Left in Place	
7	20mm TP Projectile	5/12/10	2148900.23	364476.06	Burned/Corroded	MDAS	Left in Place	
8	Missile Parts	5/13/10	2148203.25	365154.48	Burned/Corroded	MDAS	Left in Place	
9	Smoke Grenade	5/13/10	2148001.09	365362.00	Expended/Rusted	MDAS	Left in Place	
10	Smoke Marker	5/14/10	2149155.70	364505.67	Broken open/Corroded	MDAS	Left in Place	
11	Blast Plate	5/19/10	2149529.44	365306.69	Corroded	MPPEH	Left in Place	
12	Fuze Part	5/19/10	2149599.43	365228.58	Burned/Corroded	MPPEH	Left in Place	
13	Fuze Part	5/19/10	2149613.32	365103.81	Burned/Corroded	MPPEH	Left in Place	

Last Revised: 3/31/2010

TETRA TECH
MRP FF.8
MEC/MPPEH LOG FOR UXO AVOIDANCE ACTIVITIES

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

* GPS data were collected using the North American Datum of 1983, _____ (US Survey Feet). See Figure _____ for item locations.

Tetra Tech
MRP FF.9

MEC CUMULATIVE SUMMARY LOG

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Sites(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

ID No.	ITEM IDENTIFICATION/CATEGORY, BRIEF DESCRIPTION	DATE FOUND	UXO TECH NAME	DIGITAL PHOTOGRAPH NUMBER	DISPOSITION*		DISPOSITION DATE
					Type - (ex.EOD BIP/MDAS)	GPS (Y/N)	
SUXOS Signature (end of project):					**Date:**		

Last Revised: 3/31/2011

Tetra Tech
MRP FF.9

MEC CUMULATIVE SUMMARY LOG

Facility/Location: __NAS CECIL FIELD, JACKSONVILLE, FLORIDA_

Sites(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

*** GPS all disposition/shot/treatment locations if item is not BIP. Record Coordinates on MEC Accountability Form. Record full description on MEC Accountability Log.**

MRP FF.10
Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA
Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

MEC DATA AND ACCOUNTABILITY FORM

FOR UXO TEAM USE

Assigned ID No.: | Team Leader:

Grid or Lane Number: | Work Area: | Date:

Location: X (Lat): _____ Y (Long): _____ Location Type (UW or UG): _____
Other Location Information: _____
Depth (feet): _____ Inclination (Degrees): _____ Orientation (N–S, E-W): _____

TARGET/ANOMALY CHARACTERISTICS

Type of Target/Find: ☐ Surface Find ☐ Mag & Dig Target ☐ Primary Geo Target ☐ Validation (QA/QC) ☐ No Dig

Type of Anomaly: ☐ UXO ☐ MEC ☐ Inert ☐ Practice ☐ MC (waste) ☐ MD (scrap) ☐ Metal Waste
☐ No Find ☐ Rock ☐ Rust Layer ☐ Oxidation ☐ Misc.: _____

Diameter/Width: | Length: | Estimated Weight:

DIGITAL PHOTO RECORD

Was photo taken? ☐ Yes ☐ No | Camera No.: | Frame No.: | File Name:

MUNITIONS NOMENCLATURE (If Known, Record Below and record fuze condition and disposition)

Munitions Mark/Mod: | Fuze Mark/Mod: ☐ Nose: _____ ☐ Tail: _____ ☐ Transverse: _____ ☐ Casing: _____ | N.E.W. Total:

MUNITIONS CHARACTERISTICS

Munitions Filler: ☐ Explosive ☐ Inert ☐ Propellant ☐ Pyrotechnic ☐ Unknown ☐ Other: _____

Munitions Category: ☐ Depth Charges ☐ Land Mine ☐ Projectiles ☐ Sea Mines
☐ Bombs ☐ Grenades ☐ Misc. Explosive Devices ☐ Pyrotechnics and Flares ☐ Small Arms
☐ Clusters/Dispensers ☐ Guided Missiles ☐ Mortars ☐ Rockets ☐ Torpedoes

FUZE CHARACTERISTICS

Fuze Location(s) (check all that apply): ☐ Nose ☐ Tail ☐ Transverse ☐ Casing | Breaks in Fuze Body? ☐ Yes ☐ No | Fuze Markings:

Fuzing Type(s): ☐ Hydrostatic ☐ MT Long Delay ☐ Powder Train Time Fuze ☐ Nose MT/Tail Impact Inertia
☐ All-ways Acting ☐ Impact ☐ MT Superquick ☐ Pressure ☐ Pt-initiating-Base-detonating
☐ Base Detonating ☐ Influence ☐ Piezo-Electric ☐ Proximity (VT)
☐ Electric ☐ Mech Time (MT) ☐ Point Detonating (PD) ☐ Nose MT/Tail Pressure

Fuze Length: | Fuze Diameter: | Diameter of Fuze Well:

MEC STATUS & PHYSICAL CONDITION (Check all that apply)

☐ Armed ☐ Unarmed ☐ Fired ☐ Unfired
☐ Intact ☐ Broken Open ☐ Filler Visible ☐ Soil Staining

FOR SUXOS USE

Disposition: (Clarify Under Remarks) (GPS all disposition location if not BIP) | Date:
☐ Transferred ☐ Transported ☐ Left In Place ☐ Destroyed ☐ BIP ☐ Other : _____

Client Notifications By: | Signature: | Date

Transferred To: | Signature: | Date:

Destroyed By: | Signature | Date:

Remarks: (indicate if item completely destroyed or rendered MDAS and disposed of in an MSDA Container, list container number)

SUXOS Signature: | Date:

TETRA TECH
MRP FF.11
DIG SHEET - MANUAL TARGET EXCAVATION RESULTS

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA__

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

Location or Anomaly Number (1,2)	Coordinates (1)		Detection Equip.	Excavation Dimensions (L x W x D) (inches)/(feet)	Number of Dig Locations	Munitions-Related Items				Non-Munitions Items			No Finds
	N	E				Number and Description	MEC/ MPPEH/ MDAS	Explosive Weight (lbs)	Disposition Date	Number and Description	Approx. Weight (lbs)	Disposition Date	Anomaly Deeper than ___'? (Y/N)

TETRA TECH
MRP FF.11
DIG SHEET - MANUAL TARGET EXCAVATION RESULTS

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA __

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

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	N	E				Number and Description	MEC/ MPPEH/ MDAS	Explosive Weight (lbs)	Disposition Date	Number and Description	Approx. Weight (lbs)	Disposition Date	Anomaly Deeper than ___'? (Y/N)

TETRA TECH
MRP FF.11
DIG SHEET - MANUAL TARGET EXCAVATION RESULTS

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA __

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

Location or Anomaly Number (1,2)	Coordinates (1)		Detection Equip.	Excavation Dimensions (L x W x D) (inches)/(feet)	Number of Dig Locations	Munitions-Related Items				Non-Munitions Items			No Finds
	N	E				Number and Description	MEC/ MPPEH/ MDAS	Explosive Weight (lbs)	Disposition Date	Number and Description	Approx. Weight (lbs)	Disposition Date	Anomaly Deeper than ___'? (Y/N)

TETRA TECH
MRP FF.11
DIG SHEET - MANUAL TARGET EXCAVATION RESULTS

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA __

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

Location or Anomaly Number (1,2)	Coordinates (1)		Detection Equip.	Excavation Dimensions (L x W x D) (inches)/(feet)	Number of Dig Locations	Munitions-Related Items				Non-Munitions Items			No Finds
	N	E				Number and Description	MEC/ MPPEH/ MDAS	Explosive Weight (lbs)	Disposition Date	Number and Description	Approx. Weight (lbs)	Disposition Date	Anomaly Deeper than ___'? (Y/N)

TETRA TECH
MRP FF.11
DIG SHEET - MANUAL TARGET EXCAVATION RESULTS

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA __

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

Location or Anomaly Number (1,2)	Coordinates (1)		Detection Equip.	Excavation Dimensions (L x W x D) (inches)/(feet)	Number of Dig Locations	Munitions-Related Items				Non-Munitions Items			No Finds
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TETRA TECH
MRP FF.11
DIG SHEET - MANUAL TARGET EXCAVATION RESULTS

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA __

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

Location or Anomaly Number (1,2)	Coordinates (1)		Detection Equip.	Excavation Dimensions (L x W x D) (inches)/(feet)	Number of Dig Locations	Munitions-Related Items				Non-Munitions Items			No Finds
	N	E				Number and Description	MEC/ MPPEH/ MDAS	Explosive Weight (lbs)	Disposition Date	Number and Description	Approx. Weight (lbs)	Disposition Date	Anomaly Deeper than ___'? (Y/N)

TETRA TECH
MRP FF.11
DIG SHEET - MANUAL TARGET EXCAVATION RESULTS

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA __

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

Location or Anomaly Number (1,2)	Coordinates (1)		Detection Equip.	Excavation Dimensions (L x W x D) (inches)/(feet)	Number of Dig Locations	Munitions-Related Items				Non-Munitions Items			No Finds
	N	E				Number and Description	MEC/ MPPEH/ MDAS	Explosive Weight (lbs)	Disposition Date	Number and Description	Approx. Weight (lbs)	Disposition Date	Anomaly Deeper than ___'? (Y/N)

TETRA TECH
MRP FF.11
DIG SHEET - MANUAL TARGET EXCAVATION RESULTS

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA __

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

Location or Anomaly Number (1,2)	Coordinates (1)		Detection Equip.	Excavation Dimensions (L x W x D) (inches)/(feet)	Number of Dig Locations	Munitions-Related Items				Non-Munitions Items			No Finds
	N	E				Number and Description	MEC/ MPPEH/ MDAS	Explosive Weight (lbs)	Disposition Date	Number and Description	Approx. Weight (lbs)	Disposition Date	Anomaly Deeper than ___'? (Y/N)

TETRA TECH
MRP FF.11
DIG SHEET - MANUAL TARGET EXCAVATION RESULTS

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA __

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

Location or Anomaly Number (1,2)	Coordinates (1)		Detection Equip.	Excavation Dimensions (L x W x D) (inches)/(feet)	Number of Dig Locations	Munitions-Related Items				Non-Munitions Items			No Finds
	N	E				Number and Description	MEC/ MPPEH/ MDAS	Explosive Weight (lbs)	Disposition Date	Number and Description	Approx. Weight (lbs)	Disposition Date	Anomaly Deeper than ___'? (Y/N)

TETRA TECH
MRP FF.11
DIG SHEET - MANUAL TARGET EXCAVATION RESULTS

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA__

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

Location or Anomaly Number (1,2)	Coordinates (1)		Detection Equip.	Excavation Dimensions (L x W x D) (inches)/(feet)	Number of Dig Locations	Munitions-Related Items				Non-Munitions Items			No Finds
	N	E				Number and Description	MEC/ MPPEH/ MDAS	Explosive Weight (lbs)	Disposition Date	Number and Description	Approx. Weight (lbs)	Disposition Date	Anomaly Deeper than ___'? (Y/N)

-- = None found or unknown, not applicable.
1) Existing RI Grid Boundary transects are to be completed first so that step-out transects can be evaluated by the UXO Team and Technical Lead.

TETRA TECH
MRP FF.11
DIG SHEET - MANUAL TARGET EXCAVATION RESULTS

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA__

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

2) The anomaly sampling strategy is as follows:

Transect Color	Number of Excavations
Blue	0
Green	1
Yellow	2
Red	3

3)

Signature: _____Date:_____

TETRA TECH
MRP FF.12
DIG SHEET - TARGET MECHANICAL EXCAVATION RESULTS

Facility/Location: ____NAS CECIL FIELD, JACKSONVILLE, FLORIDA_

Site(s): ____SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA__

Location or Pit/ Trench Number[1]	Coordinates [1]		Date	Excavation Dimensions (L x W x D) (feet)	Munitions-Related Items					Non-Munitions Items			Soil Description
	N	E			Number and Description	Item ID Number	MEC/ MDEH /MDAS	Explosive Weight (lbs)	Disposition Date	Number and Description	Approx. Weight (lbs)	Disposition Date	

-- = Not found or unknown.
1) Coordinates supplied by GPS (end points for trenches or center points for pits, etc.)

Tetra Tech
MRP FF.13
MDAS Addition Form

Facility/Location: **NAS CECIL FIELD, JACKSONVILLE, FLORIDA** **Site(s):** **SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA**

Container #_____**Seal/Key #**_____

NO.	Description/NIIN	Quantity	Item No.*	Type of Treatment*
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

* If applicable.

"This certifies that the material potentially presenting an explosive hazard listed has been 100 percent properly inspected and to the best of our knowledge and belief, is inert and/or free of explosives or related materials"

CERTIFIER PRINTED NAME _____

SIGNATURE _____ DATE _____

POSITION _____

ORGANIZATION NAME _____

ORGANIZATION ADDRESS _____

ORGANIZATION PHONE NUMBER _____

VERIFIER PRINTED NAME _____

SIGNATURE _____ DATE _____

POSITION _____

ORGANIZATION NAME _____

ORGANIZATION ADDRESS _____

ORGANIZATION PHONE NUMBER _____

MRP FF.15

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

DAILY QUALITY CONTROL REPORT

Project Name: _____ Report No: _____

Project No: Location: Date:

I. Personnel Present (Reference/attach SUXOS's daily report if applicable): See Daily Tailgate Safety Form

II. Definable Feature of Work (see SAP Worksheet No. 12 and revise list as needed)

☐ Mob/Site Prep/Site Security/Surveying	☐ Data Processing and Interpretation	☐
☐ UXO Escort/Avoidance	☐ Donor Explosives Handling	☐
☐ Site-Specific Training/IVS Cert.	☐ MEC Mang./Insp./Cert./Disposal	☐
☐ Detector Surface Sweep	☐ Non-MEC Disposal	☐
☐ Vegetation Management	☐ Demobilization	☐
☐ GPS Positional Data Collection	☐	☐
☐ Surface/Subsurface Clearance	☐	☐
☐ Anomaly Intrusive Investigations	☐	☐ Other:

III. Quality Control Activities (Include blind seed coordinates and results and reference/attach inspection/surveillance reports):

IV. Problems Encountered / Corrective Actions Taken

V. Directions Given / Received:

VI. Special Notes / Lessons Learned

VII. Visitors:

☐ Yes (see Visitor's Log/Daily Activity Log) ☐ No

VIII. Approval

Name and Signature:	Title/Company:	Date:

Revised March 2011

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

PREPARATORY PHASE INSPECTION REPORT

Project Name: _____ Project No: _____ Report No: _____

UXO Team: _____ Location: _____ Date: _____

I. Definable Feature of Work (see SAP Worksheet No. 12 and revise list as needed)

- ☐ Project Management
- ☐ Site Preparation (incl. mobilization)
- ☐ Site Survey
- ☐ Vegetation Management
- ☐ UXO Detector-aided Surface Survey
- ☐ GPS Positional Data
- ☐ IVS
- ☐ Anomaly Intrusive Investigation
- ☐ Donor Explosives Handling
- ☐ MEC Management - Treatment
- ☐ MPPEH Management - Inspection
- ☐ MPPEH Management – Cert.
- ☐ MPPEH Management - Disposal
- ☐ Demobilization
- ☐ Final Report Prep

II. References (DOD Inst., Corporate references, SOPs, etc.):

III. Personnel Present (employees performing the work) Attach supplemental sheet if necessary

Name	Position	Company

IV. Submittals Reviewed (Work Plan, EHSP, Permits, etc.) Attach supplemental sheet if necessary

Submittals Reviewed.	Item No.	Date	Approval Authority

Have all submittals been approved? ☐ Yes ☐ No

If No, what items have not been submitted/ approved?

Are all submittals on hand? ☐ Yes ☐ No

If No, what items are missing?

Check approved submittals against delivered material. (This should be done as material arrives.)

Comments:

V. Resources (Personnel & Equipment)

Are adequate resources on hand to effectively conduct work? ☐ Yes ☐ No

If No, what action will be taken?

PREPARATORY PHASE INSPECTION REPORT

Project Name: _____ Project No: _____ Report No: _____
UXO Team: _____ Location: _____ Date: _____

VI. Procedures (Project Manger should be involved in this stage of the inspection)

Review contract specifications. (List special requirements such as location accuracy, format for deliverables, etc.)

Discuss procedure for accomplishing the work (Reference WP Section or SOP).

Clarify any differences (revisions needed).

VII. Resolve Differences (What did you do to resolve outstanding issues/problems)

Comments:

VIII. Testing/ Surveillance

Identify Tests/ Surveillance to be performed, frequency, and by whom.

Where will the testing to take place (in the test bed, at a selected monument, etc.)?

Is the Testing/ Surveillance Plan Adequate?

IX. Safety

Review applicable portion of the Health and Safety Plan.

Has the Activity Hazard Analysis been approved? ☐ Yes ☐ No

X. Results of Inspection

☐ Acceptable ☐ Unacceptable NCR #:

Name: Signature: Date:

QCM Comments

QCM Review

☐ Concur ☐ Non-Concur Signature: Date

XI. Distribution

☐ PM ☐ UXO Project MGR ☐ UXOSO/QC ☐ SUXOS ☐ CLIENT REP

MRP FF.17
Facility/Location: ____NAS CECIL FIELD, JACKSONVILLE, FLORIDA_
Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA _

INITIAL PHASE INSPECTION REPORT

Project Name: _____ Report No: _____

Project No: _____ Location: _____ Date: _____

I. Definable Feature of Work (See Worksheet No. 12 and update list)

☐ Project Management	☐ GPS Positional Data Collection	☐ MPPEH Management - Inspection
☐ Site Preparation (including mobilization	☐ Detector-Aided Survey	☐ MPPEH Management – Cert.
☐ Site Surveying	☐ Anomaly Intrusive Investigation	☐ MPPEH Management - Disposal
☐ IVS	☐ Donor Explosives Handling	☐ Demobilizaiton
☐ Vegetation Management	☐ MEC Management - Treatment	☐ Other:

II. References (DOD Inst, Corporate references, SOPs, etc.):

III. Personnel Present (employees performing the work) Attach supplemental sheet if necessary

Name	Position	Company

IV. Preparatory Work (equipment set up & testing, EZ set up, logbook entries, etc.)

Is preliminary work complete and correct? ☐ Yes ☐ No

If No, what action(s) will be taken?

V. Task Execution

Is work being completed in accordance with plans and specifications? ☐ Yes ☐ No

If No, what corrective action(s) will be taken?

Is workmanship acceptable? ☐ Yes ☐ No

If No, what action(s) will be taken?

INITIAL PHASE INSPECTION REPORT

Project Name: _____ Report No: _____

Project No: _____ Location: _____ Date: _____

V. Resolve Differences

Comments:

VI. Safety (Review work conditions using HASP and AHAs)

Comments:

VII. Results of Inspection

☐ Acceptable ☐ Unacceptable NCR #:

Name:	Signature:	Date:

QC Manager Comments

QC Manager Review

☐ Concur	☐ Non-Concur	Signature:	Date

VIII. Distribution

☐ PM ☐ UXO Project MGR ☐ UXOS/QC ☐ SUXOS ☐ CLIENT REP

MRP FF.18

Facility/Location: __NAS CECIL FIELD, JACKSONVILLE, FLORIDA__

Site(s): __SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA_

FOLLOW-UP INSPECTION/SURVEILLANCE REPORT

Project Name: _____ Report No: _____

Project No: _____ Location: _____ Date: _____

I. Definable Feature of Work (see SAP Worksheet No. 12 and revise list as needed)

☐ Project Management	☐ Donor Explosives Handling	☐
☐ Site Preparation (incl. mobilization)	☐ MEC Management - Treatment	☐
☐ Site Survey	☐ MPPEH Management - Inspection	☐
☐ Vegetation Management	☐ MPPEH Management - Certification	☐
☐ UXO Detector-aided Surface Survey	☐ MPPEH Management - Disposal	☐
☐ GPS Positional Data Collection	☐ Demobilization	☐
☐. IVS	☐ Site-Specific Final Report	☐
☐ Anomaly Intrusive Investigation	☐	☐ Other:

II. References (DOD Inst, Corporate references, SOPs, etc.):

III. Activities/Conditions Observed

Conducted By: :	Signature:	Date:

X. UXOSO/QC Review

☐ Acceptable	☐ Unacceptable	NCR #:

Comments:

Name:	Signature:	Date:

XI. Distribution

☐ PM ☐ SUXOS ☐ UXOSO/QC ☐ UXO Program Manager ☐ Client Rep

MRP FF.19

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

NON-CONFORMANCE REPORT

Client:	Project Number:
Project:	Specific Process:
Description of Process	

I. Description of Nonconformance *(Items involved, specification, code or standard to which items do not comply, submit sketch if applicable)*

Name and Signature of Person Reporting Nonconformance	Title/Company	Date

II. Root Cause Analysis

Immediate Causes: What actions and conditions contributed to this event? Check all that apply:

Substandard Acts	
☐ Operating equipment without authority	☐ Inadequate inspection/peer review
☐ Failure to follow/improper execution of procedure	☐ Poor judgment
☐ Using equipment improperly	☐ Failure to communicate—written and/or verbal
☐ Improper servicing/maintenance of equipment	☐ Acceptance of defective equipment/material
☐ Under influence of alcohol/drugs	☐ Other substandard acts
☐ Horseplay	
Substandard Conditions	
☐ Personnel not properly qualified or trained	☐ Inadequate oversight
☐ Defective equipment/material	☐ Inadequate procedure/instruction

Enter brief explanation of each *immediate cause* below:

Basic Causes: What specific personal or job management system factors contributed to this event? Check all that apply:

Personal Factors	Job Factors
☐ Inadequate physical/physiological capability	☐ Inadequate leadership and/or supervision
☐ Inadequate mental/psychological capability	☐ Inadequate engineering
☐ Physical or physiological stress	☐ Inadequate purchasing
☐ Lack of knowledge	☐ Inadequate maintenance
☐ Lack of skill	☐ Inadequate tools and equipment
☐ Improper motivation	☐ Inadequate work standards
☐ Other personal factors	☐ Excessive wear and tear
	☐ Abuse and misuse
	☐ Change
	☐ Other job factors

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

	NON-CONFORMANCE REPORT

(continued)

Enter brief explanation of each *basic cause* below:

Name and Signature of Person Conducting RCA	Title/Company	Date

III. Recommended Disposition *(Submit sketch, if applicable)*

Name and Signature of Person Recommending Disposition	Title/Company	Date

IV. Evaluation of Disposition by Tetra Tech, Reason for Disposition

V. Corrective Action ☐ Required ☐ Not Required

VI. ☐ QA/QC	☐ Project Manager	☐ Client *(if applicable)*	☐ Other
Name *(Signature)*	Name *(Signature)*	Name *(Signature)*	Name *(Signature)*
Date	Date	Date	Date
☐ Accepted ☐ Rejected ☐ Accepted with Comments	☐ Accepted ☐ Rejected ☐ Accepted with Comments	☐ Accepted ☐ Rejected ☐ Accepted with Comments	☐ Accepted ☐ Rejected ☐ Accepted with Comments

VII. Verification of Disposition ☐ Required ☐ Not Required

By	Signature	Title	Date

MRP FF.20

Facility/Location: ___NAS CECIL FIELD, JACKSONVILLE, FLORIDA__

Site(s): __SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA _

LESSONS LEARNED REPORT FORM

Client:	Project Number:
Project:	Location:
Type Of Project:	

I. TOPIC

II. DESCRIPTION (Narrative of relevant events, problem, impact)

III. LESSON(S) LEARNED (e.g. Project Specific, Location Specific, Company-wide):

IV. RECOMMENDED FUTURE ACTION
(e.g., Revise Project Procedures, Company Procedures, Additional Training):.

V. EVALUATION BY DEPARTMENT HEAD (e.g., Support Recommendation, Alternate Recommendation):

VI. List supporting data/ references (if applicable)

Reference/ Supporting Data:	Location:

VII. ☐ PM	☐ QCM	☐ UXO Program Manager
Name *(Signature)*	Name *(Signature)*	Name *(Signature)*
Date	Date	Date
☐ Accepted ☐ Rejected ☐ Accepted with Comments Comments:	☐ Accepted ☐ Rejected ☐ Accepted with Comments Comments:	☐ Accepted ☐ Rejected ☐ Accepted with Comments Comments:

VIII. Forward Approved Lessons Learned Report to Program Manager

Name *(Signature)*	Date	☐ Accepted ☐ Rejected ☐ Accepted with Comments Comments:

TETRA TECH
MRP FF.21
DAILY SAFETY LOG

Facility/Location: _NAS CECIL FIELD, JACKSONVILLE, FLORIDA__

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA _

FIELD ACTIVITY SUBJECT:		**Date**	
PROJECT NO.:	**TASK CODES**:		
SUMMARY OF DAILY ACTIVITIES AND EVENTS:			
VISITORS ON SITE (indicate if received Site-Specific raining)**:**			
CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:			
WEATHER CONDITIONS: (temp, wind, humidity, precipitation)	**IMPORTANT TELEPHONE CALLS**:		
PERSONNEL ON SITE: See Tailgate Safety Briefing/Training Record			
SIGNATURE:		**DATE**:	

TETRA TECH

MRP FF.22
DAILY TAILGATE SAFETY BRIEFING/TRAINING RECORD

Facility/Location: __NAS CECIL FIELD, JACKSONVILLE, FLORIDA_

Site(s): __SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA_

	Name	Signature	Position
1. Briefing(s) Given By:	_____ _____	_____ _____	_____ _____

Date: _____	**Time:** _____	**Team #:** _____

2. Reason for Briefing:

___ **Initial Safety Briefing**	___ **New Site Procedure:**_____
___ **Daily Safety Briefing**	___ **New Site Information:**_____
___ **New Task Briefing:**_____	___ **Review of Site Information**
___ **Periodic Safety Meeting**	___ **Other: (Specify)**_____

3. List Today's Project Tasks (reference definable features of work – See Worksheet 12.)**:**

4. Safety Topics: (Check All That Apply – per AHA or Work Permit)

___ **Site Safety Personnel**	___ **Decontamination Procedures**
___ **Site/Work Area Description**	___ **Emergency Response/Equipment**
___ **Physical Hazards**	___ **On-Site Injuries/Illness**
___ **Chemical/Biological Hazards**	___ **Reporting Procedures**
___ **Heat/Cold Stress**	___ **Directions to Medical Facility**
___ **Work/Support Zones**	___ **Drug and Alcohol Policies**
___ **PPE**	___ **Medical Monitoring**
___ **Safe Work Practices**	___ **Evacuation/Egress Procedures**
___ **Air Monitoring**	___ **Communications**
___ **Task Training**	___ **Confined Spaces**
___ **OE Precautions**	___ **Other:**

5. Remarks:

6. Personnel Attending

Name	Signature	Position

TETRA TECH

MRP FF.22

DAILY TAILGATE SAFETY BRIEFING/TRAINING RECORD

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

Name	Signature	Position

TETRA TECH
MRP FF.23
FIELD CHANGE REQUEST (FCR)

Facility/Location: NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Site(s): SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA

CONTRACT TASK ORDER NAME:	**CTO #**	**CHANGE REQUEST NO.**
TO:	**LOCATION:**	**DATE:**

RE:

SAP Worksheet: _____ Section: _____

ESS Section: _____

SOP Section: _____

Other: _____

1. DESCRIPTION (cite or attach specific text/figure changes, as necessary):

2. REASON FOR CHANGE

3. RECOMMENDED DISPOSITION (Submit sketch, if applicable):

_____ Minor Change _____ Major Change (Impacts Cost, Schedule)

4. APPROVAL:

_____ Not Approved (give reason).

_____ Considered minor change – APPROVED per recommended disposition – Documents will not be formally revised.

_____ Considered major change – Client approval required via contract modification process

Prepared by (Signature)	**Date:**
Tetra Tech UXO Manager (Signature)	**Date:**
Tetra Tech Project Manager (Signature)	**Date:**
Client Point of Contact / Client Representative (Signature) (Not applicable if minor change)	**Date:**

TETRA TECH

MRP FF.24

EQUIPMENT MAINTENANCE/REPAIR

Facility/Location: _NAS CECIL FIELD, JACKSONVILLE, FLORIDA_

Site(s): ___SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA __

MAINTENANCE/REPAIR NO._____

NECESSARY ATTACHMENTS _____ PACKING SLIP, and/or _____ MRR, abd _____LOGS

TYPE OF EQUIPMENT	SERIAL NO.
MAKE:	MODEL:
P O NUMBER	DELIVERY ORDER NO.
STANDARD MAINTENANCE	DATE

DESCRIPTION OF PROBLEM (if any)

_____

_____

_____

MAINTENANCE/REPAIRS TO BE PERFORMED

IN-HOUSE REPAIRS	DATE
SENT OUT TO	COST ESTIMATE AIRBILL NO. P O NO. DATE RET'D

CORRECTIVE ACTION

_____

_____

_____

_____

PARTS LIST

PART DESCRIPTION	QUANTITY	COST/EA
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

TOTAL LABOR (hours) PERFORMED BY	DATE

RETURNED TO WHICH JOB SITE/Stone Mountain, GA

APPENDIX C

FIELD MRP SOPS

C.1 SOP-01 - UXO DETECTOR-AIDED SURVEYS
C.2 SOP-02 - MEC MANAGEMENT AND ACCOUNTABILITY
C.3 SOP-05 - GPS DATA COLLECTION AND TRANSFER
C.4 SOP-06 - VEGETATION MANAGEMENT AT MEC SITES
C.5 SOP-07 - UXO DEMOLITION/DISPOSAL OPERATIONS
C.6 SOP 08 - UXO Documentation

C.1 SOP-01 - UXO DETECTOR-AIDED SURVEYS

STANDARD OPERATING PROCEDURE
MRP SOP 01
UXO DETECTOR-AIDED SURFACE SURVEYS

1.0 SCOPE AND APPLICABILITY

This document is designed to set a standard operating procedure (SOP) for the detector-aided surface Survey field operations during activities performed under the Munitions Response Program (MRP). This SOP is not site-specific, but rather is intended as a general guidance document for a variety of sites and conditions.

2.0 BACKGROUND

Detector-aided surface Survey activities will be performed in accordance with all local, State, and federal regulations and will include all applicable DoD requirements. The scope of the detector-aided surface Survey activities for a specific site will be defined in the project-specific work plans. Generally, all areas identified as suspect for munitions and explosives of concern (MEC) will receive an Unexploded Ordnance (UXO) detector-aided surface Survey. UXO detector-aided surface Survey operations may be used as a stand-alone method for site survey and assessment or in preparation for digital geophysical mapping (DGM) survey operations. UXO escort operations will be required during site visits (initial site assessments, planning, and stakeholders meetings), DGM operations, and munitions constituents (MC) sampling operations and any other time where non-UXO trained personnel are conducting work in an MEC site. This SOP does not address UXO escort operations. UXO escort operations are addressed in the Munitions and Explosives of Concern and Chemical Warfare Agents Activities SOP, which will be attached to the site-specific health and safety plans (HASPs) for those activities.

3.0 PERSONNEL QUALIFICATIONS

UXO personnel conducting detector-aided surface Surveys shall be graduates of a military Explosive Ordnance Disposal (EOD) School of the United States, Canada, Great Britain, Germany, or Australia or a graduate of a formal training course of instruction or EOD assistant course as stated in DDESB TP-18.

UXO Senior UXO Supervisor (SUXOS)

The SUXOS will have a minimum of 10 years experience in all aspects of munitions response actions or range clearance activities. A minimum of 5 years of the experience shall be in supervisory positions.

UXO Team Leader (UXO Technician III)

The UXO Team Leader will have a minimum of 8 years of EOD/UXO experience including prior military EOD and/or commercial UXO experience in munitions response actions, and/or range clearance activities. The UXO Team Leader may supervise up to six UXO technicians. The UXO Team Leader will conduct detector-aided surface Survey activities as directed by the project manager (PM) and UXO Manager. The UXO Team Leader will be under the direct supervision of the UXO Manager.

UXO Quality Control Specialist (UXOQC)

The UXOQC specialist shall have a minimum of 8 years experience in all phases of munitions response actions and/or range clearance activities. The UXOQC specialist shall have completed corporate quality assurance and quality control training.

UXO Safety Officer (UXOSO)

The UXOSO shall have a minimum of 8 years experience in all phases of munitions response actions and/or range clearance activities.

UXO Technicians II

The UXO Technicians II will have prior military EOD experience or a minimum of 3 years of experience in munitions response actions and/or range clearance activities. The UXO technician will conduct detector-aided surface Survey activities as directed by the UXO Team Leader.

UXO Technician I

The UXO Technician I will have training as specified in DDESB TP-18. The UXO technician I will be directly supervised by a UXO Technician III or higher when conducting UXO activities.

4.0 DETECTOR-AIDED SURFACE SURVEY OPERATIONS

Equipment

A magnetic locator such as the Schonstedt, GA-52Cx instrument or equivalent and/or an all-metal detector such as the White's XLT or equivalent will be used for detector-aided surface Survey operations. The detection depth of the instrument is limited by size and orientation of a target and soil characteristics of the work area. The locators provide an audio signal for response, but do not store data. The magnetic locator does not need to be calibrated. The all-metal detector has field calibration. Calibration settings are specific to the make and model of the all metals detector. Table 1 lists the calibration settings for the White's spectrum XLT.

To ensure each detector is operating properly, the operator turns on the instrument and slowly moves the locator towards metal. As the probe advances toward the target, the audio signal will increase. Failure to detect the object is reason to reject the instrument.

The detector will be checked daily before starting detector-aided surface Survey activities and after any battery change. The normal daily check for detector-aided surface Survey operations is the blanket test. To conduct the blanket test, an area near the work site and free of anomalies will be identified. The senior UXO Technician or UXOQC will position several inert munitions, or surrogate munitions items on the surface and cover the items with a tarpaulin or similar cover so the items are not visible the UXO technician. Each UXO technician will conduct a detector-aided surface Survey of the blanket test area and locate the test items. The senior UXO technician or UXOQC will compare the results of the test to the actual placement of the items and make corrections as necessary. UXO Technicians will also conduct random checks during daily operations.

The normal setting for the Schonstedt instrument is 2; setting the instrument to 3 or 4 will make it more sensitive and setting the instrument to 1 will make it less sensitive. The instrument will not detect copper, brass, or aluminum munitions. The normal setting for the White's all-metal detector will vary according to site conditions.

UXO Detector-Aided Surface Survey

The objective of the UXO detector-aided surface Survey is to locate suspect MEC. Materials potentially presenting an explosive hazard (MPPEH) and munitions debris (MD) on the ground surface in a munitions response site, (MRS). Early in the planning for the field activities, usually during the DQO process with the regulators and the client, the level of effort is determined for each MRS within a munitions response area, MRA). The level of effort can vary from a 100% UXO investigation where the entire foot print of the MRS receives a UXO detector-aided surface Survey, to transects where five foot wide lanes receive a UXO detector-aided surface Survey and each lane is separated by a set number of feet depending on the budget and size of the MRS, or even a meandering path where a UXO detector-aided surface Survey is conducted as the UXO technician meanders across the MRS. Each of these will be discussed in some detail below:

100% UXO Detector-aided Surface Survey

The first step in conducting a 100% UXO detector-aided surface Survey is to identify the boundaries of the MRS. This can be done with a GPS with preloaded grid coordinates, or surveyed by a land surveyor.

The next step is to remove brush and small trees within the MRS to allow access to the locations where the surface Survey is to be conducted. The degree of removal will depend on site-specific conditions. This can be accomplished with a bush cutting crew and a UXO escort, or the UXO team can conduct the brush cutting themselves depending on the size of the area and the amount of brush removal needed. Care must be taken to ensure that personnel do not disturb suspect MEC, MPPEH or munitions debris on the surface that may be obscured by vegetation

The next step is to establish a grid system across the MRS. The normal grid is 100ft X 100ft but may be larger or smaller if the MRS would be better covered with a different size. The grid is established using a GPS with preloaded grid corners, or surveyed by a land surveyor to establish the grid corners.

The next step in the set-up process is to divide each grid into search lanes. This is normally done by running a tape measure between the bottom and top east/west corner stakes. Then the UXO team will run rope lines from the 0 point on one tape to the 0 point on the other tape, from the 5ft point on one tape to the 5ft point on the next tape, and so on until the entire 100 ft grid has been divided in to lanes.

The UXO team members will now start the UXO detector-aided surface Survey of each lane. Each UXO team member will start at one of the tapes and using the metal detector, proceed toward the other tape and locate any surface MEC within their lane. If suspect MEC is encountered, its location will be recorded and/or marked using a GPS, tape measure, or other grid coordinate location system. The UXO Team will attempt to determine its condition without moving or disturbing the item prior to proceeding with the surface Survey. Each item will be marked with engineer flagging and given a unique ID number (See MEC Management and Accountability SOP). All available information about the item will be recorded in the

logbook/MEC Accountability Log, including suspect MEC location, identification, and ID number. A digital photograph will be taken of each item. The UXO Team will not move or otherwise disturb the item in an attempt to collect information. After all available information is recorded; the UXO Team will resume the detector-aided surface Survey.

When the UXO detector-aided surface Survey of a grid is complete and all items have been located with coordinates and digitally photographed, the tape measures, ropes and other equipment will be moved to the next grid and reestablished as stated above. This process will continue until the entire MRS has been investigated with as close as possible to 100% UXO detector-aided surface Survey.

Transect UXO Detector-aided Surface Survey

The first step in conducting a transect UXO detector-aided surface Survey is to identify the boundaries of the MRS. This can be done with a GPS with preloaded grid coordinates, or surveyed by a land surveyor.

The next step is to establish the end stakes of each transect across the MRS. The transect end stakes are established using a GPS with preloaded end stake locations, or surveyed by a land surveyor. The distance between transects will be established in the site-specific work plan. The direction should be either north/south, or east west although other directions may be appropriate in specific circumstances.

If necessary, each transect may require some brush cutting to aide in the surface Survey. If brush cutting is determined to be necessary, the transect should be at least 5 ft. wide. This can be accomplished with a bush cutting crew and a UXO escort, or the UXO team can conduct the brush cutting themselves depending on the size of the area and the amount of brush removal needed. Care must be taken to ensure that personnel do not disturb suspect MEC items on the surface that may be obscured by brush and tall grass.

The UXO team members will now start the UXO detector-aided surface Survey of each transect. Each UXO team member will start at one of the end stakes and using the metal detector proceed in a deliberate pattern to locate any surface MEC within their 5ft wide transect, toward the other corresponding end stake. The UXO team member will use a GPS or compass to maintain a generally straight transects during the investigation. If suspect MEC is encountered, its location will be recorded and/or marked using a GPS, tape measure, or other grid coordinate location system. The UXO Team will attempt to determine its condition without moving or disturbing the item prior to proceeding with the surface Survey. Each item will be marked with engineer flagging and given a unique ID number (See MEC Management and Accountability SOP). All available information about the item will be recorded in the logbook/MEC Accountability Log, including suspect MEC location, identification, and ID number. A digital photograph will be taken of each item. The UXO Team will not move or otherwise disturb the item in an attempt to collect information. After all available information is recorded; the UXO Team will resume the detector-aided surface Survey.

When the UXO detector-aided surface Survey of a transect is complete and all items have been located with coordinates and digitally photographed, the UXO team member may proceed to the next transect. This process will continue until the transects have been completed over the entire MRS as planned in the WP.

Meandering Path UXO Detector-aided Surface Survey

Generally the meandering path UXO detector-aided surface Survey is very similar to the transect UXO detector-aided surface Survey. The main difference is there is very little need to cut brush as the UXO team members will meander around heavy brush and other obstacles.

The GPS will have information about the MRS preloaded so as to ensure that the path stays within the MRS. Again the meandering path will be approximately 5ft wide and proceed across the MRS until the objective, (a set amount of time, distance, or suspect MEC items) have been investigated with the UXO detector-aided surface Survey. The site-specific work plans will establish the area within the MRS to be covered with the meandering transects.

If suspect MEC is encountered, its location will be recorded and/or marked using a GPS, compass, and/or tape measure, or other grid coordinate location system. The UXO Team will attempt to determine its condition without moving or disturbing the item prior to proceeding with the surface Survey. Each item will be marked with engineer flagging and given a unique ID number (See MEC Management and Accountability SOP). All available information about the item will be recorded in the logbook/MEC Accountability Log, including suspect MEC location, identification, and ID number. A digital photograph will be taken of each item. The UXO Team will not move or otherwise disturb the item in an attempt to collect information. After all available information is recorded; the UXO Team will resume the detector-aided surface Survey.

Every effort will be made to identify each suspect MEC or MPPEH item located. Under no circumstances will any suspect MEC be moved in an attempt to make a definitive identification. The MEC item will be visually examined for markings and other external features such as shape, size, and external fittings. If unknown military munitions are encountered, the facility point of contact (POC) and Tt UXO Manager will be notified.

Only UXO-qualified personnel will perform MEC identification procedures. As an exception, a UXO Technician I may assist in the performance of MEC identification procedures when under the supervision of a UXO Technician III or higher. All personnel engaged in field operations will be thoroughly trained and capable of recognizing the specific hazards of the procedures being performed. To ensure that these procedures are performed to standards, all field personnel will be under the direct supervision of a UXO Technician III or higher. All suspect MEC items will be recorded following the requirements of this SOP, the site-specific Work Plan/QAPP, the project site-specific HASP, applicable ordnance operations procedural safety guidelines, and industry-accepted safe work practices and procedures.

All items discovered during the detector-aided surface Survey of the transects/grid will be left in place. No MEC will be moved during this part of the project. The facility POC will be notified of the presence of MEC so that arrangements may be made through the facility for proper disposition of the item(s). If the facility initiates an emergency response or disposal action, follow-up documentation must be obtained to detail the date and method of disposition. This is also needed to ascertain the actual type and condition of the item (live or inert filled) to aid in future classification of the site.

Quality Control

During the detector aided surface Survey the UXOQC, or Senior UXO technician if there is no UXOQC, will recheck 25% of the first four units of work (grids or transects). If quality requirements are not met on any unit, that unit will be rejected and the UXO team will rework the entire unit. Once quality requirements are met for four units in a row, the UXOQC, or Senior

UXO technician if there is no UXOQC may reduce the level of rechecks to 10% of each unit (grids or transects). If at any time a unit fails the quality control check, that complete unit will be reworked and the rechecks will be increased to 25% until four units in a row pass the recheck.

Detector-Aided Surface Survey for Geophysical Survey

The UXO Technician will conduct a detector-aided surface Survey of the grid or area to be surveyed and record the location of any MEC items discovered. Each item will be marked and recorded as described above. UXO avoidance will be practiced during the geophysical survey.

When allowed by the conditions of the Explosive Safety Submission (ESS) determination, any non-munitions debris may be moved to facilitate a more effective geophysical survey. Non-munitions debris may be collected and stockpiled in a designated area within the boundaries of the site. The facility must agree to take possession of this non-munitions debris and arrange the proper disposition of the material before any items may be moved or disturbed.

TABLE 1

White's Spectrum XLT Settings		
Basic Adjustments:	**UXO 1**	
Target Volume	58	
Audio threshold	23	
Tone (audio frequency)	226	
Audio Disc.	on	
Silent Search	off	
Mixed-Mode	on	
A.C. Sensitivity	60	Adjust at a test Grid. Compare with another White's
D.C. Sensitivity	30	Adjust at a test Grid. Compare with another White's
Backlight	0	
Viewing Angle	25	
Pro Options:		
"Audio"		
Ratchet Pinpointing	on	
S.A.T. Speed	7	
Tone I.D.	on	
V.C.O.	on	
Absolute Value	off	
Modulation	on	
"G.E.B/Trac"		
Autotrac	on	
Trac View	off	
Autotrac Speed	14	
Autotrac Offset	+1	
Trac Inhibit	on	
Coarse B.E.B.	54	These numbers are variable and will change automatically.
Fine G.E.B.	160	These numbers are variable and will change automatically.
"Discrimination"		
Disc. Edit	+95 Accept	
Block Edit	+95 Accept	
Learn Accept	off	
Learn Reject	off	
Recovery Speed	20	
Bottlecap Reject	20	

White's Spectrum XLT Settings		
Basic Adjustments:	**UXO 1**	
"Display"		
Visual Disc.	off	
Icons	on or off	
V.D.I. Sensitivity	55	
D.C. Phase	9on	
Graph Averaging	on	
Graph Accumulating	on	
Fade Rate	u	
"Signal"		
Transmit Boost	off	
Transmit Frequency	1 to 7	
Preamp Gain	4	

TABLE 2

Related Field Forms

Form Number	Frequency	Form Name
MRP FF.1	Once	SAP Worksheet No 4-Project Sign-Off
MRP FF.2	Daily	Daily MEC Activity Log
MRP FF.3	Daily	Daily Equipment Checklist
MRP FF.5	Daily	Daily Photographic Log
MRP FF.6	Once	IVS Installation Checklist
MRP FF.7	Daily	Daily IVS Report
MRP FF.8	Daily	Daily MEC_MPPEH Log For UXO Avoidance Activities
MRP FF.10	Daily	MEC Accountability Form
MRP FF.15	Daily	Daily QC Report
MRP FF.16	Once per Definable Feature	Preparatory Phase Inspection Report
MRP FF.17	Once per Definable Feature	Initial Phase Inspection Report
MRP FF.18	Periodic	Follow Up Phase Inspection Report
MRP FF.21	Daily	Daily Safety Log
MRP FF.22	Daily	Daily Tailgate Safety Briefing-Training Record Form

C.2 SOP-02 - MEC MANAGEMENT AND ACCOUNTABILITY

STANDARD OPERATING PROCEDURE
MRP SOP 02
MEC MANAGEMENT AND ACCOUNTABILITY

1.0 SCOPE AND APPLICABILITY

This document is designed to set a standard operating procedure (SOP) for the management and accountability of Munitions and Explosives of Concern (MEC) encountered during activities performed under the Munitions Response Program (MRP).

2.0 BACKGROUND

MEC activities will be performed in accordance with all local, State, and federal regulations and will include all applicable DoD requirements. Generally, MEC will be encountered during the performance of Unexploded Ordnance (UXO) detector-aided surface Survey operations, subsurface geophysics investigations and UXO Escort operations. UXO detector-aided surface Survey operations may be used as a stand-alone method for site survey and assessment or in preparation for geophysical survey and other operations. UXO escort operations may be required during site visits (initial site assessments, planning, and stakeholders meetings), geophysical operations, construction support during subsurface activities, and MC sampling operations.

3.0. PERSONNEL QUALIFICATIONS

UXO personnel shall be graduates of a military Explosive Ordnance Disposal (EOD) School of the United States, Canada, Great Britain, Germany, or Australia or a graduate of a formal training course of instruction or EOD assistant course as stated in DDESB TP-18.

4.0. MEC MANAGEMENT AND ACCOUNTABILITY OPERATIONS

UXO Detector-Aided Surface Survey

If suspect MEC is encountered, its location will be recorded and/or marked using a GPS, tape measure, or other grid coordinate location system. The UXO Team will attempt to determine its condition without moving or disturbing the item prior to proceeding with the surface Survey. Each item will be marked with engineer flagging and given a unique ID number. ID numbers will start with a letter(s) corresponding to the site or grid in which the item is located. This will be followed by the transect number of the site or grid specific to the location of the item. Lastly, a number will be assigned to the individual items within the transect. These numbers will start at 01 and run consecutively. For example:

*The site name is **O**pen **B**urn **P**it. The first transect within the Open Burn Pit is **A1**. The first item encountered in transect A1 is item **01**. The ID number assigned to the item is **OBP-A1-01.***

All available information about the item will be recorded in the logbook/MEC Tracking Log as presented in Attachment 1 to this SOP, including suspect MEC location, identification, and ID number. A digital photograph will be taken of each item. The UXO Team will not move or otherwise disturb the item in an attempt to collect information. After all available information is recorded; the UXO Team will resume the detector-aided surface Survey.

Every effort will be made to identify each suspect MEC item located. Under no circumstances will any suspect MEC be moved in an attempt to make a definitive identification. The MEC item will be visually examined for markings and other external features such as shape, size, and external fittings. Prior to any documentation being developed on an MEC item, all fuzing will be definitively identified if it is possible to safely do so visually without disturbing the ordnance item. This identification will consist of fuze type by function and condition (armed or unarmed) and the physical state/condition of the fuze, i.e., burned, broken, parts exposed/sheared, etc.

Only UXO-qualified personnel will perform MEC identification procedures. As an exception, a UXO Technician I may assist in the performance of MEC identification procedures when under the supervision of a UXO Technician III or higher. All personnel engaged in field operations will be thoroughly trained and capable of recognizing the specific hazards of the procedures being performed. To ensure that these procedures are performed to standards, all field personnel will be under the direct supervision of a UXO Technician III or higher. All suspect MEC items will be recorded following the requirements of this SOP, the site-specific Work Plan/QAPP, the project site-specific HASP, applicable ordnance operations procedural safety guidelines, and industry-accepted safe work practices and procedures.

Detector-Aided Surface Survey for Geophysical Survey

The UXO Technician will conduct a detector-aided surface Survey of the grid or transect to be surveyed and record the location of each MEC item discovered, if any. Each item will be marked and recorded as described above. UXO avoidance will be practiced during the geophysical survey.

When allowed by the conditions of the Explosive Safety Submission (ESS) determination, any non-munitions debris may be moved to facilitate a more effective digital geophysical mapping (DGM) survey. Non-munitions debris may be collected and stockpiled in a designated area within the boundaries of the site. The facility must agree to take possession of this non-munitions debris and arrange the proper disposition of the material before any items may be moved or disturbed.

UXO Escort Operations

One UXO Technician qualified as a UXO Technician II or higher, will be required to support each field team engaged in operations in areas that might contain MEC. If any MEC is encountered, the item will be avoided during this phase of the project.

The UXO Technician will not attempt to identify the type or condition of the ordnance during escort operations. Any area with visible ordnance or MEC will be clearly marked, and the area will be avoided. The location of visible ordnance or MEC will be recorded and noted in the field logs. If more senior level personnel are present on site, MEC findings will be reported to the UXO Team Leader. No ordnance, munitions, explosives, or ordnance-related materials will be moved, removed, or disposed of during UXO Escort duties.

5.0 NOTIFICATIONS IF MEC IS ENCOUNTERED

Any MEC item discovered during a detector-aided surface Survey, geophysical survey, or UXO escort operation will be left in place and will not be moved. Should MEC be encountered, the following scenarios should be addressed as follows:

(1) If a complete MEC item or ordnance related material is encountered that is believed to pose a hazard, is unexpectedly encountered at a given site, is encountered outside of the current established site boundaries, or is unknown, the UXO Team Leader, with support by UXO Technicians on site as necessary, will document the following information, as indicated on related field forms listed in Table 2, for notification purposes:

- Site Name
- Date/Time Encountered
- Name and UXO Category of Person Providing Notification
- Location of Item (provide coordinates)
- Type of Item (provide digital photograph)
- Apparent Fuze Condition (armed or unarmed)
- Physical Condition (burned, broken, parts exposed/sheared, etc)
- Physical Appearance (buried, staged, etc.)
- Activity in Progress

The UXO Team Leader will attempt to identify the type and/or condition of the ordnance and its location, as described above, and will immediately report this information to the client point of contact at the facility and the Tetra Tech UXO Manager. Prior to any documentation being performed on a suspect MEC item, all fuzing will be definitively identified only if it is possible to safely do so visually without disturbing the item. If directed by the point of contact at the facility, UXO personnel may take emergency non-invasive action such as securing the area until the appropriate exclusion and safety zones have been determined.

The Navy point of contact at the facility will be responsible for notifying appropriate EOD personnel or for designating this notification task to the Tetra Tech UXO Team Leader. The notification to EOD personnel should be immediate if a live MEC item is encountered which could be a hazard to personnel, or if the item is unknown so that arrangements may be made through the facility for proper disposition of the item(s). If the facility initiates an emergency response or disposal action, follow-up documentation should be obtained to detail the date and method of disposition. This information is also needed to ascertain the actual type and condition of the item (live or inert filled) to aid in future classification of the site.

(2) If the MEC item cannot be identified by type as a conventional munition, and/or if in the unlikely event that the MEC is suspected to be potential Chemical Warfare Material (CWM), personnel will withdraw upwind from the area, assemble at a pre-designated rally point, secure the site, and immediately request assistance from the point of contact at the facility and notify the Tetra Tech UXO Manager. If so directed, UXO personnel will take emergency non-invasive actions such as covering the item with plastic sheeting and securing the area until the appropriate exclusion and safety zones have been determined.

(3) If Hazardous, Toxic, or Radiological Waste (HTRW) is encountered on-site, the work site will be evacuated until the Tetra Tech Project Health and Safety Officer, with concurrence of

the client point of contact at the facility, identifies and implements appropriate protective measures.

For any of the scenarios, upon receiving notification from the Tetra Tech UXO Team Leader, the Tetra Tech UXO Manager will then immediately inform the Tetra Tech Project Manager, who will then immediately inform the client Project Manager. Tetra Tech Program Management personnel will then be notified. The client Project Manager will then make all other necessary notifications within the client's organization.

TABLE 1
Contact Information

Position	Name	Organization	Direct Dial Phone	Cell Phone
Naval Facilities Engineering Command (NAVFAC) BRAC Environmental Coordinator (BEC)	Mark Davidson	NAVFAC	843.743.2124	
Technical Lead	Linda Klink	Tetra Tech	412.921.8650	
UXO Program Manager	Ralph Brooks	Tetra Tech	770.413.0965 x231	404.661.4916
Navy Remedial Project Manager (RPM)	Art Sanford	BRAC PMO SE	843.743.2135	
United States Environmental Protection Agency (USEPA) RPM	Deborah Vaughn-Wright	USEPA Region 4	404.562.8530	
Florida Department of Environmental Protection (FDEP) RPM	David Grabka	FDEP	850.245.8997	

TABLE 2
Related Field Forms

Form Number	Frequency	Form Name
MRP FF.1	Once	Sap Worksheet No 4-Project Sign-Off
MRP FF.2	Daily	Daily MEC Activity Log
MRP FF.3	Daily	Daily Equipment Checklist
MRP FF.5	Daily	Daily Photographic Log
MRP FF.9	Daily	MEC Cumulative Summary Log
MRP FF.10	Daily	MEC Accountability Form
MRP FF.15	Daily	Daily QC Report
MRP FF.16	Once per Definable Feature	Preparatory Phase Inspection Report
MRP FF.17	Once per Definable Feature	Initial Phase Inspection Report
MRP FF.18	Periodic	Follow Up Phase Inspection Report
MRP FF.21	Daily	Daily Safety Log
MRP FF.22	Daily	Daily Tailgate Safety Briefing-Training Record Form

C.3 SOP-05 - GPS DATA COLLECTION AND TRANSFER

STANDARD OPERATING PROCEDURE
MUNITIONS RESPONSE PROGRAM (MRP) SOP 05
GPS DATA COLLECTION AND TRANSFER

1.0 OVERVIEW

The primary purpose of this Standard Operating Procedure (SOP) is to provide the Field Technicians with basic instructions for operating a handheld Global Positioning System (GPS) unit allowing them to set GPS parameters in the receiver, record GPS positions on the field device, and transfer the data for integration into existing Geographic Information System (GIS) figures.

This SOP is specific to GIS quality data collection for Trimble-specific hardware and software.

If possible, the Trimble GeoXT or XH Operators Manual should be downloaded onto the operator's personal computer for reference before or while in the field. The manual can be downloaded at the following website:
http://trl.trimble.com/docushare/dsweb/Get/Document-311749/TerraSyncReferenceManual.pdf

Unless the operator is proficient in the setup and operation of the GPS unit, the Project Manager (or designee) should have the GPS unit shipped to the project-specific contact listed below in the Pittsburgh, Pennsylvania office at least five working days prior to field mobilization so project-specific data files (i.e. shape files), background images, data dictionaries, and correct coordinate systems can be uploaded into the unit.

Tetra Tech NUS
Attn: Ralph Basinski
661 Anderson Drive, Bldg #7
Pittsburgh, PA 15220

The SOP also describes how field collected data is to be transferred through the use of the MRP Website. (http://www.ttnus.com/MRPRepository/). This website serves as a centralized portal to facilitate data exchange for field personnel, GIS staff, and project managers. The website contains a "Reference" page that will contain the latest version of this SOP and other valuable documentation.

For technical questions regarding operation of the GPS units and data collection, please contact John Wright (john.wright@tetratech.com). For general questions about this SOP and use of the MRP website, please contact Mark Maguire (mark.maguire@tetratech.com).

2.0 REQUIRED EQUIPMENT

The following hardware and software should be utilized for locating and establishing GPS points in the field:

2.1 GPS Hardware & Equipment

- Hand-held GPS Unit capable of sub-meter accuracy. This includes the docking cradle, a/c adapter, stylus, and USB cable for data transfer. Two models, the GeoXH and GeoXT, are acceptable for use. The XH yields higher accuracy (in both real-time and post-processed) and **should always be requested** when highly precise data is required.

- An external antenna will yield better satellite reception, especially in heavy tree canopy. Associated accessories include a range pole and hardware clamp, for mounting the GPS unit to the pole.

- Indelible marker.

- Non-metallic pin flags for temporary marking of positions.

2.2 GPS Software

The following software is required to transfer data from the handheld GPS unit to a personal computer:

- Trimble TerraSync version 2.6 or later (pre-loaded onto GPS unit from vendor)

- Microsoft ActiveSync version 4.5 or later. Download to personal computer from:
  http://www.microsoft.com/windowsmobile/en-us/downloads/microsoft/activesync-download.mspx

  Note: Windows Vista and Windows 7 users should download Windows Mobile Device Center version 6.1 or later from the following site, if it is not already loaded on the machine:
  http://www.microsoft.com/windowsmobile/en-us/downloads/microsoft/device-center-download.mspx

- Trimble Data Transfer Utility (freeware version 2.1 or later). Download to personal computer from:
  http://www.trimble.com/datatransfer.shtml

3.0 START-UP PROCEDURES

Prior to utilizing the GPS in the field, ensure the unit is fully charged. The unit may come charged from the vendor, but an overnight charge is recommended prior to fieldwork.

The Geo-series GPS units require a docking cradle for both charging and data transfer. The Geo-series GPS unit is docked in the cradle by first inserting the far domed end in the top of the cradled, then gently seating the contact end into the latch. The power charger is then connected to the cradle at the back end using the twist-lock connector. Attach a USB cable as needed between the cradle (B end) and the laptop/PC (A end).

It is recommended that the user also be familiar and check various Windows Mobile settings. One critical setting is the Power Options. The backlight should be set as needed to conserve power when not in use.

3.1 Initial Start Up

1) Power on the GPS unit by pushing the small green button located on the lower right front of the unit.

2) Utilizing the stylus that came with the GPS unit, launch **TerraSync** from the Windows Operating System by tapping on the start icon located in the upper left hand corner of the screen and then tap on **TerraSync** from the drop-down list.

3) If the unit does not default to the Setup screen, tap the Main Menu (uppermost left tab, just below the Windows icon) and select Setup.

4) If the unit was previously shipped to the Pittsburgh office for setup, you can skip directly to Section 4.0. However, to confirm or change settings, continue on to Section 3.1.

3.2 Confirm Setup Settings

Use the Setup section to confirm the TerraSync software settings. To open the Setup section, tap the Main Menu and select Setup. (Note that if the unit was shipped from the Pittsburgh office, these settings should have been set for your specific project. Feel free to contact Pittsburgh staff with any questions.)

1) Tap on the Coordinate System.
2) Verify the project specs are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu. **Note:** It is always best to utilize the Cancel tab rather than the OK tab if no changes are made since configurations are easily changed by mistake.
3) Tap on the Units.
4) Verify the user preferences are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu.
5) Tap Real-time Settings.

6) Verify the Real-time Settings are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu.
7) The GPS unit is now configured correctly for your specific project.

3.3 Antenna Connection

1) If a connection has been properly made with the internal antenna, a satellite icon along with the number of usable satellites will appear at the top of the screen next to the battery icon. If no connection is made (e.g.: no satellite icon), tap on the GPS tab to connect antenna.
2) At this point the GPS unit is ready to begin collecting data.

3.4 Loading a Background file

This section provides instructions on pulling in a pre-loaded background file. These files are helpful in visualizing your current location.

1) From the Main Menu select Map, then tap on Layers, select the background file from drop down list.
2) Select the project-specific background file from the list of available files.
3) Once the selected background file appears, the operator can manipulate the screen utilizing the +/- and <-/-> functions at the bottom of the screen.
4) In operating mode, the operator's location will show up on the background file as a floating "x".

4.0 FIELD DATA COLLECTION

For MRP data collection activities, a new GPS file should be created **every day** and transferred **nightly** using the MRP website (see Section 9.0). This is to insure the timely transfer of data, file organization in the database, and allow for next-day GIS mapping. Also, individual GPS data files should be **unique to a particular site** or unit (typically a UXO number). If multiple sites are visited in a single data, multiple files should be created.

4.1 Creating a Data File

1) From the Main Menu select Data.
2) From the Sub Menu (located below the Data tab) select New which will bring up the New Data File menu.
3) An auto-generated filename appears and should be edited for your specific project. The following naming convention should be followed as closely as possible: **IH-UXO4-01012010-TeamA**, where "IH" is the installation abbreviation (Indian Head), "UXO04" is the site, and "01012010" is the data in MMDDYYYY format. If multiple teams are being deployed across an individual site on the same day, it is important to specify the

field team name at the end of the file name ("TeamA"). If the integral keyboard does not appear, tap the small keyboard icon at the bottom of the screen.

4) Select the data dictionary that will be used to collect features. The data dictionary provides predefined fields and drop-down menus to facilitate data collection as it relates to specific MRP data types. The MRP data dictionary is entitled "**MRP Data Collection**" and should appear in the data dictionary drop-down list. This should have been pre-loaded into the GPS prior to use. The data dictionary file is available on the MRP website under the "Reference" section.
5) After entering the file name and selecting the data dictionary, tap Create to create the new file.
6) Confirm antenna height if screen appears. Antenna height is the height that the GPS unit will be held from the ground surface (Typically 3 to 4 feet)
7) The Choose Feature screen appears.

4.2 Collecting Features

1) If not already open, the Collect Feature screen can be opened by tapping the Main Menu and selecting Data. The Sub Menu should default to Collect.
2) **<u>Do not</u> begin the data logging process until you are at the specific location for which you intend to log the data.**
3) A known reference or two should be shot at the beginning and at the end of each day in which the GPS unit is being used. This allows for greater accuracy during post-processing of the data.
4) Upon arriving at the specific location, select the proper feature type from the data dictionary list (MEP Object, Transect End Point, GPS QC Point, or General Point).
5) Tap Create to begin data logging.
6) As the GPS is collecting positions, enter the feature attributes, starting with the Item ID. This field is required and will not allow the user to continue or save the position without entering a value. Enter any additional notes or feature descriptions in the appropriate fields.
7) Data logging can be confirmed by viewing the writing pencil icon in the upper part of the screen. Also, the logging counter will begin. As a Rule of Thumb, accumulate a minimum of 20 readings on the counter, per point, as indicated by the logging counter before saving the GPS data.
8) Once the counter has reached a minimum number of counts (i.e. 20), tap on OK to save the data point to the GPS unit. Confirm the feature. All data points are automatically saved within the GPS unit.
9) Repeat steps 2 through 8, giving each data point a unique name or number.

Note: If the small satellite icon or the pencil icon is blinking, this is an indication the GPS unit is not collecting data. A possible problem may be too few satellites. While still in data collection mode, tap on Main Menu in upper left hand corner of the screen and select Status. Skyplot will display as the default showing the number of available satellites. To increase productivity (number of usable satellites) use the stylus to move the pointer on the productivity and precision line to the left. This will decrease precision, but increase productivity. The precision and productivity of the GPS unit can be adjusted as the number of usable satellites changes throughout the day. To determine if GPS is correctly

recording data, see Section 5.2. If the precision toggle is decreased, the user should frequently check the Skyplot display to restore the default values as soon as possible.

4.3 Navigation

This section provides instructions on navigating to saved data points in an existing file within the GPS unit.

1) From the Main Menu select Map.
2) Using the Select tool, pick the point on the map to where you want to navigate.
3) The location you select will have a box placed around the point.
4) From the Options menu, choose the Set Nav Target (aka set navigation target).
5) The location will now have double blue flags indicating this point is you navigation target.
6) From the Main Menu select Navigation.
7) The dial and data on this page will indicate what distance and direction you need to travel to reach the desired target.
8) Follow the navigation guide until you reach the point you select.
9) Repeat as needed for any map point by going back to Step 1.

4.4 Data Quality Control

Quality control checks should be performed each day of data collection and/or data navigation. QC checks are important both to understand real-time accuracy while in the field, and also to provide control data needed during post-processing.

1) Known survey benchmarks, surveyed monitoring wells, or other established and documented control points should be identified
2) GPS equipment should be placed on known control points and positions recorded
3) For data collection tasks - QC check data should be collected at least at the start and completion of the fieldwork for the day of data collection. Additional occupation and collection of control point data should occur as possible during the work day, and should increase in frequency as the number of data points increase and the need for accurate data collection increases
4) For navigation tasks such as stake placement for planned sample locations, QC data checks should be done at least at the start and completion of the fieldwork for each day. Known visible targets should be occupied and observed by the user, while the GPS satellite status and other user interface data is reviewed. The user should assess whether the real-time accuracy settings on the GPS are within the tolerance of the observed visual reference points.

4.5 Viewing Data or Entering Additional Data Points to the Current File

1) To view the stored data points in the current file, tap on the Main Menu and select Map. Stored data points for that particular file will appear. Use the +/- and <-/-> icons in lower left hand corner of screen to zoom in/out and to manipulate current view.
2) To return to data collection, tap on the Main Menu and select Data. You are now ready to continue to collect additional data points.

4.6 Viewing Data or Entering Data Points from an Existing File

1) To view data points from a previous file, tap on Main Menu and select Data, then select File Manager from the Sub Menu.
2) Highlight the file you want to view and select Map from the Main Menu.
3) To add data points to this file, tap on Main Menu and select Data. Continue to collect additional data points.

4.7 Shutting Down

This section provides instruction for properly shutting down the GPS unit.

1) When shutting down the GPS unit for the day, first click on the "X" in the upper right hand corner.
2) You will be prompted to ensure you want to exit TerraSync. Select Yes.
3) Power off the GPS unit by pushing the small green button located on the bottom face of the unit.
4) Place the GPS unit in its cradle to recharge the battery overnight. Ensure the green charge light is visible on the charging cradle.

5.0 DATA TRANSFER

This section describes how data should be downloaded from the GPS units and uploaded to a central website for post-processing and integration into GIS datasets. GPS data collected on a given day should be transferred **that night** for post-processing by GIS staff the next morning. Once post-processed, the GPS data will be plotted on a map and be immediately provided to the project team for review. Data upload, download, and review will be facilitated through a secure MRP website: http://www.ttnus.com/MRPRepository/

5.1 Load Data from the GPS Unit to Your Computer

1) Install the Data Transfer and ActiveSync software installed on your PC (see section 2.2)
2) Connect the GeoXH/XT to your PC via an A/B USB cable (blade end and square end type "HP printer" style)
3) ActiveSync should auto-detect the connection and recognize the data collector
4) Make sure the data file desired is CLOSED in TerraSync prior to transfer
5) Connect via ActiveSync as a guest (not a partnership)

6) Run the Trimble Data Transfer Utility program on your PC
7) Select "***GIS Datalogger on Windows CE***" or similar selection
8) Hit the green connect icon to the right - the far right area should say "***Connected to ....***" if successful
9) Select the "***Receive***" data tab (under device)
10) Select "***Data***" from file types on the right
11) Find the file(s) needed for data transfer. You can sort the data files by clicking on the date/time header
12) Select or browse to a C-drive folder you can put this file for upload
13) When the file appears on the list, hit the "***Transfer All***". Once complete, a packet of multiple data files will appear on your computer in the specified folder.

5.2 Gain Access to MRP Website

1) Confirm that your computer has internet access
2) Click on the following link: http://www.ttnus.com/MRPRepository/
3) To register for the website, click on the "Register here" link. Enter your information and click "Submit." NOTE: Requests for registration are sent to Ralph Basinski, Program Manager, for approval. Please contact mark.maguire@tetratech.com if you experience any access issues.
4) Enter your username (Tetra Tech email address) and password to log in.

5.3 Upload GPS Data from Your Computer to the MRP Website

1) From the main page, select "Upload" from the menu at left.
2) Select the type of data you are uploading, typically "GPS Field Data"
3) Select the appropriate Installation and Site. Remember that GPS files should be unique for each site, even if multiple sites are visited in one day. If collected data is not associated with a site, select "Other."
4) Select "browse" to navigate to the appropriate *.SSF file on your computer. When you use the Trimble download utility to grab data from the GPS unit, multiple files will appear on your computer. You only need to the upload the *.SSF file.
5) Populate the "Comments" field to describe the dataset and any other pertinent information. This information will be provided to the GIS analyst who will be integrating the dataset, so be sure to be as descriptive as possible especially if there are any issues with the data. (For example, if you were to sample 16 points and for some reason you believe only 15 were logged, it is helpful to share this information.)
7) Select "Upload." Users will be notified if the files were uploaded successfully.

5.4 Download Data from the MRP Website to Your Computer

The download utility on the MRP website will serve different user types. **Field staff** will use the utility to download GIS figures (in PDF format) and view the previous day(s) field data on aerial photographs, checking for any discrepancies or missing data elements. **Project Managers** will also have the ability to download and view these figures, to visualize the data and track project

progress. This utility will also allow **GIS Analysts** to download the *.SSF files posted by field staff for post-processing and map plotting.

To download GIS Figures:

1) From the main page, select "Download" from the menu at left.
2) Select an Installation and Site
3) Users can view Figures for a particular date or by a range of dates, by selecting the ` appropriate options. To search all dates, leave all of these fields as the default.
4) Select "Search"
5) A table will appear showing the files available for download. Simply click on the link to the file and you will be prompted to save it to your computer.

TABLE 1

Related Field Forms

Form Number	Frequency	Form Name
MRP FF.3	Daily	Daily Equipment Checklist

C.4 SOP-06 - VEGETATION MANAGEMENT AT MEC SITES

STANDARD OPERATING PROCEDURE
MRP SOP 06
VEGETATION MANAGEMENT AT MEC SITES

1.0 SCOPE AND APPLICABILITY

This document is designed to set a standard operating procedure (SOP) for vegetation management during activities performed at Munitions and Explosives of Concern (MEC) sites. Inherently, a strong possibility exists that MEC and material potentially presenting an explosive hazard (MPPEH) may be encountered. The procedures detailed in MRP SOP 01, UXO Detector-Aided Surface Surveys, provide specific guidance for UXO survey operations and equipment. MRP SOP 02, MEC Management and Accountability, provides instructions and procedures to be followed in the event that suspect MEC/MPPEH is encountered. Additionally, MEC activities will be performed in accordance with all local, State, and federal regulations and will include all applicable DoD requirements.

2.0 BACKGROUND

Vegetation management may be required in preparation for field activities at MEC sites. Trees, brush, grass, and other vegetation can impede the performance of MEC operations, geophysical surveys, and related investigation and remediation activities. The degree of vegetation removal will be site-specific and based upon the conditions encountered and activities to be conducted. Following is a general discussion of the type of equipment/techniques that will be used.

- Hand held brush cutters (string or blade) will be used to cut light vegetation and small grassy areas.
- Mechanized lawn mowers will be used to mow larger grassy areas.
- Chain saws will be used in heavier brush areas, to trim tree limbs, and to cut small trees up to 2 inches in diameter.
- Tractor-mounted brush hogs will be used in larger areas and heavier brush areas.
- Brush/vegetation cutting will be left at the site of the area cleared. If this is impractical, a wood chipper may be utilized.

Smaller brush cutting/vegetation management operation will be conducted by the Unexploded Ordnance (UXO) staff. On larger project sites, subcontractors may be utilized. If it is necessary to utilize subcontractors, an UXO escort will be provided during subcontracted brush/vegetation management operation.

3.0. PERSONNEL QUALIFICATIONS

UXO personnel shall meet the training requirements as stated in DDESB TP-18. Subcontractors will meet the training and medical surveillance requirements as stated in the Tetra Tech NUS Health and Safety Guidance Manual. Where applicable, vegetation

management equipment will only be operated by personnel licensed or certified on that equipment.

4.0. VEGETATION MANAGEMENT

Vegetation management at MEC sites may range from minor grass cutting and tree limb trimming to the total removal of all site vegetation. The extent and methods of vegetation management are driven primarily by the project specific scope of work, but will also be influenced by such factors as munition sensitivity, terrain, impacts to the environment, threatened or endangered species, current and future land use, available technology, and cost.

Prior to conducting vegetation management operations, a visual UXO surface survey will be conducted. All suspect MEC/MPPEH will be located and marked. UXO avoidance will be practiced during vegetation management operations. Vegetation management crews will not work within marked areas containing suspect MEC/MPPEH. Additionally, brush and grass will be cut no closer than 6 inches from the ground surface to avoid inadvertent contact with partially buried or shallow subsurface MEC.

Site Setup

The boundary of the work area will be established by land survey or GPS coordinates. Corner points of grids and start and end points of transects will also be located. Boundary lines of grids and transect lines will be marked using engineers flagging tape to provide visual guidance for the vegetation management crew when line of sight between stakes or markers is impeded.

UXO Escort will be provided for survey personnel and no stakes or markers will be driven into the ground until the immediate area of the stake or marker is surveyed and declared clear of surface and shallow subsurface anomalies.

Tree Cutting

Tree cutting will occur on a case-by-case basis as required to accomplish the site-specific scope of work. Trees will be cut using chainsaws or hand tools. Generally, trees 2 inches in diameter and smaller will be cut as necessary to facilitate the planned site activities. Trees will be sectioned, if necessary, and removed from the immediate work area to avoid interfering with site operations.

Brush Cutting

Brush cutting will be accomplished using hand held brush cutters equipped with string or blade cutting attachments. Larger or heavier brush may require the use of chainsaws. Where appropriate, a tractor or skid-steer with a bush hog mower attachment may also be used. Brush will be cut to a height that allows clearance for UXO operations and geophysical equipment operation but no closer than 6 inches above the ground surface.

Grass Cutting

Grass cutting will be accomplished using mechanized lawn mowing equipment or hand held brush cutters equipped with string attachments. Grass will be cut to a height that allows

clearance for UXO operations and geophysical equipment operation but no closer than 6 inches above the ground surface.

Alternative Methods

In rare instances, large scale vegetation clearance methods such as controlled burning or hydraulic ax deforestation may be necessary. An UXO escort will be provided during large scale vegetation clearance operations. At no time will UXO staff directly engage in controlled burning operations or in the operation of hydraulic ax deforestation equipment.

5.0 VEGETATION DISPOSAL

Vegetation disposal must be coordinated with the facility environmental office. Provided that site activities do not result in significant quantities of material, the preferred method of vegetation disposal will be on-site disposal. Vegetation will be removed from the immediate work area to avoid interfering with site activities, and allowed to naturally decompose.

A wood chipper may also be used to effectively dispose of vegetation without removing the vegetation from the work site. Wood chips will be disposed of away from the immediate work area to avoid interfering with site activities when possible. If necessary, wood chips will be spread over the work site to a depth of no greater than 4 inches to avoid interference with detection depth capabilities of UXO and geophysics equipment.

6.0 SAFETY

General safety precautions are located in the Tetra Tech NUS Health and Safety Guidance Manual. Specific guidelines are located in the site-specific Health and Safety Plan (HASP) and the Accident Prevention Plan (APP).

Personal Protective Equipment (PPE)

PPE for vegetation management operations will be level D protection with the following additions:

- Logging helmet with attached face shield
- Chainsaw chaps
- Hearing protection
- Leather work gloves

Personnel Safety

The UXO Safety Officer (UXOSO) will be on-site at all times during vegetation management operations. The primary responsibilities of the UXOSO during vegetation management activities are:

- To provide a safety brief detailing the operation, safety, and maintenance of the specific equipment being utilized;

- To insure that MEC/MPPEH hazards remain a primary concern for personnel involved in vegetation management activities;
- To insure that PPE is serviceable and worn properly during vegetation removal activities; and
- To insure that individual personnel utilizing vegetation removal equipment maintain safe working distances from other personnel within the work area.

Additionally, an UXO Escort will be provided at all times during vegetation management activities. The UXO Escort will be utilized even when UXO Staff perform vegetation management. This will provide a more focused observation of the work area for MEC/MPPEH and related hazards.

Equipment Safety

Equipment will be inspected for serviceability daily prior to the commencement of vegetation management activities. Periodic spot checks will also be conducted throughout the day to insure that chains and blades remain properly tightened and sharpened. All equipment will be operated and maintained in accordance with the manufacturer's recommendations.

TABLE 1

Related Field Forms

Form Number	Frequency	Form Name
MRP FF.1	Once	Sap Worksheet No 4-Project Sign-Off
MRP FF.3	Daily	Daily Equipment Checklist
MRP FF.5	Daily	Daily Photographic Log
MRP FF.15	Daily	Daily QC Report
MRP FF.16	Once per Definable Feature	Preparatory Phase Inspection Report
MRP FF.17	Once per Definable Feature	Initial Phase Inspection Report
MRP FF.18	Periodic	Follow Up Phase Inspection Report
MRP FF.21	Daily	Daily Safety Log
MRP FF.22	Daily	Daily Tailgate Safety Briefing-Training Record Form
MRP FF.24	As Needed	Equipment Maintenance-Repair Form

C.5 SOP-07 - UXO DEMOLITION/DISPOSAL OPERATIONS

STANDARD OPERATING PROCEDURE
MRP SOP 07
UXO DEMOLITION/DISPOSAL OPERATIONS

1.0 SCOPE AND APPLICABILITY

The purpose of this Standard Operating Procedure (SOP) is to provide the minimum procedures and safety and health requirements applicable to the conduct of demolition/disposal operations on sites contaminated with Munitions and Explosives of Concern (MEC). This SOP is not site-specific, but rather is intended as a general guidance document for a variety of sites and conditions.

2.0 BACKGROUND

This SOP applies to all site personnel, including contractor and subcontractor personnel, involved in the conduct of demolition/disposal operations on an MEC contaminated site. This SOP is not intended to contain all of the requirements needed to ensure complete compliance, and should be used in conjunction with project plans and applicable Federal, state and local regulations. Applicable sections and paragraphs in the documents listed below will be used as references for the conduct of demolition/disposal operations:

- Tetra Tech NUS, Inc. Corporate Safety and Health Program;
- EP 385-1-95a, Basic Safety Concepts and Considerations for OE Operations;
- EP 1110-1-17, Establishing a Temporary OB/OD Site for Conventional Ordnance and Explosives Projects;
- USACE EM 385-1-1, Safety and Health Requirements Manual;
- DoD 4145.26-M, Contractor's Safety Manual for Ammunition and Explosives;
- DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards;
- DA PAM 385-64, Ammunition and Explosives Safety Standards;
- TM 60A-1-1-31, EOD Disposal Procedures;
- AR 190-11, Physical Security of Arms, Ammunition and Explosives;
- ATF 5400.7, Alcohol Tobacco and Firearms Explosives Laws and Regulations; and
- Applicable sections of DOT, 49 CFR Parts 100 to 199.

3.0 PERSONNEL QUALIFICATIONS AND RESPONSIBILITIES

UXO personnel conducting explosive demolition and disposal operations shall be graduates of a military Explosive Ordnance Disposal (EOD) School of the United States, Canada, Great Britain, Germany, or Australia or a graduate of a formal training course of instruction or EOD assistant course as stated in DDESB TP-18.

3.1 UXO Project Manager

The UXO Project Manager (PM) shall be responsible for ensuring the availability of the resources needed to implement this SOP, and shall also ensure that this SOP is incorporated in plans, procedures and training for sites where this SOP is to be implemented.

3.2 Senior UXO Supervisor

The Senior UXO Supervisor (SUXOS) will be responsible for assuring that adequate safety measures and housekeeping are taken during demolition activities, and shall visit demolition locations to ensure that demolition operations are carried out in a safe, clean, efficient, and economical manner.

3.3 UXO Technician III (Demolition Supervisor)

A designated UXO Tech III shall act as the Demolition Supervisor (DS). There may be more than one DS assigned to a project site due to conducting simultaneous operations and divergent sites. The demolition activities shall be conducted under the direct control of the DS, who will have the responsibility of supervising all demolition operations assigned to him. The DS shall be responsible for training all on-site UXO demolition personnel on his team regarding the nature of the materials handled, the hazards involved, and the precautions necessary to conduct a safe demolition operation. The DS will also ensure that the Daily Operational Log, Demolition Shot Records, and inventory records are properly filled and accurately depict the demolition events and demolition material consumption for each day's operations. The DS shall be present during all demolition operations.

3.4 UXO Safety Officer

The UXO Safety Officer (UXOSO) for the site is responsible for ensuring that all demolition operations are being conducted in a safe and compliant manner, and is required to be present during all demolition operations. The only exception to this rule is when the project site has multiple sites conducting concurrent munitions response (MR) operations, and it is impossible for the UXOSO to be present at each shot. In that event, a demolition team safety officer will be designated. This individual will report to the UXOSO and assume the UXOSO's responsibilities at the designated demolition operation. In this situation, the UXOSO will conduct periodic safety audits of the demolition teams and assist the demolition team's safety officers in the performance of their duties. The UXOSO or demolition team safety officer will inspect the demolition shot(s) for hazards and then assisted by the DS and UXO Tech IIs, will inspect each demolition pit and an area of up to 250 feet in radius after each demolition shot to ensure that no kick-outs of hazardous MEC components or other hazardous items has occurred.

3.5 UXO Quality Control

The UXO Quality Control Specialist (UXOQC) is responsible for inspecting, the Daily Operational Log, the Demolition Shot Record, and the inventory of MEC and demolition material. The UXOQC will check the pit/demolition site with a magnetometer and large metal fragments exceeding the pass/fail requirements of the SOW will be removed.

4.0 GENERAL OPERATIONAL AND SAFETY PROCEDURES

All personnel, including contractor and subcontractor personnel, involved in operations on MEC contaminated sites shall be familiar with the potential safety and health hazards associated with the conduct of demolition/disposal operations, and with the work practices and control techniques used to reduce or eliminate these hazards. During demolition operations, general safety provisions listed below will strictly followed by all demolition personnel. Non-compliance

with the general safety provisions will result in disciplinary action, to include termination of employment if warranted.

- All safety regulations applicable to BIP and/or demolition range activities and the destruction of MEC materials involved shall be complied with.

- Demolition of any kind is prohibited without the express authorization from the client.

- The quantity of MEC to be destroyed will be determined by the agreed to limit, with the net explosive weight (NEW) of the demolition explosives factored into the total NEW.

- In the event of an electrical storm, or heavy snow or dust storms, immediate action will be taken to cease all demolition operations and evacuate the area.

- In the event of a fire or unplanned explosion, if possible, put out the fire. If unable to do so, notify fire and police departments, and evacuate the area. If injuries are involved, remove victims from danger, administer first aid, and seek medical attention.

- The DS is responsible for reporting all injuries and accidents that occur to the UXOSO.

- Demolition team personnel will not tamper with any safety devices or protective equipment.

- Any defect in demolition material or an unusual condition that is not covered by this SOP will be reported immediately to the DS and UXOSO.

- Demolition procedures shall be conducted in accordance with this SOP and applicable references in Section 2.0.

- Adequate fire protection and first aid equipment shall be provided at all times.

- All personnel engaged in the destruction of MEC shall wear under and outer garments made of close-weave natural fiber, such as cotton. Synthetic material such as nylon is not authorized unless treated with anti-static material.

- Care will be taken to minimize exposure to the smallest number of personnel, for the shortest time, to the least amount of hazard, consistent with safe and efficient operations.

- Work locations will be maintained in a neat and orderly condition.

- All demolition hand tools shall be maintained in a good state of repair.

- Each heavy equipment and/or vehicle operator will have in his possession a valid operator's permit, i.e., state driver’s license, certificate of training for backhoe/excavator etc.

- Leather or leather-palmed gloves will be worn when handling wooden boxes, munitions, or MEC. If bulk or binary explosives are being handled then rubber gloves, such as Nitrile, will be worn.

- Lifting and carrying require care. Improper methods cause unnecessary strains. Observe the following preliminaries before attempting to lift or carry:
    - When lifting, keep your arms and back as straight as possible, bend your knees and lift with your leg muscles; and
    - Be sure you have good footing and hold, and lift with a smooth, even motion.

- The demolition BIP location and/or range shall be provided with telephone and radio communication.

- Motor vehicles and material handling equipment (MHE) used for transporting MEC or demolition materials must meet the following requirements:
    - Exhaust systems shall be kept in good mechanical repair.
    - Lighting systems shall be an integral part of the vehicle.
    - One 20 BC rated portable fire extinguisher shall be, if possible, mounted on the vehicle outside of the driver's cab or two 10BC fire extinguishers, with one inside the cab and the other near the front portion of the vehicle bed, nearest the driver.
    - Wheels of carriers must be chocked and brakes set during loading and unloading.

- No demolition material or MEC shall be loaded into or unloaded from, motor vehicles while the engine is operating.

- Motor vehicles and MHE used to transport demolition material and MEC shall be inspected prior to use to determine that:
    - Fire extinguishers are filled and in good working order.
    - Electrical wiring is in good condition and properly attached.
    - Fuel tank and piping are secure and not leaking.
    - Brakes, steering and safety equipment are in good condition.
    - The exhaust system is not exposed to accumulations of grease, oil, gasoline, or other fuels, and has ample clearance from fuel lines and other combustible materials.

- A red warning flag, such as a "Bravo Flag", a windsock, or rag will be displayed at the entrance to the demolition range and, if applicable, the entrance gate shall be locked when demolition work is in process. This is only applicable if an open detonation (OD) range has been established with demo pits for all shots.

- Unless otherwise directed, all demolition shots will be tamped with a minimum of two feet of clean earth/dirt or the appropriate thickness of sand bags as indicated on the Fragmentation Data Review Form.

- An observer will be stationed at a location where there is a good view of the air and surface approaches to the demolition range before material is detonated. It shall be the responsibility of the observer to order the DS to suspend firing if any aircraft, vehicles or personnel are sighted approaching the general demolition area.

- Two-way radios shall not be operated while the shot is primed or during the priming process. The charts shown in Attachment 1 of this SOP shall be used for determining the safe distances from transmitter antennas.

- No Demolition operation will be left unattended during the active portion of the operation (i.e., during the burn or once any explosives or MEC are brought to the BIP location or range).

- A minimum area of 200 feet in diameter shall be cleared of dry grass, leaves, and other extraneous combustible materials around the demolition shot/pit area if a demolition range has been established. The area around the BIP location shall be free of any combustible material and wetted down if necessary.

- No demolition activities will be conducted if there is less than a 2,000-foot ceiling or if wind velocity is in excess of 20 mph.

- Demolition-shots must be fired during daylight hours (i.e., between 30 minutes after sunrise and 30 minutes before sunset).

- No more than two individuals shall ride in a truck transporting demolition material or MEC, and no one shall be allowed to ride in the trailer/bed.

- Vehicles shall not be refueled when carrying demolition material or MEC, and must be 100 feet from magazines or trailers containing such items before refueling.

- All vehicles used for the transport of explosives will be cleaned of visible explosive and other contamination before releasing the vehicles for other tasks.

- Prior to conducting any other task, personnel shall wash their face and hands after handling demolition material or MEC.

- At the demolition site, prior to “check-out” procedures, all blasting caps will be stored in approved containers (IME 22 or equivalent) and separated a minimum of 50 feet from all other explosives until they are needed.

- Demolition shots/pits shall be spaced at least 50 feet apart, with no more than 10 shots/pits prepared for a series of shots at any one time.

5.0 SPECIAL REQUIREMENTS FOR DEMOLITION

The following safety and operational requirements shall be followed during demolition operations. Any deviations from this procedure shall be allowed only after approval from the Tetra Tech UXO PM. Failure to adhere to the requirements and procedures listed in the paragraphs below could result in serious injury or death; therefore, complete compliance with these requirements and procedures will be strictly enforced.

5.1 General Requirements

The general demolition range/shot requirements listed below shall be followed at all times:

- Attachment 1 of this SOP, "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites," will be followed when destroying multiple munitions by detonation.

- Attachment 2 of this SOP, Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions.

- Attachment 3 of this SOP, “Use of Water for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions” may be used when fragmentation throws and fire is a concern.

- Items awaiting explosive destruction and demolition material shall be protected against accidental ignition or explosion from fragments, grass fires, burning embers or detonating impulses originating in materials being destroyed.

- MEC or bulk explosives, acceptable to move, and destroyed by detonation can be detonated in a pit not less than three feet deep and covered with earth which protrudes not less than two feet above existing ground level or IAW the Fragmentation Data Guide for the item which is to be detonated. The components should be placed on their sides or in a position to expose the largest area to the influence of the demolition material. The demolition material should be placed in intimate contact with the item to be detonated and held in place by tape or earth packed over the demolition materials. The total NEW to be destroyed below ground at one time shall not exceed the agreed to limit.

- Prevailing weather condition information will be obtained from the U.S. Weather Service and the data logged in the Demolition Shot Log before each shot or round of shots.

- All shots shall be dual primed.

- A minimum of 30 seconds will be maintained between each detonation.

- Detonations will be counted to ensure detonation of all shots. After each series of detonations, a search shall be made of the surrounding area for hazardous items. Items such as lumps of explosives or unfuzed ammunition may be picked up and prepared for the next shot. Fuzed ammunition or items that may have internally damaged components will be detonated in place, if possible.

- After each-detonation and at the end of each day's operations, surface exposed munitions debris, shall be recovered from the demolition site and disposed of in accordance with contracted procedures, as well as all applicable environmental regulations. All collected munitions debris metal will be 100% inspected for absence of explosive materials by demolition range personnel and certified by the SUXOS and the UXOQC.

- When operated in accordance with the conditions of this procedure the demolition shot should not present a noise problem to the surrounding community. However, if a noise complaint is received, the name, address and phone number of the complainant should be recorded and reported to the SUXOS, who in turn will report it to the UXO PM and Facility POC.

- Whenever possible, during excavation of demolition pits contour the ground so that runoff water is channeled away from the pits. If demolition operations are discontinued for more than two weeks, the pits should be back filled until operations resume.

- Upon completion of the project, all disturbed demolition areas will be thoroughly inspected for MEC. According to the SOW, the site may have to be leveled and seeded to establish a permanent vegetative cover to inhibit erosion. If necessary, this will be coordinated with the contractor representative. At a minimum, the holes/pits will be filled in and contoured.

- Prior to and after each shot, the Demolition Shot Record is to be filled out by the DS with all applicable information.

5.2 Electric Detonator Use

The following requirements are necessary when using electric detonators and blasting circuits:

- Electric detonators and electric blasting circuits may be energized to dangerous levels from outside sources such as static electricity, induced electric currents, and radio transmission equipment. Safety precautions will be taken to reduce the possibility of a premature detonation of an electric detonator and explosive charges of which they form a part. Demolition Team radios will not be operated while the pit/shot is primed or during the priming process.

- Demolition team members handling detonators will first ground themselves by bending down and touching the ground, which will discharge any static electricity.

- The shunt shall not be removed from the leg wires of the detonator until the continuity check.

- When uncoiling or straightening the detonator leg wires; keep the explosive ends of the detonator pointing away from the body and away from other personnel. When straightening the leg wires, do not hold the detonator itself; rather hold the detonator leg wires approximately one inch from the detonator body. Straighten the leg wires by hand, do not throw, or wave the wires through the air to loosen them.

- Prior to use, the detonators shall be tested for continuity. To conduct the test, place the detonators in a pre-bored hole in the ground or place them in a sand bag and walk facing away from the detonators and stretch the wires to their full length, or to 25 feet, whichever is less, being sure to not pull the detonators from the hole or sand bag. With the leg wires stretched to their full length, test the continuity of the detonators one at a time by un-shunting the leg wires and attaching them to the galvanometer and checking for continuity. After the test, re-shunt the wires by twisting the two ends together. Repeat this process for each detonator until all detonators have been tested. This process shall be accomplished at least 50 feet down wind from any MEC/demolition materials and out of the personnel and vehicle flow patterns. In addition, all personnel on the demolition range/shot shall be alerted prior to the test being conducted.

NOTE: When testing the detonator, prior to connecting the detonator to the firing circuit, the leg wires of the detonator must be shunted by twisting the bare ends of the wires together immediately after testing. The wires shall remain short circuited until time to connect them to the firing line.

- At the power source end of the blasting circuit, the ends of the firing line wires shall be shorted or twisted together (shunted) at all times, except when actually testing the circuit or firing the charge. The connection between the detonator and the circuit firing wires must not be made unless the power end of the firing wires are shorted and grounded or the firing panel is off and locked.

- The firing line will be checked using pre-arranged hand signals or through the use of two-way radios if the demolition pit/shot is not visible from the firing point. If radios are used, communication shall be accomplished a minimum of 50 feet from the demolition pit/shot and detonators. The firing line will be checked for electrical continuity in both the open and closed positions, and will be closed and shunted prior to connecting the detonator leg wires.

- MEC to be detonated or vented shall be placed in the demolition pit/shot and the demolition material placed/attached in such a manner as to ensure the total detonation and/or venting of the MEC. A section of detonation cord, time fuze, or Non-El shock tube will extend from the demolition material to a point outside the tamping material. Once the MEC and demolition material are in place and the shot has been tamped, the detonators will be connected to the demolition material. Prior to handling detonators that are connected to the firing line, personnel shall ensure that they once again ground themselves. The detonators will then be carried to the demolition pit/shot with the end of the detonators pointed away from the individual. The detonators are then connected to the detonation cord, Non-El, etc., ensuring that the detonator is not covered with tamping material to allow for ease of recovery/investigation in the event of a miss-fire.

- Prior to making connections to the blasting machine, the entire firing circuit shall be tested with a galvanometer for electrical continuity and ohmic resistance to ensure the blasting machine has the capacity to initiate the shot.

- The individual assigned to make the connections at the blasting machine or panel will not complete the circuit at the blasting machine or panel and will not give the signal for detonation until satisfied that all personnel in the vicinity have been evacuated to a predetermined distance. When in use, the blasting machine or its actuating device shall be in the blaster's possession at all times. When using the panel, the switch must be locked in the open position until ready to fire, and the single key must be in the blaster's possession.

- Prior to initiating a demolition shot(s), a warning will be given, the type and duration of such will be determined by the prevailing conditions at the demolition range/shot. At a minimum, this should be an audible signal using a siren, air horn, or megaphone, which is sounded for 1 minute duration, 5 minutes prior to the shot and again 1 minute prior to the shot.

5.3 Detonating Cord Use

The following procedures are required when using detonating cord (det cord):

- Det cord should be cut using approved crimpers and only the amount required should be removed from inventory.

- When cutting det cord, the task should be performed outside the magazine.

- For ease of inventory control, only remove det cord in one-foot increments.

- Det cord should not be placed in clothing pockets or around the neck, arm or waist, and should be transported to the demolition location in either an approved "day box" or a cloth satchel, depending upon the magazine location and proximity to the demolition area.

- When ready to "tie in" either the det cord to demolition materials, or det cord to detonator, the det cord will be connected to the demolition material and secured to the MEC. The cord is then strung out of the hole/tamping material and secured in place with soil, being sure to leave a one-foot tail exposed outside the hole/tamping material.

- Once the hole is filled or tamping in place, make a loop in the det cord large enough to accommodate the detonator, place the detonator in the loop and secure it with tape. The detonator's explosive end will face down the det cord toward the demolition material or parallel to the main line.

- In all cases, ensure there is sufficient det cord extending out of the hole/tamping material to allow for ease of detonator attachment and detonator inspection/replacement should a misfire occur.

- If the det cord detonators are electric, they will be checked, tied in to the firing line and shunted prior to being taped to the loop as described above. If the det cord detonators are non-electric, the time/safety fuse will be prepared with the igniter in place prior to taping the detonators to the det cord loop. If the det cord detonators are Non-El, simply tape the detonators into the loop as described above.

- In the event that a time/safety fuse is used, and an igniter is not available and a field expedient initiation system must be used (i.e., matches), do not split the safety fuse until the detonator is taped into the det cord loop.

5.4 Shock Tube Splicing Procedures

The high reliability of the shock tube initiating system 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 and foreign contamination, therefore care must be taken to prevent moisture and foreign matter from getting in the shock tubes exposed ends. Some general rules to follow are listed below.

- After cutting a piece of shock tube, either immediately tie a tight overhand knot in one or both cut ends or splice one exposed end and tie off the other.
- Always use a sharp knife or razor blade to cut shock tube so as to prevent the tube from being pinched or otherwise obstructed.
- Always cut shock tube squarely across and make sure the cut is clean.
- Use only the splicing tubes provided by the manufacturer to make splices
- Every splice in the shock tube reduces the reliability of the priming system; therefore keep the number of splices to a minimum.

5.4.1 Shock Tube Assembly

Step 1. If you are using a new role of shock tube cut off the sealed end, dispose of the small piece IAW local laws as they relate to flammable material and proceed to the directions listed in Step 3. If you are using a pre-assembled shock tube/detonator assembly proceed to Step 1 in paragraph 5.4.2.

Step 2. If you are using a previously cut piece of shock tube, using a sharp knife or razor blade cut approximately 18 inches from the previously cut end, whether or not it was knotted IAW the above guidance. Dispose of the 18-inch piece of shock tube IAW local regulations.

Step 3. Using a sharp knife or razor cut the sealed end off of the detonator assembly and dispose of the small piece as above.

Step 4. Loosely tie the two shock tube ends to be sliced together in a square knot, leaving at least a two-inch free end of each end of the shock tube beyond the knot. Push the shock tube lightly to tighten the knot, but not so tight as to significantly deform the shock tube.

Step 5. Push one of the shock tube ends to be spliced firmly into one of the precut splicing tubes provided by the manufacturer, at least ¼ inches. Push the other shock tube end firmly into the other end of the splicing tube at least ¼ inches.

Step 6. Spool out the desired length of shock tube and cut it off with a sharp knife or razor blade.

Step 7. Immediately seal off the shock tube remaining on the spool by tying a tight overhand knot in the cut off end.

5.4.2 Firing Assembly Setup

Step 1. Lay out the required length of shock tube from demo area to firing point.

Step 2. If there are multiple items to be destroyed using bunch block(s), supplied by the manufacturer, lay out lead lines at demo site to the shot(s) and secure the bunch block with a sandbag, or some other item which will keep it from moving. Figure 1 illustrates the procedure.

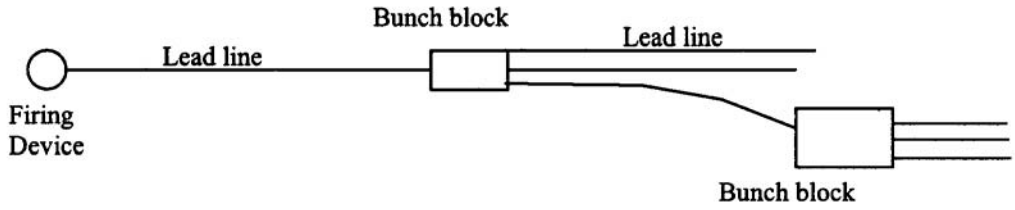

Figure 1

Note: No more than six leads may be used from any one bunch block.

Step 3. If the detonator assembly has not been attached yet then using the splicing tube, splice the detonator assembly to the shock tube lead line as explained in the splicing instructions above.

Step 4. If this is a non-tamped shot place the detonator assembly into the demolition material. If the shot is to be tamped then prepare the demolition material with a detonating cord lead long enough to stick out of the tamping at least one foot.

Step 5. Tape the detonator assembly to the detonating cord lead as shown in Figure 2.

Step 6. Clear the area IAW the approved demolition plan, return to the firing position.

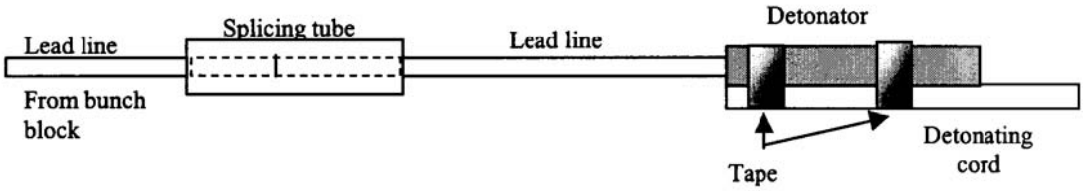

Figure 2

Step 7. Insert a primer into the firing device and connect the shock tube lead line to the firing device ensuring that the shock tube is properly seated in the firing device.

Step 8. Proceed IAW the approved demolition procedures.

5.5 Time/Safety Fuse Use

The following procedures are required when using a time/safety fuse:

- Prior to each daily use, the burn rate for the time/safety fuse must be tested to ensure the accurate determination of the length of time/safety fuse needed to achieve the minimum burn time of five minutes needed to conduct demolition operations.

- To ensure both ends of the time/safety fuse are moisture free, use approved crimpers to cut 6 inches off the end of the time/safety fuse roll and place the 6 inch piece in the time/safety fuse container.

- If quantity allows, accurately measure and cut off a 6 foot long piece of the time/safety fuse from the roll, and take the six-foot section out of the magazine and attach a fuse igniter.

- In a safe location, removed from demolition materials and MEC, ignite the time/safety fuse, measure the burn time from the point of initiation to the "spit" at the end, and record the burn time in the DS's Log.

- To measure the burn time, use a watch with a second hand, stopwatch, or chronograph.

- To calculate the burn rate in seconds per foot, divide the total burn time (in seconds) by the length (in feet) of the test fuse.

- Whenever using time/safety fuse, for demolition operations, the minimum amount of fuse to be used will be the amount needed to permit a minimum burn time of five minutes.

5.6 Perforator Use

The following procedures are required when using perforators:

- Only remove from inventory the number of perforators required to perform the task.
- Transport perforators in an approved "day box", cloth satchel or plastic container, depending upon magazine location and proximity to the demolition operations.
- When ready to use, place the det cord through the slot on the perforator and knot the det cord, ensuring the cord fits securely and has good continuity with the perforator.
- Once the det cord is secure, place the perforator in the desired location and secure it in place.
- Proceed from this point as described in paragraph 5.3.

5.7 Use of Two-Component Explosives

The following procedures are required when using two-component (binary) demolition materials:

- Only remove from inventory the amount of two-component required to perform the task.
- When transporting the solid and liquid, they need only be placed apart in the bed of a truck.
- Do not mix the solid and liquid components until certain that it will be used, since the resulting mixture is classified as a Class 1.1 explosive by Department of Transportation.
- When mixing the solid and liquids components, follow the manufacturer's instructions, while being sure to wear rubber gloves and goggles. Mix components in an area away from other demolition materials, the MEC, and if possible, sheltered from the wind.
- Once the components have been mixed, it is essential that the lid to the solid bottle be put on securely as soon as possible after mixing to prevent evaporation of the liquid.
- Attach the det cord as recommended by the manufacturer, place the assembled unit in the desired location in the hole/shot and secure the unit.
- Proceed from this point as described in paragraph 5.3.

5.8 Demolition Range/BIP Inspection Schedule

The demolition range/BIP inspection schedule outlined in Table 5-1 will be followed at all sites where demolition operations are being conducted. This inspection shall be conducted by the UXOSO and will be documented in the Site Safety Log. If any deficiencies are noted, demolition operations shall be suspended and the deficiency reported to the SUXOS and DS. Once the deficiencies are corrected, demolition operations may be resumed.

Table 5-1 - Demolition Range Inspection Schedule

Check List Item	Inspection Schedule	Check List Item	Inspection Schedule
Site and Explosive Carrier Vehicle	Weekly or Prior to Use	Personal Protective Equipment	Prior to Use
Range Access/Egress Route	Weekly or Prior to Use	Circuit Testing Device	Prior to Use
Entrance Gate/Lock	Weekly or Prior to Use	Demolition Site	Prior to Use
Storage Trailer/Magazine	Daily, Prior to Use and After Use	Operating Equipment	Prior to Use
Fire Extinguishers	Daily, Prior to Use and After Use	Hospital Route	Prior to Use

6.0 METEOROLOGICAL CONDITIONS

In order to control the effects of demolition operations and to ensure the safety of site personnel, the following meteorological limitations and requirements shall apply to demolition operations:

- Demolition operations will not be conducted during electrical storms or thunderstorms.
- No demolition operations shall be conducted if the surface wind speed is greater than 20 miles per hour.
- Demolition operations will not be conducted during periods when visibility is less than 1 mile caused by, but not limited to, dense fog, blowing snow, rain, sand or dust storms.
- Demolition shall not be carried out on extremely cloudy days that are defined as: overcast (more than 80% cloud cover) with a ceiling of less than 2,000 feet.
- Demolition operations will not be conducted during any atmospheric inversion condition (low or high altitude).
- Demolition operations will not be conducted during periods of local air quality advisories.
- Demolition operations will not be initiated until 30 minutes after sunrise, and will be secured at least 30 minutes prior to sunset.

7.0 PRE-DEMOLITION/DISPOSAL PROCEDURES

7.1 Pre-Demo/Disposal Operational Briefing

The DS will brief all personnel involved in range/shot operations in the following areas:

- Type of MEC being destroyed.
- Type, placement, and quantity of demolition material being used.

- Method of initiation (electric, non-electric or Non-El).
- Means of transporting and packaging MEC, if applicable.
- Route to the disposal site.
- Emergency procedures.
- Equipment being used (i.e., galvanometer, blasting machine, firing wire, etc.).
- Misfire procedures.
- Post shot clean up of range.

7.2 Pre-Demo/Disposal Safety Briefing

The UXOSO and DS will conduct a safety brief for all personnel involved in range operations in the following areas:

- Care and handling of explosive materials.
- Personal hygiene.
- Two-man rule and approved exceptions.
- Potential trip/fall hazards.
- Horseplay on the range.
- Stay alert for any explosive hazards.
- Location of emergency shelter (if available).
- Vehicle parking (vehicles must be oriented out of the site for immediate departure, with keys in the ignition).
- Location of emergency vehicle (keep engine running).
- Wind direction (to assess potential toxic fumes).
- Location of first aid kit and fire extinguisher.
- Route to nearest hospital or emergency aid station.
- Type of communications in event of an emergency.
- Storage location of demolition materials and MEC awaiting disposal.

7.3 Task Assignments

Individuals with assigned tasks will report the completion of the task to the DS. The types of tasks that may be required are:

- Contact local Police, Fire department, USCG and FAA as required.
- Contact hospital/emergency response personnel if applicable.
- Secure all access roads to the range/shot area.
- Visually check range/shot area for any unauthorized personnel.
- Check firing wire for continuity and shunt.
- Prepare designated pits/shots as required.
- Check continuity of detonators.
- Check time/safety fuse and its burn rate.
- Designate a custodian of the blasting machine, fuse igniters or Non-El initiator.
- Secure detonators in a safe location.
- Place MEC in pit, if applicable, and place charge in desired location.

7.4 Preparing Explosive Charge for Initiation

To prepare the explosive charge for initiation, the procedures listed below will be followed:

- Ensure firing wire is shunted.
- Connect detonator to the firing wire.
- Isolate or insulate all connections.
- Prime the demolition charge.
- Place demolition charge on MEC.
- Depart to firing point (if using non electric firing system, obtain head count, pull igniters and depart to designated safe area).
- Obtain a head count, and test blast machine for proper operation.
- Give 1-minute duration warning signal, using a bullhorn or siren, 5 minutes prior to detonation, and again at 1 minute prior to detonation.
- Check the firing circuit with a galvanometer.
- Yell "fire in the hole" three times (or an equivalent warning) and take cover.
- If using electric firing system connect firing wires to blasting machine and initiate charge.
- Remove firing wires from blasting machine and shunt.
- Remain in designated safe area until DS announces "All Clear". This will occur after a post-shot waiting period of 5-minutes and the UXOSO has and inspected the pit(s)/shot(s).

8.0 POST DEMOLITION/DISPOSAL PROCEDURES

Do not approach a smoking hole or allow personnel out of the designated safe area until cleared to do so, and follow the below listed procedures:

- After the "All Clear" signal, check pit/shot for low orders or kick outs.
- Check pit with a magnetometer and remove any large fragmentation.
- Any MEC items, failing to be properly disposed of, discovered during the post demolition procedures, will be destroyed prior to the end of the day.
- Back fill hole as necessary.
- Secure all equipment.
- Notify police, fire, etc. that the operation is complete.

9.0 MISFIRE PROCEDURES

A thorough check of all equipment, firing wire and detonators will prevent most misfires. However, if a misfire does occur, the procedures outlined below shall be followed.

9.1 Electric Misfires

To prevent electric misfires, one technician will be responsible for all electrical wiring in the circuit. If a misfire does occur, it must be cleared with extreme caution, and the responsible technician will investigate and correct the situation, using the steps outlined below:

- Check firing line and blasting machine connections and make a second initiation attempt.
- If unsuccessful, disconnect and connect to another blasting machine (if available) and attempt to initiate charge.
- If unsuccessful, commence a 60-minute wait period.

- After the maximum delay predicted for any part of the shot has passed, the UXOSO will proceed down range to inspect the firing system, and a safety observer must watch from a protected area.
- Disconnect and shunt the detonator wires from the leg wires, connect a new detonator to the firing circuit, check the replacement detonator for continuity, and prime the charge without disturbing the original detonator.
- Follow normal procedures for effecting initiation of the charge.

9.2 Non-Electric Misfires

Working on a non-electric misfire is the most hazardous of all operations. Occasionally, despite all painstaking efforts, a misfire will occur. Investigation and corrective action should be undertaken only by the technician that placed the charge, using the following procedure:

- If charge fails to detonate at the determined time, initiate a 60-minute wait period plus the time of the safety fuse, i.e., 5-minute safety fuse plus 60 minutes for a total of 65 minutes.
- After the wait period has expired, the designated technician will proceed down range to inspect the firing system. A safety observer must watch from a protected area.
- Prime the shot with a new non-electric firing system and install a new fuse igniter.
- Follow normal procedures for initiation of the charge.

9.3 Non-EL Misfire The most common cause of misfires is known as "black tube failure"

The shock tube propagates up to the detonator but the detonator fails to function, or there is a crimp in the line causing the shock wave to be interrupted. The following steps will be taken in the event of a misfire:

- If the shock tube fails to propagate and the tube remains clear, remove the shock tube from the firing device, cut off 6 inches of the shock tube, insert a new primer, reinsert the shock tube ensuring that it is properly seated and re-fire. If when you activate the firing device and the shock tube is blown out of the firing device without activating, cut off 6 inches of the shock tube, replace the primer and re-insert the shock tube into the firing device.

- If the primer functioned properly and the shock tube was heard or seen to fire, observe the standard 1 hour waiting period prior to going downrange.

- After the 1 hour waiting period has passed, proceed downrange and check the first component in the priming train i.e. splice, bunch block or detonator assembly. Repeat this process until you reach the detonator assembly. As you conduct this inspection and discover the problem, replace the firing train, which functioned (tube is no longer clear) with a new one and ensure that all the connections are correct and secure.

- After the system has been checked and repaired/replaced return to the firing point and repeat the firing process.

9.4 Detonating Cord Misfire

Det cord may be used to tie in multiple demolition shots and to ensure that electric detonators are not buried. Since det cord initiation will be either electrical or non-electrical, the procedures presented in paragraphs 9.1, 9.2, or 9.3, as appropriate to the type of detonator used, will be used to clear a det cord misfire. In addition, the following will be followed:

- If there is no problem with the initiating system, wait the prescribed amount of time and inspect the initiator to the cord connection to ensure it is properly connected. If it was a bad connection, simply attach a new initiator and follow the appropriate procedures in paragraph 6.0.

- If the initiator detonated and the cord did not, inspect the cord to ensure it is det cord and not time fuze. Also, check to ensure there is PETN in the cord at the connection to the initiator.

- It may be necessary to uncover the det cord and replace it. This must be accomplished carefully to ensure that the demolition charge and the MEC item are not disturbed.

9.5 Perforator Misfire

The use of perforators is considerably safer than the use of C-4 and many other demolition materials. If the perforator is not initiated properly, it could malfunction. Since the perforator is covered with tamping material, det cord is used as the initiator. Therefore, in the event of a misfire, the procedures presented in paragraph 9.4 will be followed, along with the items presented below:

- If everything went but the perforator, one of four things has occurred:

1. Det cord grain size was insufficient to initiate the perforator;

- Check to ensure the grain size of the det cord is sufficient, with 80-grain size or greater being the recommended size.

2. The det cord was dislodged from the perforator when placing tamping materials;

- If the det cord connection to the perforator was the problem, ensure that the next connection is secured (use duct tape if necessary).

3. The perforator was defective;

4. The perforator was moved during the placement of tamping materials.

- If it is evident that the perforator was moved, ensure it is properly secured for the next shot.
- If cord size and connection are sufficient, replace the perforator, leaving the defective one on the shot.

10.0 RECORD KEEPING REQUIREMENT

To document demolition operations and the destruction of MEC, the following record keeping requirements shall be met:

- Tetra Tech will obtain and maintain all required permits.
- The DS will ensure the accurate completion of the logs, and the SUXOS and UXOQCS will monitor the entries in the log for completeness, accuracy, and compliance with meteorological conditions.
- The DS shall enter the appropriate data on the Demolition Shot Record, to reflect the MEC destroyed, and shall complete the appropriate information on the Magazine Data Card, which indicates the demolition materials used.
- The quantities of MEC recovered must also be the quantities of MEC destroyed or disposed of as munitions debris or munitions constituents.
- Tetra Tech and/or its subcontractors will retain a permanent file of all Demolition Records, including permits, Magazine Data Cards, training records, inspector reports, waste manifests if applicable, and operating logs.
- Copies of ATF License and any state or local permits must be on hand.

Table 10-1
Related Field Forms

Form Number	Frequency	Form Name
MRP FF.1	Once	Sap Worksheet No 4-Project Sign-Off
MRP FF.2	Daily	Daily MEC Activity Log
MRP FF.5	Daily	Daily Photographic Log
MRP FF.10	Daily	MEC Accountability Form
MRP FF.21	Daily	Daily Safety Log
MRP FF.22	Daily	Daily Tailgate Safety Briefing-Training Record Form

11.0 SAFETY AND PPE REQUIREMENTS

The following safety measures and personal protective equipment shall be used in preventing or reducing exposure to the hazards associated with MEC demolition/disposal operations. These requirements will be implemented unless superseded by site-specific requirements stated in the Accident Prevention Plan (APP):

- Steel-toed safety boots will not be worn by demolition team personnel conducting demolition/disposal operations, unless a toe crush hazard exists, in which case personnel will wear boots with plastic or fiber toed safety toes;
- Unless a serious head, eye or face hazard exists, demolition team personnel will not be required to wear hard hats, safety glasses or face shields when conducting operations involving the handling of demolition explosives or MEC, except as stated previously; and

- In the event that a serious head, eye or face hazard does exist, demolition team personnel will wear the required PPE, but positive restraining means shall be required to secure the PPE to the head, face etc. and prevent it from falling and causing an accidental detonation.

12.0 AUDIT CRITERIA

The following items related to demolition/disposal operations on an MEC contaminated site will be audited to ensure compliance with this SOP:

- The Demolition Shot Record
- The Site Daily Operational and Safety Logs;
- The MEC Operations Daily/Weekly Report;
- The Safety Training Attendance Forms, for the initial site hazard training;
- The Safety Training Attendance Forms, for the Daily Tailgate Safety Briefings;
- The Daily Safety Inspection and Audit Log.

13.0 ATTACHMENTS

The following attachment to this SOP will be reviewed by all UXO-qualified personnel participating in demolition/disposal activities.

- Attachment 1 "Procedures for Demolition of Multiple Rounds Consolidated Shots on Ordnance and Explosives (OE) Sites"

- Attachment 2 Use of Sandbags for Mitigation of Fragmentation and Blasts Effects due to Intentional Detonation of Munitions (HNC-ED-CS-S-98-7)

- Attachment 3 Use of Water for Mitigation of Fragmentation and Blasts Effects due to Intentional Detonation of Munitions (HNC-ED-CS-S-00-3)

US Army Corps of Engineers
Engineering and Support Center, Huntsville

Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites

AUGUST 1998 (Terminology Update March 2000)

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331-0600

OCT 27 1998

DDESB-KO

MEMORANDUM FOR DIRECTOR US ARMY TECHNICAL CENTER FOR EXPLOSIVES SAFETY (ATTENTION: SIOAC-ES)

SUBJECT: Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives Sites

References: (a) Memorandum from SIOAC-ESL to Chairman DDESB (ATTN: DDESB-KO), 14 September 1998, SAB

(b) M. Crull and Wayne Shaw, US Army Corps of Engineers, Huntsville, "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites" (August 1998)

The subject procedures forwarded by reference (a) and defined in reference (b) have been reviewed with respect to explosives safety criteria. Based on the information furnished, the procedures proposed in reference (b) for the demolition of consolidated ordnance at OE sites are approved.

Point of contact is Dr. Chester E. Canada, DDESB-KT2 (PH: 703-325-1369, FAX: 703-325-6227, E-MAIL: canadce@hqda.army.mil).

for DANIEL T. TOMPKINS
Colonel, USAF
Chairman

Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites

August 1998

Prepared By

Michelle Crull, PhD, PE
Department of the Army
Huntsville Center, Corps of Engineers
Attn: CEHNC-ED-CS-S
P.O. Box 1600
Huntsville, AL 35807-4301
Telephone: Commercial 256-895-1653
And
Wayne Shaw
Department of the Army
Huntsville Center, Corps of Engineers
Attn: CEHNC-OE-CX
P.O. Box 1600
Huntsville, AL 35807-4301
Telephone: Commercial 256-895-1513

Reviewed by: _____ 8/27/98
Chief, Structural Branch — Date

Reviewed by: _____ 8/27/98
Chief, Civil-Structures Division — Date

Reviewed by: _____ 8/27/98
Chief, OE Center of Expertise — Date

Reviewed by: _____ 8/31/98
Chief, Ordnance & Explosives Team — Date

Reviewed by: _____ 8/28/98
Chief, OE Safety — Date

FOREWORD

The terminology in this report has been updated (March 2000) to reflect terminology used in the field. Specifically the term “personnel separation distance” has been replaced with the term “minimum separation distance for intentional detonations.” This is a change in terminology only, no change in content.

Per discussions with Dr. Chester Canada, Department of Defense Explosives Safety Board (DDESB) and Mr. Cliff Doyle, U.S. Army Technical Center for Explosives Safety (USATCES) this report is not re-submitted to the DDESB for approval.

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1.0 Introduction

The U.S. Army Engineering and Support Center, Huntsville (USAESCH) includes the Ordnance and Explosives Center of Expertise (OE-CX). Part of the OE-CX mission is development of procedures for removal and destruction of munitions found on OE sites. Standard procedures are to destroy the munitions by detonation on site. This includes both single round detonation in-place and multiple round detonation (or consolidated shots) at a pre-determined location. The procedures for multiple round detonation are described in this paper.

There are two situations that may describe the consolidated shot process: 1) munitions may be collected from anywhere on site and detonated at a designated, sited disposal area or 2) munitions may be collected within a grid and detonated at a designated spot within the grid. In either situation the same procedures, as described in the following paragraphs, must be followed.

2.0 Placement of Munitions

Munitions shall be placed with their sides touching such that their axis is horizontal as shown in Figure 1. The munitions shall be placed so that the nose of each munition is pointing in the same direction. Munitions shall be oriented so that lugs and/or strong-backs, and nose and/or tail plate sections are facing away from personnel locations.

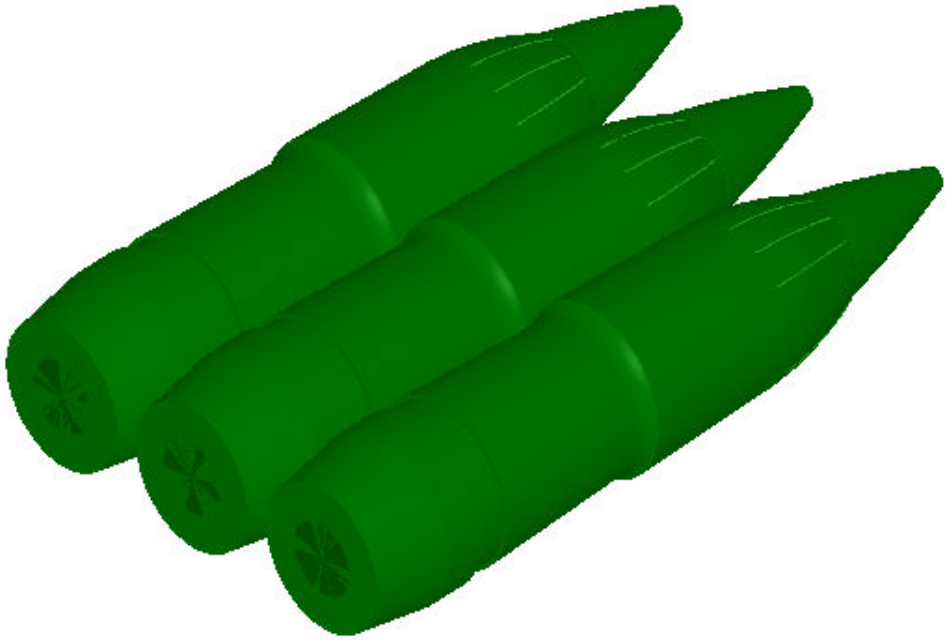

Figure 1 – Placement of Munitions for Consolidated Shots

3.0 Minimum Safe Separation Distance for Intentional Detonations

3.0.1 This document covers procedures for intentional detonations only.

3.0.2 In accordance with DoD 6055.9-STD Chapter 5 paragraph E.4.a(2), the minimum safe separation distance for all personnel will be the greater of the overpressure distance or the appropriate fragment range as determined by the maximum fragment range or the mitigated fragment range.

3.1 Overpressure Distance

In accordance with DoD 6055.9-STD Chapter 5 paragraph E.4.a(2), the allowable overpressure distance will be determined as the scaled distance, K328, based on the total net explosive weight (NEW) of all munitions plus the initiating explosives.

3.2 Fragment Criteria

3.2.1 Maximum Fragment Range

The maximum fragmentation characteristics shall be computed in accordance with HNC-ED-CS-S-98-1. The maximum fragment range shall be computed using these fragmentation characteristics with a trajectory analysis such as the computer software TRAJ. The maximum fragment range shall be the maximum fragmentation distance computed for the most probable munition (MPM) for an OE area at a site, and this shall be the maximum fragment range for a consolidated shot.

3.2.2 Fragment Mitigation

Fragment mitigation may be provided by an appropriate Department of Defense Explosives Safety Board (DDESB) approved engineering control. Typical engineering controls for intentional detonation include tamping and sandbags. The design of such an engineering control shall be based on the maximum fragmentation characteristics of the MPM. The NEW used for the design of the engineering control shall be the total NEW of all munitions plus the initiating explosives. Engineering controls not already approved by DDESB may be submitted (along with appropriate technical data) as part of a site specific explosive safety submission for use at that site. Engineering controls will not be put into use until approved by DDESB and specific applications verified by the appropriate agency; for example, the OE-CX verifies applications for U.S. Army Corps of Engineers.

4.0 Initiation

The consolidated shot shall be initiated in such a manner that detonation of all munitions is simultaneous.

5.0 References

DoD 6055.9-STD, “Department of Defense Ammunition and Explosives Safety Standards”, August 1997.

HNC-ED-CS-S-98-1, Methods for Predicting Primary Fragmentation Characteristics of Cased Explosives, January 1998.

Memorandum, DDESB, DDESB-KO, 27 January 1998, subject: Guidance for Clearance Plans.

US Army Corps of Engineers
Engineering and Support Center, Huntsville

Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions

HNC-ED-CS-S-98-7
AUGUST 1998

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331-0600

DDESB-KO

23 February 1999

MEMORANDUM FOR DIRECTOR US ARMY TECHNICAL CENTER FOR EXPLOSIVES SAFETY (ATTENTION: SIOAC-ES)

SUBJECT: Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonations of Munitions, Report HNC-ED-CS-S-98-7 (August 1998)

References: (a) SIOAC-ESL memorandum, dated 30 Nov 98, same subject

(b) Joseph M. Serena and Michelle Crull, "Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonations of Munitions, Report HNC-ED-CS-S-98-7," (August 1998)

The subject site plan forwarded by reference (a) has been reviewed with respect to explosives safety criteria. The site plan addresses the use of sandbags, IAW reference (b) to mitigate hazards and protect personnel from intentional detonations of munitions up to the 155-mm M107. Based on the information furnished, the proposed use of sandbags for intentional detonations at ordnance and explosives (OE) sites, IAW reference (b) is approved.

A copy of this site plan package and this letter of approval must be available at OE sites where intentional detonations are conducted that use procedures of this siting package.

Point of contact is Dr. Chester E. Canada, DDESB-KT2 (PH: commercial: 703-325-1369, FAX: 703-325-6227, E-MAIL: canadce@hqda.army.mil).

Daniel T. Tompkins

DANIEL T. TOMPKINS
Colonel, USAF
Chairman

cc:
Army Safety Office, ATTN: DACS-SF, Chief of Staff, 200 Army Pentagon, Washington, DC 20310-0200
Commander, U.S. Army Corps of Engineers, ATTN: CESO, 20 Massachusetts Avenue NW, Washington DC 20314-1000
Commander, U.S. Army Engineering and Support Center Huntsville, ATTN: CEHNC-ED-CS and CEHNC-OE-CX-Q, P.O. Box 1600, Huntsville, AL 35807-4301

Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions

Prepared by
Joseph M. Serena, III, PE
Michelle Crull, PhD, PE

August 1998

Department of the Army
Huntsville Center, Corps of Engineers
Attn: CEHNC-ED-CS-S
P.O. Box 1600
Huntsville, AL 35807-4301
Telephone: Commercial 256-895-1650

Reviewed by: _____ 8/13/98
WALLACE WATANABE — Date
Chief, Structural Branch

Reviewed by: _____ 8/[illegible]
PAUL M. LAHOUD, PE — Date
Chief, Civil-Structures Division

EXECUTIVE SUMMARY

The U.S. Army Engineering and Support Center, Huntsville (USAESCH) is currently engaged in projects which require the disposal of uncovered/discarded ordnance and explosives (OE) on public and private lands. The uncovered OE item is often detonated in place if it is too dangerous to move. In some cases, covering and tamping with loose earth is used to contain the blast and fragments. Another method to mitigate the fragmentation and blast effects is to cover the item with sandbags. However, traditionally there has been no method to determine the optimum configuration or the required thickness of such a sandbag enclosure.

The Structural Branch, USAESCH, sponsored a test program in 1997 to evaluate the use of sandbag enclosures for fragment and blast mitigation, for intentional detonations at Ordnance and Explosives (OE) sites. Southwest Research Institute (SwRI), under contract to USAESCH, performed a two phase test program of sandbag enclosures. In phase one, the preliminary explosive test phase, four tests on a 155-mm projectile were performed to refine and optimize the test procedure. This test procedure was used in phase two, the comprehensive explosive test phase. In phase two, a total of fourteen tests with five different munitions were performed to determine the thickness of sandbags required to capture all primary fragments. Measurements were made of the overpressures at various places, sandbag throw distances, depth of fragment penetration, and noise levels. High-speed film cameras, video recorders and digital cameras were used to visually record the events.

Required Wall and Roof Thicknesses for Sandbag Enclosures, with Expected Sandbag Throw Distances and Pressures, for Five Tested Munitions

Munition	Charge Weight, Comp B, lb	Required Wall and Roof Sandbag Thickness, in	Expected Maximum Sandbag Throw Distance, ft	Expected Peak Pressure @ 40 feet, psi	Expected Peak Pressure @ 80 feet, psi	Expected Sound Level @ 100 feet, dB
155-mm M107	15.4	36	220	0.18	0.09	115
4.2-in M329A2	8.17 (TNT)	24	125	0.16	0.06	116
105-mm M1	5.08	24	135	0.18	0.08	120
81-mm M374A2	2.1	20	125	0.14	0.05	119
60-mm M49A3	0.43	12	25	0.08	0.03	118

The results of these tests have been used to develop guidelines for the use of sandbag enclosures. The guidelines include required sandbag thicknesses, configuration and construction of the sandbag enclosures, and withdrawal distances based on the greater of sandbag throw distances or 200 ft. This document provides a summary of the test results and these guidelines.

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1.0 Introduction

The U.S. Army Engineering and Support Center, Huntsville (USAESCH) is currently engaged in projects which require the disposal of uncovered/discarded ordnance and explosives (OE) on public and private lands. The uncovered OE item is often detonated in place if it is too dangerous to move. In some cases, covering and tamping with loose earth is used to contain the blast and fragments. Another method to mitigate the fragmentation and blast effects is to cover the item with sandbags. However, traditionally there has been no method to determine the optimum configuration or the required thickness of such a sandbag enclosure.

The Structural Branch, USAESCH, sponsored a test program in 1997 to evaluate the use of sandbag enclosures for fragment and blast mitigation, for intentional detonations at Ordnance and Explosives (OE) sites. Southwest Research Institute (SwRI), under contract to USAESCH, performed a two phase test program of sandbag enclosures. In phase one, the preliminary explosive test phase, four tests on a 155-mm projectile were performed to refine and optimize the test procedure. This test procedure was used in phase two, the comprehensive explosive test phase. In phase two, a total of fourteen tests with five different munitions were performed to determine the thickness of sandbags required to capture all primary fragments. Measurements were made of the overpressures at various places, sandbag throw distances, depth of fragment penetration, and noise levels. High-speed film cameras, video recorders and digital cameras were used to visually record the events.

The results of these tests have been used to develop guidelines for the use of sandbag enclosures. The guidelines include required sandbag thicknesses, configuration and construction of the sandbag enclosures, and withdrawal distances based on the greater of sandbag throw distances or 200 ft. This document provides a summary of the test results and these guidelines.

2.0 Test Program

2.1 Fragmentation Characteristics of Munitions

Prior to beginning this test program the fragmentation characteristics of a variety of munitions frequently encountered during OE site operations were determined. The fragmentation characteristics were calculated in accordance with procedures outlined in TM5-1300, “Structures to Resist the Effects of Accidental Explosions” [1] and detailed in CEHNC-ED-CS-S-98-1, “Methods for Predicting Primary Fragmentation Characteristics of Cased Explosives” [2]. The fragmentation characteristics were used to predict preliminary thicknesses of sand required to prevent perforation for the five munitions tested.

Optimally, the fragments from the munition will strike the sandbags before the blast wave so that the fragments are penetrating undisturbed sand. To ensure that this will occur it is necessary to reduce the coupling between the explosive charge and the

surrounding soil. This coupling is dependent on the separation distance between the charge and the soil. Full coupling implies that the maximum amount of energy, or velocity, is transferred from the explosive into the soil immediately adjacent to the charge. If an explosive charge is placed in a cavity, so that an air gap exists between the charge and the walls of the cavity, coupling between the explosive and soil is reduced. Therefore, a standoff of some distance is required to reduce the coupling effect. Calculations to determine the velocity of sand particles from a buried explosion were performed. The velocity of the sand particles was compared to the velocity of the design fragment through sand. These calculations suggest that at a distance between 6 and 12 inches from the explosion, the fragment velocity exceeds the particle velocity. Therefore, the initial standoff distances for the tests were 6 and 12 inches.

2.2 Preliminary Explosive Test Phase

In the preliminary explosive tests, four tests of statically detonated 155-mm M107 projectiles were performed. These tests provided the data needed to specify the amount and configuration of sandbags that are required to safely detonate a 155-mm projectile in place, verified that the general test procedure was satisfactory, and defined the instrumentation and data acquisition systems for the subsequent comprehensive explosive tests. Figure 1 shows the site layout for the tests of sandbag enclosures. Although, munitions are rarely oriented vertically for demolition in place, the vertical orientation provided the opportunity to evaluate a greater number of combinations of wall thicknesses and standoff distances. Figures 2 and 3 show the sandbag enclosure configurations for vertical and horizontal weapon tests.

The test matrix for the preliminary explosive tests is shown in Table 1. Two tests were run with the 155-mm in the vertical orientation and two in the horizontal orientation. Each test allowed five standoff distances and five sandbag thicknesses to be evaluated.

The sandbags were made of woven polypropylene, as is commonly used by explosives and ordnance disposal (EOD) personnel, and the volume/weight of the sandbags was either 0.5 ft^3/50 lbs for the large bags or 0.25 ft^3/25 lbs for the small bags. The small bags were used for test two. No additional information was provided by using the small bags so these were not used for any other tests. The bags were filled with a “washed river” sand that was judged to be “typical” by a local soil consultant (Fugro-McClelland Southwest, Inc.).

To determine the sandbag throw distribution some of the sandbags in the first two tests were filled with sand colored with dye. The dye did not improve the quality of the test results. Spray paint was used in the subsequent tests to mark each bag with its original position in the sandbag enclosure. A different color was used to indicate the wall or the roof and numbers were used to indicate the layer in which the sandbag was located.

Detailed descriptions of all tests and results are provided in “Evaluation of Sandbags for Fragment and Blast Mitigation” by Southwest Research Institute [3].

Table 1 – Test Matrix for Preliminary Explosive Tests

Test No.	Orientation	Standoff, in.					Wall Thickness, in. (Bag Size)				Wall Height, in. (Bag Size)	
		S_1	S_2	S_3	S_4	S_R	T_1	T_2	T_3	T_4	H_1	H_2
155-1	Vertical	12	6	6	12	6	32	32.5	45	43	32	20
155-2	Vertical	6	6	6	6	6	18(s)	54	18(s)	53(s)	32	22
155-3	Horizontal	6	6	6	6	6	30	48	24	24	12	30
155-4	Horizontal	6	6	6	6	6	35	36	34	36	12	36

Note: All walls were constructed with large bags, except for those designated with an “s” for small bags.

2.2.1 Preliminary Explosive Test Results

For tests 1 and 2, the 155-mm M107 projectile was detonated using a donor charge of 200 g of C-4 placed in the fuze well and initiated with an Exploding Bridge Wire. For tests 3 and 4, the 155-mm M107 projectile was detonated using a well perforator shaped charge. This approach is typically used for on-site detonations. Time of arrival (TOA) pins were used for all tests to determine if a high order detonation was achieved.

All detonations were high order and results were obtained. The make screens and their frames and the assorted witness screens were scattered across the site. Where possible, each screen was identified and photographed and the number of fragment holes or the condition of the screen was recorded. The results of the first three tests suggested that a wall and roof thickness of 36 inches should be sufficient to contain all of the fragments and to reduce the overpressure levels. The dimensions of test 4 confirmed this configuration.

From the limited data collected on standoff distance, it appears that for standoffs of 6 and 12 inches there is no difference in the thickness of sandbags required to stop fragments. Test 2 showed that the size of the sandbag did not affect the fragment penetration. Test 3 showed that the horizontal orientation of the munition did not greatly effect the fragment penetration. Tests 3 and 4 showed that the base plate of the munition broke up and was stopped by 24 inches or less of sandbags.

The data collected showed that approximately 20 inches of sandbags will completely contain the fragments from the 155-mm M107 projectile. The only indications of fragments exiting the sandbag enclosure came from the two identical 18 inch walls of test 2 (external witness screens on sides 1 and 3 both registered fragment impacts). Internal witness screens at depths of 20 inches to 24 inches for all 4 tests did not indicate any fragment impacts. In tests 2 through 4, the roof witness screens also showed no penetrations for 20 to 36 inches of roof depth. The CONWEP software [4] predicts that 24 inches of sand will stop the design fragment from the 155-mm M107 projectile.

Sandbag throw distances were recorded in 10 foot increments from ground zero to the furthest sandbags. The maximum sandbag throw distances were 150 feet, 191 feet,

157 feet, and 150 feet for tests 1 through 4, respectively. All of the furthest thrown sandbags came from the roof. In most cases, the roof sandbags were found relatively intact while the wall sandbags were often disintegrated. The bulk of the sandbags fell within 100 feet with only a few beyond this distance. An examination of the sandbag throw distances show that the standoff, the size of the bag, and the weapon orientation did not affect the throw distance to any significant degree.

Blast overpressures were recorded for all 4 tests (see Table 2). As shown, the sandbag enclosures greatly reduced the magnitude of the pressure. In test 3, a digital sound meter was placed 100 feet from ground zero and the maximum sound level recorded was 114.7 decibels.

Table 2 – Blast Overpressures from Preliminary Explosive Tests

Test No.	Side 1				Side 4			
	P1 @ 40', psi	P2 @ 40', psi	P3 @ 80', psi	P4 @ 80', psi	P5 @ 40', psi	P6 @ 40', psi	P7 @ 80', psi	P8 @ 80', psi
155-1	0.67	0.71	ND	ND	0.37	0.38	ND	ND
155-2	1.31	1.18	ND	ND	0.74	0.97	ND	ND
155-3	0.16	0.16	0.07	0.06	0.16	0.18	0.09	ND
155-4	0.04	0.04	0.03	0.03	0.07	0.08	ND	0.05

ND = no data

2.3 Comprehensive Explosive Tests

An additional fourteen tests were performed: one more using 155-mm M107 projectiles, four using 105-mm M1 projectiles, three using 4.2-in M329A2 projectiles, four using 81-mm M374A2 mortars, and two using 60-mm M49A3 mortars. The test matrix for the comprehensive explosive tests is shown in Table 3. For all tests performed with the munition in the vertical orientation, detonation was achieved using a donor charge of 100 grams (50 grams for test 60-1) of C-4 in the fuze well. For all tests performed with the munition in the horizontal orientation, detonation was achieved using a well perforator. TOA pins were used for all tests to check if a high order detonation was achieved.

For each of the comprehensive explosive tests, woven polypropylene 0.5 ft^3 sandbags were filled with 50 lbs of washed river sand. The sandbags were painted and numbered as described in Section 2.2 to indicate their original position in the sandbag enclosure. Moisture content was not controlled nor monitored during the test program.

Pressure gages, a sound meter, high speed cameras, digital cameras and video cameras were used for data acquisition during each test. Internal and external witness screens were used to determine how deeply the fragments moved into the sandbag mass and whether any fragments exited the sandbag enclosure.

Table 3 – Test Matrix for Comprehensive Explosive Tests

Test No.	Orientation	Standoff, in.					Wall Thickness, in.				Wall Height, in.	
		S_1	S_2	S_3	S_4	S_R	T_1	T_2	T_3	T_4	H_1	H_2
155-5	Horizontal	7	7	5	6	7	36	36	36	36	13	36
4.2-1	Vertical	5.5	5.5	5.5	5.5	6	20	24	31	36	19	24
4.2-2	Horizontal	6.5	6.5	6	6	7	24	25	24	24	11	24
4.2-3	Horizontal	6	5	5	6	7	24	25	25	24	11	24
105-1	Vertical	5.5	5.5	5.5	5.5	6	20	26	31	35	25	24
105-2	Vertical	0	0	4	6	6	29	25	19	25	26	23
105-3	Horizontal	7	5	5	5	9	24	24	24	24	13	24
105-4	Horizontal	6.5	6	5	6	7	25	25	24	24	11	23
81-1	Vertical	5	5	6	6	6	12	19	23	30	15	18
81-2	Horizontal	7	6	5.5	7	6	18	24	18	24	9	18
81-3	Horizontal	7	6	5	6	7	18	19	18	19	10	18
81-4	Horizontal	6	5.5	5.5	5.5	8	19	20	19	20	11	18
60-1	Vertical	6	6	6	6	6	13	19	23	30	11	12
60-2	Horizontal	6.5	3	5.5	3	6	12	12	12	12	8	13

All detonations were high order and results were obtained. The assorted witness screens were scattered across the site. Where possible, each screen was identified and photographed and the number of fragment holes or the condition of the screen was recorded. Sandbag throw distances were recorded in 10 foot increments from ground zero to the furthest sandbags. Blast overpressures were recorded for all tests at 40 feet and 80 feet from ground zero. A digital sound meter was placed 100 feet from ground zero. A summary of the results is shown in Table 4.

The final test for each munition was a confirmation test. These included tests 155-5, 4.2-3, 105-4, 81-3 and 60-2. The purpose of the confirmation tests was to model as closely as possible the actual use of sandbags in field conditions. In each test the internal witness screens were omitted. Sandbags were staggered both horizontally and vertically. External witness screens were placed over the roof and the two sides facing away from the pressure gages. After each test, the external witness screens were recovered and inspected for fragment penetrations. No such penetrations were identified. Therefore, the sandbag thicknesses defined in Table 4 are those used in the confirmation tests. For two munitions, the penetration data from internal witness panels suggests that somewhat smaller sandbag thicknesses may be sufficient to capture all fragments. As stated above for the 155-mm M107, internal witness screens show no fragment penetrations for sandbag thicknesses of about 24 inches or more. For the 4.2-inch M329A2 mortar, the internal witness screens show no fragment penetrations deeper than about 18 inches. However, the thicknesses of 36 inches for the 155-mm M107 and 24 inches for the 4.2-inch M329A2 are retained for use in the field, since sandbag throw distances are based on these thicknesses. While possibly thicker than necessary from capturing fragments, the increased total mass of the sandbags results in reduced sandbag throw distances.

Detailed descriptions of all tests and results are provided in “Evaluation of Sandbags for Fragment and Blast Mitigation” by Southwest Research Institute [3].

3.0 Guidelines for Use of Sandbags

3.1 Enclosure Geometry

Table 5 summarizes the results of the tests. This table specifies the minimum thickness of sandbag walls and roof that is needed to completely contain the fragments for the five munitions that were tested in this project. It also gives the expected maximum sandbag throw distances, the peak pressures at 40 feet and 80 feet, and the sound level at 100 feet, for the five munitions. For safety and conservatism, the expected sandbag throw distances are approximately 10% larger than the largest distances actually measured in the tests. Thus, the expected sandbag throw distances given in Table 5 are conservative in two ways: first, the largest measured sandbag throw distance from all tests of a particular round is used and second, this value is increased by 10%. Due to the already low values of peak pressures, a similar increase in the expected peak pressures was not deemed necessary or justified.

Table 4 – Summary of Results from Comprehensive Explosive Tests

Munition	Sandbag Thickness (in) to Defeat Fragments	Max. Sandbag Throw Distance (ft)		Max Peak Overpressure (psi) @ 40 ft		Max Peak Overpressure (psi) @ 80 ft		Max Noise Level (dB) at 100 ft
		Side of Round	Nose/Tail of Round	Side of Round	Nose of Round	Side of Round	Nose of Round	
155-mm M107	36	200	130	0.06	0.12	0.04	0.05	114.7
4.2-in M329A2	24	110	70	0.12	0.14	0.04	0.06	115.8
105-mm M1	24	120	50	0.17	0.18	0.07	0.08	119.3
81-mm M374A1	20	110	30	0.14	0.08	0.05	0.03	118.3
60-mm M49A3	12	20	20	0.06	0.08	0.02	0.03	117.3

Obviously, the five munition types do not cover all of the munitions that may be encountered. To determine the minimum wall and roof thickness for a particular shell other than those found in Table 5, the approach is as follows:

(1) Determine the initial fragment velocity (V_F) in ft/s, the maximum fragment weight (W_F) in pounds, and the kinetic energy ($W_F V_F^2/2$) in lb-ft^2/s^2 for the particular munition.

(2) Identify the munition with the next largest kinetic energy, from Table 6.

(3) Use the sandbag wall and roof thickness from Table 5 for the munition with the next largest kinetic energy shown in Table 6.

Table 6 provides the maximum fragment weight, the initial fragment velocity, and the resulting kinetic energy for the 5 munition types. The maximum fragment weight and the initial fragment velocity values were determined with the Mott and Gurney equations, as presented in TM 5-1300 [1] and detailed in HNC-ED-CS-S-98-1 [2].

Table 5 - Required Wall and Roof Thicknesses for Sandbag Enclosures, with Expected Sandbag Throw Distances and Pressures, for Five Tested Munitions

Munition	Charge Weight, Comp B, lb	Required Wall and Roof Sandbag Thickness, in	Expected Maximum Sandbag Throw Distance, ft	Expected Peak Pressure @ 40 feet, psi	Expected Peak Pressure @ 80 feet, psi	Expected Sound Level @ 100 feet, dB
155-mm M107	15.4	36	220	0.18	0.09	115
4.2-in M329A2	8.17 (TNT)	24	125	0.16	0.06	116
105-mm M1	5.08	24	135	0.18	0.08	120
81-mm M374A2	2.1	20	125	0.14	0.05	119
60-mm M49A3	0.43	12	25	0.05	0.03	118

Table 6 - Maximum Fragment Weight, Initial Fragment Velocity and Kinetic Energy for Five Tested Munitions

Munition	W_F, Maximum Fragment Weight, lb	V_F, Initial Fragment Velocity, ft/s	Kinetic Energy, 10^6 lb-ft^2/s^2
155-mm M107	0.467	4667	5.085
4.2-in M329A2	0.079	6391	1.613
105-mm M1	0.155	4870	1.868
81-mm M374A2	0.031	6721	0.700
60-mm M49A3	0.033	3605	0.214

As an example, for a shell such as the 3-in Stokes Mortar Round, the maximum fragment weight and initial fragment velocity are 0.0436 lb and 6189 ft/s, respectively. The resulting kinetic energy is 0.835 x 10^6 lb-ft^2/s^2. The next largest fragment kinetic energy in Table 6 is the 4.2-in M329A2 round. Therefore, a sandbag enclosure with a roof and wall thicknesses of 24 inches should be used to contain the fragments and suppress the blast overpressures. The maximum sandbag throw distance is 125 ft. Therefore, the withdrawal distance is 200 ft.

Based on this procedure, a more complete list of typical munitions is given in Table 7. This table includes the required sandbag wall and roof thicknesses and maximum expected sandbag throw distances to be used for each munition. For other munitions not listed in Table 7, the procedure given above can be used. The procedure should not be used to extrapolate sandbag thicknesses or sandbag throw distances for munitions larger than the 155-mm M107.

3.2 Enclosure Construction Method

The enclosure construction method follows the procedure that was used to build the test enclosures, with a few modifications. Figure 4 illustrates a typical enclosure. Figure 5 shows a photograph of a sandbag enclosure for an 81 mm mortar.

The sandbag fabric should be woven polypropylene. Each bag should have a nominal volume of 0.5 ft^3 and an approximate weight when full of 50 lb. The bags should be filled with washed sand, either dry or in saturated surface dry (that is, slightly moist) condition. Wet sand should not be used. Prefilled sandbags should be protected from the rain by storage on pallets, off the ground surface, and by covering them with a plastic tarpaulin or similar cover to prevent them from becoming saturated with water. The gradations and physical composition of the sand are not critical but it should be at least typical of local construction practice for sand used in foundations and backfill. Minor inclusions of clay or soils materials can be permitted. However, no rocks or stones should be placed in the sandbags. Typically, the sand used for the tests had a density of about 100 pounds per cubic foot and a moisture content of 6-7%.

Four walls of identical thickness should surround the munition. The minimum wall thickness should be the thickness determined using the procedure in Section 3.1 above. The sandbag walls should be stacked to maintain a clear standoff distance of 6 inches between the shell and the inside face of each wall. The interior face of each wall should be vertical but the exterior face can be built with a 1:6 slope (2" horizontal to 12" vertical). If a sloped outer face is used, the thickness of the wall, at the nominal “top” of the wall, 6 inches above the top of the munition, must be no less than the specified required thickness

The sandbags should be placed tightly against each other. All vertical joints should be staggered, so there is no clear line of sight from the munition to the exterior. As the wall is built, each new layer of sandbags should run in opposite direction to the layer below, so that the layers are interlocked (see Figure 6).

At a minimum, a double layer of sandbags shall be used. For example, when a 12” thickness is required, the sandbags should be oriented so that two sandbags are necessary to achieve this thickness (see Figure 7).

After the walls are constructed to a height of 6" above the upper surface of the munition, the shaped charge or other initiator should be placed on the shell. Ideally, the use of shaped charges, such as oil well perforators, is recommended. These add very little to the total charge weight for each detonation, given the highly directional nature of the effects of the shaped charge. Also, the use of shaped charges for initiation parallels test procedures. The shaped charge should be located either on top of the munition or on its side. If it is located on the side of the round, the charge should be tilted downward sufficiently to ensure that the shaped charge jet penetrates the round and is directed into the ground, rather than into the opposite sandbag wall. Generally, a small mound of sand next to the round can be used to establish this orientation.

A sheet of 3/4-inch thick Douglas Fir (or equivalent) plywood should be cut to the dimensions of the cavity between the walls, plus 12 inches in each direction. The plywood sheet is then centered on the walls so that it bears on 6" of each wall. The additional sandbags that make up the roof of the enclosure are then placed on top. As with the side walls, the roof sandbags should be stacked with staggered horizontal joints and alternating directions in each layer. The exterior sides of the roof may also be vertical or have a 1:6 slope. The thickness of the sandbag roof, above the plywood panel, must be the same as the required wall thickness.

After the sandbag layers of the roof have been placed to the correct height, the enclosure is complete and the munition may be detonated.

Table 7 - Required Wall and Roof Thicknesses for Sandbag Enclosures, with Expected Sandbag Throw Distances and Pressures, for Tested and Non-Tested Munitions

Munition	Charge Weight (lb)	W_F, Maximum Fragment Weight, lb	V_F, Initial Fragment Velocity, ft/s	Kinetic Energy, 10^6 lb-ft^2/s^2	Required Wall and Roof Sandbag Thickness, in	Expected Maximum Sandbag Throw Distance, ft	With-drawal Distance, ft
155mm M107*	15.48	0.467	4667	5.086	36	220	220
4.7-in Mark I	6.07	0.591	3566	3.761	36	220	220
105mm M1*	5.08	0.155	4870	1.840	24	135	200
4.2-in M329A2*	8.165	0.079	6391	1.607	24	125	200
4-in Stokes	7.92	0.078	6336	1.570	24	125	200
75mm M48	1.47	0.153	3471	0.922	24	125	200
3-in Stokes	2.1	0.044	6189	0.835	24	125	200
2.75-in M229 Rocket	4.8	0.050	5569	0.777	24	125	200
81mm M374*	2.1	0.031	6721	0.696	20	125	200
37mm MK II	0.53	0.030	5758	0.490	20	125	200
60mm M49A3*	0.42	0.024	5114	0.310	12	25	200
FMU 54A/B	0.357	0.006	9031	0.263	12	25	200
40mm MK2 Mod 0	0.187	0.033	3605	0.215	12	25	200
MK II Grenade	0.125	0.014	3425	0.083	12	25	200
25mm M792	0.096	0.005	5736	0.081	12	25	200
M67 Grenade	0.40625	0.001	7006	0.029	12	25	200
20mm M56A4	0.0264	0.0000011	4941	0.004	12	25	200

* = tested munitions

3.3 Withdrawal Zone

A withdrawal zone is necessary for any detonation. This withdrawal zone applies to everyone, both public and operational personnel. The withdrawal zone is the maximum of the sandbag throw distance, the distance to a sound level of 140 db, or 200 ft. For all munitions tested, the sound level at 100 ft was substantially less than 140 db. At 200 ft. the sound level will be even lower. The withdrawal zones are also listed in Table 7.

4.0 Summary and Conclusions

A test program has been performed to determine the effects of sandbag enclosures for mitigating fragments and blast effects due to an intentional detonation of a munition. A total of eighteen tests on five different munitions were performed. A summary of the test procedures and results are presented in this document.

The results of these tests have been used to develop guidelines for the use of sandbag enclosures to mitigate the fragments and blast effects due to an intentional detonation of a munition. Methods for determining the required sandbag thickness and the resulting sandbag throw distance are detailed in Section 3.0. Figures 4, 5, 6 and 7 show the resulting sandbag enclosures.

5.0 References

1. TM5-1300, “Structures to Resist the Effects of Accidental Explosions”, Departments of the Army, the Navy, and the Air Force, November 1990.

2. HNC-ED-CS-S-98-1, “Methods for Predicting Primary Fragmentation Characteristics of Cased Explosives”, M. Crull, U.S. Army Engineering and Support Center, Huntsville, January 1998.

3. “Evaluation of Sandbags for Fragment and Blast Mitigation”, D. Stevens, Southwest Research Institute, San Antonio, TX, January 1998.

4. “User’s Guide for Microcomputer Programs CONWEP and FUNPRO Applications of TM 5-855-1. “Fundamentals of Protective Design For Conventional Weapons””, Revision 2, D. Hyde, US Army Corps of Engineers Waterways Experiment Station, February 1989.

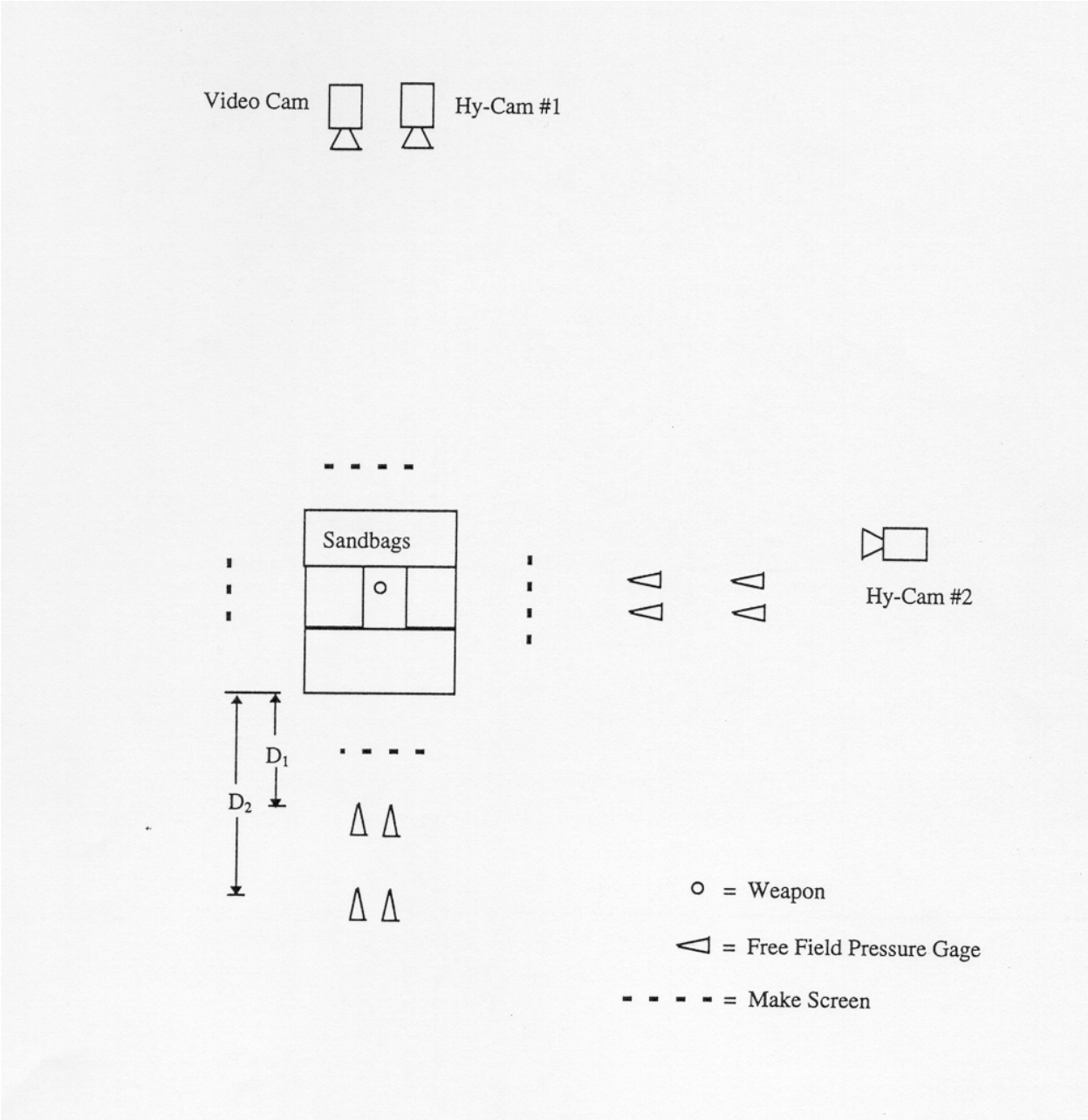

Figure 1 – Site Layout for Tests of Sandbag Enclosures

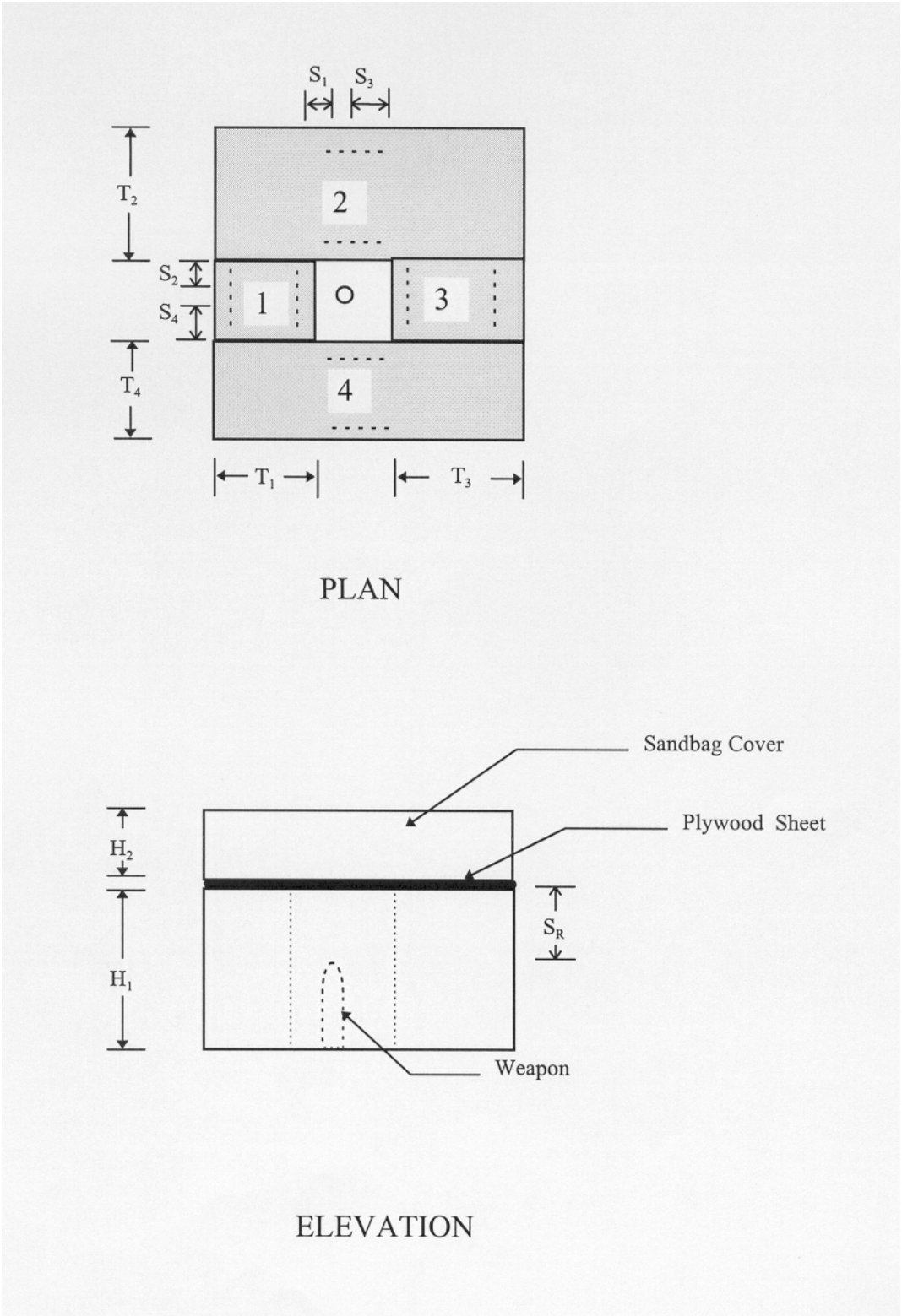

Figure 2 – Sandbag Enclosure Configuration for Vertical Weapon Tests

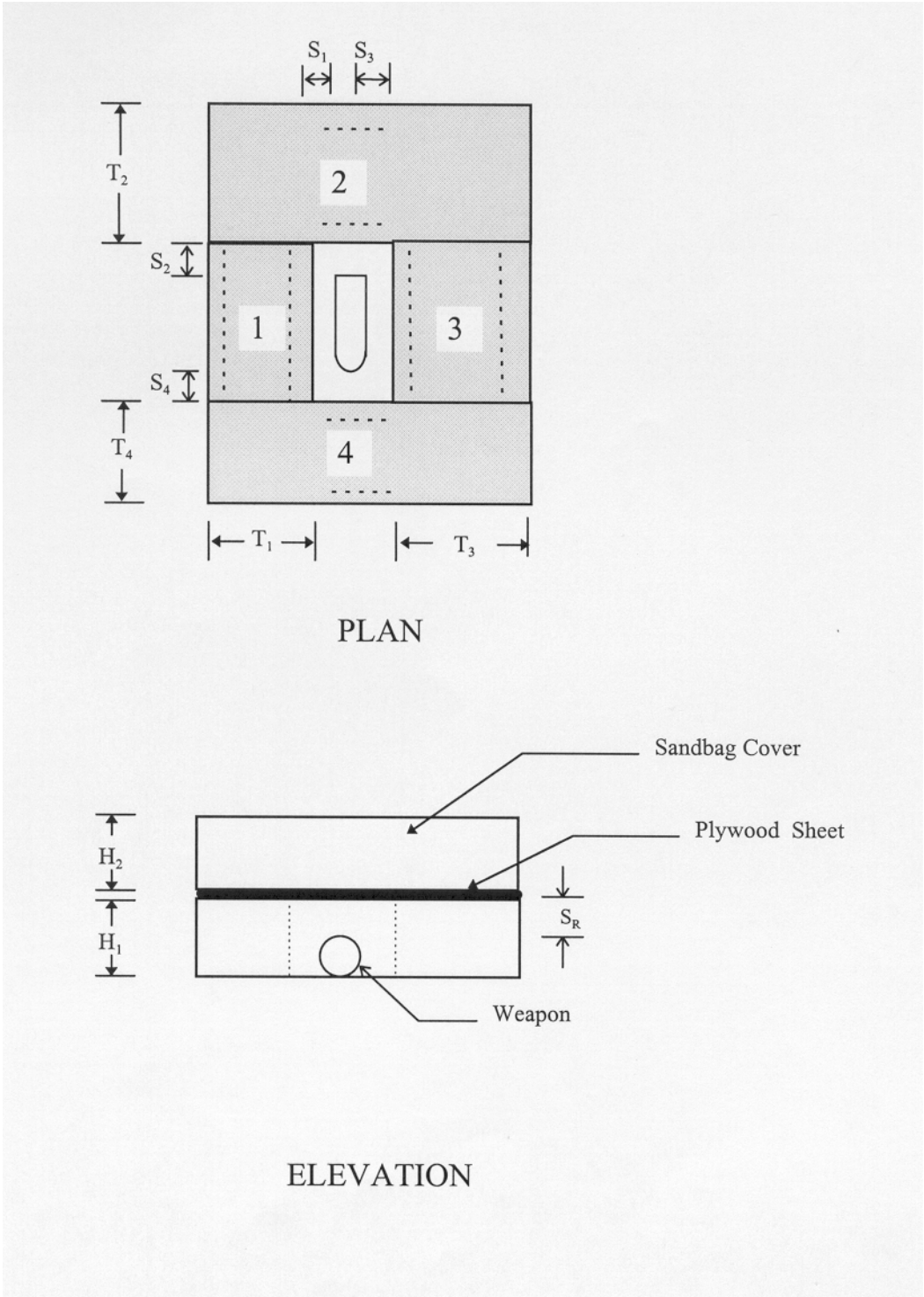

Figure 3 – Sandbag Enclosure Configuration for Horizontal Weapon Tests

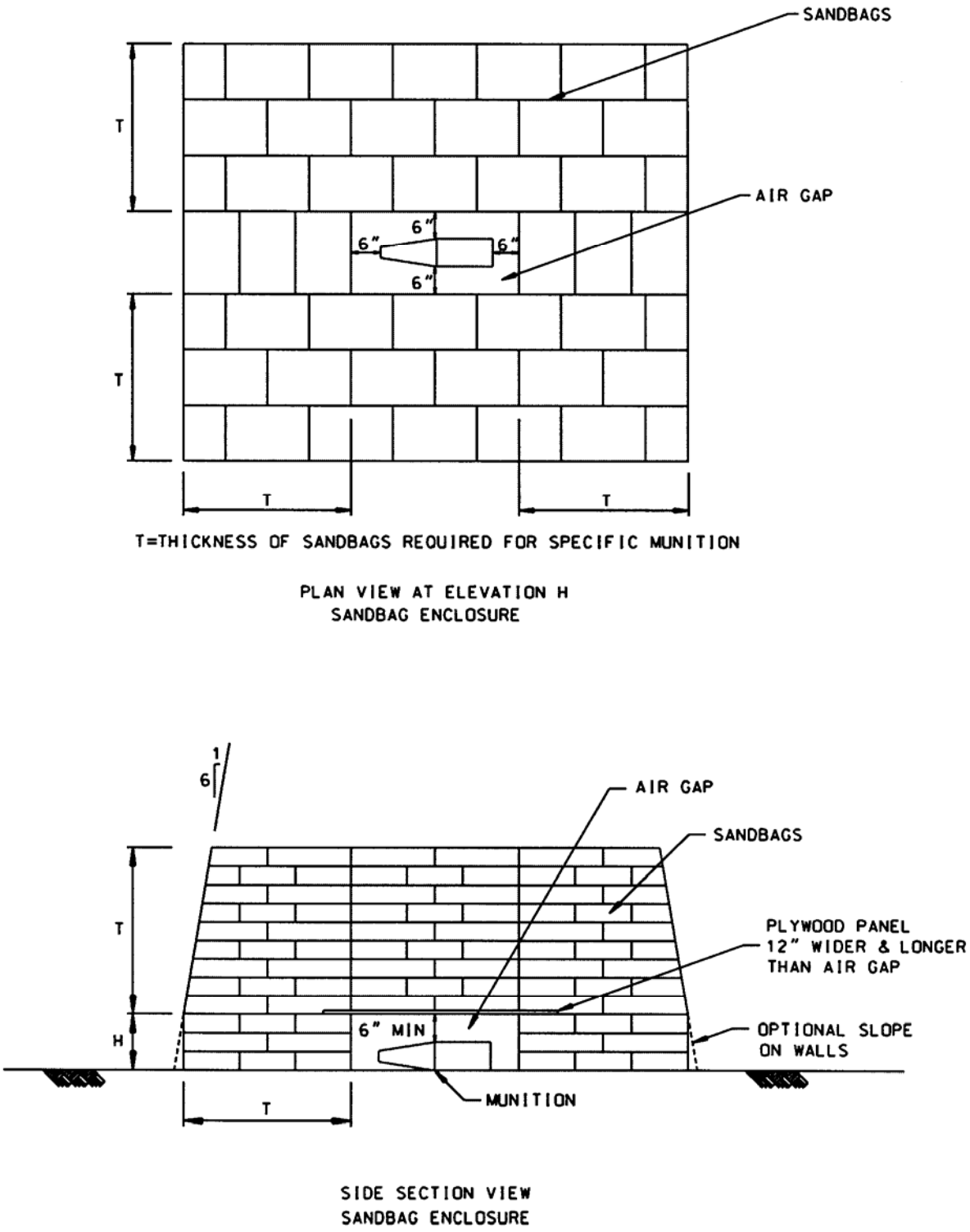

Figure 4 - Typical Sandbag Enclosure

Figure 5 – Sandbag Enclosure for an 81 mm M374A2 mortar.

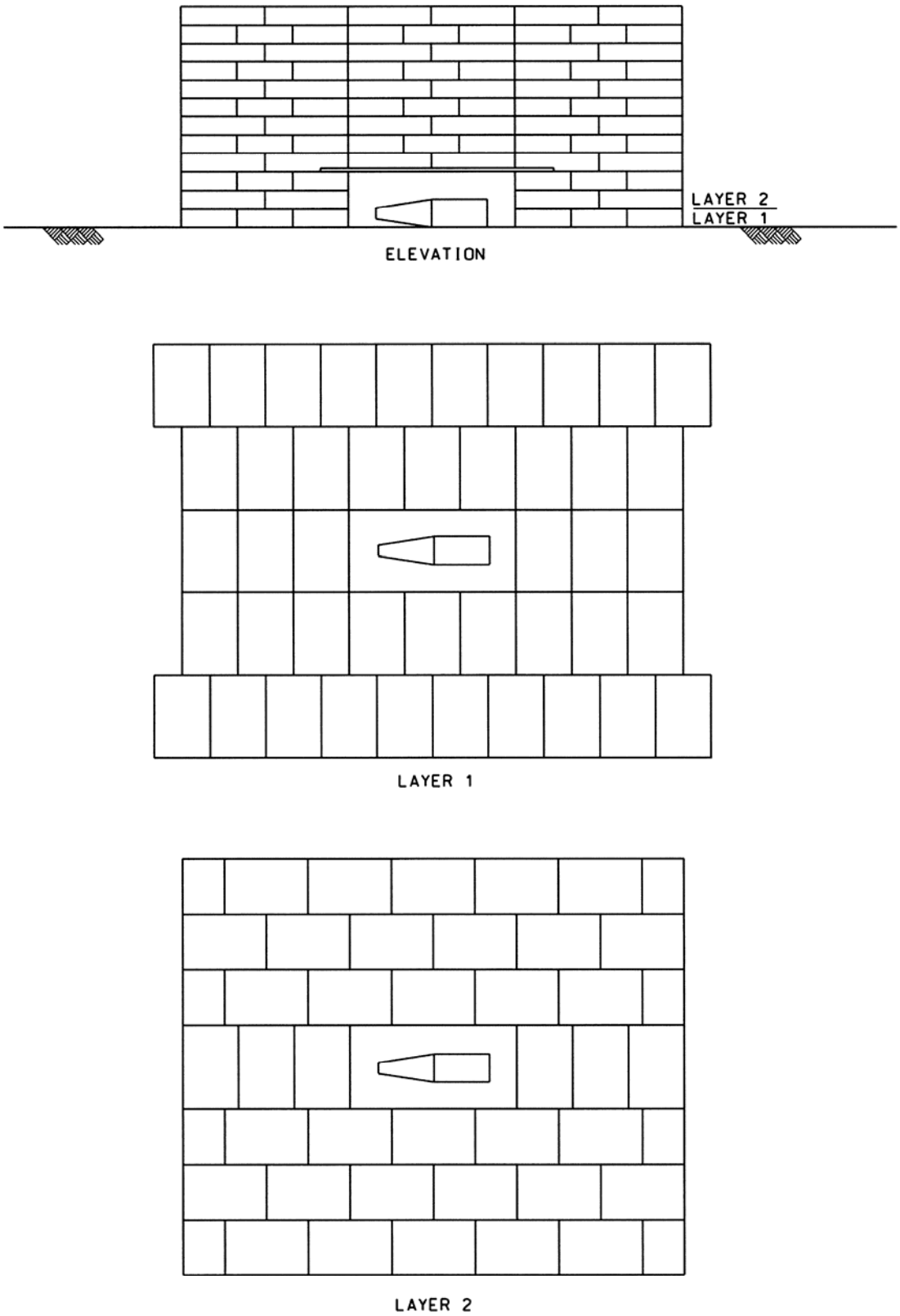

Figure 6 - Interlocking Alternate Layers of Sandbags

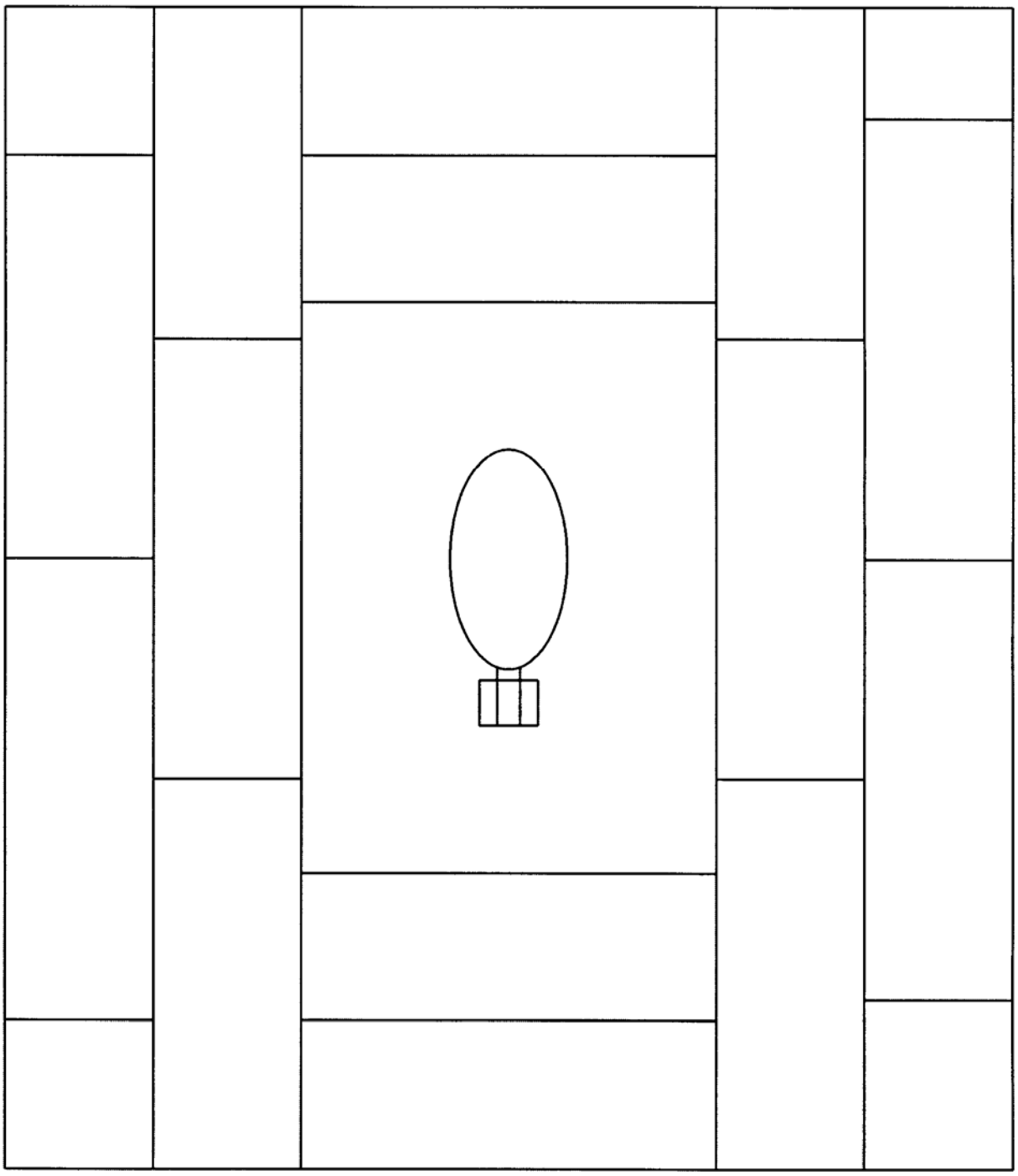

Figure 7 - Configuration for 12” Wall Enclosures

US Army Corps of Engineers
Engineering and Support Center, Huntsville

USE OF WATER FOR MITIGATION OF FRAGMENTATION AND BLAST EFFECTS DUE TO INTENTIONAL DETONATION OF MUNITIONS

Not Applicable

HNC-ED-CS-S-00-3
SEPTEMBER 2000

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331-0600

DDESB-KT

27 FEB 2001

MEMORANDUM FOR US ARMY DEFENSE AMMUNITION CENTER
(ATTENTION: SMAAC-ESL)

SUBJECT: Use of Water for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonations of Munitions, Report HNC-ED-S-00-3 (December 2000)

Reference: SMAAC-ESL (CESO-E/19 Dec 00) (385[A]) 1st End dated 21 December 2000, Subject: Explosives Safety Submission (ESS) for Use of Water for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonations of Munitions, HNC-ED-S-00-3, September 2000

The Department of Defense Explosives Safety Board (DDESB) Secretariat has reviewed the mitigation technology described in the subject report as requested by the reference. Based on the information furnished in the report the water mitigation techniques for intentional detonations defined in Section 3.0 of the report are approved for field use in Ordnance Explosives (OE) removal action projects.

A copy of this memorandum of approval must be included with a DDESB approved site plan, and be available at OE sites where intentional detonations are conducted that use the approved water mitigation technique.

The DDESB point of contact for this action is Dr. Jerry M. Ward, Director, Technical Programs Division, DSN: 221-2525, Commercial phone: (703) 325-2525; Fax: (DSN) 221-6227 and E-mail: Jerry.Ward@hqda.army.mil.

DANIEL T. TOMPKINS
Colonel, USAF
Chairman

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USE OF WATER FOR MITIGATION OF FRAGMENTATION AND BLAST EFFECTS DUE TO INTENTIONAL DETONATION OF MUNITIONS

HNC-ED-CS-S-00-2

FEBRUARY 2000

Prepared By
Michelle Crull, PhD, PE

Department of the Army
U.S. Army Engineering and Support Center, Huntsville
Attn: CEHNC-ED-CS-S
P.O. Box 1600
Huntsville, AL 35807-4301

Telephone: Commercial (256) 895-1650

Reviewed by: _____

WILLIAM H. ZEHRT, PE DATE
Chief, Structural Branch

Approved by: _____

PAUL M. LAHOUD DATE
Chief, Civil-Structures Division

Not Applicable

EXECUTIVE SUMMARY

The U.S. Army Engineering and Support Center, Huntsville (USAESCH) is currently engaged in projects which require the disposal of uncovered/discarded ordnance and explosives (OE) on public and private lands. The uncovered OE item is often detonated in place if it is too dangerous to move. In some cases, covering and tamping with loose earth is used to contain the blast and fragments. Another method to mitigate the fragmentation and blast effects is to cover the item with sandbags. However, both of these methods result in secondary fragments (earth clumps or sandbags) being thrown some distance from the blast. Preliminary tests show that water can be used to mitigate the fragmentation and blast effects and, depending on the method used to contain the water, there may be no hazardous secondary fragments. In addition, the water quenches the fireball and there is no fire hazard associated with the detonation. This last observation is especially important when working in a high fire hazard area.

The Structural Branch, USAESCH, sponsored a test program in 1999 to evaluate the use of water for fragment and blast mitigation, for intentional detonations at Ordnance and Explosives (OE) sites. The U.S. Army Engineer Research and Development Center (USAERDC), with USAESCH performed a two-phase test program of water mitigation of blast and fragmentation. In phase one, tests were conducted using four different munitions to determine the depth of water required to defeat the fragments. In phase two, different water containment systems were tested for these munitions.

For phase one, the munitions were suspended vertically in an aboveground pool in an off-center position. Thus the fragments were dispersed through varying thicknesses of water. Witness panels of 0.032” aluminum were used to record any fragments that might exit the pool. Witness screens were placed in the pool at various distances from the munition to determine if the fragments had penetrated that far.

Once a required water thickness was determined for each of the four munitions in phase one, containers were selected to test for use in actual disposal situations. The points considered in this selection were adaptability to munition size, transportability (empty or pre-filled with water), debris producing potential, adaptability to uneven terrain, and cost. The water containment systems tested were 55-gallon plastic drums, 1100-gallon plastic agricultural chemical tanks, 5-gallon stackable plastic carboys, and inflatable plastic wading pools.

These tests showed that water is a feasible means of mitigating fragments and blast effects from an intentional detonation. The containers that are made of heavy plastic produce secondary fragments that may be thrown some distance from the blast. The inflatable swimming pools did not produce any significant secondary fragments. Some small pieces of these pools were found around the site but, since the pool was made of thin flexible plastic, these pieces were very

Not Applicable

lightweight and not hazardous. High-speed photography of the tests shows that there is no fireball. Therefore, there is no fire hazard associated with the detonation.

The results of these tests have been used to develop guidelines for the use of water to mitigate fragments and blast effects due to an intentional detonation of a munition. Methods for determining the required water containment system and the resulting minimum separation distance are detailed in this report. Figures are provided to show the resulting munition/initiator configuration and water containment systems.

Not Applicable

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1.0 INTRODUCTION

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Once a required water thickness was determined for each of the four munitions in phase one, containers were selected to test for use in actual disposal situations. The points considered in this selection were adaptability to munition size, transportability (empty or pre-filled with water), debris producing potential, adaptability to uneven terrain, and cost. The water containment systems tested were 55-gallon plastic drums, 1100-gallon plastic agricultural chemical tanks, 5-gallon stackable plastic carboys, and inflatable plastic wading pools.

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site but, since the pool was made of thin flexible plastic, these pieces were very lightweight and not hazardous. High-speed photography of the tests shows that there is no fireball. Therefore, there is no fire hazard associated with the detonation.

2.0 TEST PROGRAM

The munitions used in both phases of the tests are the 60 mm M49A4 mortar, the 81 mm M362A1 mortar, the 105 mm M1 projectile and the 155 mm M107 projectile.

2.1 Phase One Tests

Commercially available aboveground swimming pools were used to contain the water in the phase one tests because they were easily obtainable and relatively inexpensive. Different size pools were used for different munitions. In the phase one tests the munitions were suspended vertically in the pool at a specified distance from the edge of the munition to one edge of the pool (off-center). Window screens were suspended from 2”x2” wood beams 180 degrees from the nearest edge of the pool at specified distances from the munition. These were used as witness panels in the pool. Witness panels of 0.032” aluminum were placed around the outside of the pool to record any fragments that might leave the pool. The test layout is shown in Figure 1 and the dimensions of the pool and placement of the munition and witness screens are shown in Table 1. The detonations were initiated using C-4 packed in the fuze well.

TABLE 1 – Phase One Test Parameters

Munition	Pool Diameter	Distance, R1 Edge of Pool	Expected Penetration	Pool Depth	Munition Distance from		Munition to Screen Distance			
					Bottom	Surface	S1	S2	S3	S4
60mm	90"	6"	8"	18"	2"		5"	10"	15"	20"
81mm	90"	12"	18"	24"	2"		10"	15"	20"	25"
105mm	12'	24"	30"	24"	3.5"	3"	30"	30"	40"	50"
155mm	18'	36"	48"	46"	4"	15"	40"	50"	60"	70"

2.1.1 155 mm M107 Projectile

The 155 mm M107 projectile contains 15.4 lbs of Comp B. For the phase one test, the booster was removed and the fuze well was packed with C-4. An 18 ft diameter, 4 ft deep pool was used for this test. The projectile was placed base down to make sure the base plate did not become airborn. Fragments were found all around the pool. One section of the metal pool wall from the near blast region was wrapped in a witness panel and thrown over 200 feet from ground zero.

Not Applicable

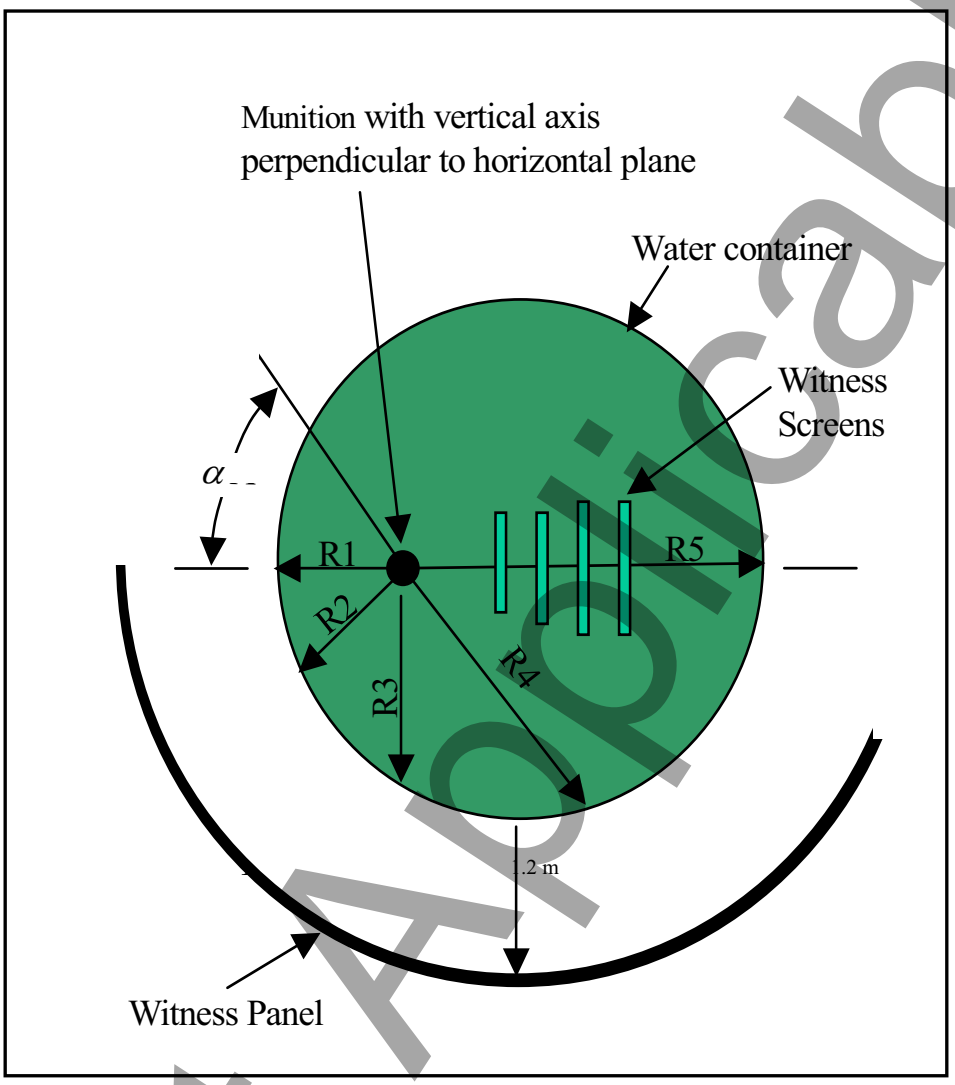


FIGURE 1 – Test Layout for Phase One Tests

Not Applicable

TABLE 2 – 155 mm M107 Phase One Results

Perforation of Pool			Fragment Size		Comments	Witness Screens	
Angle A, degrees	Distance D, in.	Height, in.	Length, in.	Width, in		Screen No.	Distance, in.
40.54	70.31		2	1.5		1	24
59.93	96.46		4	2		2	30
66.45	104.96		1	0.125		3	40
						4	50
						5	60
						6	70

Note: Fragment penetrated 5th screen but not 6th.

2.1.2 105 mm M1 Projectile

The 105 mm M1 projectile contains 5.07 lbs of Comp B. For the phase one test the fuze well was packed with C-4. A 12 ft diameter, 2 ft deep pool was used for this test. The projectile was placed base down to make sure the base plate did not become airborn. Fragments were recovered out to a distance of approximately 75 feet from the pool. There were no penetrations in the side or rear of the pool or witness panels, so the explosive mass apparently lofted these fragments along with the water.

TABLE 3 – 105 mm M1 Phase One Results

Perforation of Pool			Fragment Size		Comments	Witness Screens	
Angle A, degrees	Distance D, in.	Height, in.	Length, in.	Width, in		Screen No.	Distance, in.
25.97	38.87	28	5	1		1	30
47.96	53.83	12	6	1	Tear?	2	42
						3	54
						4	66
						5	80

Note: Fragment penetrated 1st screen only.

2.1.3 81 mm M362A Mortar

The 81 mm M362A mortar contains 2.1 lbs of Comp B. For the phase one test the fuze well was packed with 113 grams of C-4. A 90 inch diameter, 24 inch deep pool was used for this test. The mortar was placed nose down in the pool with the nose 2 inches off the bottom. No fragments penetrated the rear side of the pool. The tail fin was recovered 42 feet from the pool. One fragment was recovered 130 feet from the pool.

Not Applicable

TABLE 4 – 81 mm M362A Phase One Results

Perforation of Pool			Fragment Size		Comments	Witness Screens	
Angle A, degrees	Distance D, in.	Height, in.	Length, in.	Width, in		Screen No.	Distance, in.
2.56	12.12	17	2.5	0.25		1	10
2.56	12.12	17	1.5	0.125	Dent	2	15
1.79	12.06	36	0.25	2		3	20
7.62	13.05	7	4	2		4	25
7.34	12.97	5	1	0.25	Dent		
7.62	13.05	9	0.75	0.5			
8.46	13.28	12	1	0.5	3 together		
9.61	13.63	14	0.25	0.25	Frag imbedded		
7.62	13.05	22	0.5	0.25			
7.34	12.97	33	2	1			
7.89	13.12	36	1	0.5			
10.50	13.92	9	3	1			
10.80	14.02	37	0.75	0.75			

Note: Fragment penetrated 3rd screen but not 4th.

2.1.4 60 mm M49A4 Mortar

The 60 mm M49A4 mortar contains 0.42 lbs of Comp B. For the phase one test the fuze well was packed with 65.2 grams of C-4. A 90 inch diameter, 18 inch deep pool was used for this test. The mortar was placed nose down in the pool with the nose 2 inches off the bottom. The pool was filled to the top (22 inch depth) but no effort was made to level the ground under the pool. As a result the low side of the pool began to sag before the test. Sandbags were used to prop up this side. No fragments penetrated the rear of the pool, but were found in the bottom of the pool. Fragment holes were found in the lower portion of the witness panel. Several fragments were found 30 to 40 feet from the pool, but the fragment field extended only 30 degrees off a line running through the center of the munition to the nearest point on the side of the pool. No fragments were found in the same region behind the witness panel side, although several fragments penetrated the witness panel.

TABLE 5 – 60 mm M49A4 Phase One Results

Perforation of Pool			Fragment Size		Comments	Witness Screens	
Angle A, degrees	Distance D, in.	Height, in.	Length, in.	Width, in		Screen No.	Distance, in.
2.97	7.32	10	1.75	1.25		1	5
6.07	8.26	4	2.25	0.25		2	10
6.07	8.26	12	0.5	0.125		3	15
6.67	8.49	4	1	0.125	dent	4	20

Note: Fragment penetrated 1st screen but not 2nd.

2.1.5 Phase One Summary and Conclusions

Open front barricade tests using the 60 mm and 81 mm mortars and the 105 mm projectile were also conducted at this test range during this time. The

Not Applicable

detonations were all initiated by packing the fuze wells with C-4. It was observed that the fragments from the water tests were significantly larger than those from the barricade tests. This is most likely due to the confinement of the water. Compared to the number of fragment impacts observed in the barricade tests, a very small number of fragments penetrated the witness panels in the water tests. The water contained all but the most energetic fragments. A summary of the penetration distances is presented in Table 6. The screen distance is the distance of the first screen that was not penetrated by fragments. The panel distance is the longest travel distance through water of a fragment impacting the witness panel.

Because these fragments were larger than would be expected from the detonation of a munition not submerged in water, they probably penetrated a greater thickness of water than would be expected in an intentional detonation of a munition in the field. Consequently, in actual field conditions, the thickness of water required to contain munition fragments can be expected to be less than those shown here.

TABLE 6 – Water Penetration Distance, Phase One

Munition	Fragment Penetration, in.	
	Screen	Panel
60 mm M49A4	< 10	8.5
81 mm M362A	< 25	14
105 mm M1	< 42	53
155 mm M107	< 70	105

2.2 Phase Two Tests

Phase Two tests were set up in a manner simulating actual field conditions. For each test the munition was placed in a horizontal orientation in a hole with the top of the munition six inches below the ground surface. A piece of plywood was placed over the hole to keep the water containers from resting on the munition. The detonation was initiated using a GOEX oil well perforator charge containing 26 grams of RDX. The perforator was placed on the side of the munition so that the shaped charge was directed slightly downward. Pressure gages and sound meters were used to measure the blast effects. Video cameras and a high speed digital camera were used to record each test. The test setup is shown in Figure 2.

2.2.1 155 mm M107 Projectile

Two water containment systems were tested with the 155 mm M107 projectile. The first system was two layers of 55 gallon drums and the second system was a single 1100 gallon agricultural tank.

Not Applicable

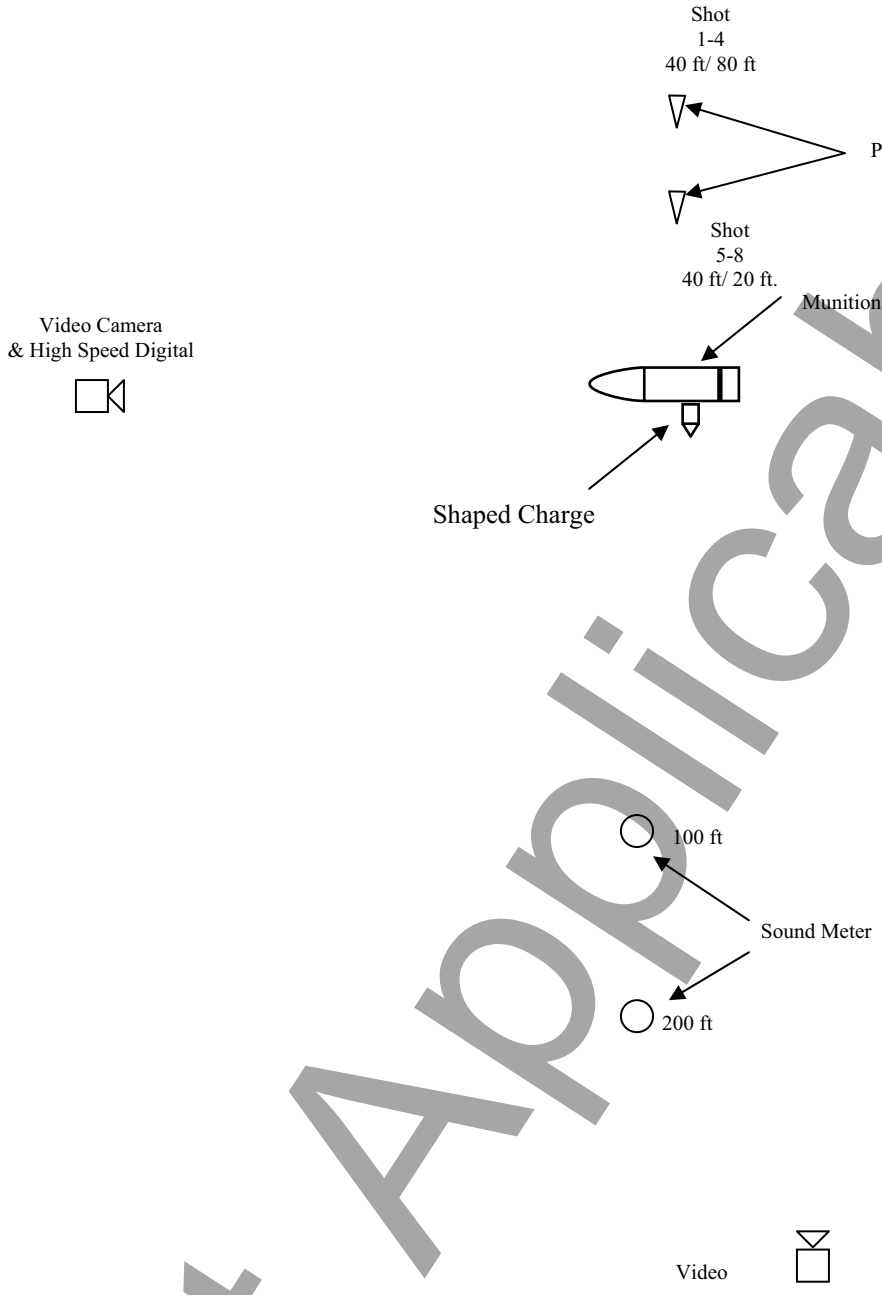


FIGURE 2 – Instrument and Camera Layout for Phase Two Tests

Not Applicable

2.2.1.1 Water Contained in 55 Gallon Drums

After placing the 155 mm M107 with the initiator in the hole (see Figure 3), a sheet of ¾ inch plywood was placed over the hole and two layers of 55 gallon drums were placed over the projectile. A total of 28 drums were used with a witness panel placed between the layers and around the outside of the drums. This layout is shown in Figure 4.

The barrels were thrown seventy feet into the air. One barrel, mostly intact, was recovered about 300 feet from ground zero. It had apparently rolled part of this distance. The rest of the barrels were recovered within 100 feet of the crater.

A partially destroyed barrel was recovered approximately 55 feet from the crater with a 3 inch long fragment embedded in the inside surface. Beside this barrel was another fragment about 2 inches long, which may have fallen out of the barrel as it rolled. A small fragment was found inside one of the barrels from the top layer. Several fragments were found between 30 and 40 feet from the crater.

A small fragment hole (about ¼ inch in diameter) was found in the witness plate that was between the layers of barrels. The penetration appeared in the gap between barrels indicating that at least part the fragments path was through air and not water. The top barrel directly over the charge was perforated on the bottom and a circular section over the charge was dented by fragments but not perforated at the top.

Airblast and sound pressure measurements (converted from decibels to psi) are plotted against open-air blast pressure curves for a 155 mm M107 projectile in Figure 5.

Fragments from the 155 mm M107 projectile can penetrate more water than the 3 ft height of the barrels. Because there are significant gaps between the barrels when they are stacked (even more so on uneven ground), a greater area must be covered with barrels to insure that fragments do not escape. This method is very time consuming. Several hours were required to stack and fill all the barrels with water.

2.2.1.2 Water Contained in 1100 Gallon Agricultural Tank

An 1100 gallon agricultural tank was placed over the munition and filled with water. The cylindrical tank was 7 feet in diameter and 58 inches tall. The opaque plastic was approximately 1/8 inch thick. The test layout is shown in Figure 6. The detonation tore the tank into large pieces. One piece was recovered approximately 250 feet from ground zero. One fragment was embedded in the inner side of a piece of the tank but no fragments penetrated the tank.

Not Applicable

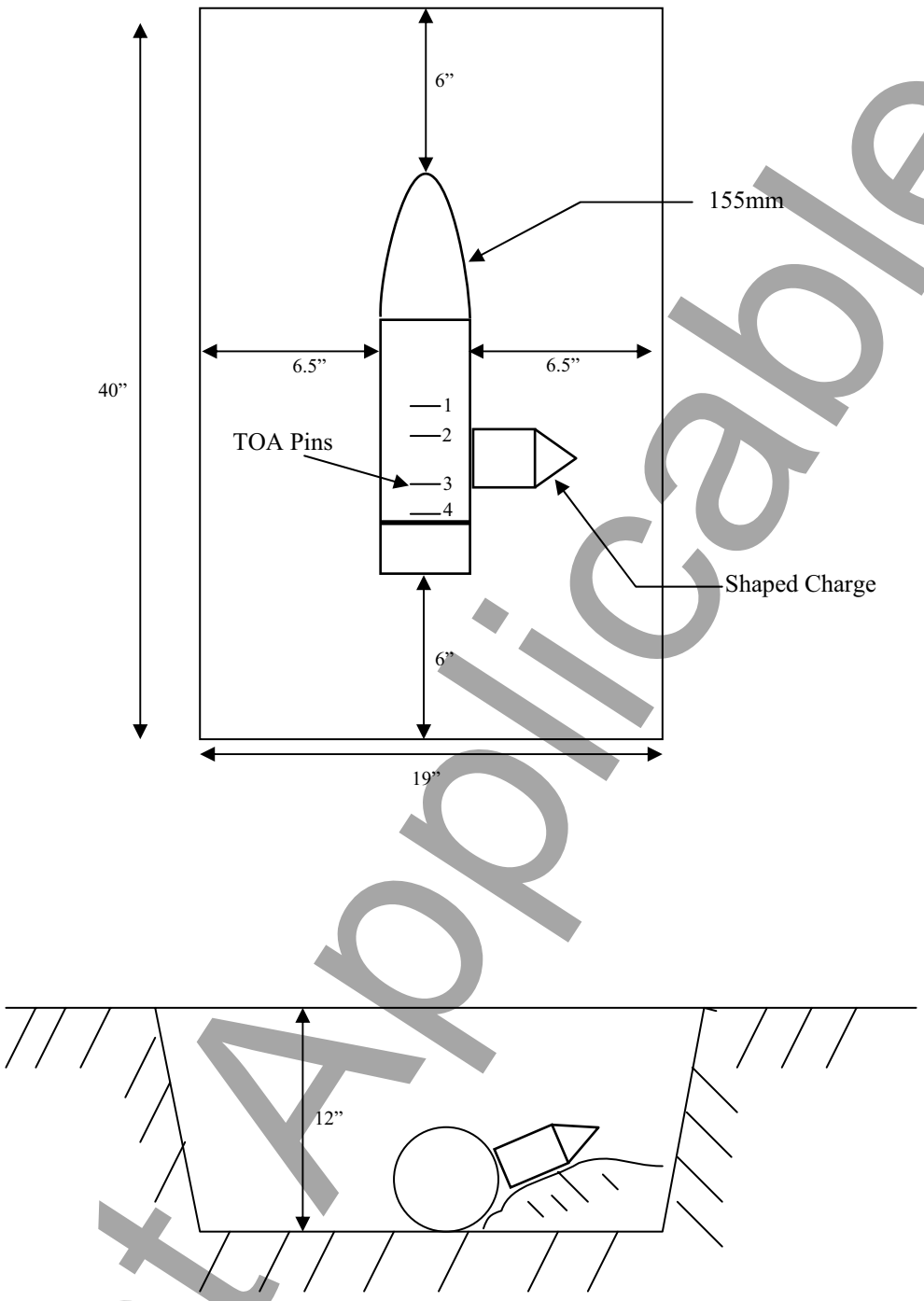
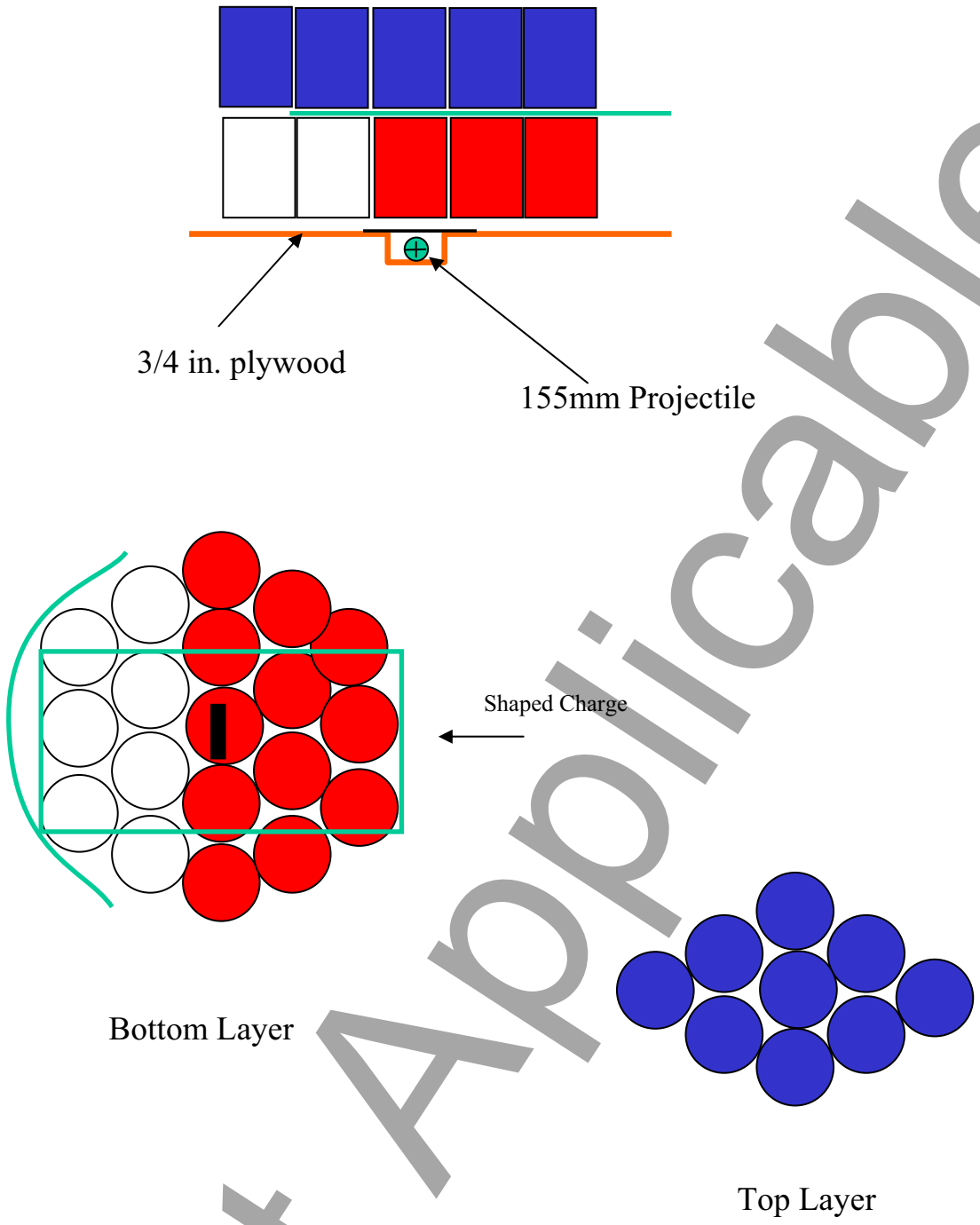


FIGURE 3 – Munition and Initiator Placement for 155 mm M107 Projectiles

Not Applicable



Not Applicable

FIGURE 4 – Test Layout for 155 mm M107 Under 55 Gallon Drums

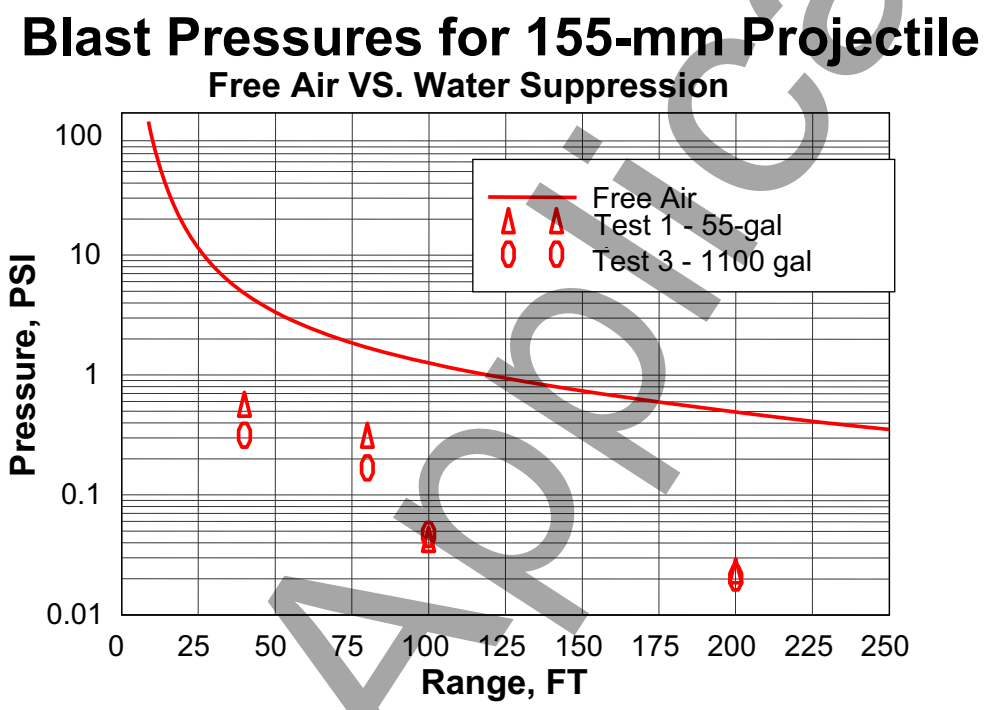


FIGURE 5 – 155 mm M107 Blast Pressures

Not Applicable

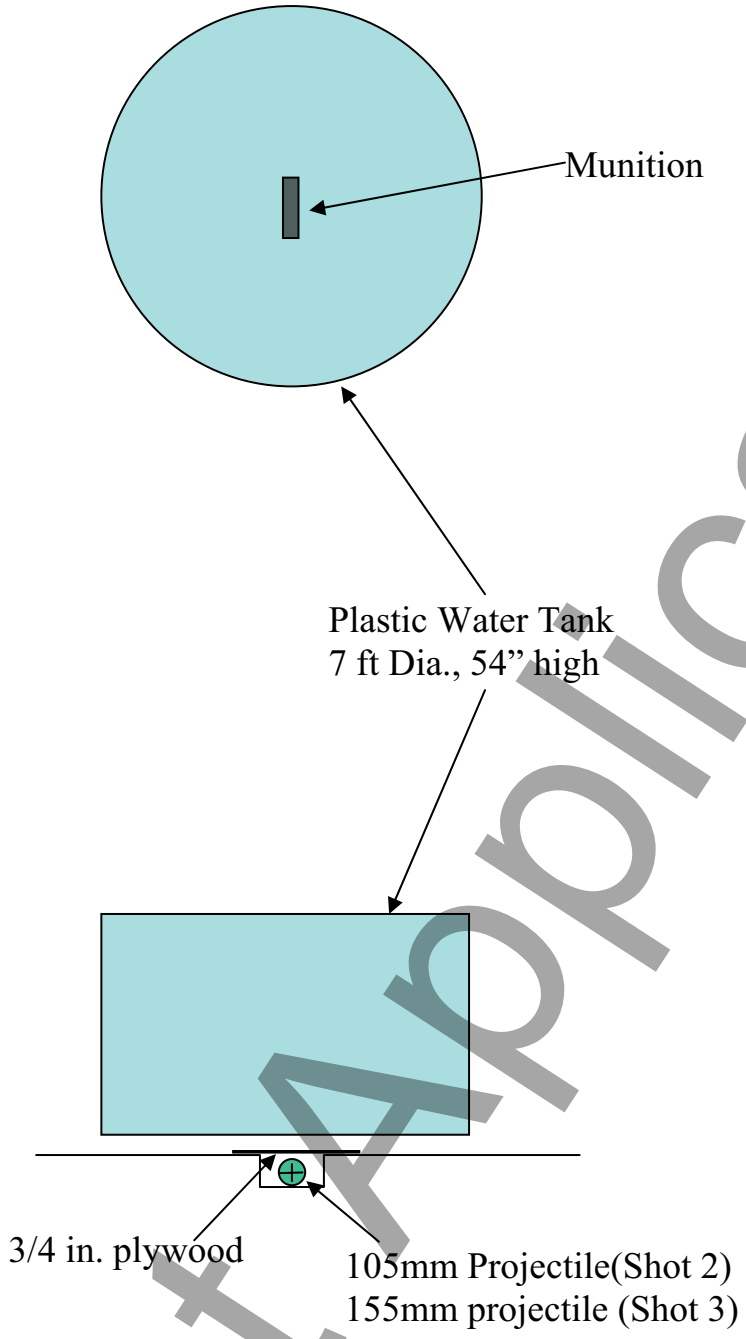


FIGURE 6 – Layout for Tests Using 1100 Gallon Agricultural Tank

Not Applicable

2.2.2 105 mm M1 Projectile

Two water containment systems were tested with the 105 mm M1 projectile. The first system was two layers of 55 gallon drums and the second system was a single 1100 gallon agricultural tank.

2.2.2.1 Water Contained in 55 Gallon Drums

After placing the 105 mm M1 with the initiator in the hole (see Figure 7), a sheet of ¾ inch plywood was placed over the hole and two layers of 55 gallon drums were placed over the projectile. A total of 22 drums were used with a witness panel placed between the layers and around the outside of the drums. This layout is shown in Figure 8.

Several fragments penetrated the witness panel between the layers of drums and there were a few dents where the panel was impacted but the fragments did not penetrate. As in the 155 mm M107 test, the fragments penetrating the witness panel were in the gaps between barrels.

The furthest drum was recovered 70 feet from ground zero. Most of the top layer of drums seemed to come straight back down and land in or near the crater. Two of the drums in the crater were undamaged and full of water.

Airblast and sound pressure measurements (converted from decibels to psi) are plotted against open-air blast pressure curves for a 105 mm M1 projectile in Figure 9.

2.2.1.2 Water Contained in 1100 Gallon Agricultural Tank

The test layout is shown in Figure 6. Most debris was within 35 feet of the crater. A number of fragments were found within 50 feet of ground zero, including a piece of the base plate at 50 feet off the base end of the munition. A large piece of the tank was found at 180 feet. A 6 inch long fragment was stuck in the plastic with the bulk of the fragment on the inside of the tank. There were several dents in the witness panels, but only one complete penetration and the fragment causing this penetration was found within a few feet of the panel. Only one obvious exit hole was found in the side of the tank.

The tank is light, easy to place and, because of a large filler hole, can be filled with water in just a few minutes. This container defeated essentially all of the fragments. The one or two that did penetrate the container had been slowed enough that they did not travel any distance. The container pieces traveled further than these primary fragments.

Not Applicable

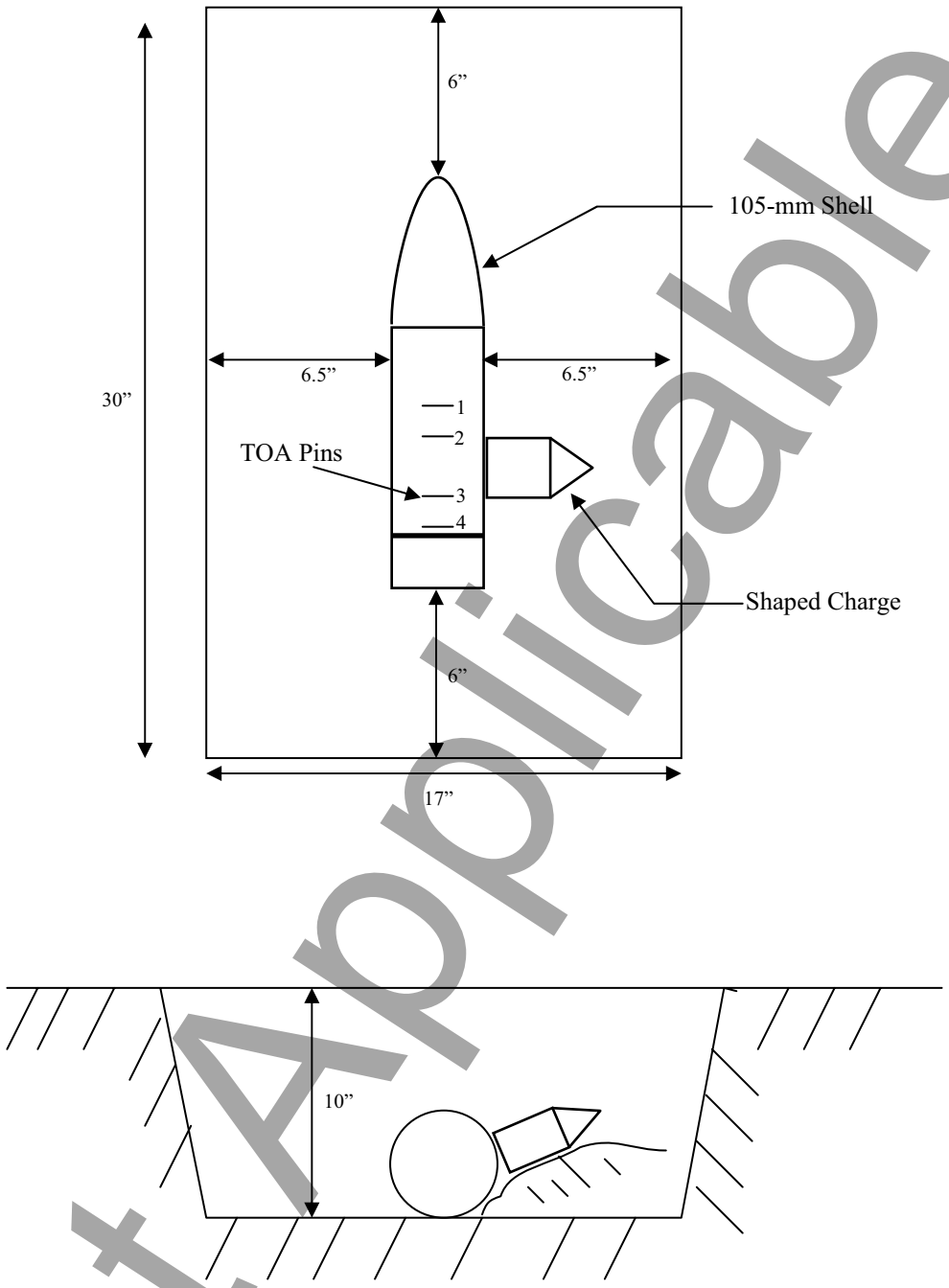
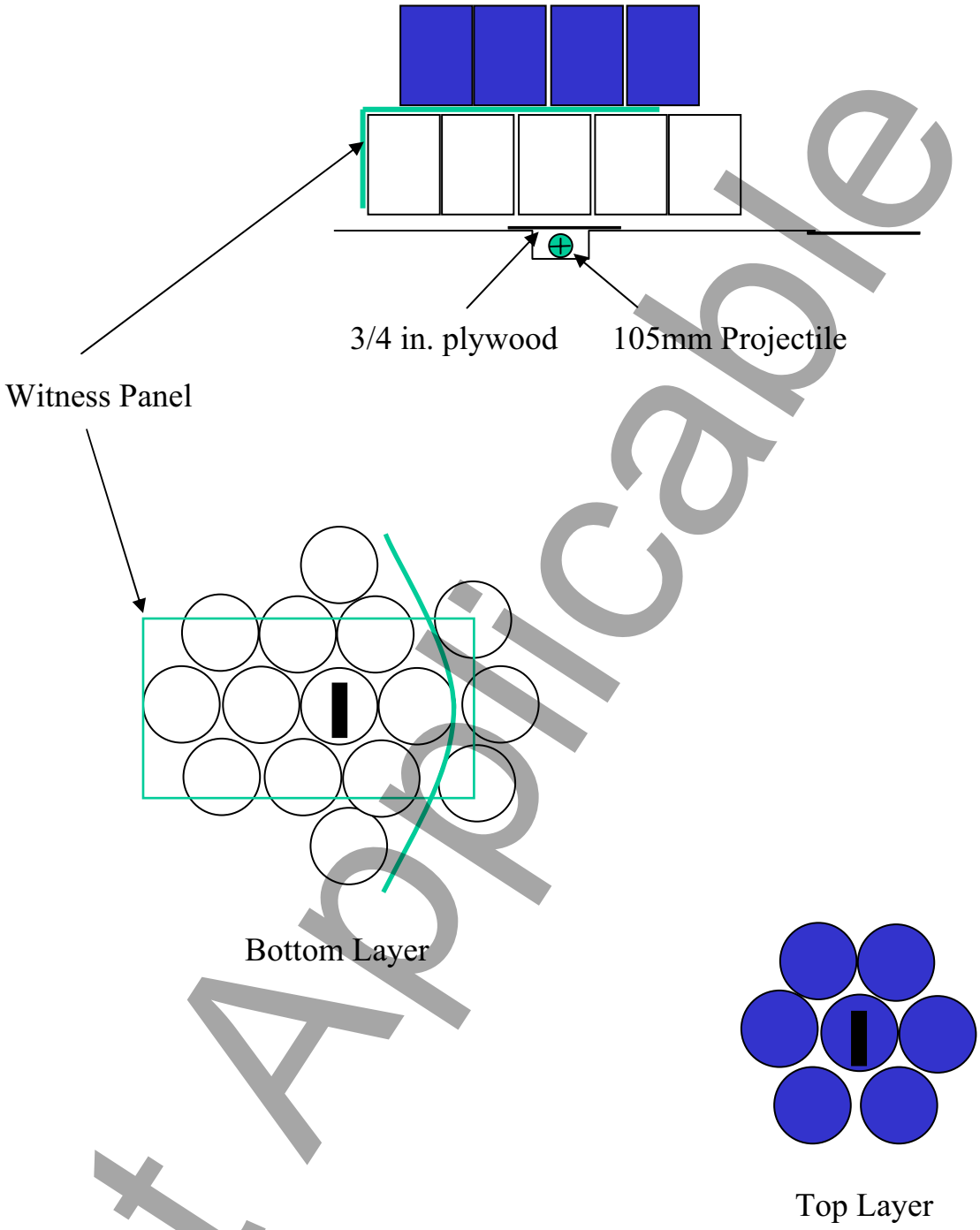


FIGURE 7 – Munition and Initiator Placement for 105 mm M1 Projectiles

Not Applicable



Not Applicable

FIGURE 8 - Test Layout for 105 mm M1 Under 55 Gallon Drums

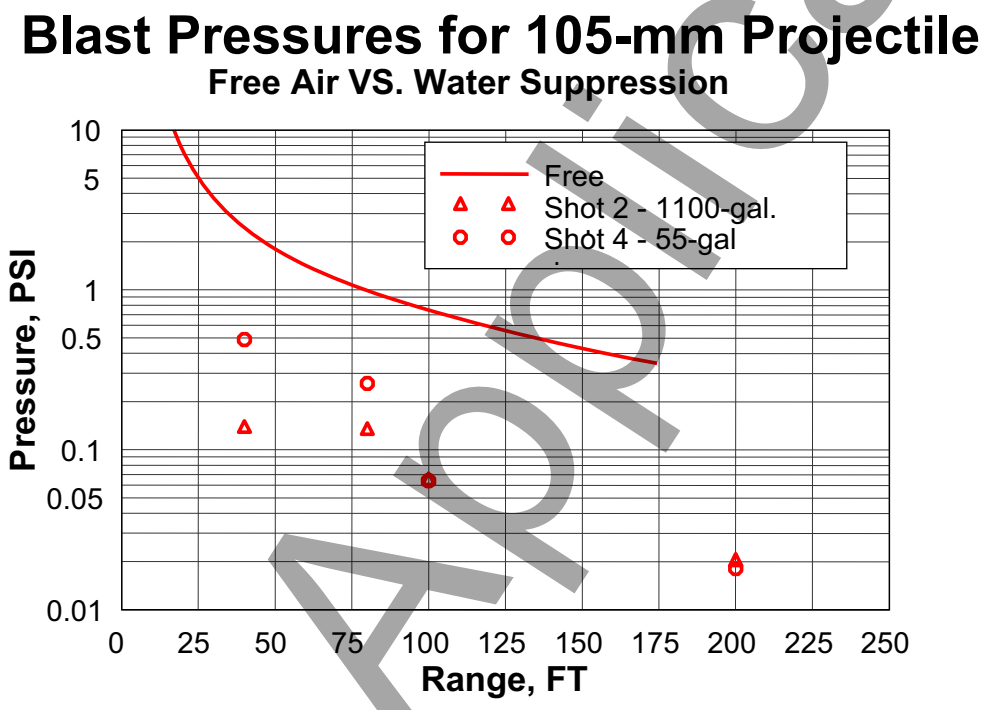


FIGURE 9 - 105 mm M1 Blast Pressures

Not Applicable

2.2.3 81 mm M362A Mortar

Two water containment systems were tested with the 81 mm M362A mortar. The first system was two layers of 5 gallon plastic carboys and the second system was a 90 inch diameter inflatable wading pool.

2.2.3.1 Water Contained in 5 Gallon Carboys

After placing the 81 mm M362A with the initiator in the hole (see Figure 10), a half sheet of ¾ inch plywood was placed over the hole and two layers of 5 gallon carboys were placed over the mortar. A total of 31 carboys were used with a witness panel placed between the layers and around the outside of the carboys. This layout is shown in Figure 11.

There was one small fragment hole in the witness panel over the bottom layer of containers and a larger hole about 3 inches long and an inch wide right behind the rear of the munition, probably made by the tail fin. One carboy was found off the side of the stack in the woods at 223 feet and another in a pond about 240 feet off the nose end of the munition. Several were found at distances near 100 feet. Many were still full of water. The tail fin of the mortar was recovered intact directly to the rear of the munition at a distance of 107 feet. Blast pressures from the 81 mm tests are shown in Figure 12.

2.2.3.2 Water Contained in 90 inch Inflatable Wading Pool

After placing the 81 mm M362A with the initiator in the hole, a half sheet of ¾ inch plywood was placed over the hole and a 90 inch diameter inflatable wading pool was placed over the mortar (see Figure 16). The water depth was 18 inches. A witness panel was placed over the pool.

The witness panel was thrown several feet into the air. A hole was blown in the bottom of the pool but the inflated perimeter of the pool was essentially intact. The side of the pool had a small puncture on the inside that caused it to slowly deflate. The witness panel was not perforated.

2.2.4 60 mm M49A4 Mortar

Two water containment systems were tested with the 60 mm M49A4 mortar. The first system was two layers of 5 gallon plastic carboys and the second system was a 90 inch diameter inflatable wading pool.

2.2.4.1 Water Contained in 5 Gallon Carboys

After placing the 60 mm M49A4 with the initiator in the hole (see Figure 13), a half sheet of ¾ inch plywood was placed over the hole and two layers of 5 gallon carboys were placed over the mortar. A total of 11 carboys were used with a

Not Applicable

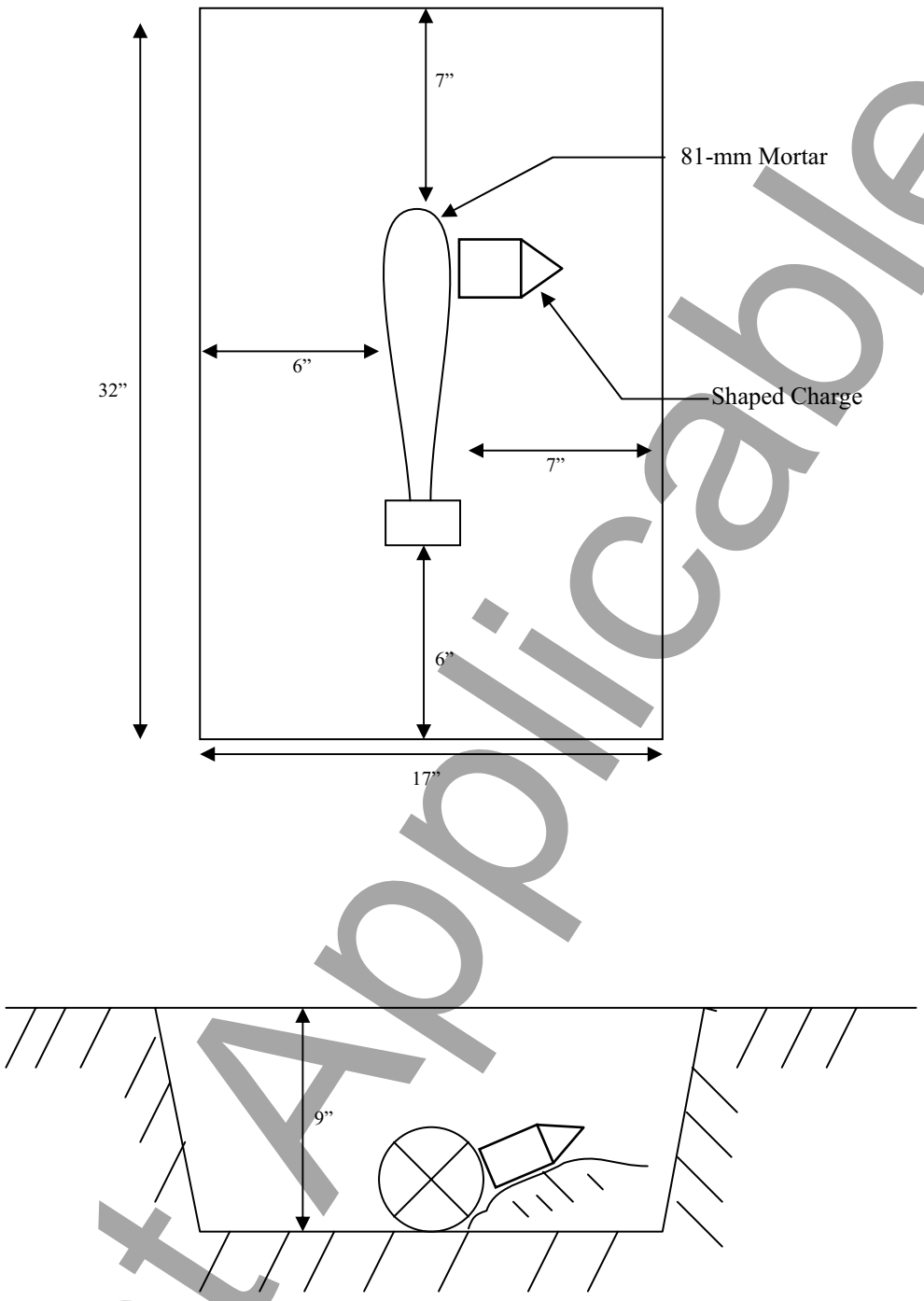
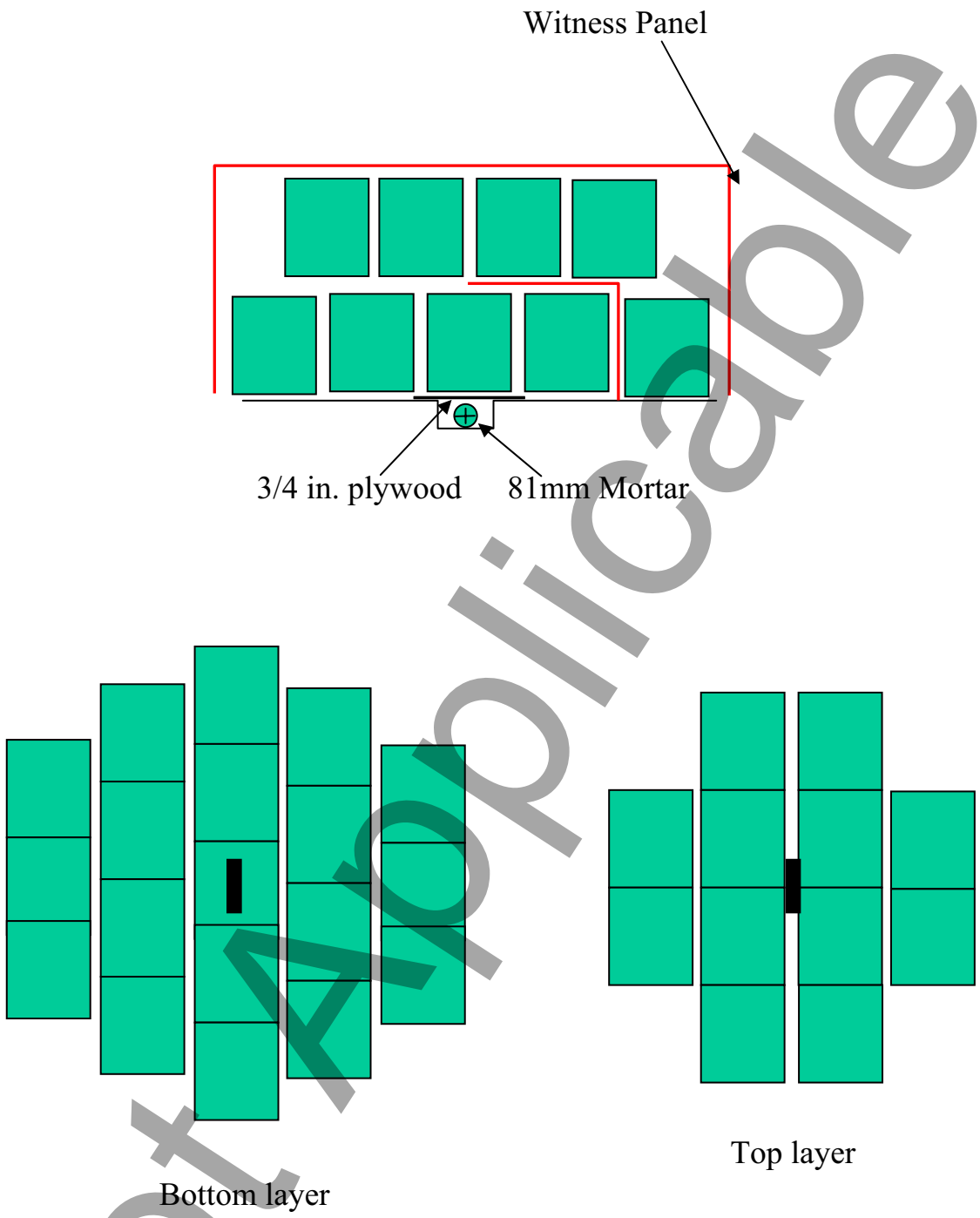


FIGURE 10 – Munition and Initiator Placement for 81 mm M362A Mortars

Not Applicable



Not Applicable

FIGURE 11 - Test Layout for 81 mm M362A Under 5 Gallon Carboys

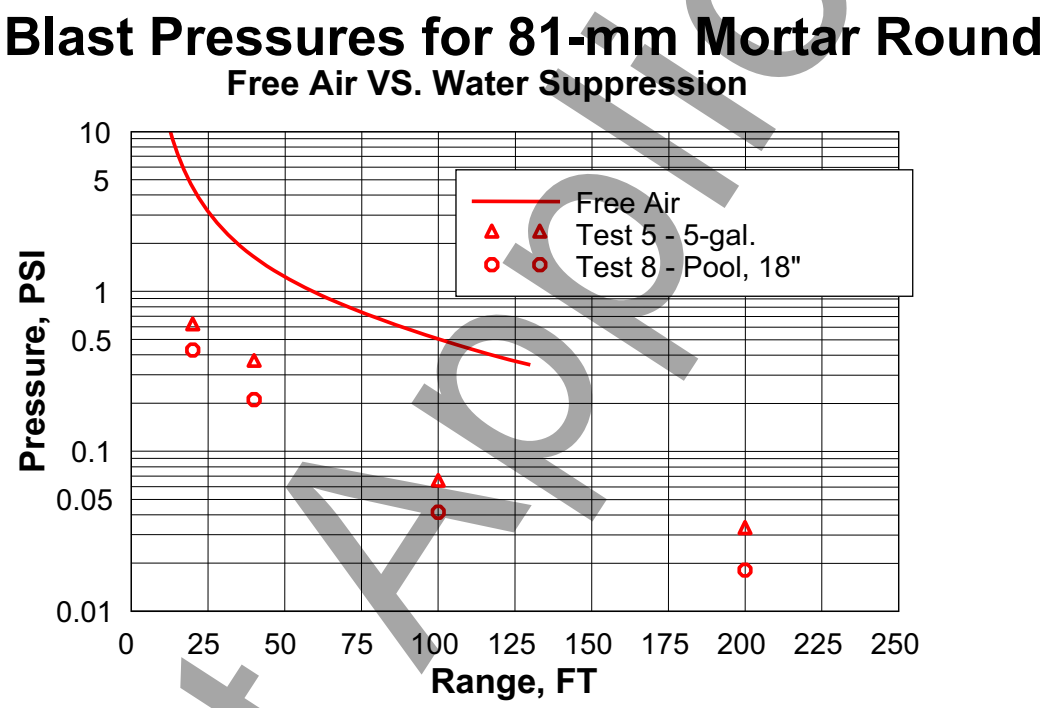


FIGURE 12 - 81 mm M362A Blast Pressures

Not Applicable

witness panel placed between the layers and around the outside of the carboys. This layout is shown in Figure 14.

The carboys were thrown more than 100 feet into the air. Those on top landed within 10 feet of the crater. It was observed that the containers on the outer layers are the ones thrown the furthest. The most distant carboy on this test was recovered 44 feet from the nose of the munition. There were no holes in the witness panels. The blast pressures for the 60 mm tests are shown in Figure 15.

2.2.4.2 Water Contained in 90 inch Inflatable Wading Pool

After placing the 60 mm M49A4 with the initiator in the hole, a half sheet of ¾ inch plywood was placed over the hole and a 90 inch diameter inflatable wading pool was placed over the mortar (see Figure 16). The water depth was 18 inches. A witness panel was placed over the pool.

The witness panel was thrown off of the pool. A hole was blown in the bottom of the pool but the inflated perimeter of the pool was not punctured. There were no perforations or even dents in the witness panel.

2.2.5 Phase Two Summary and Conclusions

Water is an excellent medium for mitigating blast and fragmentation due to the intentional detonation of unexploded ordnance. Test results show that noise due to detonation is reduced by the water and the fragments from the munitions can be defeated by water.

The best results were obtained using single containers for the water. When multiple containers are used fragments can travel through gaps between containers and the containers are thrown some distance by the blast. Also, containers that are not rigid seem to be a better option than rigid containers because the pieces of the non-rigid containers are smaller, lighter (non-hazardous) and don't travel as far. Non-rigid containers require a more level ground surface but the sides could be supported by soil or sandbags.

As the required thickness of water increases, rigid sides are necessary to contain the large volumes of water and the rigid sides may contribute to the secondary fragment distances. The small pools are readily available at local stores during the spring and early summer but may be difficult to obtain at other times. The agricultural tanks are available any time but may need to be ordered requiring advance planning.

Whenever possible a half sheet (4 ft x 4 ft) of plywood rather than a full sheet (8 ft x 8 ft) should be used under the charge. All of the plywood should be covered by the water container(s) to minimize debris from the plywood.

Not Applicable

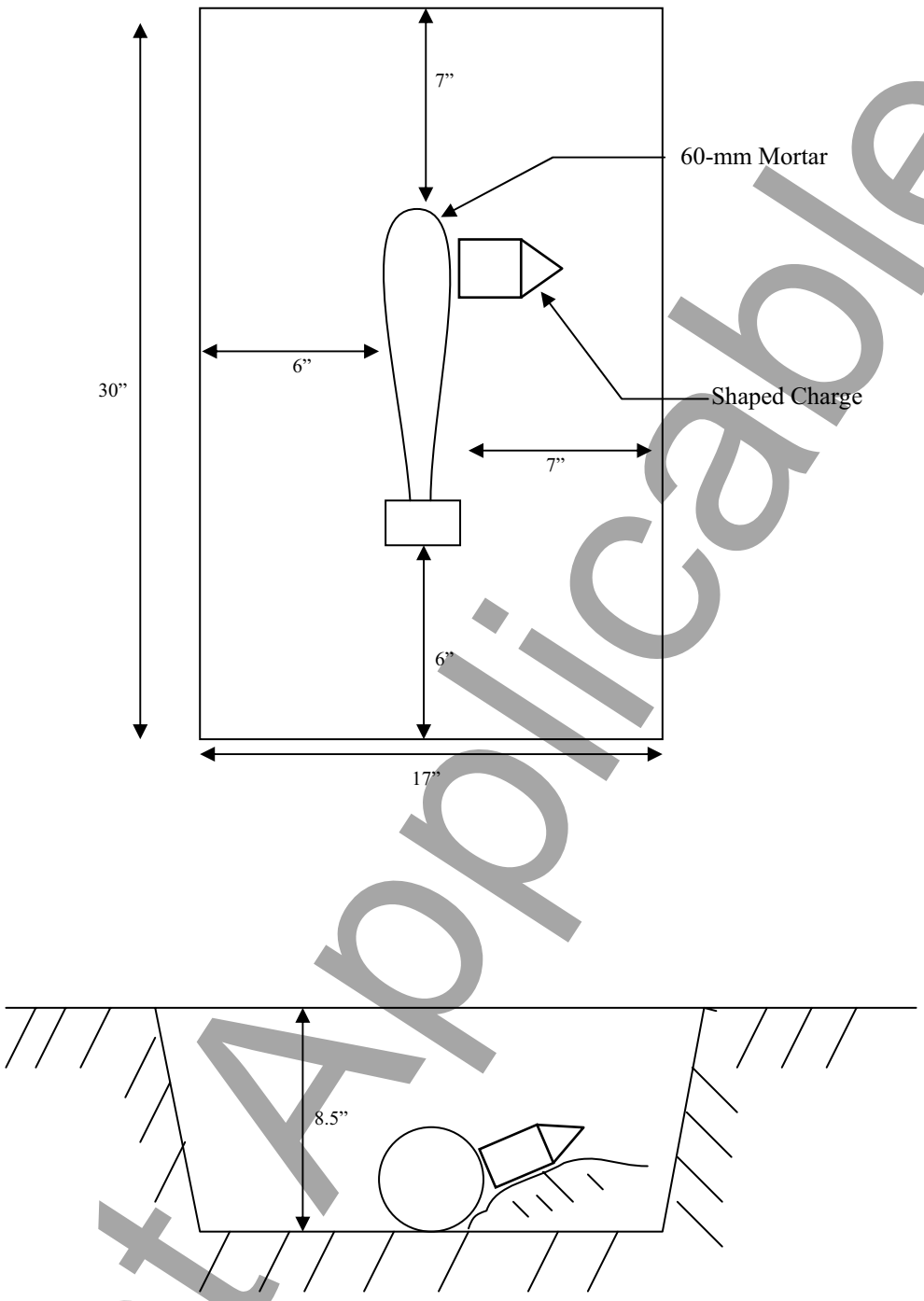
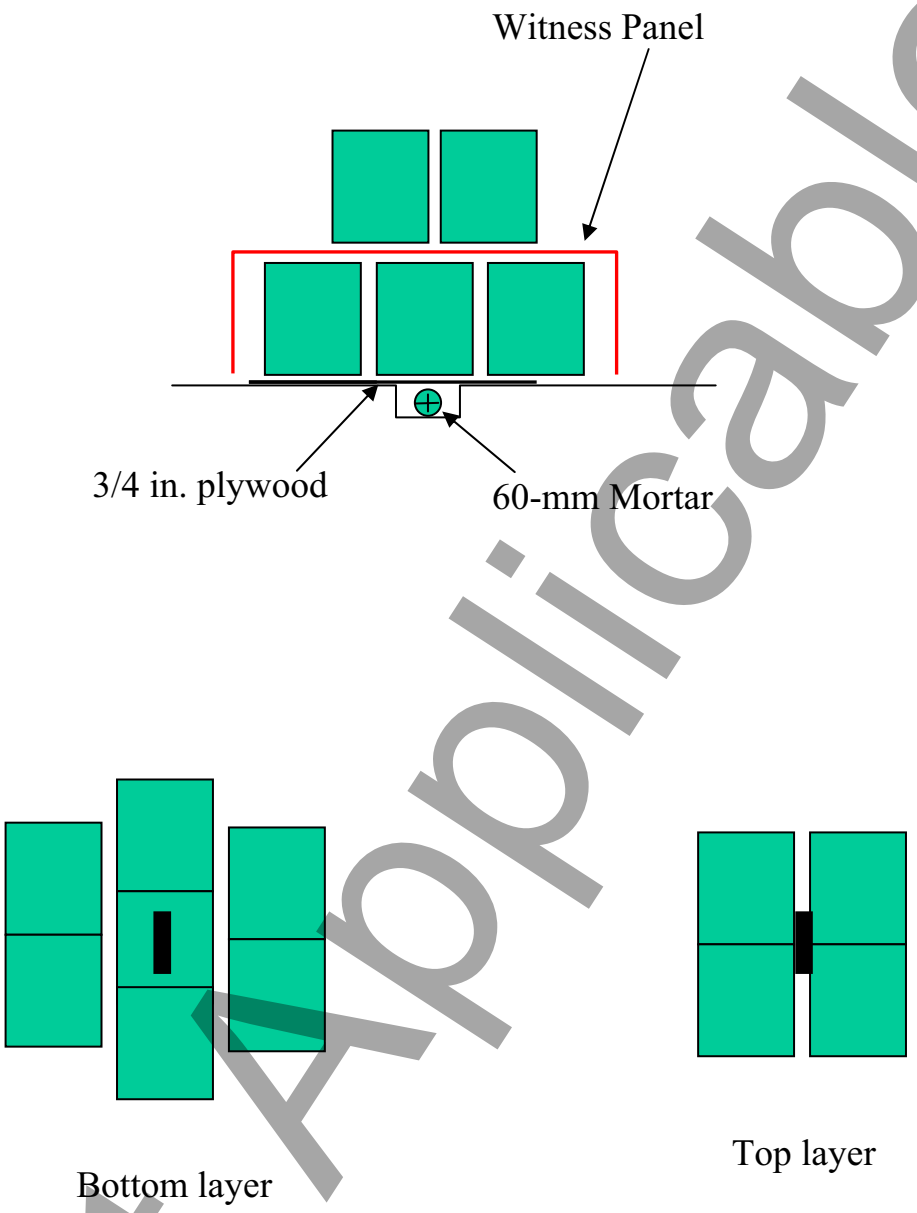


FIGURE 13 – Munition and Initiator Placement for 60 mm M49A4 Mortars

Not Applicable



Not Applicable

FIGURE 14 - Test Layout for 60 mm M49A4 Under 5 Gallon Carboys

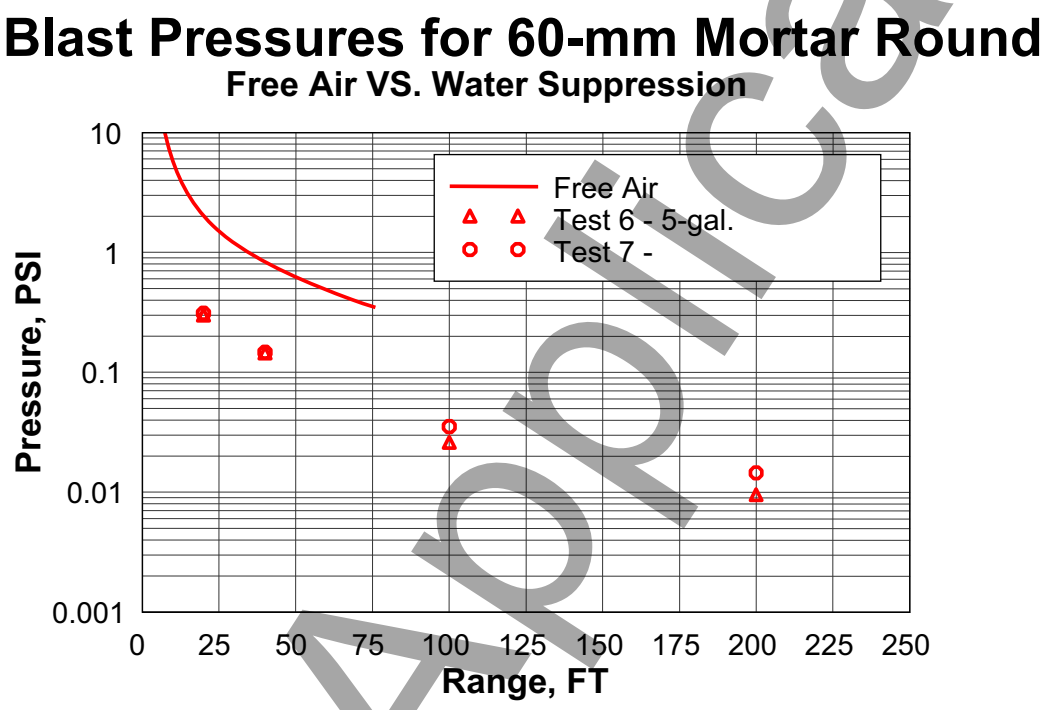


FIGURE 15 - 60 mm M49A4 Blast Pressures

Not Applicable

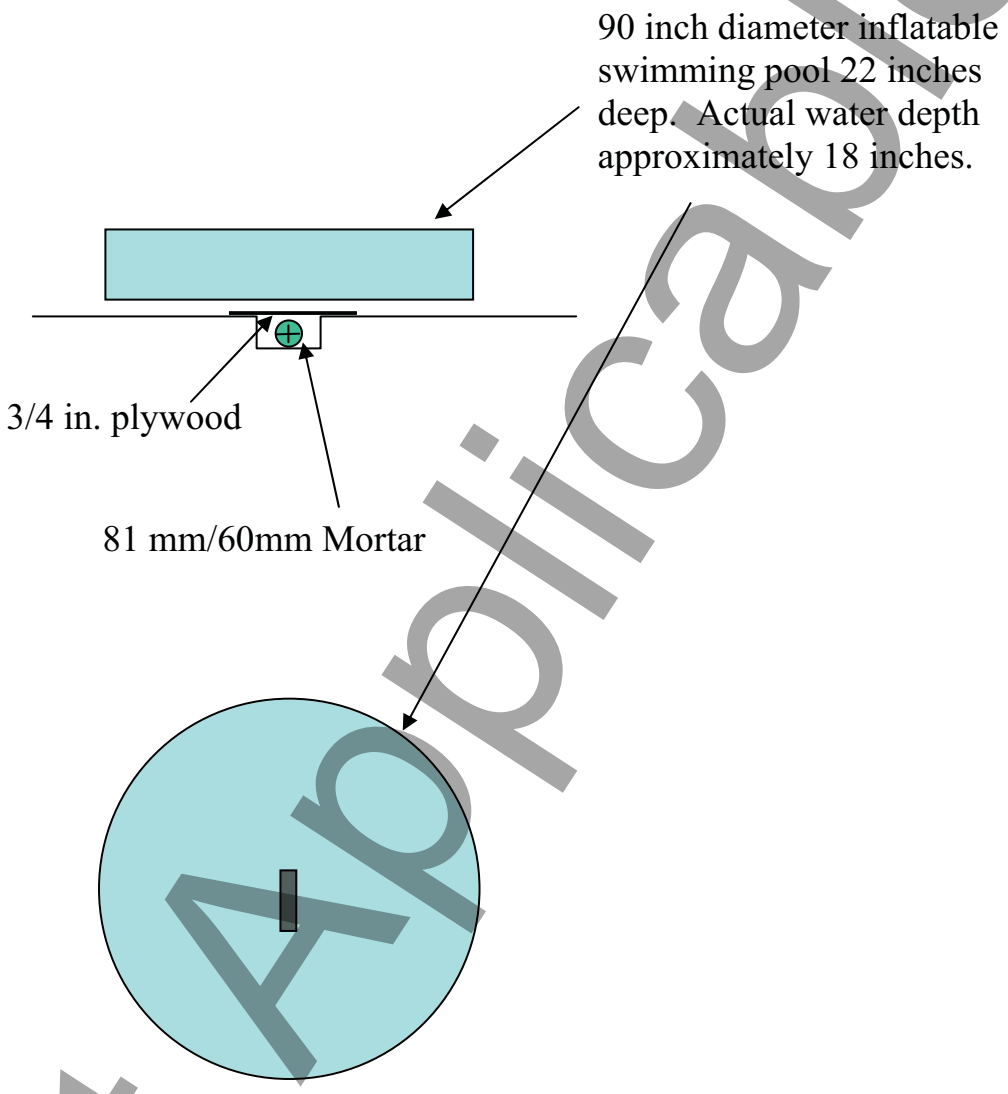


FIGURE 16 - Test Layout for 81 mm M362A and 60 mm M49A4 Under Inflatable Pool

Not Applicable

Care should be taken to insure that there are no water spills of sufficient volume to the hole in which the munition is located. This could lead to a misfire. Also, as observed in phase one, the water may cause sufficient confinement to increase fragment size and penetration capabilities.

3.0 Water Mitigation for Intentional Detonations

3.1 Water Containment System

Based on the results from the Phase Two tests, the fragments from an intentional detonation of a 155 mm M107 or a 105 mm M1 projectile are defeated using an 1100 gallon agricultural tank filled with water. The 55 gallon drums are not a viable system for defeating fragments from an intentional detonation because of the gaps between the cylindrical barrels. The fragments from an intentional detonation of an 81 mm M362A or a 60 mm M49A4 mortar are defeated using either a system of 5 gallon plastic carboys or a 90 inch diameter, 18 inch deep wading pool. The results of the Phase Two tests are summarized in Table 7. To be conservative, the maximum secondary debris throw distance shown in Table 7 is 10% greater than the measured maximum secondary debris throw distance. Due to the small values, the overpressures have not been increased from the measured values.

TABLE 7 – Summary of Results From Phase Two Tests

Munition	Water Containment System	Max. Secondary Debris Throw Distance (ft)	Max Peak Overpressure (psi)				
			@ 20 ft	@ 40 ft	@ 80 ft	@ 100 ft[A]	@ 200 ft[A]
155 mm M107	1100 gal. Tank	275		0.28	0.15	0.0415	0.018
105 mm M1	1100 gal. Tank	198		0.136	0.132	0.064	0.02
81 mm M362A	5 gal. Carboys	264	0.61	0.36		0.064	0.0325
81 mm M362A	Inflatable Pool	See note	0.43	0.21		0.0415	0.018
60 mm M49A4	5 gal. Carboys	48	0.29	0.14		0.0251	0.0092
60 mm M49A4	Inflatable Pool	See note	0.31	0.147		0.0352	0.0145

[A]Pressure calculated from measured sound level.
Note: Inflatable pool did not produce any hazardous secondary debris.

The four munition types tested do not cover all of the munitions that may be encountered. To determine the water containment system required for a particular munition other than those tested, the approach is as follows:

Not Applicable

(1) Determine the initial fragment velocity (v_f) in ft/s, the maximum fragment weight (W_f) in pounds, and the equivalent weight kinetic energy ($W_f v_f^2/2$) in lb-ft^2/s^2 for the particular munition.

(2) Identify the munition with the next largest kinetic energy from the four tested munitions.

(3) Use the water containment system from Table 7 for the tested munition with the next largest kinetic energy shown.

The maximum fragment weight, the initial fragment velocity, and the resulting kinetic energy for a variety of munitions are provided in Table 8. Table 8 also shows the suitable water containment system for these munitions. The munition/initiator placements and water containment systems are detailed in Figures 3, 6, 7, 10, 11, 13, 14, and 16. The maximum fragment weight and the initial fragment velocity values have been determined with the Mott and Gurney equations, as presented in TM 5-1300 [1] and detailed in HNC-ED-CS-S-98-1 [2]. This procedure should not be used to extrapolate water containment systems for munitions larger than the 155 mm M107 projectile.

3.2 Minimum Separation Distance

A minimum separation distance is required for any detonation. This minimum separation distance applies to everyone, both public and operational personnel. The minimum separation distance is the maximum of the debris throw distance, the distance to an overpressure of 0.065 psi (corresponds to K328 = $328W^{1/3}$, where W is the net explosive weight), or 200 ft. For all munitions tested the overpressure at 200 ft was substantially less than 0.065 psi. In some cases, the debris throw distance exceeds 200 ft. The minimum separation distances are listed in Table 8.

4.0 Summary and Conclusions

A test program has been performed to determine the effects of water for mitigating fragments and blast effects due to an intentional detonation of a munition. Tests were performed using four different munitions and two water containment systems for each munition.

The results of these tests have been used to develop guidelines for the use of water to mitigate fragments and blast effects due to an intentional detonation of a munition. Methods for determining the required water containment system and the resulting minimum separation distance are detailed in Section 3.0. Figures 3, 6, 7, 10, 11, 13, 14, and 16 show the resulting munition/initiator configuration and water containment systems.

Not Applicable

In addition to mitigating the fragments and the overpressure, water quenches the fireball due to an explosion. Therefore, this system insures that there in no fire hazard from an intentional detonation.

5.0 References

1. TM 5-1300, “Structures to Resist the Effects of Accidental Explosions”, Departments of the Army, the Navy, and the Air Force, November 1990.

2. HNC-ED-CS-S-98-1, “Methods for Predicting Primary Fragmentation Characteristics of Cased Explosives”, M. Crull, U.S. Army Engineering and Support Center, Huntsville, January 1998.

Not Applicable

TABLE 8 – Water Containment System and Minimum Separation Distance

Munition	Max Fragment Weight (lb)	Critical Fragment Velocity (fps)	Equivalent Weight Kinetic Energy 10^6 (lb-ft^2/s^2)	Water Containment System	Minimum Separation Distance (ft)
20 mm M56A4	0.00058	3183	0.0029503	5 gal carboys/ inflatable pool	200
25 mm M792	0.00820	4256	0.0742528	5 gal carboys/ inflatable pool	200
M31 Rifle Grenade[A]	0.000361	11642	0.0244643	5 gal carboys/ inflatable pool	200
VB Rifle Grenade Mark I	0.0078	3660	0.0522428	5 gal carboys/ inflatable pool	200
37 mm Mk I, LE Practice	0.034207	1368	0.0320079	5 gal carboys/ inflatable pool	200
37 mm MK II	0.02953	5758	0.4894774	5 gal carboys	264
				inflatable pool	200
40 mm M406	0.00036	4508	0.0036986	5 gal carboys/ inflatable pool	200
GP Grenade M42 (submunition)[A]	0.00035	5805	0.0058803	5 gal carboys/ inflatable pool	200
40 mm MK2 Mod 0	0.03306	3605	0.2148275	5 gal carboys/ inflatable pool	200
40 mm HEDP M433	0.00023	11313	0.0147821	5 gal carboys/ inflatable pool	200
M73 Submunition	0.00200	8059	0.0649475	5 gal carboys/ inflatable pool	200
57 mm Chinese	0.01940	5500	0.2933645	5 gal carboys/ inflatable pool	200
57 mm M306	0.01291	3495	0.0788236	5 gal carboys/ inflatable pool	200
MK II Grenade	0.014217	3425	0.0833871	5 gal carboys/ inflatable pool	200
M39 Submunition	0.00011	2338	0.0003006	5 gal carboys/ inflatable pool	200
2.36 " Rocket (Case Only)	0.001035	8888	0.0408807	5 gal carboys/ inflatable pool	200
60 mm M49A3	0.02367	5114	0.3095835	5 gal carboys/ inflatable pool	200
60 mm M49A5	0.01660	6290	0.328382	5 gal carboys/ inflatable pool	200
M15 WP Grenade	0.00340	2685	0.0122557	5 gal carboys/ inflatable pool	200
BLU-59, BLU-26, BLU-36 Submunition	0.00152	6278	0.0299541	5 gal carboys/ inflatable pool	200

Not Applicable

TABLE 8 (cont) - Water Containment System and Minimum Separation Distance

Munition	Max Fragment Weight (lb)	Critical Fragment Velocity (fps)	Equivalent Weight Kinetic Energy 10^6 (lb-ft^2/s^2)	Water Containment System	Minimum Separation Distance (ft)
Fragmentation Grenade, M67 (approx)	0.0011828	7006	0.0290283	5 gal carboys/ inflatable pool	200
2.75" M229 Rocket	0.005217	5569	0.0808994	5 gal carboys/ inflatable pool	200
6 lb Incendiary Bomb	0.0021	9431	0.0933909	5 gal carboys/ inflatable pool	200
FMU 54A/B Fuze	0.0064491	9031	0.2629909	5 gal carboys/ inflatable pool	200
75 mm M48	0.15303	3471	0.921814	1100 gal tank	200
3"/50 AP Mk 29	0.42992	1058	0.240619	5 gal carboys/ inflatable pool	200
3 in Stokes Mortar	0.04360	6189	0.835023	1100 gal tank	200
M1A1 Anti-Tank Mine	0.0138139	9891	0.6757199	5 gal carboys	264
				inflatable pool	200
4 lb Frag Bomb M83	0.076176	3266	0.4062754	5 gal carboys	264
				inflatable pool	200
81 mm M374	0.03083	6721	0.6963488	5 gal carboys	264
				inflatable pool	200
81 mm M56	0.03270	5724	0.5356943	5 gal carboys	264
				inflatable pool	200
3.5" M28A2 Rocket Case	0.05242	6126	0.9836056	1100 gal tank	200
90 mm M71	0.3426	2335	0.9339661	1100 gal tank	200
90 mm HEAT M371	0.124	3075	0.5862488	5 gal carboys	264
				inflatable pool	200
20 lb Frag Bomb M41	0.33321	3303	1.8176287	1100 gal tank	275
4 in Stokes Mortar	0.07820	6336	1.5696915	1100 gal tank	200
105 mm M1	0.20573	4055	1.6914479	1100 gal tank	200
105 mm HEAT M456	0.07010	6326	1.4026406	1100 gal tank	200
106 mm M344 (Case)	0.0630543	6238	1.2268048	1100 gal tank	200
4.2 in M3A1	0.07869	6391	1.6069785	1100 gal tank	200
British Naval 4.5"	0.408519	2461	1.237102	1100 gal tank	200
4.5 inch rocket M8	0.1485	5352	2.1268099	1100 gal tank	275
4.7 in Mark I	0.59147	3566	3.7606709	1100 gal tank	275
120mm M356	0.32909	3493	2.0076278	1100 gal tank	275
5 in 38 Caliber Mk 35	0.36485	3563	2.3158861	1100 gal tank	275
6" Trench Mortar	0.11418	3939	0.8857615	1100 gal tank	200
155 mm M107	0.64821	3426	3.8041893	1100 gal tank	275

[A]These rounds contain a shaped charge. Care must be taken that the destruction method does not allow formation of a jet and fragment slug.

Not Applicable

C.6 SOP 08 - UXO Documentation

STANDARD OPERATING PROCEDURE
MRP SOP 08
UXO DOCUMENTATION

1.0 SCOPE AND APPLICABILITY

This document is designed to set a standard operating procedure (SOP) for the documentation of unexploded ordnance (UXO) related field operations during activities performed under the Munitions Response Program (MRP). The purpose of this SOP is to identify and designate the field data record forms, logs, and reports generally initiated and maintained for documenting munitions related projects performed by Tetra Tech. This SOP is not site-specific, but rather is intended as a general guidance document for a variety of sites and conditions. Documents presented within this SOP (or equivalents) shall be used for all Tetra Tech munitions related field activities, as applicable. Other or additional documents may be required by specific client contracts or project planning documents.

2.0 PERSONNEL QUALIFICATIONS

UXO personnel shall be graduates of a military Explosive Ordnance Disposal (EOD) School of the United States, Canada, Great Britain, Germany, or Australia or a graduate of a formal training course of instruction or EOD assistant course as stated in DDESB TP-18.

Project Manager (PM)

The Project Manager is responsible for placing all field documentation used in site activities (i.e., records, field reports, sample data sheets, field notebooks, and the site logbook) in the project's central file upon the completion of fieldwork.

Senior UXO Supervisor (SUXOS)/ Field Operations Leader (FOL)

The SUXOS will have a minimum of 10 years experience in all aspects of munitions response actions or range clearance activities. A minimum of 5 years of the experience shall be in supervisory positions.

The SUXOS/FOL is responsible for ensuring that the site logbook, notebooks, and all appropriate and current forms and field reports included in this SOP (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time frame.

UXO Team Leader (UXO Technician III)

The UXO Team Leader will have a minimum of 8 years of EOD/UXO experience including prior military EOD and/or commercial UXO experience in munitions response actions, and/or range clearance activities. The UXO Team Leader may supervise up to six UXO technicians. The UXO Team Leader will conduct UXO activities as directed by the project manager (PM) and

UXO Manager. The UXO Team Leader will be under the direct supervision of the UXO Manager.

UXO Quality Control Specialist (UXOQCS)

The UXOQCS shall have a minimum of 8 years experience in all phases of munitions response actions and/or range clearance activities. The UXOQCS shall have completed corporate quality assurance and UXO quality control training.

UXO Safety Officer (UXOSO)

The UXOSO shall have a minimum of 8 years experience in all phases of munitions response actions and/or range clearance activities. The UXOSO shall have completed 30-hour Construction Safety course or other approved specialized safety training.

3.0 FIELD FORMS

All Tetra Tech MRP related field forms (see list in Table 1 of this SOP) can be found on the MRP Website. (http://www.ttnus.com/MRPRepository/). This website serves as a centralized portal to facilitate data exchange for field personnel, GIS staff, and Tetra Tech Project Managers. The website contains a "Reference" page that will contain the latest version of this SOP and other valuable documentation. For general questions about the use of the MRP website, please contact Mark Maguire (mark.maguire@tetratech.com).

Forms may be altered or revised for project-specific needs, subject to UXO Program Manager and Tetra Tech Project Manager approval. Care must be taken to ensure that all essential information can be documented. This SOP does not include field forms required by other agencies such as Naval Ordnance Safety and Security Activity (NOSSA), Department of Defense Explosives Safety Board (DDESB), or Bureau of Alcohol Tobacco, and Firearms (ATF).

3.1 FIELD FORM TYPES

Four types of field forms are associated with the MRP SOPs. All forms are listed in Table 1 and include Daily Activities Documentation, Quality Control (QC), Health and Safety (H&S), and Miscellaneous Forms.

The Daily Activities Documentation Forms (MRP FF.1 through MRP FF.14) are maintained by the SUXOS and should be used to document daily site activities related to Definable Features of Work and activities associated with specific MRP SOPs such as performing UXO detector-aided surface surveys, digital geophysical mapping (DGM), UXO Intrusive investigations, or munitions and explosives of Concern (MEC) management and treatment.

The QC forms (MRP FF.15 through MRP FF.20) are maintained by the UXOQCS and document daily and periodic quality control activities associated with Definable features of Work and MRP SOPs such as vegetation management, blind seeding, global positioning system (GPS) accuracy, and field documentation.

The MRP H&S Forms (MRP FF.21 through MRP FF.22) are maintained by the UXOSO and document daily and periodic issues related to health and safety. Examples include site-specific training, daily tailgate safety briefings, injuries, and accidents. The UXOSO should review the project site-specific health and safety plan/Accident Prevention Plan (HASP/APP) for additional forms, which are required for each project by the Tetra Tech Corporate H&S Department.

Miscellaneous Forms (MRP FF.23 through MRP FF.24) are maintained by either the UXO Program Manger or SUXOS. The Field Change Request Form is initiated by the either the SUXOS/FOL or UXO Program Manager to document deviations from the project planning documents. A copy of all Field Change Request Form will be emailed to the SUXOS and a copy placed in the Field Files. The Equipment Maintenance-Repair Form is initiated by the SUXOS for any piece of equipment which is in need of maintenance or repair.

4.0 PROCEDURES

4.1 SITE LOGBOOK/DAILY MEC ACTIVITY LOG/DAILY QC LOG/DAILY SAFETY LOG

The site logbook is a hard-bound, paginated, controlled-distribution record book in which all major on-site activities are documented. The Daily MEC Activity Log and Daily Safety Log are methods of tracking the progress of field activities by daily transferring field activity information gathered in the logbook to the UXO Program Manager and Tetra Tech Project Manager.

At a minimum, record or reference the following activities/events (daily) in the site logbook, Daily MEC Activity Log, Daily QC Log, and/or Daily Safety Log:

- All field personnel present
- Arrival/departure times and names of site visitors
- Times and dates of health and safety training
- Arrival/departure times of equipment
- Times and dates of equipment calibration and maintenance
- Daily on-site activities referencing the Definable Features of Work as described in the SAP (Worksheet 12)
- All munitions-related or environmentally significant non-munitions-related finds (e.g., drums, staining, construction debris, trash) and their location
- Quality control (QC) Issues
- Health and safety issues (level of protection, personal protective equipment [PPE], etc.)
- Weather conditions

Maintain a site logbook for each project and initiate it at the start of the first on-site activity (e.g., site visit or initial reconnaissance survey). Make entries every day that on-site activities take place involving Tetra Tech or subcontractor personnel. Upon completion of the fieldwork,

provide the site logbook to the PM or designee for inclusion in the project's central file. On a daily basis, email the Daily MEC Activity Log to the UXO Program Manager and Tetra Tech PM for review.
Record the following information on the cover of each site logbook:

- Project name
- TtNUS project number
- Sequential book number
- Start date
- End date

Information recorded daily in the site logbook/Daily MEC Activity Log need not be duplicated in the Daily QC Log, Daily Safety Log, or other field forms but must summarize the contents of these other notebooks/Logs and reference the specific dates in these notebooks/Field Forms for detailed information (where applicable).

Key field team personnel (UXOSO/UXOQCS) will maintain a separate dedicated field notebook to document the pertinent field activities conducted directly under their supervision. The Daily QC Log and Daily Safety Log may be combined in one field notebook if one person is filling both roles on the project team.

On large projects with multiple investigative sites and varying operating conditions, a Field Team Leader may maintain a separate field notebook to document the pertinent field activities conducted directly under their supervision. However, the SUXOS must include all information related to munitions-related items in the Daily MEC Activity Log.

Make all logbook, notebook, and log sheet entries in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, cross out the entry with a single strike mark, initial, and date it. At the completion of entries by any individual, the logbook pages used must be signed and dated by the person making the entries. The site logbook must also be signed by the SUXOS/FOL at the end of each day. An example of a typical site logbook entry and Daily MEC Activity Log is shown in Attachment A.

4.2 PHOTOGRAPHS

Sequentially number movies, slides, or photographs taken of a site or any munition-related item to correspond to logbook/notebook entries. Complete an entry in the Daily Photographic Log (MRP FF.6) by entering the photograph number, date, time, initials of the photographer, item/subject description, anomaly identifier, and any additional remarks or comments as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, for munitions items, treatment locations, or other unique photograph subjects collect a geographical position system (GPS) measurement and record it

Download all photographs onto the SUXOS' project computer daily. Photographs may be emailed directly to the UXO Program Manager or uploaded to the MRP Website (Section 5.3).

At a minimum the following items should be photographed:

- Generally site photographs showing site features (buildings, berms, craters, targets, etc)
- Any munitions-related item such as MEC or munitions potentially presenting an explosive hazard (MPPEH) which require management or treatment
- A representative photograph of the various types of material documented as safe (MDAS) such as scrap material, small arms ammunitions, casings, etc.
- MEC/MPPEH treatment setups (pre and post detonation)
- Documentation of Definable Features of Work such as vegetation management, surveying activities, trenching, performance of manual or mechanical intrusive activities.
- Environmentally significant finds such as drums, staining, construction debris, landfilling material

4.3 Equipment Calibration and Maintenance Forms

The calibration or standardization of monitoring, measuring, or test equipment is necessary to ensure the proper operation and response of the equipment, to document the accuracy, precision, or sensitivity of the measurements, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. The manufacturer calibrates some equipment; the user calibrates others.

Daily Equipment Checklist

Each instrument requiring calibration has its own Daily Equipment Checklist (MRP FF.4), which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. Maintain an Daily Equipment Checklist for each device (weed eater, mower, brush hog, GPS, Schonstedt GA-52Cx, White's Spectrum XLT, Vallon NMH 3, or digital geophysical equipment) used in the field; make entries for each day the equipment is used noting the time the equipment was checked out and in, the daily conditions, any malfunctions or repairs needed.

Instrument Verification Strip (IVS) Installation Checklist/Daily IVS Checklist

The Instrument Verification Strip (IVS) Installation Checklist (MRP FF.2) is maintained by the UXOQCS and documents the installation of the IVS and the initial testing of all UXO Technicians who will be performing UXO detector-aided surveys on the first day of the surveying activities. An abbreviated Daily IVS Checklist (MRP FF.4) will be completed for all subsequent days noting the test will be completed twice daily, once prior to beginning surveying and again later in the day (e.g. after lunch or battery change). Note: The DGM Instrument Verification Strip (IVS) Installation Checklist (MRP FF.14.2) and DGM Daily IVS Checklist (MRP FF.14.3) contain specific information required during DGMs and should be completed by the site geophysicist.

Table 1

Field Forms

Form Type	Form Number	Frequency	Form Title
Daily Activities Documentation	MRP FF.1	Once	Sap Worksheet No 4-Project Sign-Off
	MRP FF.2	Once	IVS Installation Checklist
	MRP FF.3	Daily	Daily MEC Activity Log
	MRP FF.4	Daily	Daily Equipment Checklist
	MRP FF.5	Daily	Daily Visitors Log
	MRP FF.6	Daily	Daily Photographic Log
	MRP FF.7	Daily	Daily IVS Report
	MRP FF.8	Daily	Daily MEC_MPPEH Log For UXO Avoidance Activities
	MRP FF.9	Daily	MEC Cumulative Summary Log
	MRP FF.10	Daily	MEC Accountability Form
	MRP FF.11	Daily	Dig Sheet - Manual Target Excavation Results
	MRP FF.12	Daily	Dig Sheet - Mechanical Target Excavation Results
	MRP FF.13	Daily	MDAS Container Form
	MRP FF.14	Daily	Geophysical Survey Field Forms (1 - 6)
	MRP FF.14.1	*Daily*	*Daily DGM Quality Control Report*
	MRP FF.14.2	*Daily*	*DGM Instrument Verification Strip (IVS) Installation Checklist*
	MRP FF.14.3	*Daily*	*DGM Daily IVS Checklist*
	MRP FF.14.4	*Daily*	*DGM Initial Instrument Checklist*
	MRP FF.14.5	*Daily*	*DGM Daily Instrument Checklist*
	MRP FF.14.6	*As Needed*	*DGM Field Editing Checklist*
QC	MRP FF.15	Daily	Daily QC Report
	MRP FF.16	Once per Definable Feature	Preparatory Phase Inspection Report
	MRP FF.17	Once per Definable Feature	Initial Phase Inspection Report
	MRP FF.18	Periodic	Follow Up Phase Inspection Report
	MRP FF.19	As Needed	Non Conformance Report
	MRP FF.20	As Needed	Lessons Learned
H&S	MRP FF.21	Daily	Daily Safety Log
	MRP FF.22	Daily	Daily Tailgate Safety Briefing-Training Record Form
Miscellaneous	MRP FF.23	As Needed	Field Change Request
	MRP FF.24	As Needed	Equipment Maintenance-Repair Form