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MUNITIONS AND EXPLOSIVES OF CONCERN TIME-CRITICAL REMOVAL ACTION WORK PLAN FOR QUARRY AREA AND SITE 12 EXPLOSIVE ORDNANCE DISPOSAL AREA NAS BRUNSWICK ME

3/1/2012

TETRA TECH

Munitions and Explosives of Concern Time-Critical Removal Action Work Plan
for
Quarry Area
and
Site 12 Explosive Ordnance Disposal Area

Former Naval Air Station Brunswick
Brunswick, Maine

Naval Facilities Engineering Command
Mid-Atlantic
Contract Number N62472-03-D-0057
Contract Task Order 69

March 2012

MUNITIONS AND EXPLOSIVES OF CONCERN TIME-CRITICAL REMOVAL ACTION WORK PLAN FOR QUARRY AREA AND SITE 12 EXPLOSIVE ORDNANCE DISPOSAL AREA

FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command Mid-Atlantic
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Norfolk, Virginia 23511

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CONTRACT NUMBER N62472-03-D-0057
CONTRACT TASK ORDER 69

MARCH 2012

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ACRONYMS

ºF	degree Fahrenheit
APP	Accident Prevention Plan
ATF	Alcohol, Tobacco, and Firearms
ATFP	Alcohol, Tobacco, and Firearms Pamphlet
bgs	below ground surface
BIP	blow-in-place
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CSM	Conceptual Site Model
CTO	Contract Task Order
CWM	chemical warfare material
DDESB	Department of Defense Explosive Safety Board
DGM	Digital Geophysical Mapping
DID	Data Item Description
DoD	Department of Defense
DOT	Department of Transportation
EGIS	Environmental Geographical Information System
EM	Engineering Manual
EOD	Explosives Ordnance Disposal
EP	Engineer Pamphlet
ESQD	explosive safety quantity distance
ESS	Explosive Safety Submission
EZ	Exclusion Zone
FAR	Federal Acquisition Regulations
FOL	Field Operations Leader
FUDS	Formerly Used Defense Sites
GIS	Geographical Information System
GPS	global positioning system
HASP	Health and Safety Plan
HDOP	horizontal dilution of precision
HE	high explosives
HFD	hazardous fragmentation distance
HTRW	hazardous, toxic, or radiological waste

IAAR	Interim After Action Report
IBD	Inhabited Building Distance
ISO	Industry Standard Object
IVS	Instrument Verification Strip
MC	munitions constituents
MDAS	material documented as safe
MDEH	material documented as an explosive hazard
MEC	munitions and explosives of concern
MEDEP	Maine Department of Environmental Protection
MGFD	munition with the greatest fragmentation distance
mm	millimeter
mph	mile per hour
MPPEH	material potentially presenting an explosive hazard
MRP	Munitions Response Program
MRS	Munitions Response Site
MSDS	Material Safety Data Sheet
msl	mean sea level
NAD 83	North American Datum 1983
NAS	Naval Air Station
NAVSEA	Naval Sea Systems Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEW	net explosive weight
NOSSA	Navy Ordnance Safety and Security Activity
NOSSAINST	NOSSA Instruction
OP	Operations Pamphlet
OPNAVINST	Office of the Chief of Naval Operations Instruction
OSHA	Occupations Safety and Health Administration
PA	Preliminary Assessment
PDOP	position dilution of precision
PM	Project Manager
POC	Point of Contact
QA	quality assurance
QC	quality control
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RCWM	Recovered Chemical Warfare Material
RI	Remedial Investigation

RPM	Remedial Project Manager
SCAR	sub-caliber aircraft rocket
SI	Site Inspection
SOP	Standard Operating Procedure
SUXOS	Senior Unexploded Ordnance Supervisor
TCRA	Time-Critical Removal Action
Tetra Tech	Tetra Tech NUS, Inc.
TP	Technical Paper
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer

1.0 INTRODUCTION

This Munitions and Explosives of Concern (MEC) Time-Critical Removal Action (TCRA) Work Plan describes the technical approach for performing MEC removal action activities to address the past use of MEC at the Quarry Area and Site 12 Explosive Ordnance Disposal (EOD) Area, two Munitions Response Program (MRP) sites at the Former Naval Air Station (NAS) Brunswick located in Brunswick, Maine (Figure 1 of Appendix A). Tetra Tech NUS, Inc. (Tetra Tech) is performing this work under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-03-D-0057, Contract Task Order (CTO) 069. This Work Plan was prepared in accordance with direction from the Navy to address potential public safety risks from the two sites pending base closure and supersedes the TCRA Work Plan prepared for Site 12 EOD Area and the Former Munitions Bunker West by Tetra Tech in September 2009. Safety-related issues associated with activities in this Work Plan are addressed in the previously prepared Quarry Area and Site 12 EOD Area Site-Specific Health and Safety Plans (HASP)/Accident Prevention Plans (APP), which were prepared as internal Navy documents. The activities are also addressed in site-specific Explosive Safety Submission (ESS) Amendments, which are also internal Navy documents approved by the Department of Defense Explosive Safety Board (DDESB).

The purpose of MEC removal action activities at the Quarry Area and Site 12 EOD Area is primarily to clear the ground surface to mitigate the surface explosive safety hazard or risk to human health and the environment. Information and data gathered during the MEC investigation and removal action will be used, as appropriate, to update and/or revise the current Conceptual Site Models (CSMs) for the Quarry Area and Site 12 EOD Area and to plan future phases of investigation if necessary.

The regulatory agencies, Maine Department of Environmental Protection (MEDEP) and the United States Environmental Protection Agency (USEPA), will be notified 2 weeks in advance of the start of any field work. In addition, a weekly summary of field tasks will be provided to the project team.

<u>Quarry Area</u>

At the Quarry Area, digital geophysical mapping (DGM) during the 2008 Site Inspection (SI) indicated that subsurface anomalies extend beyond the southern survey site boundary into a densely wooded area. The results of the Exploratory MEC Investigation performed by Tetra Tech in 2010 (draft report currently in Navy review) determined that MEC and material potentially presenting an explosive hazard (MPPEH), which includes both material documented as safe (MDAS) and material documented as an explosive hazard (MDEH), was present on the ground surface and in subsurface soil within the Quarry Area. Former borrow pits identified on a 1958 topographic map prepared for the Navy's Bureau of Yards and Docks (and first identified for review in March 2011) appear to have been filled in by approved land-spreading events that occurred in the 1990s and by landfilling of non-munitions-related material (reinforced concrete, pipes, wire rope, scrap metal, and culverts), which complicated the subsurface geophysical signatures of these features. There are three new areas identified for the subject TCRA (Area A, Area B, and Area C) located outside of the 2008 SI and 2010 Exploratory MEC Investigation Area boundary. Figure 2 (Appendix A) depicts these areas. As part of the Base Realignment and Closure (BRAC) property transfer process, NAS Brunswick was disestablished May 30, 2011, and the Navy no longer has guarded access points for the base. To ensure the safety of people potentially entering the vicinity of the Quarry Area through Area A, B, or C, a surface clearance will be performed in these areas to identify and remove any MEC/MPPEH that may be present. Additionally, a limited subsurface investigation will be performed in Area A and B by identifying and manually excavating subsurface anomalies to identify the source of each anomaly. All metallic material will be removed from the excavation and any MEC/MPPEH found will be identified, certified, or detonated, if required. No intrusive investigations will be completed in Area C. Intrusive investigation of the western area of the site (Area C) is not warranted at this time considering the sparse geophysical anomalies encountered during the 2008 SI and the absence of MEC/MPPEH at the ground surface and in the subsurface during the 2010 exploratory investigation. A detector-aided surface survey will be conducted for Area C to confirm the absence of surface MEC/MPPEH. The results of these efforts will aid in the planning process for installation of a perimeter fence around the Quarry Area (Area A and C), which will be installed under a separate task order and will provide engineering controls for safety at the Quarry Area following base transfer. It is unlikely that Area B contains MEC/MPPEH items, however, if MEC/MPPEH are identified during the TCRA in Area B then a separate fence will be considered for this area considering the road separating Area B from Areas A and C.

Site 12 EOD Area

At the Site 12 EOD Area, the previous TCRA, completed by Tetra Tech in late summer 2010, was conducted to facilitate construction of the Marine Corps Armed Forces Reserve Center north of the Site 12 EOD Area, which began in fall 2010 as part of the BRAC property transfer process. During this TCRA, designated wetlands areas were not investigated due to environmental concerns regarding the cutting of wetland vegetation, and a steep rocky slope was not cleared due to safety concerns. In a comment letter dated March 2, 2011, on the Site 12 draft Interim After Action Report (IAAR), MEDEP informed the Navy that clearance activities on all wetlands could occur and vegetation could be cut “under the Permit by Rule standards, Natural Resources Protection Act-Restoration of a Natural Area (Title 38 M.R.S.A., §480, Natural Resources Protection Act (NRPA), Chapter 305 (Permit by Rule), Section 12 (Restoration of Natural Areas). The BRAC property transfer process and disestablishment of NAS Brunswick on May 30, 2011, also allows unguarded access to the Site 12 EOD Area. To complete the surface investigation at the Site 12 EOD Area, which will ensure the safety of people potentially entering the site, a surface clearance operation will be performed in the wetlands areas and a visual survey will be conducted on the steep rocky slope to identify MEC and other munitions-related items that may be at the site. In addition, an area of non-munitions debris located north of the perimeter road at Site 12 EOD Area was identified in March 2011 during a Resource Conservation and Recovery Act (RCRA) closure site visit (Figure 3 in Appendix A). Although the area is not suspected to contain MEC/MPPEH, a surface detector-aided surface survey will be conducted to confirm the absence of munitions-related items in this area.

MEC removal action activities at the Quarry and Site 12 EOD Areas will be performed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Sections 104 and 121, Executive Order 12580, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). All activities conducted during this TCRA involving work in areas potentially containing MEC hazards will be conducted with approval from the Navy Ordnance Safety and Security Activity (NOSSA) and will be performed in accordance with local, state, and federal regulations to include Office of the Chief of Naval Operations Instruction (OPNAVINST) 8020.15, Naval Sea Systems Command (NAVSEA) Operations Pamphlet (OP) 5, NOSSA Instruction (NOSSAINST) 8020.15C, Department of Defense (DoD) Manual 6055.09-M., Engineer Pamphlet EP-75-1-2, and all other Department of the Navy and DoD requirements regarding personnel, equipment, and procedures.

1.1 WORK PLAN OVERVIEW

This Work Plan and associated appendices were prepared following the format, content, and preparation instructions specified in the United States Army Corps of Engineers (USACE) Data Item Description (DID) OE-005-01-01 for a Type II Work Plan (2002a). Sections referenced in the DID that are not applicable to the scope of this TCRA are not included in this Work Plan.

1.2 SITE DESCRIPTION

The Former NAS Brunswick, once consisted of approximately 3,200 acres in Brunswick, Cumberland County, Maine, and was home to three active duty and two Reserve squadrons and 29 tenant commands (Malcolm Pirnie, 2007). The facility was designated for closure by BRAC in 2005 and was disestablished on May 30, 2011.

<u>Quarry Area</u>

The Quarry Area is an approximately 4-acre site located in the southwestern portion of the installation. The boundaries of the Quarry Area were identified during an interview with Former NAS Brunswick environmental office personnel during the 2006 Preliminary Assessment (PA) and investigated during both the 2008 SI and 2010 MEC Exploratory Investigation. MEC/MPPEH were found within the Quarry Area during these investigations. In March 2011, a topographic map depicting the outline of the former quarrying activities was discovered. The map indicated three areas of interest (subsequently designated Areas A, B, and C) that extended beyond the MEC Exploratory Investigation boundary. Area A is located between the southern boundary of the Quarry Area and Old Route 24, Area B is located north of the radar tower access road, and Area C is located between the southwestern boundary of the Quarry Area and Old Route 24 (see Figure 2 of Appendix A).

Site 12 EOD Area

Site 12 EOD Area is an approximately 112-acre site located in the southeastern portion of the installation. The boundary was based on the 1,250-foot Inhabited Building Distance (IBD) established as the range limit, but the area where MEC are expected to be present is much smaller. During the 2008 SI, the area investigated all portions of the site within the perimeter road, which encircles the EOD Area. The investigation area was extended in step-outs beyond the perimeter road to include a buffer zone of 100 feet past the last MEC/MPPEH item found during the SI surface survey (see Figure 3 of Appendix A). In addition, an area of non-munitions debris located north of the Site 12 EOD Area perimeter road was identified in March 2011 during a RCRA closure site visit.

1.2.1 Site Location

The Former NAS Brunswick Main Base is situated between the Androscoggin River and Casco Bay southeast of the Town of Brunswick and approximately 25 miles northeast of Portland, Maine. It is located approximately 5 miles inland from the Atlantic Ocean and is bordered by Route 123 and Route 1 on the western and northern sides, respectively, and is adjacent to Route 24 on the eastern side (see Figure 1 of Appendix A).

The Quarry Area is located southwest of the runways of the Former NAS Brunswick western boundary adjacent to Maine State Route 123 and Old Route 24 (see Figure 1 of Appendix A). The Site 12 EOD Area is located in a remote, open, upland area on Buttermilk Mountain in the southeastern portion of the base (see Figure 1 of Appendix A).

1.2.2 Installation History

NAS Brunswick was first commissioned on April 15, 1943. The primary mission of the station at this time was the training of British Naval Command pilots. The station carried out a secondary mission of anti-submarine warfare during World War II. The first U.S. squadron to arrive at NAS Brunswick was an air scouting squadron. When the squadron began operations, the station consisted of only 0.5 mile of runway and had no hangers or operations tower. Construction was still underway on the runways and various other parts of the station when Royal Canadian Air Force crews arrived. Over the next few years, the station experienced tremendous growth and expansion of facilities and infrastructure. At the height of its wartime operations, the station supported three auxiliary landing fields, in Sanford, Lewiston, and Rockland, Maine.

The base remained active for 4 years and was subsequently deactivated in 1947. The land and buildings were leased jointly to the University of Maine and Bowdoin College as annexes to ease overcrowding caused by the G.I. Bill student influx. The University of Maine and Bowdoin College terminated their leases in 1949, and the station was taken over by the Brunswick Flying Service. At that time, the buildings that had housed military personnel and equipment were put to other uses. Hanger one was converted to a skating rink, hanger two and the operations tower were used for a civilian flying school, and hanger three housed automobiles, ammunitions magazines became mushroom farms, and shrubbery nurseries were located in the northern portion of the station.

Following this period, the station was selected by the Navy as a prime center for development. During the development period, the United States Air Force reached an agreement with the Navy authorizing the construction of an Air Force Control and Warning Facility at the station as a part of the continental circumferential radar screen.

On March 15, 1951, the dormant air station was recommissioned as a Naval Air Facility with the established mission of supporting three land-plane patrol squadrons and one Fleet Aircraft Service Squadron and with a planned future mission as a master jet air station. The station also retained the mission of anti-submarine warfare. In December 1950, the Navy requested funds from Congress to be used for this master jet project, which required dual 8,000-foot runways and two outlying fields, one for gunnery and one for carrier practice landings. In addition, the Secretary of Defense submitted a request to Congress for approximately $20,000,000 in June 1951 to be used for additional barracks, officers' quarters, and enlisted men's clubs; control tower, storage, and communication buildings; and new galleys and mess facilities.

Following the reactivation period, several new permanent facilities were erected to replace the World War II "temporary" buildings. New facilities included a modern operations tower, three-deck barracks, and a large mess hall. In addition to these facilities, a new enlisted men's club, Navy Exchange, and Bachelor Officers' Quarters were constructed.

During 1951, the designation of the facility was officially changed to Naval Air Station. The Arctic Survival Training School was established in September 1956 to train personnel deploying to the Arctic in north country survival.

To practice rocket and bombing training, in 1958, the Navy acquired by condemnation Seal Island, located south of the main facility. Bombing and rocket training continued through the early 1960s along with anti-submarine warfare training. Units trained at NAS Brunswick served in action during the Lebanon crisis in the fall of 1958, when squadrons of Fleet Air Wing Three provided anti-submarine protection for the Sixth Fleet, then operating in the Mediterranean Sea. Also in 1958, a small detachment of Marines of the 2nd Marine Division from Camp Lejeune, North Carolina, was assigned to NAS Brunswick. In March 1959, the Marine detachment became the Marine Barracks of NAS Brunswick. Marine Barracks personnel eventually assumed full surveillance of facility entrances from the civilian security police.

The Navy declared Seal Island excess property in 1965 and began to transfer the island to the National Park Service (Department of Interior) through the General Services Administration. The transfer was completed sometime after 1972. Today, Seal Island is in the Formerly Used Defense Sites (FUDS) program managed by USACE.

On July 1, 1971, Commander Patrol Wings United States Atlantic Fleet/Commander Patrol Wing Five established its headquarters at NAS Brunswick. In the late 1990s, base consolidation efforts resulted in the demolition of surplus buildings around the installation. For over 40 years, six squadrons (Patrol Squadrons 8, 10, 11, 23, 26, and 44) were based at NAS Brunswick. The facility was designated for closure by BRAC in 2005 and was disestablished on May 30, 2011.

1.2.3 Historical Munitions-Related Activities

The base-wide PA (Malcolm Pirnie, 2006) indicated that there was an “undocumented report” that the Quarry Area may have been used for past EOD activities (E.C. Jordon Company, 1991); however, no written record of this report was found during the PA process. Interviews conducted during the PA with former personnel stationed at the base during the 1960s and 1970s confirmed the report of EOD activity at the Quarry Area. The sources did not know of a specific portion of the Quarry Area that was used for EOD activity; therefore, the entire Quarry Area was designated a suspected MEC area at that time.

The Site 12 EOD Area was used from 1981 through June 2004 for the disposal of small quantities of ordnance, pyrotechnics, privately manufactured explosive devices, and war souvenirs. The range was officially designated a Class “D” disposal site with a maximum limit of 25 pounds net explosive weight (NEW) on September 18, 1990. It was briefly designated as a training area with a maximum limit of 5 pounds NEW and bare charges only in June 2000. In October 2002, the site was restored to a Class “D” range with a limit of 25 pounds NEW and retained that status until June 1, 2004, when EOD activities at NAS Brunswick were officially terminated. It was reported by E.C. Jordan Company (1991) that since 1984, EOD activity has consisted of six “burns” for training and destruction of ordnance/explosives.

1.3 PREVIOUS STUDIES OF EXTENT OF MEC CONTAMINATION

Information from the Supplemental Feasibility Study Report (E.C. Jordan Company, 1991), PA Report and Addendum (Malcolm Pirnie, 2006 and 2007), MEC SI Reports for the Quarry Area and Site 12 EOD Area (Tetra Tech, 2009a), Site 12 EOD Area Draft IAAR (Tetra Tech, 2011a) and Draft Exploratory MEC Investigation Report (Tetra Tech 2011b) were used in the development of this MEC TCRA Work Plan. These investigations and studies are discussed below.

1.3.1 <u>Quarry Area</u>

Malcolm Pirnie conducted a visual survey and site walk in October 2006 in support of the PA (Malcolm Pirnie, 2006). The survey team reported that the Quarry was not being used, that there were no physical indications of historical EOD activities at the Quarry, and that no MEC were observed. It is possible that physical evidence of EOD activities was covered by the MEDEP-approved land-spreading of petroleum-contaminated soil that took place at the site in the 1990s. During the PA visual survey, a significant amount of debris, including scrap metal, tires, and concrete, was observed, especially along the rock face at the eastern end of the Quarry. Interviews conducted during the PA with former personnel stationed at the base during the 1960s and 1970s confirmed the report of EOD activity at the Quarry Area, but sources did not know of a specific area within the Quarry Area that was used for EOD activity; therefore, as stated above, the entire Quarry Area was designated as a suspected MEC area at that time.

Tetra Tech project personnel and the Former NAS Brunswick escort, Dave Valley, conducted a site walk on May 31, 2007, which confirmed observations made by Malcolm Pirnie. Observation that the Quarry area was also used for debris/garbage dumping activities were made at this time and complicated the CSM because the presence of debris/garbage made it difficult to differentiate between buried MEC and debris/garbage during DGM.

A PA Addendum finalized by Malcolm Pirnie (2007) concluded that the entire site was considered suspect for MEC and MC based on the undocumented reports of EOD activities, but because no MEC were found in the area at the time of the PA, confirmation of the absence of MEC was recommended. Malcolm Pirnie developed a CSM in the July 2007 PA Addendum and this CSM was updated based on the 2007 site walks performed by Tetra Tech. Former NAS Brunswick personnel believed that any EOD activities that may have occurred were limited to the burning/treatment of small arms. No known MEC were fired or impacted at the Quarry; therefore, ordnance penetration depths are not applicable, but MEC could be buried at the site. Potential MEC density was estimated to be low.

The 2008 SI conducted at the Quarry Area included vegetation clearance, unexploded ordnance (UXO) detector-aided surface surveys, and DGM surveys over 100 percent of the site, approximately 4 acres (see Figure 4 in Appendix A). No suspect MEC were detected by the detector-aided surface survey; however, one piece of MDAS, a 2.75-inch rocket tail fin assembly, was discovered on the ground surface in the south-central area of the site. During the SI DGM, other non-munitions-related debris and numerous subsurface anomalies were identified, consistent with the CSM at the time that quarrying and dumping/disposal activities had taken place. DGM identified numerous anomalies of different sizes, amplitudes, and locations across the survey area, but in general, larger anomalies were encountered only along the southern edge of the surveyed area, and the density of small to medium anomalies was greatest in the central portion of the surveyed area. Anomalies detected during the DGM survey were not investigated intrusively during the SI.

In 2010, an Exploratory MEC Investigation was conducted that included trenching (up to 4 feet bgs) of targeted large anomalies and manual hand excavation (up to 2 feet bgs) of targeted small anomalies identified by the 2008 DGM (Tetra Tech, 2011b). MPPEH identified during trenching activities included multiple flares and an unknown fuze. Numerous MDAS items were identified during the trenching operations, including a 2.75-inch rocket motor case, shipping case, and tail assembly, an MK31 MOD 0 day/night signal, and miscellaneous munitions debris such as small arms spent casings. One MEC item, a single .50 caliber M2 ball round was identified at approximately 1 foot bgs during manual excavations in the western portion of the site; it appears to be a kick-out from a munitions burn operation. Three MDAS items, a second 2.75-inch rocket motor case and two fragments were identified during manual excavation. The items encountered were within the site boundaries to the north, east, and west; however, the horizontal extent of the munitions items extended to the tree line, which was the extent of the DGM survey and assumed site boundary at the time of investigation to the south (see Figure 4 in Appendix A).

Non-munitions debris identified during trenching and manual excavation activities consisted of miscellaneous scrap including wire and wire cables, a metal bar, nails, sheet metal, a railroad spike, soda/beer cans and bottle tops, fence posts, asphalt, concrete blocks, concrete with wire and pipes, channel iron, wood and boards, and a refrigerator. Also found were a few empty 55-gallon drums (crushed) and a drum lid. The 2010 investigation confirmed the presence of MEC/MPPEH in the subsurface of the Quarry Area; therefore, an explosive hazard/risk likely exists within the Quarry Area 2008 SI boundary of investigation (Tetra Tech, 2011b). In addition, the surface/subsurface in the wooded area between the 2008 SI DGM survey boundary and the road to the south (Old Route 24) was deemed highly suspect for MEC/MPPEH based on the results of the MEC Exploratory Investigation and was designated as Area A for the subject TCRA investigation. The recent identification of a 1958 topographic map showing that the area was quarried and the presence of MEC/MPPEH at the ground surface near the tree line supports the suspicion that MEC/MPPEH may be present in the wooded area between the DGM boundary and Old Route 24 (Tetra Tech, 2011b). While the 1958 topographic map provides a snapshot of the borrow pit activities, it is unclear if the activity continued after 1958. Due to these findings, a perimeter fence will be installed, under a separate task order, around the accessible portions of the Quarry Area and Areas A and C, which will provide engineering controls for safety at the Quarry Area following base transfer. Area B is not expected to contain MEC/MPPEH items, however if MEC/MPPEH items are found during the TCRA a separate fence will be considered for this area considering the road separating Area B from Areas A and C. Figure 5 in Appendix A shows the approximate location of the fence.

1.3.2 Site 12 EOD Area

During a 1989 investigation of the Site 12 EOD Area, what appeared to be two small demolition craters and a dumpster were present within the existing berm area at the site, as documented in the Supplemental Feasibility Study Report (E.C. Jordan Company, 1991). Also according to the Feasibility Study report, six burns were conducted as training exercises at the site to destroy ordnance and explosives between 1984 and 1989. According to the Former NAS Brunswick personnel, the dumpster that was used during burns was removed from the site in the 1990s.

To clear the site for exploratory work (E.C. Jordan Company investigation), surface and subsurface surveys were conducted by EOD-certified personnel in 1990, including a detailed inspection of the EOD training area and adjacent terrain (inside and outside of the current berm area). Subsurface clearance at sample locations was conducted using a Forester MK-26 Ordnance Locator. The berm area was confirmed to contain MEC. After clearing the site, three test pits approximately 20 feet apart were excavated. Micaceous schist (bedrock) was encountered at 3 feet bgs in two of the test pits; bedrock was not encountered in the third test pit, which was excavated to 6 feet bgs, During test pitting, an expended solid rocket-fuel booster (“JATO” bottle) was unearthed. Other similar devices were observed just outside the berm area on the surface and in the subsurface.

A PA Addendum, finalized by Malcolm Pirnie in July 2007, summarized the history of munitions use at the Site 12 EOD Area and provided the results of a visual survey, assessment of current conditions, and CSM. The PA Addendum concluded that the entire Site 12 EOD Area was suspected to contain MEC and MC and recommended a SI to determine the presence or absence of MEC and MC at the site. Based on information obtained during the PA data collection process, the Site 12 EOD Area was not suspected to contain chemical warfare material (CWM)-filled munitions or hazardous, toxic, or radiological waste (HTRW)-associated munitions. The PA Addendum reported that munitions were destroyed with explosives by certified EOD personnel. Munitions were not fired at the site; however, the possibility exists that kick-outs may have occurred during disposal operations. Kick-outs result when munitions items are not consumed during explosive disposal operations but instead are thrown from the detonation area by the force of the explosion. The PA Addendum estimated that the maximum probable depth for material from kick-outs was approximately 1 foot bgs which encompassed the majority of the site outside of the berm area and inside the perimeter road. A 4-foot bgs probable penetration depth was estimated for detonation areas within the berm area because disposal operations typically occurred within demolition pits where munitions may have been buried, prior to being treated with explosives, to reduce fragmentation distances and control noise. Research conducted as part of the PA data collection process indicated that the Site 12 EOD Area was used from 1981 through June 1, 2004, the date on which EOD activities at the Former NAS Brunswick were officially terminated. On two aerial photographs dated May 1992 and November 1993, there appeared to be two areas surrounded by a berm, the existing berm area and an area located directly southeast sharing a portion of the existing berm structure as part of its embankment. In addition to the PA historical aerial photographs, the internet provided imagery dated April 28, 2001, which showed five pits located inside the existing berm area that were most likely related to demolition operations that took place during this time. In a letter from MEDEP, dated March 2, 2011 another apparent historical berm location was identified in a 1978 aerial photograph located northeast of the current berm location. This berm indicated usage of the area prior to 1981 data indicated in the PA and shown in Figure 3 in Appendix A.

SI field work was conducted at the Site 12 EOD Area in July and August 2008 (Tetra Tech, 2009). The SI Report confirmed historical and visual evidence that MEC may be present at the Site 12 EOD Area inside and possibly outside of the historical and existing berm areas. Suspect MEC items found on the ground surface in and near the berm area included two smoke grenades and one cartridge case; an unidentified ordnance-related item (suspected to be a JATO M8 rocket motor) was found just outside of the berm area and within the perimeter road. A gator mine was found along one of the detector-aided surface survey transects northwest of the berm area. An MDAS item, a rocket motor, and a frag item were also discovered during the detector-aided surface survey along with several areas of magnetic influence outside of the berm area and within the perimeter road. Anomaly density around the berms was determined to be moderate to high during subsurface geophysical surveying and more extensive than anticipated. Several large high-amplitude anomalies were detected outside of the existing and historical berms and at the edges of the SI geophysical survey boundary. Areas with several closely spaced anomalies and also areas of general elevated response were identified during the geophysical survey; these areas could possibly include a greater density of munitions-related metal, including MEC than the rest of the area within the perimeter road. However, without intrusive investigation, this could not be confirmed. It may be that additional bermed areas were historically present and/or that the area was disturbed when historical berms were leveled at the end of their use.

The Site 12 EOD Area TCRA in summer 2010 (Tetra Tech, 2011a) confirmed the presence of MEC/MPPEH on the ground surface and in the subsurface. A detector-aided surface survey/clearance was performed over the Site 12 EOD Area in all accessible areas within the perimeter road except the pond, designated wetlands, and a steep rocky slope (see Figure 3 in Appendix A). The extensive work that would have been required to investigate the pond was not in the scope of the 2010 TCRA, and the wetlands and steep rocky slope were excluded via field decisions based on environmental (wetlands) and safety concerns (rocky slope). MEC/MPPEH items identified on the ground surface to date included an inert 500-pound Mk82 bomb with an Mk31 safety device in the fuze well, multiple unknown types of fuzes and components, 40-millimeter (mm) cartridge cases with live primer, a 40-mm practice grenade, M-18 smoke grenades with and without fuzes, an empty 60-mm mortar, bulk propellant filler exposed in an unknown rocket type, 20-mm projectiles with and without fuzes, an M904 bomb nose fuze, an 75-mm projectile base, an ANMk228 tail fuze, and a gator mine (labeled inert).

During trenching in and around the central area of the site near the existing and historical berms, targeting subsurface anomalies identified during the 2008 SI geophysical investigation, MEC/MPPEH items identified included unknown fuzes and a small amount of bulk high explosives (HE). MDAS items identified during the trenching survey included a 75-mm projectile base, various munitions-related fragments and scrap, ballistic shield, 40-mm cartridge base, ejection cartridge base, 37-mm cartridge base, 2.5-inch rocket motor, rocket motor venturi, 2.25-inch sub-caliber aircraft rocket (SCAR) solid steel warhead, 2.75-inch rocket venturi, rotating band (5 inch), Mk34 torpedo, and an unknown fuze.

The 2010 Draft Site 12 EOD Area IAAR (Tetra Tech, 2011a) concluded that, in addition to the potential for kick-outs, some items found outside the primary berm areas were inert training items and were most likely placed within the perimeter road during training exercises however, no specific documentation could be found to describe the location of training exercises. Therefore, training activities could have occurred anywhere within the perimeter road. Although the ground surface at the site has been investigated, the majority of the site's subsurface has not been investigated or cleared and may still contain MEC/MPPEH.

Contrary to the CSM revised after the SI, an unexpected quantity of non-munitions debris was identified during the detector-aided surface survey and subsurface trenching activities, including approximately 1,800 pounds of rebar-reinforced concrete, concrete culverts, two empty 55-gallon drums, and scrap sheet metal. The CSM for Site 12 EOD Area originally assumed all or most items encountered would be munitions related; however, the large quantities of non-munitions debris indicated that the site was also used for landfilling of non-munitions debris. Because landfilling activities occurred at that Site 12 EOD Area, anomalies that are not related to munitions are likely throughout the site.

The 2010 Site 12 EOD Area IAAR (Tetra Tech, 2011a) recommended decreasing the site boundary, which was based on the IBD, to approximately the extent of the perimeter road in the north, west, and south and encompassing the pond to the east. The 2010 TCRA removed surface MEC hazards and reduced exposure to personnel passing near or through the accessible areas of the site; however, subsurface MEC hazards and associated potential exposure are still suspected because a subsurface clearance action was not completed.

In March 2011, a RCRA closure site visit identified non-munitions-related debris material north of the Site 12 EOD Area and the perimeter road. Based on the exposed material at the surface, the material appears to be primarily concrete demolition debris, but asphalt debris, discarded fuel hose, an apparent fuel tank, and discarded sonobuoys were also observed (Figure 3 in Appendix A). This area is not suspected to contain MEC/MPPEH related to kick-outs based on the distance from the central berm area (approximately 600 feet) where detonations took place. Regardless, a surface detector-aided surface survey will be conducted to confirm the absence of munitions-related items in this area.

1.4 TOPOGRAPHY

In the developed portion of the Former NAS Brunswick, the topography has been altered so that the area is relatively level. Elevations range from approximately 60 to 75 feet above mean sea level (msl). In undeveloped portions of the base, slopes vary between 0 and 15 percent. Slopes between 3 and 8 percent are common in the southern and western margins of the installation. Steeper slopes occur primarily along stream banks and are isolated occurrences on hills that generally have more gentle slopes. The highest elevations at the Former NAS Brunswick occur in the southeastern and southwestern portions of the installation. A northeast-trending ridge with an elevation of approximately 120 feet above msl occurs near Dyer Corner. A more extensive ridge, Buttermilk Mountain, occurs northeast of Harpswell Cove. At the southern boundary of the installation at the Harpswell Cove shoreline, the elevation is at sea level. However, elevations rise rapidly to 60 feet above msl north of Harpswell Cove.

Quarry Area

The topography of the Quarry area is relatively flat, with a steep slope in the northeastern portion as the access road extends to the Radar Tower and a steep rock face on the eastern side, a remnant of former quarrying activities. The southern and western sides of the Quarry slope down to Old Route 24.

Site 12 EOD Area

The northern portion of the Site 12 EOD Area slopes slightly to the south with a 10-foot change in elevation. The northern half of the site is marked by undulating hills, and the southern half of the site is relatively flat.

1.5 CLIMATE

The State of Maine is divided into three major climatic divisions; the Former NAS Brunswick is located in the Coastal Division, which is strongly influenced by its proximity to the Atlantic Ocean to the east and the White Mountains to the northwest. The Atlantic Ocean moderates extremes in temperature and increases the amount of precipitation received by the area. The White Mountains keep considerable snow from reaching the area from the northwest and moderate temperatures.

Information obtained from the National Climatic Data Center station in Portland, Maine (approximately 25 miles southwest of Brunswick) provides representative climatic data for the area in which the installation is located. Average temperatures range from 20.8 degrees Fahrenheit (°F) in January to 68.6°F in July, with an annual average of 45.4°F. Mean daily maximum and minimum temperatures of 78.8°F in July and 12.4°F in January have been recorded. During extreme conditions, a daily maximum of 99°F in July and a daily minimum of minus 26°F in January have been recorded. There are, on average, 13 days of zero or subzero temperatures per year.

The annual average precipitation is 44.34 inches, with monthly average peaks as high as 5.17 inches in the fall and as low as 2.87 inches in the summer. The annual average relative humidity ranges from 65 to 77 percent. The mean seasonal snowfall is 70.90 inches. Because of its proximity to the Atlantic Ocean, winter precipitation in southern midcoastal Maine is often in the form of rain or wet snow. Fog occurs frequently along the Maine coast at all times of the year except winter. On average, there are 57 days with heavy fog, defined as visibility less than 0.25 mile. Days with the possibility of sunshine range from 48 percent in November to 64 percent in August; the annual percentage of days with sunshine is 57.

Prevailing winds are from the south from April to September, from the north in November and December, and from the west to northwest for the remainder of the year. The annual average wind speed is approximately 9 miles per hour (mph), with monthly average wind speeds not varying considerably (7.7 mph in the summer to 10.1 mph in the spring). Strong winds in the winter, generated by coastal storms, can produce abnormally high wind-driven tides. Regional diurnal and seasonal variations may moderately influence wind directions and wind speeds.

2.0 TECHNICAL MANAGEMENT PLAN

This Technical Management Plan was prepared to document the approach and procedures to be used to execute the tasks required for this TCRA and follows the format, content, and preparation instructions specified in USACE's DID OE-005-02.01 (2002b).

2.1 APPLICABLE GUIDANCE AND REGULATIONS

MEC represents a safety hazard and may constitute an imminent and substantial endangerment to personnel and the local population due to its explosive potential. All activities conducted during this TCRA involving work in areas potentially containing MEC hazards will be conducted in accordance with the site-specific ESS for the Quarry Area dated June, 2010 and as amended in June 2011 and ESS for Site 12 dated April 2010 and as amended in June 2011 following approval from NOSSA and DDESB; local, state, and federal regulations to include OPNAVINST 8020.15, NAVSEA OP 5, NOSSAINST 8020.15C, DoD 6055.9-M, EP-75-1-2; and all other Navy and DoD requirements regarding personnel, equipment, and procedures.

2.2 DISCOVERY OF CWM OR HTRW

Potential exposure to CWM at these sites is not anticipated. In the event that CWM is located or suspected, Tetra Tech personnel will evacuate the area immediately in an upwind direction, secure the site, and request assistance from the Navy Point of Contact (POC) and Navy Remedial Project Manager (RPM). Project-specific contact information and the organizational chart for this project are included in Appendix B.

Upon discovery of suspect materials, 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 Manager
- Notify the Navy POC and Navy RPM
- Stop all field operations
- Assemble the crew at a designated assembly point
- Standby 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 Tetra Tech CLEAN Health and Safety Manager, with concurrence of the Navy POC and Navy RPM, identifies and implements appropriate protective measures.

2.3 OFF-SITE MEC DISPOSAL/UNIDENTIFIED MEC

2.3.1 Off-Site MEC Disposal

In the unlikely event that MEC are discovered on site that are beyond the capabilities of the UXO personnel, the Navy POC will be notified and the RPM will contact the nearest military EOD component in Rhode Island for treatment. All site operations will temporarily stop, and the area will be under the control of the UXO Technician until relieved by the Navy POC or military EOD. Military EOD will make a determination as to how to handle and dispose of these MEC items. The ESS for the specific site will be reviewed and amended as needed in these cases. If amendment is required, operations will not resume until the amended ESS has been approved. It is not anticipated that the UXO Technicians will require routine EOD support for MEC findings during this investigation and removal action.

2.3.2 Unidentified MEC

If any MEC items are located that cannot be identified, Tetra Tech personnel will notify the Navy POC and the Navy RPM who will notify the nearest military EOD component in Rhode Island and will request their assistance with proper identification of the suspect item(s). Items will not be moved until a positive identification is made.

2.4 TECHNICAL SCOPE

Munitions Response Site (MRS) characterization and investigation activities to support the MEC TCRA are planned in accordance with this Work Plan and site-specific ESSs (as Amended in June 2011) for the Quarry Area and Site 12 EOD Area. Certain assumptions have been made regarding the level of effort required to complete the proposed investigation/clearance activities. These assumptions are based on the results of the previous investigations for each site and discussions with the Navy and regulators. Summaries of tasks and assumptions for the Quarry Area (Areas A, B, and C) and Site 12 EOD Area investigations are included in the following subsections (see Figures 2 and 3 in Appendix A).

2.4.1 Quarry Area – Areas A, B, and C

The tasks to be completed at the Quarry Area (Areas A, B, and C) during this TCRA are as follows:

- Cutting vegetation within Areas A, B, and C at the Quarry Area, as necessary, to conduct the TCRA investigation. Trees greater than 2 inches in diameter will not be cut.

- Detector-aided surface surveys of the Quarry Area Areas A, B, and C, with complete coverage of all accessible areas.

- Surface investigation and surface MEC/MPPEH removal at the Quarry Area within Areas A, B, and C, as necessary.

- Subsurface manual (hand dig) investigation of a minimum of 30 and maximum of 60 subsurface anomalies detected during the detector-aided survey and associated with suspected munitions burial trenches or pits in Areas A and B (minimum 15 hand digs in each area) to depths no greater than 2 feet bgs. Subsurface anomalies to be investigated will be determined by the Tetra Tech project team for adequate coverage of the suspect area.

The assumptions associated with the Quarry Area (Areas A, B, and C) tasks to be completed during this TCRA are as follows:

- Areas A and C combined encompass approximately 2 acres, and Area B is approximately 0.5 acre based on the extent of the borrow pit as depicted on the 1958 topographic map, the boundaries of the 2008/2010 investigation, and the natural boundary formed by Old Route 24.

- During the 2008 SI, a UXO detector-aided surface survey was performed over 100 percent of the cleared area, and a subsurface DGM investigation was conducted over 100 percent of the cleared area bounded by the rock face to the north and east, the radar tower access road to the west, and the tree line/embankment to the south. During the 2010 Exploratory MEC Investigation, a limited number of small manual/hand excavations and mechanically aided trenches were excavated within the same investigation area. The investigation and clearance activities associated with this TCRA will be limited to Area A located between the southern boundary of the 2008/2010 investigation area and Old Route 24, Area B located northwest of the site in the former borrow pit, and Area C located between the southwestern boundary of the 2008/2010 investigation area and Old Route 24 (as shown on Figure 2 in Appendix A). A minimum of 15 hand excavations each will be completed in Areas A and B based on the results of the UXO detector-aided survey. A maximum of 60 manual hand excavations will be completed site wide. Surface and subsurface MEC/MPPEH items found in these areas will be investigated and detonated via donor charge. No intrusive activities will take place in Area C due to the proximity of this area to the public road.

- Non-munitions items small enough to be moved by hand such as tire rims and shovel heads located during the detector-aided surface surveys will be moved to a nearby location, and marshalling and off-site disposal of non-munitions debris will be deferred to the Remedial Investigation (RI) or addressed by NAS Brunswick. Although unexpected, any drums identified at Site 12 will remain in place, documented, and location coordinates recorded. After removal of the non-munitions debris, a detector-aided surface survey will be conducted to ensure that no surface MEC/MPPEH are visible beneath the non-munitions item.

2.4.2 Site 12 EOD Area

The tasks to be completed at the Site 12 EOD Area during this TCRA are as follows:

- Cutting vegetation within the designated emergent wetlands at Site 12 EOD Area, as necessary, with a gas-powered weed trimmer. Vegetation is not to be uprooted, and no herbicide is to be used.

- Detector-aided surface surveys of the Site 12 EOD Area designated wetlands, with complete coverage.

- Inspect the steep rocky slope for any changes to site conditions which may allow access to the area. Collect GPS coordinates of the boundary of inaccessible areas. Visual survey any inaccessible areas of the steep rocky slope using binoculars or a similar visual aid.

- Surface investigation and surface MEC/MPPEH removal at the Site 12 EOD Area within the designated wetlands and any accessible portions of the steep rocky slope, as necessary.

- Vegetation management within the northern non-munitions debris pile, as necessary to conduct the TCRA investigation. No trees greater than 2 inches in diameter will be cut.

- Detector-aided surface surveys to the extent of the Site 12 EOD Area non-munitions debris pile located north of the perimeter road, with complete coverage of all accessible areas.

The assumptions associated with the Site 12 EOD Area tasks to be completed during this TCRA are as follows:

- Only the designated wetlands, steep rocky slope, and non-munitions debris pile will be investigated and surface cleared of MEC/MPPEH.

- During the 2010 Site 12 EOD Area MEC TCRA, detector-aided surface surveys and complete surface clearances were conducted within the perimeter road of the site (step-outs were also conducted that extended the survey beyond the perimeter road to provide a 100-foot buffer from the last MEC/MPPEH item discovered), with the exception of the designated wetlands and the steep rock slope in the northeastern portion of the site. Investigation and clearance activities will be limited to the ground surface for the wetlands, steep rocky slope, and non-munitions debris pile, as shown on Figure 3 in Appendix A. Any surface MEC items found will be investigated and detonated via donor charge.

- Although the investigation depth is 2 feet bgs to address the primary exposure pathway, MEC/MPPEH may be buried at greater depths.

- The steep rocky slope was not investigated during the MEC TCRA in 2010 due to safety concerns. This area will be investigated during this TCRA by visual survey only. MEC/MPPEH will only be treated/removed from its original location if it is determined safe to do so based on the slope conditions. Other observed items will be reported to the Navy POC for treatment.

- The pond will not be investigated at this time but will be investigated during a subsequent RI.

- Non-munitions items small enough to be moved by hand such as tire rims and shovel heads located during the detector-aided surface surveys will be moved to a nearby location, and marshalling and off-site disposal of non-munitions debris will be deferred to the Remedial Investigation (RI). Any drums identified at Site 12 should remain in place, documented, and location coordinates recorded. After removal of the non-munitions debris, a detector-aided surface survey will be conducted to ensure that no surface MEC/MPPEH are visible beneath the non-munitions item.

2.4.3 Detection Equipment, Methods, and Standards

A Schonstedt GA-52Cx ferrous metal detector, or equivalent, will be used during the detector-aided surveys that will cover all accessible area within Area A, B and C at the Quarry Area and within the wetlands and non-munitions debris pile at the Site 12 EOD Area (see Figures 2 and 3 in Appendix A). In addition to the Schonstedt, a White's Spectrum XLT all-metals detector, or equivalent, will be used during the surveys at the Quarry Area (Areas A, B, and C) and Site 12 EOD Area to assist in the location of metal targets with little or no ferrous metal content. Each manual investigation area at the Quarry Area (Areas A and B, only) will be checked with the Schonstedt GA-52Cx and/or White's Spectrum XLT before it is considered cleared of MEC/MPPEH hazards.

No additional DGM is planned during the MEC/MPPEH investigation and removal action at either site as part of the TCRA. The use of analog detector-aided survey equipment in conjunction with a visual survey for MEC will be used to determine that each anomaly location is cleared of all MEC/MPPEH hazards and that no MEC/MPPEH remain on the ground surface at the site. The instruments described above are the best technology for this operation based on industry standards.

The selected analog detector-aided survey equipment is expected to detect the target items. The White's Spectrum XLT has reduced depth detection capabilities but has the added capability of detection of non-ferrous metals.

To test the analog detector-aided survey instruments in accordance with the DID MR-005-05 standard, the UXO Quality Control (QC) Specialist (UXOQCS) will install an Instrument Verification Strip (IVS) using Industry Standard Objects (ISOs) buried in a location free of ferrous anomalies. The IVS used during the 2010 MEC Exploratory Investigation of the Quarry Area and MEC TCRA at Site 12 EOD Area will be reused for the subject TCRA, as discussed in Section 5.0. This IVS will be used to test equipment and procedures for the Quarry Area (Areas A, B, and C) investigation of subsurface anomalies and to support the Site 12 EOD Area detector-aided surface survey, although no intrusive investigation will be conducted at Site 12 EOD Area at this time.

2.4.4 Navigational Equipment, Method, and Standards

A Trimble global positioning system (GPS), or equivalent, will be used for navigational data collection, locating corner grid stakes, and collecting positional data for identified MEC/MPPEH and non-munitions debris items such as 55-gallon drums that could be associated with hazardous waste contamination. Depending on the amount of interference from the tree canopy, use of other navigational systems (e.g., tape measure and compass) may be necessary to meet project objectives. Sensor data will be correlated with navigational data based on two local “third-order” monuments or survey markers. These standards were established using guidance from Engineering Manual (EM) 1110-1-4009 (USACE, 2007c). If suspect a MEC item is encountered, its location will be recorded and/or marked using a GPS, tape measure, or other grid coordinate location system.

2.4.5 Equipment Checkout and Calibration

All UXO instruments used during this investigation and removal action operation will be checked at the start and end of each day and after each battery change to ensure they are capable of detecting the buried target items/surrogates. If any instrument is found not to detect the target items/surrogates, that instrument will be removed from operation until repaired and retested. The UXOQCS will record the results of the checks in the UXOQCS logbook.

GPS instruments will be checked twice daily by direct comparison to known monuments [per Standard Operating Procedure (SOP)-05 in Appendix C]. Positional accuracy will be within the manufacturer's standard for the GPS equipment used (i.e. sub-meter accuracy). Positional accuracy achieved will be recorded in the Daily QC Report.

The procedures presented in SOP-05 will be conducted on a daily basis, checked for accuracy and repeatability, and archived by the field team leader. If abnormalities are discovered, corrections will be made and the process will be repeated.

2.4.6 Data Collection and Storage

Digitally recorded data collected at the sites will be transferred from the GPS/field storage unit to a computer each day and then uploaded to the MRP Repository website. All maps will be oriented to a coordinate system designated by the Navy to be consistent with existing map files for ease of interpretation.

2.5 CHANGED SITE CONDITIONS

Tetra Tech will keep the Navy POC updated on project status via daily reporting and frequent communication of on-site activities and conditions. In the event of extreme adverse weather conditions or a change in site conditions, Tetra Tech will notify the Navy POC immediately.

2.6 PROJECT ORGANIZATION

A project organizational chart, site-specific project personnel contact information, and local contact information are presented in Appendix B. The subsections below describe the responsibilities of site-specific personnel.

2.6.1 Project Manager

The Tetra Tech Project Manager (PM) will have a minimum of 5 years of project management experience. The PM will have overall responsibility for management and completion of the project, which includes at a minimum, resource allocation, financial reporting, schedule control, review and approval of deliverables, invoice review and approval, and overall management of the project.

2.6.2 Field Operations Leader

The Field Operations Leader (FOL) will act as a liaison between the PM and on-site personnel and ensure that all responsibilities of on-site personnel are fulfilled. The FOL will keep the PM informed of all directives from the Navy POC. The FOL has immediate-stop work authority. The Senior UXO Supervisor (SUXOS) (see Section 2.6.4) will function as the FOL for this project.

2.6.3 UXO Manager

The Tetra Tech UXO Manager will ensure that all UXO issues are addressed and resolved, including equipment, staffing, and administrative requirements. The UXO Manager will provide support off site throughout the project duration unless requested by the PM to be on site.

2.6.4 Senior UXO Supervisor

In addition to FOL responsibilities as outlined in Section 2.6.2, the SUXOS will direct daily implementation and enforcement of the TCRA scope requirements as they apply to UXO support and safety during site activities. The SUXOS is the technical lead and will have overall responsibility for day-to-day UXO operations at the site and will provide direction to subcontractors and other personnel at the site on UXO support issues to ensure their safety. The SUXOS will be responsible for all site MEC documentation. The SUXOS will meet the qualifications stated in DDESB Technical Paper (TP) 18 (2004). Other responsibilities of the SUXOS include the following:

- Review of this Work Plan and initiation of Field Change Requests as needed.
- Ensuring that site activities are scheduled and executed with adequate personnel and equipment resources to perform each activity safely, with the required quality, and in a timely manner.
- Ensuring adequate communications.
- Ensuring that site personnel are trained in accordance with the HASP/APP.

- Ensuring that all notifications are given prior to beginning work.
- Ensuring that required exclusion zones (EZs) are established and maintained.
- Ensuring that all intrusive operations are conducted in accordance with this Work Plan and state and federal regulations.
- Implementing the approved UXO safety program in compliance with all federal, state, and local regulations.
- Analyzing UXO and explosives operational risks, hazards, and safety requirements.
- Enforcing personnel limits and safety EZs for UXO operations.
- Conducting safety inspections to ensure compliance with UXO safety standards/regulations.
- Implementing QC requirements including QC inspections of all UXO-related work.
- Directing and approving corrective actions to ensure that UXO-related work complies with contractual requirements.

The SUXOS will have a minimum of 10 years of EOD/UXO experience including UXO clearance operations and supervision of personnel. The SUXOS will have the authority to stop site activities if an immediate/dangerous/hazardous situation exists. The situation will be immediately reviewed with the UXO Safety Officer (UXOSO)/UXOQCS and reported to the Tetra Tech PM and Navy POC.

2.6.5 UXOSO/UXOQCS

The UXOSO/UXOQCS will be on site at all times during UXO-related work and has immediate stop-work authority. The UXOSO/UXOQCS will meet the qualifications stated in DDESB TP 18 (2004). Other responsibilities of the UXOSO/UXOQCS include the following:

- Ensuring that site personnel are trained in accordance with the HASP/APP.
- Ensuring adequate communications.

- Ensuring that required EZs are established and maintained.
- Ensuring that intrusive operations are conducted in accordance with this Work Plan.
- Implementing the approved UXO safety program in compliance with all federal, state, and local regulations.
- Analyzing UXO and explosives operational risks, hazards, and safety requirements.
- Enforcing personnel limits and safety EZs for UXO operations.
- Conducting safety inspections to ensure compliance with MEC safety standards/regulations.
- Conducting QC inspections to ensure compliance with this Work Plan and the site-specific HASP/APP.

The UXOSO/UXOQCS will have a minimum of 8 years of EOD/UXO experience in all phases of munitions response actions or range clearance activities, as appropriate for the contracted operations, and applicable safety and QC standards.

2.6.6 UXO Team Leader - UXO Technician III

The UXO Team Leader (UXO Technician III) 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 and will conduct UXO activities as directed by the SUXOS or UXO Manager in his/her absence. The UXO Team Leader will meet the qualifications stated in DDESB TP 18 (2004) and be under the direct supervision of the SUXOS or UXO Manager in his/her absence.

The UXO Team Leader will direct implementation and enforcement of project requirements as they apply to UXO support and safety during site activities. The UXO Team Leader will be responsible for UXO Team operations at the team's work sites and will provide direction to other personnel at the team's work site on UXO issues to ensure their safety. The UXO Team Leader will be responsible for the team's work site MEC and MPPEH documentation and will submit all documentation to the SUXOS at the end of each workday. Other responsibilities of the UXO Team Leader include the following:

- Making all required notifications prior to beginning work.
- Establishing required EZs and ensuring they are maintained.
- Ensuring that all MEC operations are conducted in accordance with this Work Plan and state and federal regulations.
- Implementing the approved HASP and APP in compliance with all federal, state, and local regulations.
- Analyzing MEC and explosives operational risks, hazards, and safety requirements.
- Enforcing personnel limits and safety exclusion zones for MEC operations.

The UXO Team Leader will have the authority to stop site activities if an immediate/dangerous/hazardous situation exists. The dangerous situation will be immediately reviewed and reported to the SUXOS, Tetra Tech PM, and Navy POC.

2.6.7 UXO Technician - UXO Escort

A UXO Technician will be assigned UXO escort/avoidance activities as needed to prevent accidental exposure to potentially hazardous ordnance items. The UXO Technician will ensure that areas of intrusive operation, to include the installation of survey stakes, are free of anomalies and UXO concerns and will conduct UXO escort duties for all non-UXO personnel. The UXO Technician will meet the qualifications of a UXO Technician II at a minimum and be under the supervision of the SUXOS or UXO Manager in his/her absence. The UXO Technician II may not be required on a full-time basis for non-intrusive activities.

2.6.8 UXO Technician - UXO Technician II or I

A UXO Technician II will have prior military EOD experience or a minimum of 3 years experience in munitions response actions or range clearance activities. A UXO Technician I will have training as stated in DDESB TP 18 (2004) and have a valid UXO Training Certificate. These UXO Technicians will conduct UXO activities as directed by the UXO Team Leader and SUXOS, including the anomaly investigation effort to clear all non-UXO items and identification of all UXO and munitions debris items. The UXO Technicians will meet the qualifications of a UXO Technician as stated in DDESB TP 18 (2004) and be under the direct supervision of the UXO Team Leader.

2.7 MOBILIZATION, SET-UP, AND PRELIMINARY ACTIVITIES

Tetra Tech will schedule the arrival of its workforce on site in a manner that is most effective and designed to allow for immediate productivity. All personnel mobilized to the site will meet the Occupational Safety and Health Administration (OSHA) training and medical surveillance requirements specified in the HASP/APP. All UXO Technicians will have the appropriate level of training and experience as stated in DDESB TP 18. As part of the mobilization process, site-specific training for all on-site personnel will be performed. The purpose of this training is to ensure that personnel fully understand the operational procedures and methods to be used at the Former NAS Brunswick, to include individual duties and responsibilities, and all safety and environmental concerns associated with these MEC operations. The training will include, but not be limited to, a review of this TCRA Work Plan, Site 12 EOD Area ESS, Quarry Area ESS, and HASP/APP for each site. Any personnel arriving at the site after this initial training session will be trained when they arrive. Training will be conducted by a UXO Technician III.

Project equipment for the UXO survey will be allocated through Tetra Tech sources and/or procured through 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 and according to the established schedules included in Appendix D. This system of checks ensures that all 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.

2.8 INITIAL SITE PREPARATION

During initial set-up at each site and prior to bringing non-UXO personnel or mechanized equipment on site, the UXO team will conduct visual and detector-aided surface surveys within the areas of operation. Manual removal of non-munitions-related metallic debris (no mechanized equipment is planned for this operation) and flagging all munitions-related debris and suspect MEC/MPPEH will be conducted prior to bringing non-UXO personnel or mechanized equipment on site. Non-munitions debris or items too heavy to manually remove will be left in place. Non-mechanized vegetation removal will be conducted as necessary to facilitate site set-up. After all surface non-munitions-related metallic debris has been removed and all munitions-related debris and suspect MEC/MPPEH have been treated or flagged for UXO avoidance, the SUXOS will allow non-UXO personnel and mechanized equipment on site in cleared areas, as necessary.

2.8.1 Site Accessibility and Traffic Control

Explosive safety requires that an EZ be established and maintained before any UXO activities occur due to the potential for encountering live explosively configured munitions. An EZ is intended to keep non-essential personnel from being exposed to hazardous blast overpressure and fragments resulting from an unintentional detonation of the munition with the greatest fragmentation distance (MGFD). In late March 2009, DDESB published Change 1 to DoD 6055.09-STD, which for the first time established separate rules for "high-input" and "low-input" mechanized MEC processing operations. In accordance with the change, the EZs for this project were selected so that during low-input processing operations, non-essential personnel are provided protection for accidental (unintentional) detonations [greater of hazardous fragmentation distance (HFD) or K40, blast overpressure].

The sizes of the EZs around UXO operations are described in the site-specific ESS Addenda for the Quarry Area and Site 12 EOD Area. Once established, the EZs will be controlled by barricades at each access point. Each barricade will be marked with a red Bravo flag and the name and number of the person who can be contacted to request access.

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 secured and brought to a designated location at the end of each day.

2.8.2 Site Security

Site security will be maintained during MEC/MPPEH clearance operations to ensure that non-essential personnel do not access the area. An EZ intended to keep non-essential persons from being exposed to hazardous blast overpressure and fragments resulting from an unintentional detonation of the MGFD will be established at each site and controlled by barricades at each access point. Each barricade will be marked with the name and number of the person who can be contacted to request access. A red Bravo flag shall be displayed near main access points when MEC/MPPEH operations are in progress. Security for treatment and blow-in-place (BIP) operations will be set outside the EZ, and the area will be checked for the presence of staff and intruders.

2.8.3 Vegetation Management

Brush can hinder the performance of survey detectors, which need to be in close proximity to the ground surface for proper operation. The degree of brush cutting will be site specific and based on the conditions at the time that the investigations are conducted. Vegetation must be cleared to a level no greater than

12 inches above the ground surface to permit the passage of the detection equipment. The types of equipment/techniques to be used for brush cutting in each area are listed in the following subsections; further detail is presented in SOP-04 (Appendix C).

The UXO team will visually inspect as much of the work area as possible to identify any obvious MEC/MPPEH hazards prior to brush-cutting activities. Any suspect MEC/MPPEH found during the surface inspection will be flagged by the UXO team and reported, and the brush cutting team will avoid these areas. Brush will be cut to a height that allows clearance for UXO operations and analog geophysical operation but no closer than 6 inches above the ground surface. The 6-inch clearance will minimize the likelihood of accidental contact with smaller MEC/MPPEH items on the surface or partially buried items that were not located during the initial inspection. Additionally, an UXO Escort will be provided at all times during vegetation management activities, even when the UXO team performs vegetation management. This will provide a more focused observation of the work area for MEC/MPPEH and related hazards.

2.8.3.1 Quarry

Brush cutting required at the Quarry Area (Areas A, B, and C) to prepare for detector-aided surveys may include the following:

- Hand-held brush cutters (string or blade) to clear light vegetation and small grassy areas.
- Mechanized lawn mowers to mow larger grassy areas.
- Chain saws in heavier brush areas and to cut small trees up to 2 inches in diameter.

Brush/vegetation cuttings will be left at the site of the area cleared.

2.8.3.2 Site 12 EOD Area

Although the Navy is not conducting removals that will significantly disturb the wetlands and it is anticipated that wetland vegetation will recover in one or two field seasons, special consideration will be required for vegetation removal in Site 12 EOD Area wetlands, following the Intent of the Natural Resources Protection Act-Restoration of a Natural Area [Title 38 M.R.S.A., §480, Natural Resources Protection Act (NRPA), Chapter 305 (Permit by Rule), Section 12 (Restoration of Natural Areas)].

- Prior to initiation of work, a biologist from Tetra Tech will assess site conditions in the wetland areas to help the munitions team plan for the fieldwork and minimize impacts to the wetland, etc.

- The emergent wetlands located within the area of concern will be cut to a height that will permit visual inspection of the ground surface in a safe and efficient manner. Following site work, the area will be allowed to grow in a natural manner, and no further disturbance will be necessary. By using hand-held brush cutters (string or blade) to clear vegetation to a height of 6 to 12 inches, there will be no loss of wetland area or existing function. The cut vegetation will then be removed from the wetland to the extent practical.

- No mower type equipment or other vehicular machines will be permitted in the wetland prevent rutting of the ground surface.

- No plants will be uprooted and no herbicides used to facilitate site clearing.

2.9 SURFACE SURVEY INVESTIGATION

Tetra Tech plans to use an analog hand-held detector (such as the Schonstedt GA-52Cx, a fluxgate magnetometer, and White's Spectrum all-metals detector) to complete detector-aided surface surveys of the areas of concern.

A Trimble GPS unit, or other equivalent unit, will be used during data collection for precise navigation. Depending on the amount of interference from the tree canopy, use of other navigation systems (e.g., tape measure and compass) may be necessary to meet project objectives. GPS accuracy will be checked by verifying position dilution of precision (PDOP) or horizontal dilution of precision (HDOP) at two known GPS points daily before data collection. If GPS accuracy is not sub-meter for the detector-aided surveys, data will not be collected until more satellites are available and the accuracy criteria are met or an alternative positioning technique will be employed (e.g., fiducials or total stationing). If interference from the tree canopy is unacceptable, use of a tape measure and compass may be implemented.

All equipment tests, acceptance criteria, and test frequencies are the same as those for the IVS, as described in Section 5.0.

2.10 INVESTIGATION TECHNIQUES

2.10.1 Quarry Area Specific Techniques

Surface

UXO detector-aided surveys will be completed during this TCRA in Areas A, B, and C at the Quarry Area. The UXO team will survey the areas using a Schonstedt GA-52Cx and White's Spectrum XLT (or equivalents), manually removing non-munitions-related metallic debris where possible, and flagging all munitions-related debris and suspect MEC/MPPEH. All surface munitions-related debris and suspect MEC/MPPEH will be certified as MDAS and removed from the site for off-site disposal or treated in accordance with the site-specific ESSs (as Amended, June 2011) and this TCRA Work Plan, if needed.

Subsurface

Subsurface anomalies chosen by the Tetra Tech Project Team for investigation to provide adequate coverage based on the results of detector-aided surveys conducted during TCRA activities in Areas A and B at the Quarry Area (see Figure 2 in Appendix A) will be cleared to a depth no greater than 2 feet bgs. The analog instrumentation is capable of detecting items in the shallow subsurface; therefore, select subsurface anomalies will be investigated if the location is suspected of being an MEC/MPPEH burial area. Subsurface anomalies will be investigated to the extent necessary, with an anticipated maximum 2-foot radius and maximum depth of 2 foot bgs (e.g., recognizing that anomalies may be attributable to natural ferrous rock, as suspected in some areas during the SI). Excavations will be conducted using manual procedures until the sidewalls and bottom of each small excavation are clear of anomalies. Each intrusive “dig team” will consist of two qualified UXO personnel including at least one UXO Technician II. 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 UXO Team Leader has given a site-specific safety briefing to their team, communications are established, and all non-essential personnel are evacuated from the area.

2.10.2 Site 12 EOD Area Specific Techniques

Surface

A UXO detector-aided surface survey will be completed using a Schonstedt GA-52Cx and White's Spectrum XLT, manually removing non-munitions-related metallic debris if possible, and flagging all munitions-related debris and suspect MEC/MPPEH. Surface anomalies discovered during the detector-aided surface survey will be investigated and cleared at the Site 12 EOD Area in accordance with the site-specific ESSs (as Amended, June 2011).

Subsurface

No subsurface investigation is planned at this time at the Site 12 EOD Area.

2.10.3 General Techniques

If a UXO team member discovers a suspect MEC/MPPEH item, he/she will: (1) call for a temporary work stoppage within the team separation distance of the item as listed in the site specific ESS 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 the proper identification of the item and its condition, and only the SUXOS can declare that an item is safe to move. Once identified, each MEC/MPPEH item will given a unique identification number, and all information and observations about the item will be recorded in the field logbook and MEC Tracking Log (per SOP-02 and SOP-08). Suspect MEC/MPPEH items that are not safe to move will be secured in place, and the SUXOS will coordinate for detonation of the item with a donor charge. Suspect MEC items determined by the SUXOS to be safe to move can be removed to a secure area of each site (the central area of the Quarry and the berm area of Site 12 EOD Area. The SUXOS will coordinate the detonation of the item before the end of the workday if possible or as soon as possible based on the arrival of donor charges and explosives. All explosives will be ordered on demand, and no explosives or related material will be stored on site overnight. Once an item is moved to the detonation area, site operations can continue in the investigation areas. If an item cannot be treated on the same day it is discovered, the SUXOS will maintain security of the item and report its location and other information to the Tetra Tech UXO Manager, Tetra Tech PM, and Navy POC. Tetra Tech or third party security personnel will maintain security of the item until it is treated or until responsibility for its security is transferred to the Navy POC. To ensure complete clearance, non-munitions debris will also be removed and a detector-aided surface survey will be performed over these areas to ensure there are no underlying anomalies.

Depending on the amount of potential munitions-related debris and/or metal fragments remaining, these items will be removed either by hand or by using a magnet and collected in plastic containers. Easily identifiable MPPEH will be segregated from other metal material during this collection process.

Metal debris collected and MPPEH identified will be brought to a separation area for segregation. Two UXO Technicians will separate the MPPEH from the other metal debris through visual inspection. MPPEH will be transported to a designated area for storage. In the event that MEC are discovered at this process area, the SUXOS and UXOQCS will be called immediately for identification and disposition.

The UXO Team Leader will maintain a daily log recording, at a minimum, the location(s) excavated, the length, width, and depth of any manual excavations conducted at the Quarry Area (Areas A and B, only), and a description of the MEC/MPPEH removed, including the estimated weight and number of pieces of other metallic debris. Estimated weight and number of expended cartridges and bullets (small arms MDAS) removed will also be documented. If it is not feasible to determine precisely where each item came from, the UXO Team Leader will make note with a general observation and description. Moreover, any debris that could be associated with hazardous waste contamination will be documented.

2.11 QUALITY CONTROL

QC measures will be implemented to ensure that project objectives are met. The required equipment tests and frequency of testing are detailed in the IVS section (Section 5.0). In addition, blind seed items, (small ISOs) will be placed at the surface at locations throughout Areas A, B, and C of the Quarry Area and Site 12 EOD Area prior to performance of the detector-aided survey. At least one blind seed item and no more than six will be placed in each estimated daily lot of work. If a blind seed is missed, that lot of work will be reworked as stated above.

The SUXOS, UXOQCS, or UXO Team Leader will place the blind seed items using the guidelines outlined in Chapter 9 of EM 1110-1-4009 (USACE, 2007c). UXO avoidance, with the assistance of metal detectors, will be used to clear areas selected for the placement of blind seeds. All items placed in the study area will be clearly marked with an identifier so that the UXOQCS and SUXOS can record their locations during both placement and reacquisition. This information will be recorded in accordance with the requirements noted in Section 10. Acceptance and failure criteria for blind seed areas discussed in Section 10 and are identified in Table 10-1.

All raw data files, final processed data files, hard copies, and field notes associated with the field activities will be maintained for the duration of the project. All raw files will be available on site for QC checks to ensure that proper field and data processing procedures were used during site activities.

2.12 REPORTING AND DISPOSITION OF MEC

Initial MEC identification will be the responsibility of the UXO team. MEC will not be moved until a positive identification is made by a UXO Technician II or higher and the UXO Team Leader and SUXOS concur that the item(s) can be safely moved. If MEC are identified and deemed safe to move, the UXO team may transport the item(s) to a temporary holding area that will be established at each site for recovered MEC/MPPEH that are determined safe to move and awaiting disposal. This area will be under the control of the UXO Team Leader until disposal operations have been completed. The explosive safety quantity distance (ESQD) arc created by the NEW for each temporary holding area will not extend beyond that established for the site. To prevent the spreading of MEC/MDEH debris and related munitions constituents (MC) residues, items will be destroyed in “detonation areas” using engineering controls identified in the Fragmentation Data Review Form for the item. Detonation operations will be performed on the day an MEC item is discovered, if possible. In the event that the item cannot be disposed of on the day it is discovered, the item will be flagged, its location marked for disposal for the following day, and the Navy POC will be informed of its location. The UXO Team or third party security personnel will maintain security of the item. Tetra Tech will use BIP procedures to treat items encountered that are not safe to move.

If the UXO team is unable to identify an MEC item, Tetra Tech personnel will notify the Navy POC at the Former NAS Brunswick and the Navy RPM who will request assistance from the nearest military EOD. Emergency EOD support will be provided by EOD Mobile Unit Twelve Detachment Newport Rhode Island. Their telephone numbers are 401-832-3301 or 401-832-3302.

The UXO Team will identify all MEC items, and their original locations will be recorded by GPS or other means, such as compass and tape measure, in wooded areas where the GPS does not work. This information will be recorded on the MEC Tracking Log, and all MEC items will be photographed. This information will be added to the data collected for the sites.

2.13 REPORTING AND DISPOSITION OF MPPEH

If MPPEH are encountered during operations, a UXO Technician II or higher and the UXO Team Leader will inspect and separate the MPPEH into MDEH or MDAS. A UXO Technician II or higher will perform a 100-percent inspection of each item as it is recovered and determine the following:

- Is the item MDEH or MDAS?
- Does the item contain explosives hazards or other dangerous fillers?
- Does the item require detonation?
- Does the item require demilitarization or venting to expose dangerous fillers?
- Does the item require draining of visible liquid HTRW material?

Items will then be segregated into items that require demilitarization or venting procedures from those items ready for certification. If any items are suspected or found to contain HTRW, procedures described in Section 2.2 will be followed.

A UXO Technician III (Team Leader) will then:

- Re-inspect 100 percent of all recovered items to determine if they are free of explosives hazards and other visible liquid HTRW materials.

- Record the information supporting the determination that the recovered items are free of explosive hazards and other visible HTRW materials.

- The recovered items will then be considered MDAS. Following the inspection and re-inspection, MDAS will be certified and verified then transported off-site by an approved subcontractor.

- Coordinate transfer of remaining MPPEH that cannot be fully inspected to a central processing work area established at each site.

The UXOQCS will:

- Conduct daily audits of the procedures used by UXO teams and individual 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.

- Ensure that all procedures for processing MPPEH are being performed safely and consistently.

The SUXOS will:

- Ensure that all documentation is completed for all MDAS.

- Perform random checks to satisfy 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 is lost on the sealed container, another 100-percent inspection of all MDAS will be conducted by the SUXOS and UXOQCS.

- 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 and will be closed in such a manner that a seal must be broken to open the container. The seal and container will bear the same unique identification number 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.

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

A chain-of-custody form will be maintained for MDAS, and the proper documentation must be completed and signed by the responsible personnel 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 included in EM 1110-1-4009, Chapter 14 (USACE, 2007c) and DoD Instruction 4140.62 (2008b).

An attempt will be made to identify all MPPEH items, and their original locations will be recorded by GPS equipment (or compass and tape measure if the GPS cannot attain the required accuracy). This information will be added to the data collected for the sites.

If an MPPEH item is determined to be MDEH, it will be treated as MEC. In the unlikely event that an MDEH item cannot be treated with a donor charge (e.g., item encountered with NEW greater than 25 pounds), assistance from the nearest military EOD component in Rhode Island will be requested. If an MPPEH item is determined to be MDAS, it will be secured in a locked/sealed container. The locked and sealed containers 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 MDAS material to an off-site facility for disposal or demilitarization.

2.13.1 MPPEH Certification and Verification

The SUXOS will certify that the each MDAS item has been 100 percent properly inspected and, to the best of his/her knowledge and belief, is free of explosive hazards. The UXOQCS will verify that the MPPEH inspection process has been followed in accordance with this Work Plan and that each MPPEH item has been 100 percent properly inspected and, to the best of his/her knowledge and belief, is free of explosive hazards. All certification/verification documentation will clearly show the printed names of the

SUXOS and UXOQCS, organization, signature, and phone numbers of the persons certifying and verifying the material as free of explosive hazards.

The following certification/verification will be entered on each form for turnover of MDAS and will be signed by the SUXOS and UXOQCS:

> "This certifies that the materials listed has been 100% properly inspected and, to the best of our knowledge and belief, are free of explosive hazards and other visible liquid HTRW materials."

2.13.2 <u>Maintaining the Chain of Custody and Final Disposition</u>

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, ensure 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 a 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. After this inspection, 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 IAAR.

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

2.14 LESSONS LEARNED

Lessons learned during the project will be captured and documented in accordance with the Tetra Tech Quality Assurance Program Manual, Paragraph 3.5.5, Lessons Learned. The Lessons Learned Report Form used for documentation is included in Appendix C. The UXOSO/UXOQCS will attach the completed Lessons Learned Report Form(s) to daily and weekly QC reports. The UXOSO/UXOQCS will recap all lessons learned at daily safety briefings or sooner, as necessary.

3.0 EXPLOSIVE MANAGEMENT PLAN

This Explosives Management Plan outlines the procedures that will be used for managing explosives required for the detonation of MEC/MPPEH for this SOW and was prepared following the format, content, and preparation instructions specified in the USACE DID OE-005-03.01 (2002c).

3.1 GENERAL REQUIREMENTS AND LICENSING

The explosives used for this project will be managed in accordance with Federal Acquisition Regulations (FAR) 45.5, local and state laws and regulations, Bureau of Alcohol, Tobacco, and Firearms (ATF) Pamphlet (ATFP) 5400.7, DoD 6055.9-M (2010a), United States Department of Transportation (DOT) regulations, and applicable NAS Brunswick guidance documents.

Tetra Tech will have and will upon request make available to any local, state, or federal authority a copy of the ATF license/permit authorizing the purchase, storage, transport, and use of explosives.

3.2 EXPLOSIVES ACQUISITION AND MANAGEMENT

3.2.1 Acquisition

Explosives will be ordered on an as-needed basis. The quantity of explosives to be used will be kept to a minimum determined by the anticipated needs of the UXO team.

Explosives will be purchased from a local vender such as:

Austin Powder Company
Hudson Hill Road
Hudson, Maine 04449
207-327-1390

All explosives will be issued and used on the same day they arrive at NAS Brunswick. Based on discussions with the Maine State Fire Marshal's Office, a State Explosives Permit/License is not required for explosives work on federal property. The substantive requirements of the law established in ATF Publication 5400.7, Federal Explosives Law and Regulations will be following during this project.

Maine State Fire Marshall Office
Nelson Collins
Assistant State Fire Marshall
52 State House Station
Augusta, Maine 04333-0052
nelson.e.collins@maine.gov
207-626-3880
Fax: 207-287-6251

3.2.2 Initial Receipt

The SUXOS and UXOSO/UXOQC will be responsible for receipt of explosives from the commercial vendor and will follow all applicable facility procedures. The SUXOS will coordinate the receipt and management of all explosives with the Navy POC and Navy RPM before receipt and transportation of explosives to the site.

The Navy POC or Navy RPM will provide Tetra Tech with a copy and an understanding of all facility explosives management requirements before the transportation of any explosives required for this project.

The explosives delivered to the site will be inspected to the level necessary to confirm the content and quantity of the delivery. Discrepancies will be reconciled at the time of receipt with the SUXOS, vendor, UXO Manager, and Tetra Tech PM. Any discrepancies and their resolution will be documented.

3.2.3 Storage

Explosives will not be stored at the Former NAS Brunswick. All explosives and related material will be issued and used on the day they are received. Any explosives remaining after the treatment of MEC/MPPEH will be issued and used during a final cleanup shot at the end of each day.

3.2.4 Transportation

Transportation of explosives by a local vendor will comply with the use of designated explosive-laden routes and DOT, 49 Code of Federal Regulations (CFR), and AFT licensing requirements. Explosives will be issued by the SUXOS and will require two signatures from personnel designated by Tetra Tech as able to sign for and handle explosives to confirm the type and quantity of explosives issued. Delivery of explosives will be communicated with the Navy POC to ensure that explosive-laden routes are followed and that an escort (Navy or Tetra Tech) meets and guides the delivery truck along the correct route. Delivery trucks will report to the front gate and will be escorted by UXO personnel along the appropriate route to the MRS site.

3.2.5 Receipt Procedures

Each delivery of explosives will be receipted from initial delivery to the Former NAS Brunswick until the item is expended. Tetra Tech will provide 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 (i.e., SUXOS) will certify in writing that the explosives were used for their intended purpose. Receipt documents will be reconciled at the time of delivery, issue, and disposal. Any discrepancies will be documented by the SUXOS and reported to the Tetra Tech UXO Manager, Tetra Tech PM, Navy POC, Navy RPM, and others as required by law.

3.2.6 Inventory

All explosives will be physically inventoried by the SUXOS and UXOSO/UXOQC. Any discrepancies will be documented by the SUXOS and reported to the Tetra Tech UXO Manager, Tetra Tech PM, Navy POC, Navy RPM, and others as required by law. Inventories of explosives will be conducted upon receipt.

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

1. Immediately notify the Tetra Tech UXO Manager, Tetra Tech PM, Navy POC, and Navy RPM by telephone and follow up with a written report within 24 hours.

2. Report by telephone within 24 hours of discovery to ATF (toll free: 1-800-800-3855) and then to appropriate local authorities. Following telephone notification, a written report on ATF Form 5400.5, Report of Theft of Loss – Explosives Materials, will be submitted to the nearest ATF Division Office (Portland Maine, phone 207-780-3324) in accordance with the instructions on the form.

3. Navy authorities will coordinate with local authorities and the State Fire Marshall as required.

Any explosives not expended during daily demolition operations will be issued and used during a final cleanup shot at the end of each day and documented in the SUXOS daily log. The final cleanup shot will not exceed the 25-pound explosive limit. There will be no excess explosive inventory to warehouse or ship. Documents will be completed showing final disposition of all explosives.

3.2.7 Forms and Documents

Project forms, including those related to explosives management, are located in Appendix C of this Work Plan.

4.0 EXPLOSIVES SITING PLAN

This Explosives Siting Plan has been prepared to direct Tetra Tech activities in the performance of this TCRA.

4.1 ORDNANCE AND EXPLOSIVES AREAS

The minimum separation distance for non-essential personnel during MEC operations (unintentional detonation) at the Quarry Area (Areas A, B, and C) is established in the Quarry Area ESS dated June 2010 and Amended in June 2011. The minimum separation distance will be an arc of 195 feet from the outermost boundary of the area of operation, based on the Fragmentation Data Review Form provided in the ESS, for the known/suspected munitions. This separation distance will be maintained during all UXO operations.

The minimum separation distance for non-essential personnel during MEC operations (unintentional detonation) at the Site 12 EOD Area is established in the ESS dated April 2010 and Amended in June 2011. The minimum separation distance will be an arc of 132 feet from the outermost boundary of the area of operation, based on the Fragmentation Data Review Form provided in the ESS, for the known/suspected munitions. This separation distance will be maintained during all UXO operations.

If munitions with a greater HFD or K40 than the 2.75-inch MK40 rocket motor (Quarry Area) or the 40-mm MK 2 projectile (Site 12 EOD Area) anticipated are identified or encountered during operations, all work will cease and the Navy RPM and Navy POC will be notified. No further work will be conducted unless authorized by designated explosives safety personnel.

4.2 PLANNED OR ESTABLISHED DEMOLITION AREAS

Items determined to be unsafe to move will be treated with BIP procedures. Suspect MEC/MDEH items determined by the SUXOS to be safe to move can be moved to a secure area designated by the SUXOS where the item will be treated before the end of the workday. This will allow site operations to continue. Post-demolition procedures will include a check of the demolition location with a magnetometer and removal of large fragmentation to ensure that there is no remaining MEC/MPPEH debris or related residues. Any MEC items failing to be properly disposed of that are discovered during post-demolition procedures will be destroyed prior to the end of the day.

4.3 FOOTPRINT AREA

4.3.1 Blow-In-Place Operations

If BIP operations become necessary, the maximum fragmentation distance determined in the ESS for each site will be used to establish an EZ for intentional detonations. The Quarry Area intentional detonation EZ for the 2.75-inch MK 40 rocket motor is 596 feet, and the Site 12 EOD Area intentional detonation EZ for the 40-mm MK 2 projectile is 1,095 feet.

4.3.2 Collection Points

No detonation explosives or recovered MEC/MPPEH will be stored on site; all items will be addressed on a daily basis. A temporary holding area will be established to store recovered MEC/MPPEH determined safe to move by UXO personnel and awaiting disposal. The ESQD arc created by the NEW for each temporary holding area will not extend beyond the EZ established for the site. These areas will be under the control of a UXO Technician unless relieved by third party security personnel.

4.3.3 Consolidated Shots

No consolidated shots will be completed at either the Quarry Area or Site 12 EOD Area.

4.4 EXPLOSIVES STORAGE MAGAZINES

Detonation explosives (donor charges) will not be stored at the Former NAS Brunswick. All explosives will be issued and used by the end of each day.

4.5 SITE MAPS

See Appendix A for site maps. The ESSs include maps of the minimum separation distances for each site.

5.0 SURFACE SURVEY INSTRUMENT VERIFICATION STRIP

5.1 OBJECTIVE

Specific objectives of the IVS are as follows:

- Demonstrate that detector-aided survey equipment are operating properly.
- Provide a safe area with a known set of isolated objects for testing detection with survey equipment.
- Assess operator performance.
- Evaluate detection of seed items. The Tetra Tech UXOQCS and SUXOS will determine whether the IVS performance is acceptable and consequently when survey work may begin.

Before the start of site surveying activities, site operators and the detector-aided or analog geophysical survey equipment/methodologies planned for site work must have successfully completed the initial IVS and been given approval to move on to the site production work. Following completion of the initial IVS, data will be collected over the IVS at the beginning of each fieldwork day, and assessment of the data will be made by the UXOQCS or SUXOS before proceeding with survey work for the day. The IVS will be established in a clear (unvegetated) area devoid of cultural debris such as clutter and utilities. The location will be 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 be requested from the Navy POC prior to establishing the IVS. To streamline the process of locating a suitable test site, the instrument test strip area used for the Quarry Area during the 2010 MEC Exploratory Investigation will also be used for the subject 2011 TCRA IVS (see Figure 6 in Appendix A).

5.2 IVS SURVEY PROCEDURE

Prior to seeding the area with ISO items, the UXO team will conduct a detector-aided survey of the selected IVS location to ensure that it is free/or has minimal anomalies and to evaluate the instrument response to site background conditions. The resulting data will be analyzed to judge suitability for seeding and to guide any cleanup and/or anomaly avoidance that may be necessary before seeds are emplaced. Tetra Tech will bury the seeds horizontally in a well-marked straight line at least 10 feet from one another to allow survey passage directly over top of the emplaced seeds. Each seed item will be labeled with a unique identifier, photographed (open hole), and located in relation to the IVS survey ends, which will also be located. Depths, orientation (azimuth and inclination), and physical descriptions of the seeds will be accurately documented.

Seeds will consist of ISOs buried at the following depths.

Item and Burial Depth	Burial Depth
Small ISO (1-inch-diameter 4-inch-long pipe)	**6 inches**
Medium ISO (2-inch-diameter 8-inch-long pipe)	**13 inches**
Large ISO (4-inch-diameter 12-inch-long pipe)	**20 inches**

5.2.1 Equipment Standardization

UXO detectors (Schonstedt GA-52Cx and White's Spectrum XLT), support equipment, navigation equipment, and operator performance will be tested at specific intervals and must meet the appropriate acceptance criteria. Table 5-1 lists additional tests or checks, their required frequencies, and acceptance criteria. Initially, before the IVS is performed, out-of-box tests are planned as described in Section 5.2.2.

5.2.2 Out-of-Box Tests

The following out-of-box tests will be conducted before the survey of the IVS area 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

5.2.3 Anomaly Avoidance

Anomaly avoidance will be practiced during the IVS, that is, the area will be pre-screened by UXO Technicians using hand-held magnetometers, and areas where magnetic anomalies or surface objects are detected will be avoided during the IVS.

5.2.4 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 test strip area, and the holes will be backfilled and restored.

TABLE 5-1

EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION
NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

Field Equipment	Activity[1]	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
GPS	Positioning	Twice Daily	Accuracy: sub-meter 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	Operational	Beginning of day and after battery change	Operating properly	Replace battery, replace instrument	UXO Technician	MRP SOP 01	None
All-Metals Detector	Calibration	Beginning of day and after battery change	Detect inert surface surrogate	Recalibrate, replace instrument	UXO Technician	MRP SOP 01	None

6.0 GEOPHYSICAL INVESTIGATION PLAN

DGM is not planned at the Quarry Area (Areas A, B, and C) or Site 12 EOD Area under this TCRA. DGM will be considered as part of the RI to be conducted at these sites after the MEC TCRA has been completed, if required. Analog geophysical investigations will be conducted during the detector-aided survey of the Quarry and Site 12 EOD Area. The Site 12 EOD Area and Area C at the Quarry surveys will be of the ground surface only. Surface and subsurface surveys will be conducted in the remainder of the Quarry Area (Areas A and B). See Section 2 for additional information on the Mag and Flag operation planned for Areas A and B at the Quarry Area.

7.0 GEOGRAPHICAL INFORMATION SYSTEM PLAN AND ELECTRONIC SUBMITTALS

This Geographical Information System (GIS) Plan has been prepared to ensure that data collected as part of the proposed TCRA are consistent with the GIS maintained for the Former NAS Brunswick.

7.1 GENERAL

The recorded GPS information will be incorporated into the existing Environmental GIS (EGIS) established for the Former NAS Brunswick and will be provided to the regulatory agencies in a spreadsheet containing the coordinates of each surveyed location and reference point. Geo-referenced maps showing all coordinates and MEC/MPPEH findings will be included in the IAAR.

7.2 LOCATION SURVEY AND MAPPING PLAN

This Location Survey and Mapping Plan has been prepared to direct all activities associated with locating, tracking, and documenting MEC occurrences within the areas of concern.

7.3 MEC/MPPEH DOCUMENTATION

Tetra Tech will establish a system to record MEC/MPPEH findings in the areas of concern (per SOP-02, MEC Management and Accountability, in Appendix C). Location information as well as information on the type of MEC/MPPEH item, physical condition and appearance, whether fuzed or unfuzed, and additional observations and notes made by the field team will be entered into the field logbook and/or onto the MEC Tracking Log. The SUXOS will direct the establishment of the system for numbering and recording the coordinates for each MEC/MPPEH item. The location of each area for investigation and type/condition of discovered and disposed of MEC/MPPEH items that require follow-up MC sampling as part of any RI efforts will be established using the GPS or tape measure to determine the XYZ coordinates of the area. Each MEC/MPPEH item will be located using the GPS or tape measure to determine XYZ coordinates for each item. The anomalies identified on the dig sheet will be located using GPS or tape measure procedures, if required.

Field logbooks will be used during each phase of the operation to record significant findings and information using the established numbering and coordinate system (in accordance with SOP-08, UXO Documentation). The IAAR will include geo-referenced maps of the areas investigated, provide the northing and easting coordinates of the areas in a coordinate system consistent with the system used by NAS Brunswick (this information will also be provided to the regulatory agencies to record and manage areas of concern), and detail the location of each MEC/MPPEH item found/removed, as well as debris items that are suspected to be associated with hazardous waste contamination. Coordinate data recorded in the field will be converted, as necessary, to the Maine State Plane Coordinate System, North American Datum 1983 (NAD 83), to be consistent with existing NAS Brunswick and MEDEP mapping. The IAAR will also provide observations made by the UXO team and recommendations for future maintenance activities, if appropriate.

8.0 WORK, DATA, AND COST MANAGEMENT PLAN

The technical reports and submittals under this TCRA may include Project Work Plans, Corrective Action Reports, HASPs (separate document), permit applications, Regulatory Compliance Reports, and IAAR. Tetra Tech will use Microsoft Office software, specifically Word and Excel, to prepare these documents, and PowerPoint to prepare formal and informal presentations.

9.0 PROPERTY MANAGEMENT PLAN

No government property will be purchased or acquired in the performance of this TCRA. Tetra Tech and its subcontractors will not be authorized to acquire or control government property.

10.0 QUALITY CONTROL PLAN

This QC Plan (QCP) was developed to identify and implement quality requirements to ensure that overall project activities are accomplished using an acceptable level of internal controls and review procedures. The intent of such controls is to eliminate conflicts, errors, and omissions and to ensure the technical accuracy of all deliverables. Field work under this TCRA has been divided into definable features of work, and the tasks required to complete each definable feature of work have been identified. Procedures for these tasks, including recording data, forms and checklists, data generation, QC checks, data management, and information management, are defined in the SOPs and project forms included in Appendix C and the QC and Assessment Tables included in Appendix D.

Definable Feature of Work	Tasks
Site Preparation (including mobilization)	• Prepare Work Plan. • Review all planning documents (subject Work Plan, ESSs, and HASP/APP). • Verify personnel qualifications. • Coordinate with local authorities and establish communication logistics. • Set up administrative office (computer, printer, charging station). • Set up EZs. • Set up and check out equipment. • Remove surface non-munitions-related debris, as applicable. • Conduct initial orientation and training (including Safety and Emergency Response). • Verify certification from Navy Commanding Officer of UXO Technician to certify MDEH/MDAS.
Site Surveying	• Survey site boundaries, work areas, equipment laydown areas, and access ways. • Surface survey.
Vegetation Management	• Inspect equipment. • Set cutting height to between 6 and 12 inches above the ground surface Only hand-held brush cutters will be used in the Site 12 EOD Area designated wetlands.
GPS Positional Data	• Conduct twice daily comparisons with two known reference locations. • Monitor HDOP parameters. • Collect GPS data. • Backup GPS data. • Transfer GPS data to Tetra Tech GIS website.
IVS	• Install IVS at Quarry Area and/or Site 12 EOD Area. • Perform IVS at Quarry Area and/or Site 12 EOD Area. • Review and approve IVS.

Definable Feature of Work	Tasks
Detector-Aided Survey	**Site 12 EOD Area and Quarry Area (Areas A, B, and C)** • Conduct surface survey to locate any MEC/MPPEH and suspect hazardous waste in work areas. • Record locations (GPS and photograph) of MEC/MPPEH and suspect hazardous waste. • Conduct UXO escort duties. **Quarry Areas A and B Only** • Generally determine the surface and subsurface extent of the construction debris and landfilling operations.
Target Acquisition (Quarry Areas A and B Only)	• Evaluate in real-time the results of detector-aided surveys to locate suspected burial trenches, pits, or subsurface anomaly areas. • Mark with pin flags a minimum of 30 subsurface anomaly areas (if found) in both Areas A and B (15 anomalies each) and up to a maximum of 60 subsurface anomalies site wide. Field determination with input from UXO Manager and Tetra Tech Project Manager. • GPS all flagged anomalies to aid in intrusive dig location selection process. • GPS the boundaries of suspected burial trenches, pits, or subsurface anomaly areas.
Manual Intrusive Operations (Hand Digs) (Quarry Areas A and B Only)	• Conduct surface manual removal of non-munitions-related debris, as applicable. • Excavate and investigate acquired target areas (a minimum of 30 subsurface anomaly areas in both Areas A and B (15 anomalies each) and up to a maximum of 60 subsurface anomalies site wide). • Excavate and investigate within a 2-foot radius of each pin flag at center of each acquired anomaly to a depth of 2 feet bgs in each anomaly area. • Record location (GPS and photograph) of each MEC or MPPEH item discovered, then detonate or remove as appropriate. If item is not MEC/MPPEH, also record location and description. • Report MEC in accordance with Section 2. • Temporarily 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	• Correctly post proper placarding, warning signs, flagging, and firefighting equipment. • Complete receipt, usage, and inventory control documentation per OP 5/ATF requirements. • Conduct work in compliance with explosive handling and transportation requirements.

Definable Feature of Work	Tasks
MEC Management (Treatment)	• Establish EZs per ESS requirements. • Prepare site if item unsafe to move (i.e., BIP). • Transport item to site-specific treatment area if item safe to move and prepare MEC management site. • Prepare and apply donor charge. • Check results of treatment.
MPPEH Management (Inspection)	• Inspect MPPEH. • Segregate MPPEH into MDAS and MDEH. • Secure MDAS in a secure locked container. • MDEH secure item and treat as MEC.
MPPEH Management (Certification)	• Certify MDAS. • Certify MDEH.
MPPEH Management (Disposal)	• Dispose of MDAS per OP 5. • Treat MDEH with donor change as MEC. • Maintain custody of MDEH through treatment.
Demobilization	• Remove IVS. • Remove temporary survey markers. • Verify site restoration. • Complete all field forms. • Close out field logbooks. • Return equipment. • Provide all field documentation (verify requirements established in the Work Plan).
Site-Specific Final Report Preparation and Approval	• Close out MEC Tracking Log. • Collect all documentation from field activities. • Prepare and submit site-specific final report with courtesy copy for regulatory agencies. • Address comments. • Receive approval of site-specific final report.

The requirements presented in this QCP are intended as overall QA and QC requirements to be performed at the Quarry Area (Areas A, B, and C) and Site 12 EOD Area and are applicable to all administrative, engineering, and technical activities associated with the TCRA. The requirements of this plan are applicable to all Tetra Tech personnel and their subcontractors unless an alternate QCP is used that is consistent with or exceeds the requirements of this document either completely or in part.

10.1 PROJECT ORGANIZATION AND RESPONSIBILITIES

Under the direction of the Navy, Tetra Tech will provide a staff of experienced administrative and technical professionals to serve as key personnel responsible for implementing QC requirements associated with this project. These personnel will be selected for their management and technical abilities and will include the following core employees:

- PM
- UXO Manager
- SUXOS/FOL
- UXOSO/UXOQCS
- UXO Team Leader
- UXO Technicians

10.2 QUALITY REQUIREMENTS

A summary of the quality requirements associated with field activities in support of the Quarry Area (Areas A, B, and C) and Site 12 EOD Area TCRA scope of work are defined in Table 10-1, and more detail is presented in Appendix D. These requirements apply to all field activities that affect the quality of work and work products. QC checks will be conducted as follows:

- Daily Briefings - The SUXOS/UXO Team Leader will ensure that daily safety and operational briefings are conducted.

- Communications - Communications with the Navy POC and site personnel will be maintained throughout the workday.

    - At a minimum, communication checks will be conducted each morning prior to starting work. Additional checks will be performed as necessary throughout the workday to monitor progress, safety, and/or QC.
    - Teams will not start operations until satisfactory checks have been achieved.
    - Navy POC and Navy RPM will provide notifications as needed to the local community should demolition of MEC/MPPEH be required. This may include the local town manager, local fire department, and local police department, as necessary.

- Training - The SUXOS/UXOSO will ensure that initial site-specific training is performed for all field personnel prior to startup of field activities and that all safety control measures have been established. Training will be accomplished using only approved training materials. The UXOSO will ensure that all certifications for field personnel are available for Navy inspection.

- Documentation - The SUXOS/UXOQCS will ensure the completion of all documentation listed in Section 10.3.

- Review - The SUXOS will be responsible for supervising all site activities including the following:

  - Supervision of Tetra Tech personnel and subcontractor staff.
  - Compliance with this Work Plan, QCP, ESSs (internal Navy documents approved by DDESB), and HASP/APP.
  - Adherence to the contract schedule.
  - Review and submission of all daily and job status reports and documentation.
  - Direct daily communication with the Tetra Tech PM.

The UXOQCS has overall responsibility for verifying compliance with project requirements throughout the project through implementation of the three-phase control inspection process. This process ensures that project activities comply with the approved plans and procedures. Elements of the three-phase control inspection process are: (1) Preparatory Phase, (2) Initial Phase, and (3) Follow-Up Phase. Each control phase is important for obtaining a quality product.

10.3 FIELD DOCUMENTATION

All field activities affecting QC will be performed in accordance with documented procedures, instructions, or drawings identified in this Work Plan, SOP-08, UXO Documentation, (Appendix C), and/or applicable DIDs. During all field activities, Tetra Tech will use the following reporting forms:

- QC Daily Report
- Preparatory Phase Inspection Report
- Initial Phase Inspection Report
- Follow-Up Phase Inspection Report
- Nonconformance Report
- Corrective Action Report
- Lessons Learned Report
- Field Logbooks
- Daily Equipment Checklist

The SUXOS will maintain a field logbook of all inspection and testing activities that will be used in preparing the QC Daily Report. All QC Reports generated during this effort will be submitted with the IAAR. Reports will not be prepared for days on which no work is performed. At a minimum, one report will be submitted for every 7 days of no work and on the last day of a period of work stoppage. Daily Reports will be signed and dated by the SUXOS. IAAR will be signed by the Tetra Tech PM.

The QC Daily Reports will include summaries of the following:

- Tetra Tech personnel/subcontractors and responsibilities.
- Equipment used, with any idle or downtime noted.
- Location, personnel, and description of work.
- Safety evaluations including descriptions of inspections, results, and any corrective actions.

10.4 AUDITS

Field performance will be evaluated to ensure that the quality standards and objectives of this Work Plan are met. This evaluation will be accomplished through audits of the QC Daily Reports. Audits will be conducted and corrective actions will be implemented when nonconformances or deficiencies are identified. Additional audits will be conducted periodically and will be planned and conducted by the Program or Project QA Manager. Procedures for auditing activities will be identified prior to implementation of the audits.

The audit process will involve identifying non-conformances or deficiencies, reporting and documenting them, initiating corrective actions through appropriate channels, and following up with a compliance review. Records will be kept of all auditing tasks and findings on the QA Audit Checklist and in audit notes. In addition, copies of the audit findings will be provided to the Navy RPM within 1 week of completion of an audit.

All members of field teams involved with site work are responsible for reporting any suspected technical non-conformances or deficiencies to the Program QC Manager. The Program QA Manager is responsible for evaluation of the situation and taking action, if any is required, following the notification protocol.

CH2M Hill will provide oversight and conduct audits directly for the Navy. CH2M Hill will be granted site access by appropriate personnel under the direct supervision of the Tetra Tech SUXOS or UXOQCS. CH2M Hill will comply with all applicable training, safety briefings, and site security procedures. CH2M Hill will also be provided access to this Work Plan, site-specific HASP/APP documentation, personnel training and qualification documentation, and other site documentation as warranted.

TABLE 10-1

QUALITY REQUIREMENTS FOR
UXO SUPPORT TO THE NAVY AT
NAS BRUNSWICK, BRUNSWICK, MAINE

Objective	Definable Feature of Work	Activity Quality Requirement	Quality Control Verification
Prepare Site	Site Preparation (including mobilization	Mobilize equipment and personnel, and prepare site as described in this Work Plan.	• Daily Site Health and Safety Meeting Report • Field Logbooks
Site Work	Site Surveying	Survey site boundaries, work areas, equipment laydown areas, and access ways.	• Field Logbooks • QC Daily Report • Daily Equipment Checklist
Site Work	Vegetation Clearance	UXO Technicians, supervised by the UXO Team Leader, will perform vegetation clearance and removal to allow access to areas for detector-aided surveys and anomaly acquisition. Fail criteria will be any area with vegetation smaller than 2 inches in diameter and taller than 12 inches.	• QC Daily Report • Daily Site Health and Safety Meeting Report • Daily Equipment Checklist • QA Audit Checklist and Audit Form • Health and Safety Compliance Inspection • Field Logbooks • QC/observe vegetation clearance operations
Site Work	GPS Positional Data	The UXOQCS, supervised by the SUXOS, will compare GPS coordinates of two known reference locations twice daily to collected data. Fail criteria will be a greater than 1-meter difference between the known reference location coordinates and the measured location.	• QC Daily Report • Daily Equipment Checklist • QA Audit Checklist and Audit Form • Field Logbooks
Site Work	IVS	UXO Technicians, supervised by the UXOQCS will demonstrate competency with field equipment and survey techniques by completing the IVS and detecting all items in the IVS with the appropriate field instrument. Fail criteria will be not detecting all items in the IVS or performing the survey without proper techniques.	• QC Daily Report • Daily Equipment Checklist • QA Audit Checklist and Audit Form • Field Logbooks

TABLE 10-1

QUALITY REQUIREMENTS FOR
UXO SUPPORT TO THE NAVY AT
NAS BRUNSWICK, BRUNSWICK, MAINE

Objective	Definable Feature of Work	Activity Quality Requirement	Quality Control Verification
Site Work	Detector-Aided Survey and Target Acquisition	UXO Technicians, supervised by the SUXOS, will complete a grid/target inspection to collect data on the type and location of MEC on the surface at the sites and will remove MEC/MPPEH from the surface within the Quarry Area (Areas A, B, and C) and Site 12 EOD Area. For the Quarry Area (Areas A, B, and C) generally determine the extent of the construction debris and landfilling operations; surface and subsurface and evaluate in real-time the results of detector-aided survey to locate suspected burial trenches, pits, or subsurface anomaly areas. QC checks will be performed to ensure that the UXO Team locate, identify, collect data, and report all identified MEC and removes all surface MEC. Fail criteria will be any MEC larger than 20mm discovered in a grid/target that was not reported in the data logs or a missed blind seed.	• QC Daily Report • Daily Site Health and Safety Meeting Report • Daily Equipment Checklist • QA Audit Checklist and Audit Form • Health and Safety Compliance Inspection • Field Logbooks • QC/observe that all blind seed items are located and investigated during surveys activities
Site Work	Manual Intrusive Operations (Hand Digs) (Quarry Area A and B Only)	UXO Technicians, supervised by the SUXOS, will remove MEC from the excavated soil during manual intrusive excavation within the Quarry Area A and B, only. QC checks will be performed to ensure that the UXO Team removes all MEC from the excavated soil. Fail criteria will be any MEC discovered in cleared areas.	• QC Daily Report • Daily Site Health and Safety Meeting Report • Daily Equipment Checklist • QA Audit Checklist and Audit Form • Health and Safety Compliance Inspection • Field Logbooks • QC 10% of excavated soil
Site Work	UXO Escort/Avoidance Operations	UXO Technician will conduct avoidance while conducting UXO Escort Duties. QC checks will be performed to ensure that no anomalies are moved or disturbed during this phase of the project. Fail criteria will be any anomaly moved or disturbed.	• QC Daily Report • Daily Site Health and Safety Meeting Report • Daily Equipment Checklist • QA Audit Checklist and Audit Form • Health and Safety Compliance Inspection • Field Logbooks • QC/observe UXO Escort duties

TABLE 10-1

QUALITY REQUIREMENTS FOR UXO SUPPORT TO THE NAVY AT NAS BRUNSWICK, BRUNSWICK, MAINE

Objective	Definable Feature of Work	Activity Quality Requirement	Quality Control Verification
Site Work	MEC Management (Treatment)	UXO Technicians supervised by the SUXOS will conduct MEC/MPPEH disposal/treatment operations. QC checks will be performed to ensure that MEC disposal is conducted in a safe and effective manner. Fail criteria will be any unsafe or ineffective MEC disposal operation.	• QC Daily Report • Daily Site Health and Safety Meeting Report • Daily Equipment Checklist • QA Audit Checklist and Audit Form • Health and Safety Compliance Inspection • Field Logbooks • QC/observe MEC disposal operation
Site Work	MPPEH Management (Inspection/Certification)	UXO Technicians supervised by the SUXOS will conduct MPPEH segregation into MDAS and MDEH SUXOS will inspect 100% of all MDAS UXOQC will reinspect 100% of all MDAS SUXOS will prepare certification for MDAS. QC checks will be performed to ensure that no energetic material remains in the Certified MDAS. Fail criteria will be any energetic material discovered in certified MDAS.	• QC Daily Report • Daily Site Health and Safety Meeting Report • Daily Equipment Checklist • QA Audit Checklist and Audit Form • Health and Safety Compliance Inspection • Field Logbooks • QC/inspect MDAS during certification process
Site Work	Demobilization	Demobilize equipment and personnel according to schedule.	• Daily Site Health and Safety Meeting Report • Health and Safety Compliance Inspection • Field Logbooks

11.0 ENVIRONMENTAL PROTECTION PLAN

Soil Erosion and Sediment Control – Erosion controls are not anticipated to be necessary based on the short duration and shallow depth (2 feet bgs) of manual excavations at the Quarry Area (Areas A and B only). Each excavation will be backfilled before the end of each days operation. Silt fence, temporary berms, or other erosion control measures are not anticipated to be required.

Stockpiled Soil – Large quantities of soil will not be stockpiled at the Quarry Area (Areas A and B only). Any soil removed from a manual excavation will be staged as closely as possible to the work area without interfering with the investigation/clearance activities. Silt fence, temporary berms, or other erosion control measures are not anticipated to be required.

Pollution Prevention – All project site work methods and procedures will be conducted in a manner that minimizes pollution and controls dust within reasonable limits. All vehicles used for this project will be operated at low rates of speed to reduce dust emissions.

Chemicals On Site – Chemicals associated with the donor explosives for this project will be ordered as needed and will not be stored on site. Procedures to be followed during handling of these chemicals are addressed in Appendix F-1 (SOP-05). Material Safety Data Sheets (MSDSs) are provided in Appendix E.

Vehicles designated to travel on roads will be fueled at commercial filling stations, which will prevent on-site spills during refueling. Fuel for use in equipment not designated to travel on roads will be transported and dispensed from fuel cans designed to reduce the potential for spills. Fuels will be transported in small containers, and fueling will be conducted in areas designated by the SUXOS. Spill kits will be maintained in the same vicinity and will be on site for any spills and/or leaks. Fuel will not be stored on site. Should any spill occur, notifications will first be made to Navy POC and Tetra Tech PM. The Navy POC will contact MEDEP [Public Safety (all hours) 800-482-0777 and Southern Maine Regional Office (normal working hours) 207-287-7800]. The Navy RPM will be notified within 1 business day of any spill. Any spill will be cleaned up as quickly as possible (additional details are provided in Section 9.0 of the HASP).

It is anticipated that the only significant waste generated during this project will be any munitions -elated scrap recovered during TCRA activities. As stated in Section 2.13.2, ordnance-related scrap that is certified and verified as MDAS will be released to a certified subcontractor. Additionally, Section 2.4 states that non-munitions debris located during detector-aided surveys will be manually moved to a nearby location when possible (area designated by Navy POC); marshalling and off-site disposal of non-munitions debris will be deferred to the RI or addressed by the Navy.

12.0 INVESTIGATION-DERIVED WASTE PLAN

An Investigation-Derived Waste Plan is not required for performance of this TCRA because the project team will not be generating investigation-derived waste. Scrap metal (non-munitions related) removed from the site will be placed in an area designated by Navy POC for disposition by the Navy. Munitions-related debris handling requirements are described in Sections 2.12 and 2.13.

13.0 INTERIM HOLDING FACILITY SITING PLAN FOR RCWM

No Recovered CWM (RCWM) is expected under during these TCRA activities; therefore, an RCWM Interim Holding Plan is not required.

14.0 PHYSICAL SECURITY PLAN FOR RCWM PROJECT SITES

No RCWM is anticipated under this TCRA; therefore, an RCWM Security Plan is not required.

15.0 REFERENCES

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

DoD, 2010a. DoD Ammunition and Explosive Safety Standards DoD 6055.9-M. August.

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

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APPENDIX A

SITE MAPS

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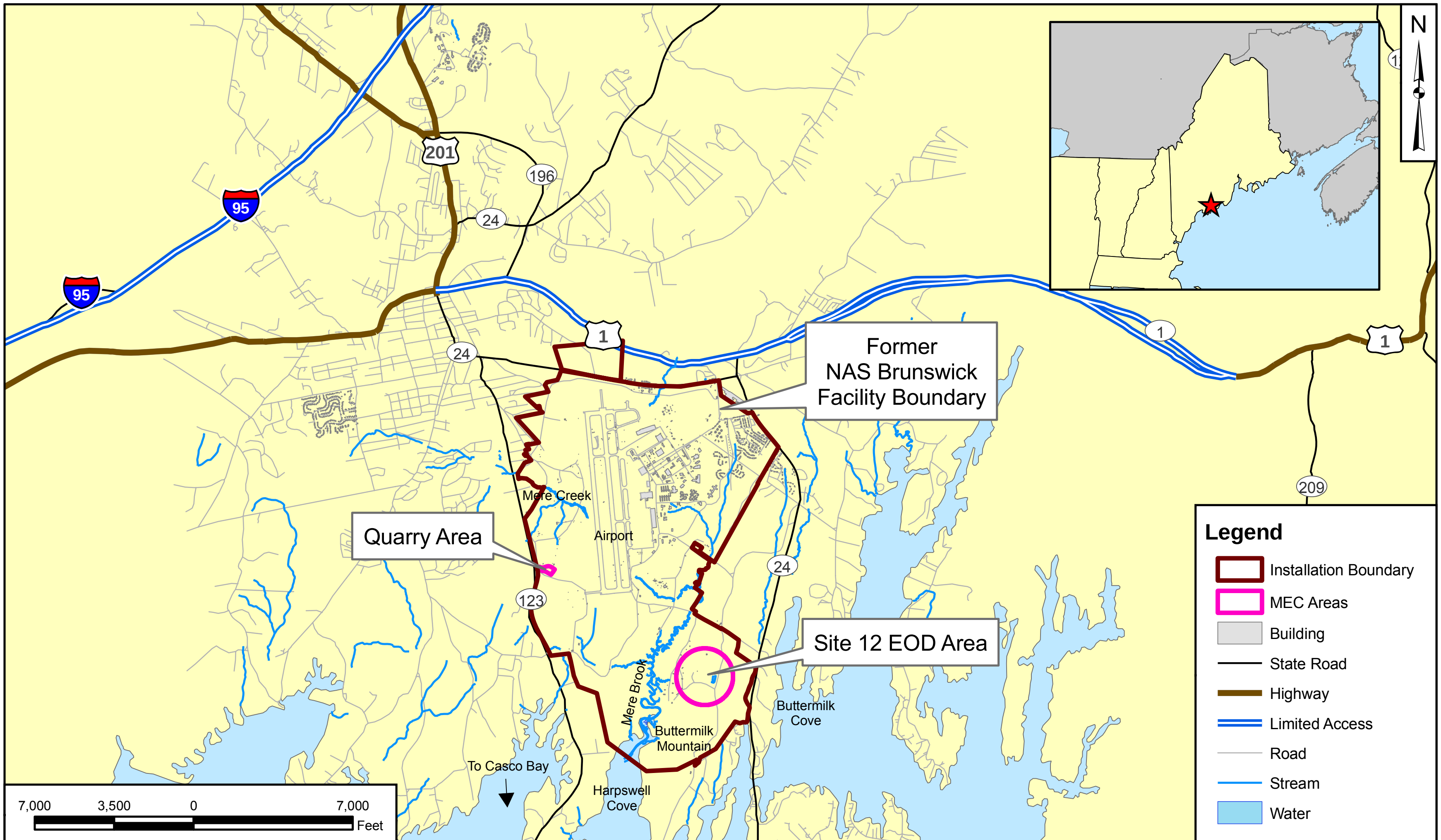
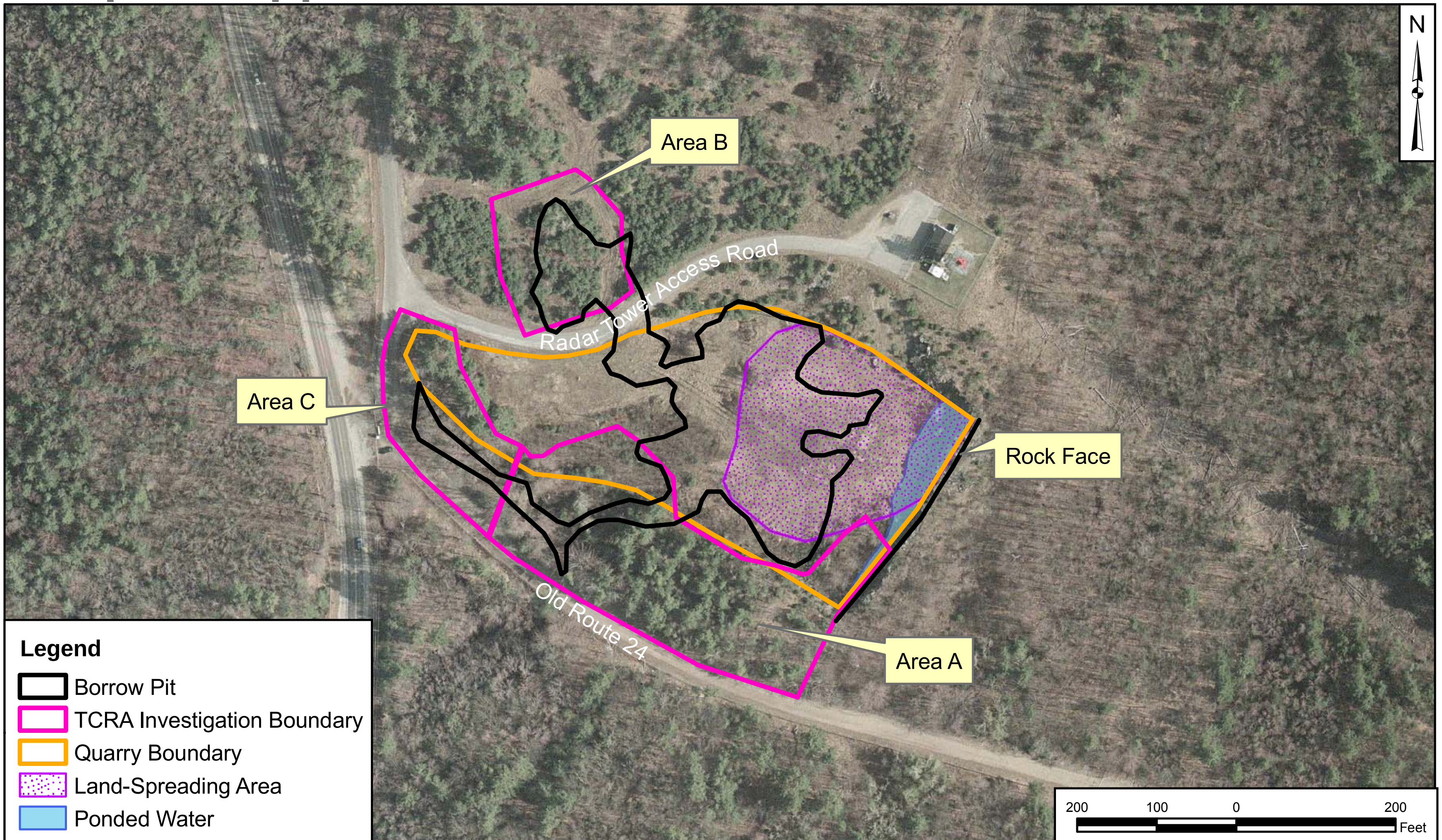


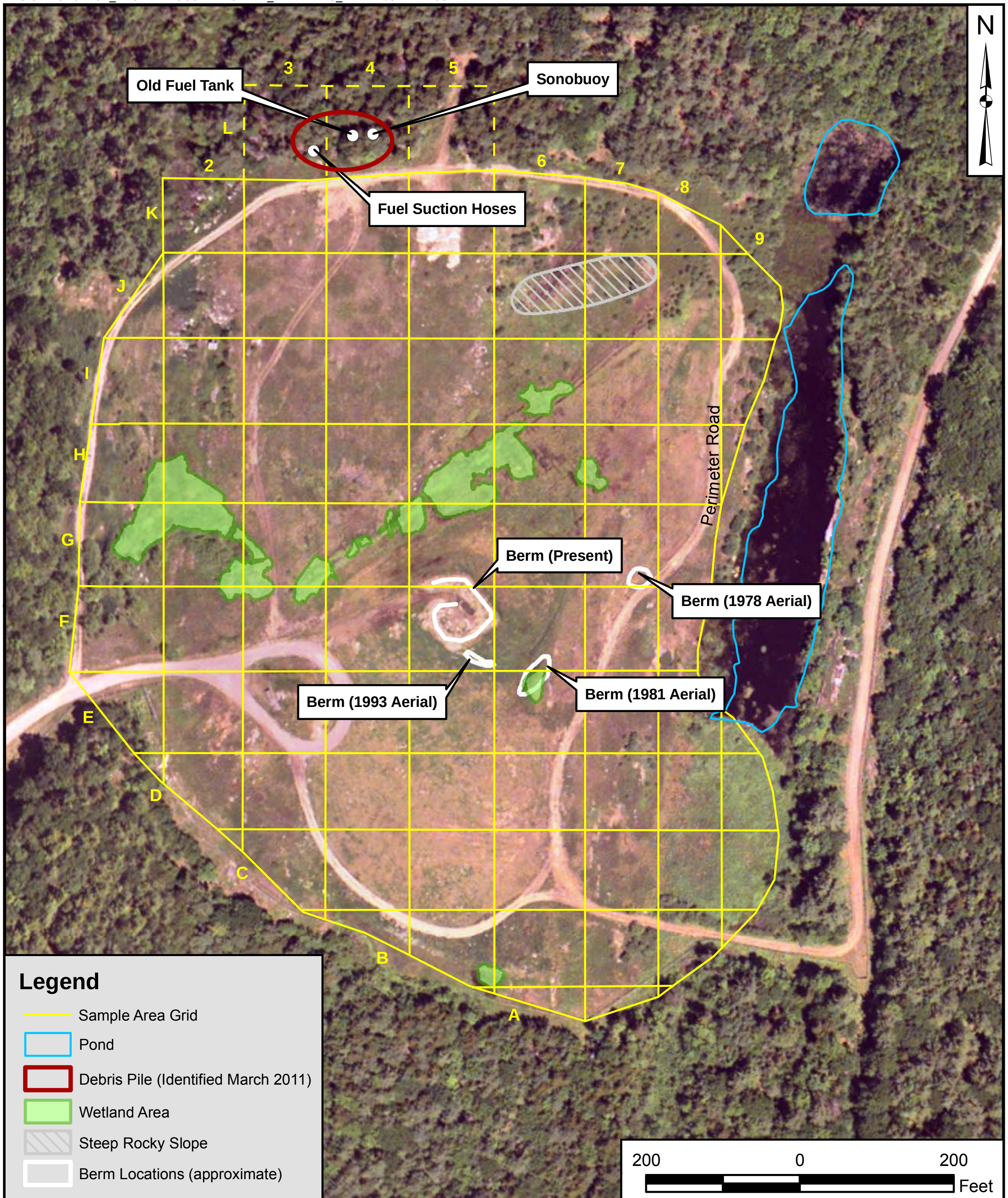
DRAWN BY T. WHEATON	DATE 08/26/09	TETRA TECH	CONTRACT NUMBER CTO WE09
CHECKED BY E. LOVE	DATE 06/10/11	REMOVAL ACTION SITE LOCATIONS FORMER NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 1 / REV 0

P:\GIS\BRUNSWICK_NAS\MAPDOCS\MXD\QUARRY_SITE_2.MXD 05/17/11 SS



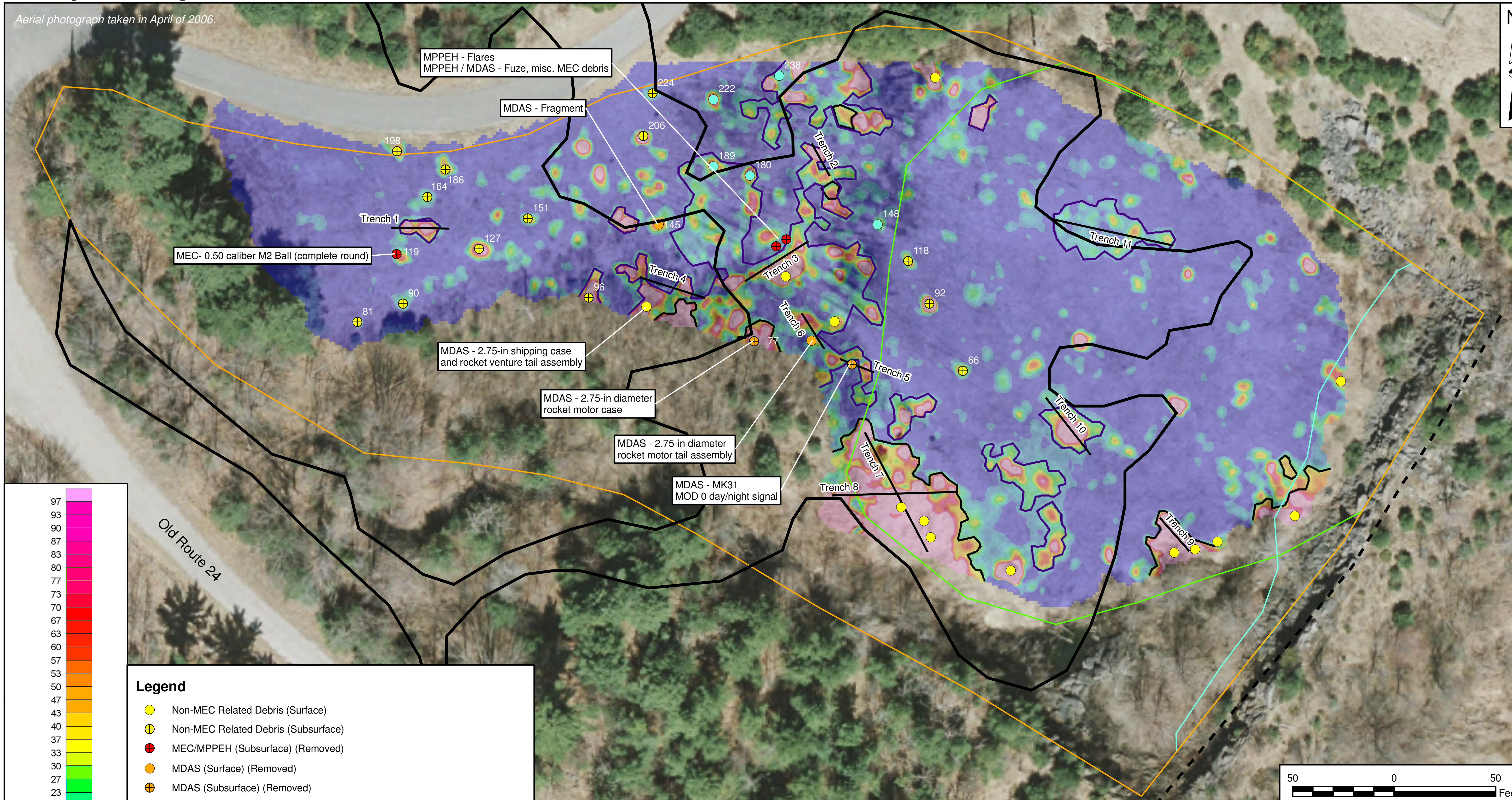
DRAWN BY S. STROZ	DATE 05/16/11	TETRA TECH	CONTRACT NUMBER CTO 0069	
CHECKED BY E. LOVE	DATE 05/17/11	QUARRY AREA - SITE LAYOUT FORMER NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY	DATE
REVISED BY	DATE		APPROVED BY	DATE
SCALE AS NOTED			FIGURE NO. FIGURE 2	REV 0

P:\GIS\BRUNSWICK_NAS\MAPDOCS\MXD\SITE12_WETLANDS_1.MXD 05/17/11 SS



DRAWN BY T. WHEATON — DATE 11/22/10	TETRA TECH	CONTRACT NUMBER CTO WE09
CHECKED BY E. LOVE — DATE 05/17/11	SITE 12 EOD AREA - SITE LAYOUT FORMER NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ — DATE ___
REVISED BY S. STROZ — DATE 05/17/11		APPROVED BY ___ — DATE ___
SCALE AS NOTED		FIGURE NO. FIGURE 3 — REV 0

P:\GIS\BRUNSWICK_NAS\MAPDOCS\MXD\QUARRY_RESULTS.MXD 08/09/11 TW



Legend

- Non-MEC Related Debris (Surface)
- Non-MEC Related Debris (Subsurface)
- MEC/MPPEH (Subsurface) (Removed)
- MDAS (Surface) (Removed)
- MDAS (Subsurface) (Removed)
- Trench Location
- Rock Face
- Quarry Boundary
- Ponded Water
- Land Spreading Area
- Borrow Pit

NOTE: EM61 color contour map intrepretation of anomalies during 2008 MEC SI geophyscial survey.

DRAWN BY K. MOORE	DATE 11/29/10	CONTRACT NUMBER	CTO 0069
CHECKED BY E. LOVE	DATE 08/09/11	APPROVED BY	DATE
REVISED BY T. WHEATON	DATE 08/09/11	APPROVED BY	DATE
SCALE AS NOTED		FIGURE NO. FIGURE 4	REV 0

NAVFAC

RESULTS OF 2008 SI AND 2010 EXPLORATORY MEC INVESTIGATION
QUARRY AREA
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

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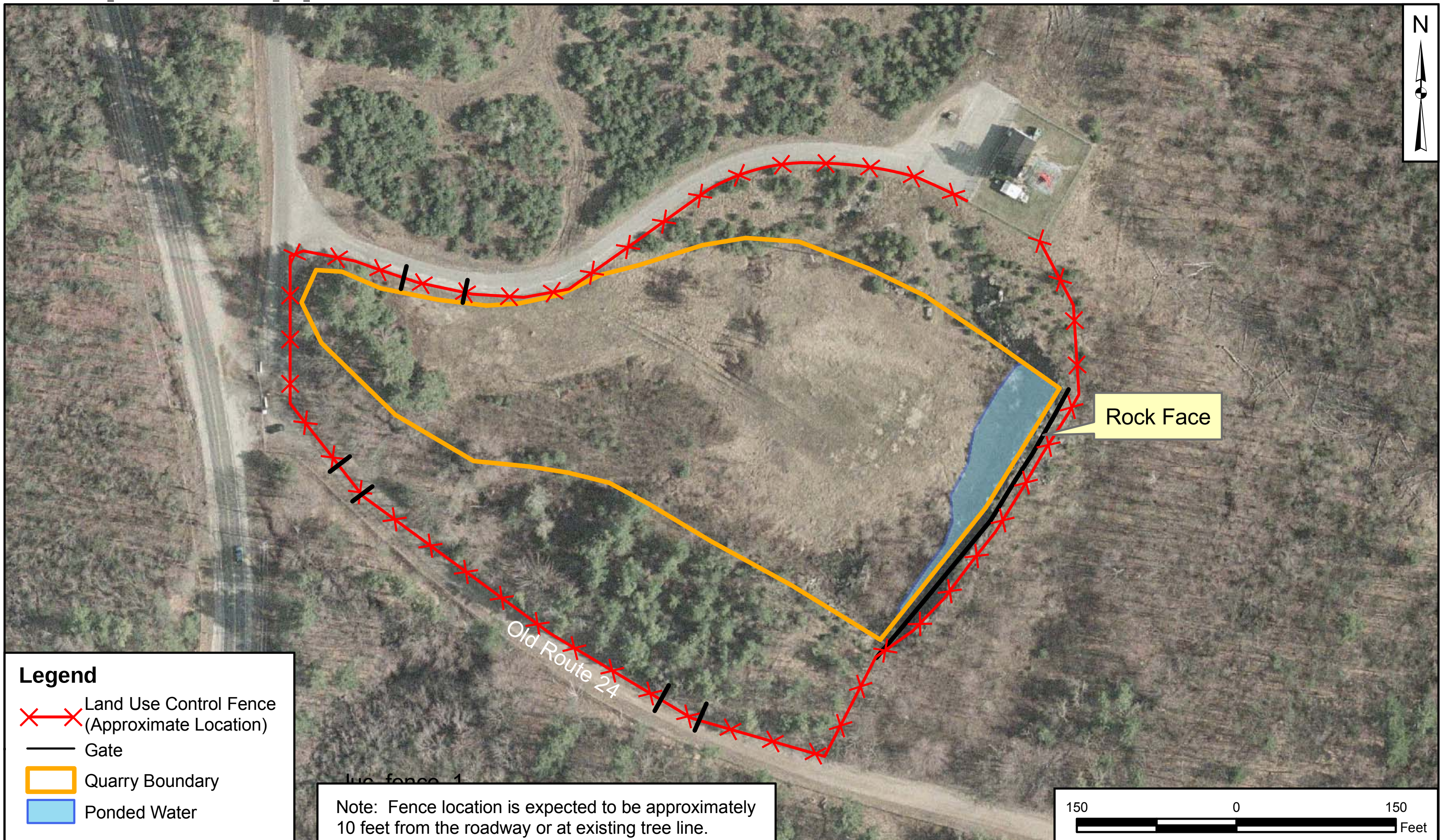

DRAWN BY K. MOORE — DATE 10/18/07	TETRA TECH	CONTRACT NUMBER CTO 0069
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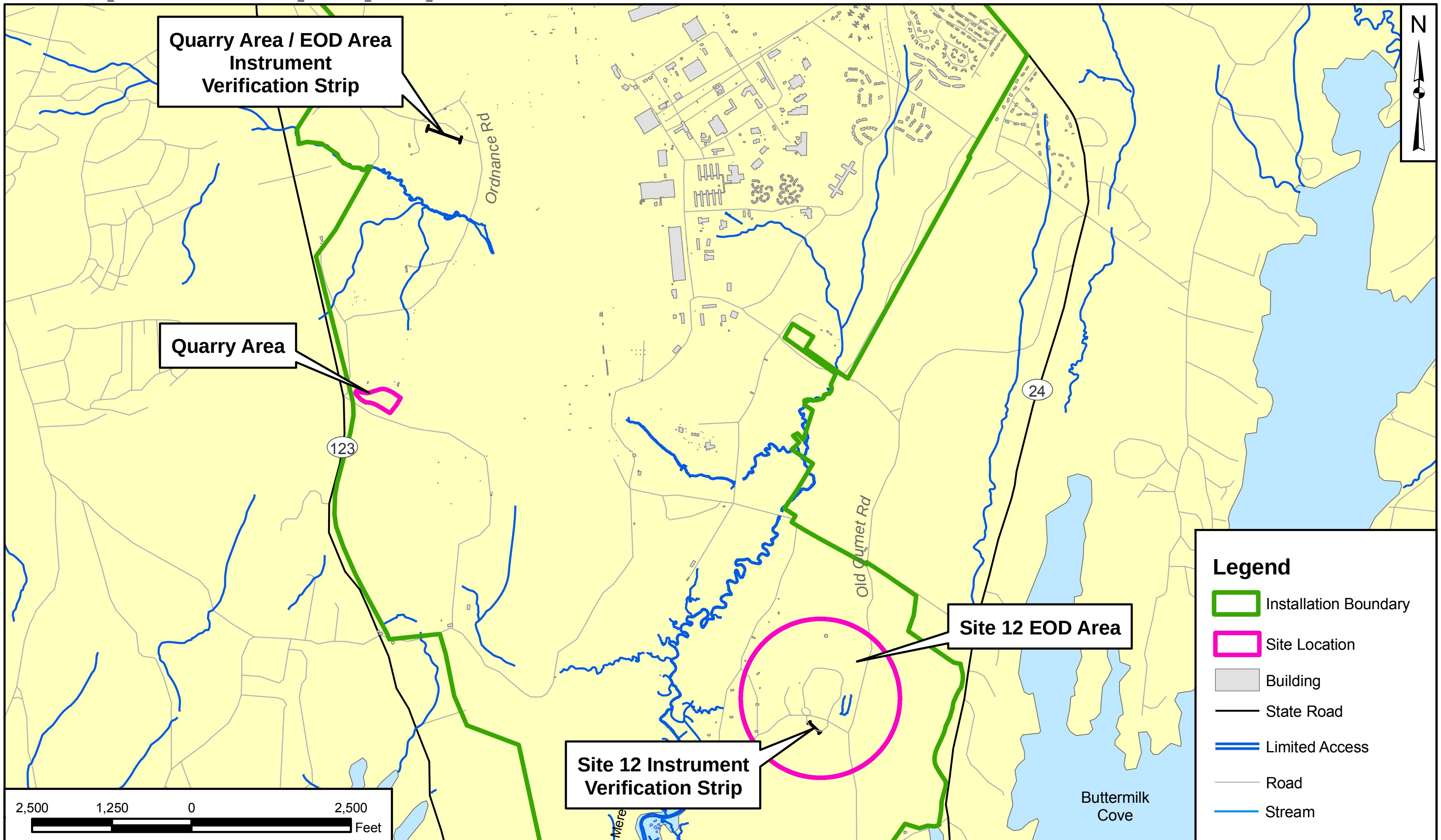
REVISED BY J. ENGLISH — DATE 06/10/11		APPROVED BY ___ — DATE ___
SCALE AS NOTED		FIGURE NO. FIGURE 5 — REV 0

P:\GIS\BRUNSWICK_NAS\MAPDOCS\MXD\INSTRUMENT_TESTSTRIP_LOCATION_ALT.MXD 05/16/11 SS



DRAWN BY J. ENGLISH	DATE 12/23/10	TETRA TECH	CONTRACT NUMBER CTO WE09
CHECKED BY E. LOVE	DATE 05/16/11	INSTRUMENT VERIFICATION STRIP LOCATIONS FORMER NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 6 / REV 0

APPENDIX B

PROJECT CONTACT INFORMATION

B.1 EMERGENCY REFERENCE LOCAL POINTS OF CONTACT

EMERGENCY REFERENCE
LOCAL POINTS OF CONTACT
FORMER NAS BRUNSWICK, BRUNSWICK, MAINE

CONTACT	PHONE NUMBER
Emergency Number for Fire, Police, and Ambulance	**9-1-1**
Fire Department (non-emergency): Central Station 21 Town Hall Place Brunswick, Maine 04011-2003	(207) 725-5541
Police Department (non-emergency): 28 Federal Street Brunswick, Maine 04011	(207) 725-5521
Mid Coast Hospital	(207) 373-3635
BRAC PMO NE Remedial Project Manager (RPM): Todd Bober	(215) 897-4911
BRAC PMO NE Environmental Coordinator: Paul Burgio	215-897-4915
EOD Support: EODMU TWELVE DET Newport 1176 Howell Street BLDG 119 Code 0032 Newport, RI, 02841-1708	(401) 832-3301
Former NAS Brunswick Point of Contact (POC): Robert LeClerc Public Works Officer Building 53	(207) 921-2281
Chemtrec	(800) 424-9300
National Response Center	(800) 424-8802
NORTHERN NEW ENGLAND POISON CENTER	(800) 222-1222
WorkCare	(800) 455-6155 ext. 109
CLEAN Health and Safety Manager: Matthew M. Soltis, CIH, CSP	(800) 245-2730 ext. 8912. OR (412) 921-8912

B.2 SITE SPECIFIC CONTACT INFORMATION

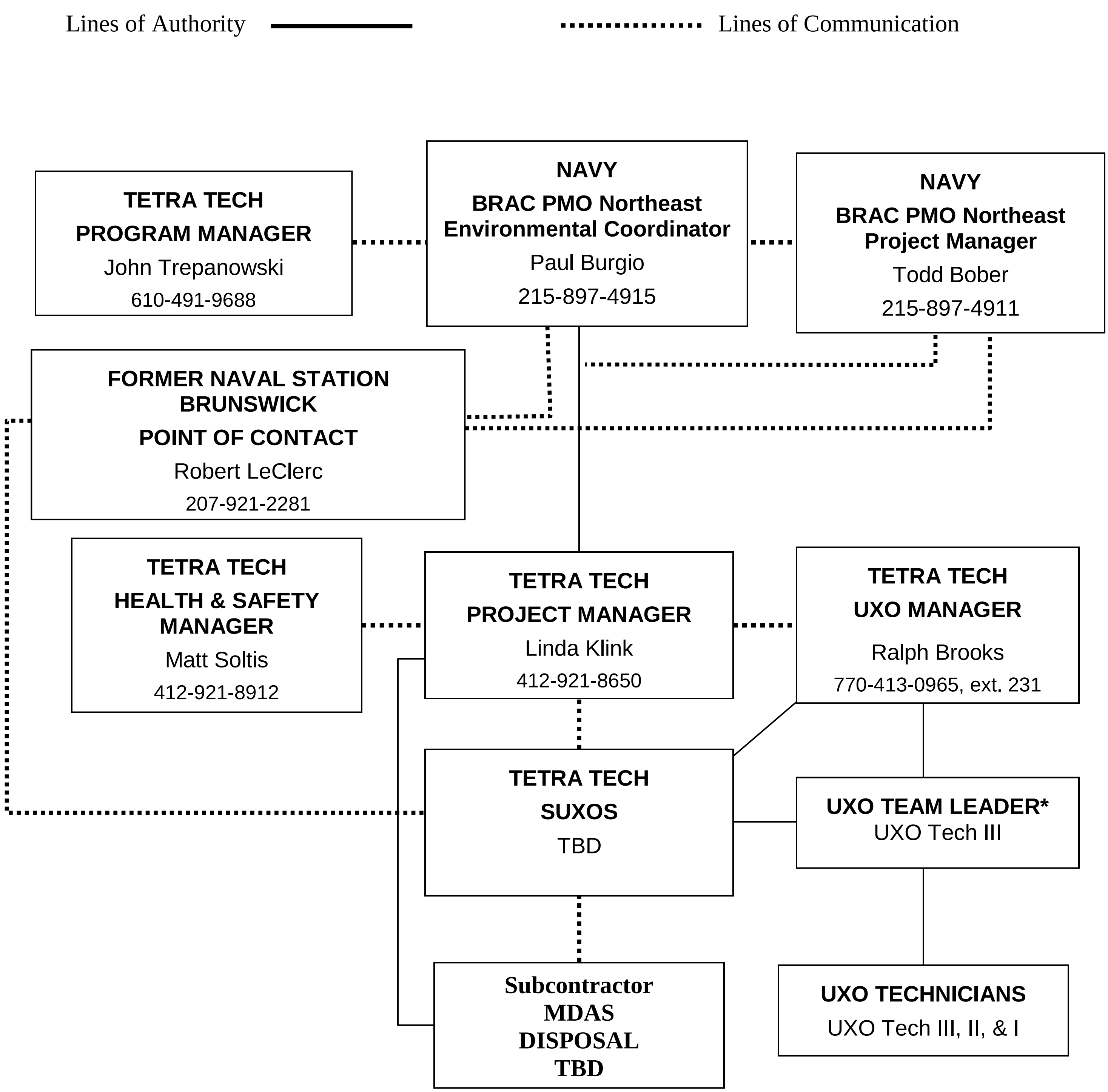
Project Specific Contact Information
Former Naval Air Station Brunswick
Brunswick, Maine

Name	Title/Role	Organization	Telephone Number (Optional)	E-Mail Address or Mailing Address
Todd Bober	Remedial Project Manager (RPM)	Navy BRAC PMO NE 4911 South Broad Street Philadelphia, PA 19112	215-897-4911	todd.bober@navy.mil
Paul Burgio	BRAC Environmental Coordinator	Navy BRAC PMO NE 4911 South Broad Street Philadelphia, PA 19112	215-897-4915	paul.burgio@navy.mil
Victoria Boundy	Planning and Environmental Manager (MMRA)	Midcoast Regional Redevelopment Authority 5450 Fitch Avenue Brunswick, ME 04011	207-798-6512	victoriab@mrra.us
Michael Green	MRP Senior Technical Advisor	NAVFAC Atlantic Attn: Code EV32 6506 Hampton Blvd., LRA Bldg. A Norfolk, VA 23508	757-322-8108	mike.green@navy.mil
Robert LeClerc	Former NAS Brunswick Point of Contact (POC)	Public Works Officer Building 53	207-921-2281	
Carolyn LePage	Technical Advisor to BASCE	LePage Environmental Services 731 Hotel Road Auburn, ME 04210	207-777-1049	calepage@adelphia.net
Jennifer Wright	Environmental Technical Support	NAVFAC Atlantic Attn: Code EV32 6506 Hampton Blvd Norfolk, VA 23508-1278 Jen (Code EV32JW)	757-322-8428	Jennifer.H.Wright@navy.mil
David Barclift	Navy BRAC PMO NE Technical Support	Navy BRAC PMO NE 4911 South Broad Street Philadelphia, PA 19112	215-897-4913	david.barclift@navy.mil
Michael Daly	Remedial Project Manager	USEPA Region I Federal Facilities Superfund Section 1 Congress Street, Suite 1100 (HBT) Boston, MA 02114-2023	617-918-1386	Daly.Mike@epamail.epa.gov

Name	Title/Role	Organization	Telephone Number (Optional)	E-Mail Address or Mailing Address
Claudia Sait	Remedial Project Manager	Maine Department of Environmental Protection Bureau of Remediation & Waste Management State House, Station 17 Augusta, ME 04333-0017	207-287-7713	claudia.b.sait@maine.gov
Chris Evans	Project Hydrogeologist	Maine Department of Environmental Protection Bureau of Remediation & Waste Management State House, Station 17 Augusta, ME 04333-0017	207-287-7656	Gordon.C.Evans@maine.gov
Linda Klink	Tetra Tech Project Manager (PM)	Tetra Tech NUS, Inc. 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	412-921-8650	linda.klink@tetratech.com
Ralph Brooks	Tetra Tech UXO Manager	Tetra Tech NUS, Inc. 2171 West Park Court, Suite E Stone Mountain, GA 30087	770-413-0965 (Ext. 231)	ralph.brooks@tetratech.com
Tom Johnston	Tetra Tech Project Chemist and Quality Assurance Manager (QAM)	Tetra Tech NUS, Inc. 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	412-921-8615	tom.johnston@tetratech.com
Matt Soltis (HASP only)	Tetra Tech Health and Safety Manager (HSM)	Tetra Tech NUS, Inc. 661 Andersen Drive Foster Plaza 7 Pittsburgh, PA 15220	412-921-8912	matt.soltis@tetratech.com
John Trepanowski	Tetra Tech Program Manager	Tetra Tech NUS, Inc. 234 Mall Boulevard, Suite 260 King of Prussia, PA 19406	610-491-9688	john.trepanowski@tetratech.com

B.3 ORGANIZATIONAL CHART

PROJECT ORGANIZATION CHART



* - Dual-hatted position

Note: Specific staffing is contingent on project schedule and experience and availability of personnel.

B.4 EOD CONTACT INFORMATION

6/13/2011

Officer In Charge
EODMU TWELVE DET Newport
1176 Howell Street
BLDG 119 Code 0032
Newport, RI, 02841-1708
(401) 832-3301

DSN: 432-XXXX
FAX: (401) 832-6157

Name	***Phone***
LT Dan Tereshko	Desk (401) 832-3302 CELL (401) 862-6864 dan.tereshko@navy.mil
EODCS Sean Phillips	Desk (401) 832-4484 CELL (401) 862-6865 darryl.s.phillips@navy.mil
EODC Kenneth J Virgilio	Desk (401)832-4456 CELL (401)862-6870 kenneth.virgilio@navy.mil
EODC Ronald McCalicher	Desk (401)832-4483 CELL (401)862-6867 ronald.mccalicher@navy.mil

APPENDIX C

STANDARD OPERATING PROCEDURES AND PROJECT FORMS

C.1 STANDARD OPERATING PROCEDURES

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 Tetra Tech 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	

White's Spectrum XLT Settings		
Basic Adjustments:	**UXO 1**	
Bottlecap Reject	20	
"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

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) <u>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</u>, 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
Project Manager	Linda Klink	Tetra Tech	412.921.8650	
UXO Manager	Ralph Brooks	Tetra Tech	770.413.0965 x231	404.661.4916
Navy POC	Robert LeClerc	Former NAS Brunswick	207.921.2281	206.780.1034
Navy Remedial Project Manager	Todd Bober	BRAC PMO NE	215.897.4911	
BRAC PMO Environmental Coordinator	Paul Burgio	BRAC PMO NE	215.897.4915	
Remedial Project Manager	Claudia Sait	MEDEP	207.287.7713	
Remedial Project Manager	Michael Daly	USEPA Region 1	617.918.1386	

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

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 **<u>every day</u>** and transferred **<u>nightly</u>** 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 **<u>unique to a particular site</u>** 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. For example, 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

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

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.

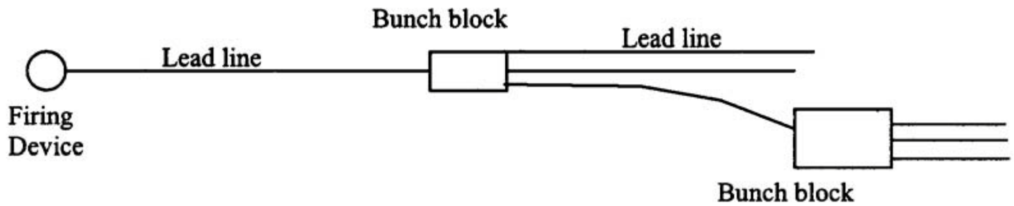


Figure 1

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.

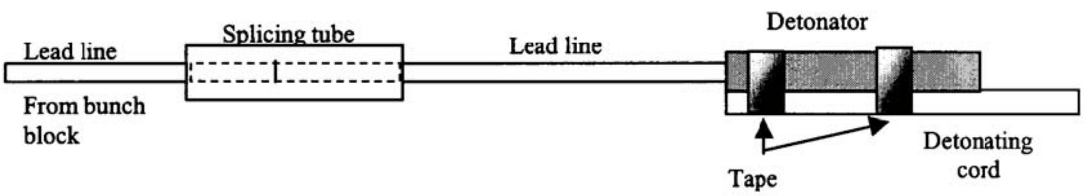


Figure 2

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

Not Applicable

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

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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.

TABLE OF CONTENTS

LIST OF FIGURES

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.

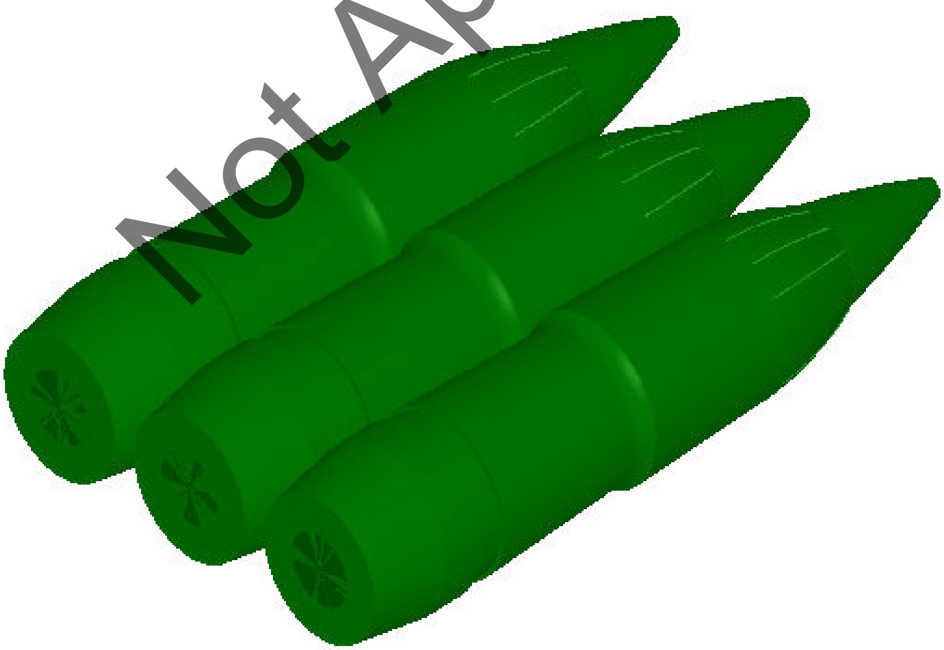

Figure 1 – Placement of Munitions for Consolidated Shots

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:
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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

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Reviewed by: Paul M. LaHoud 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

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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.

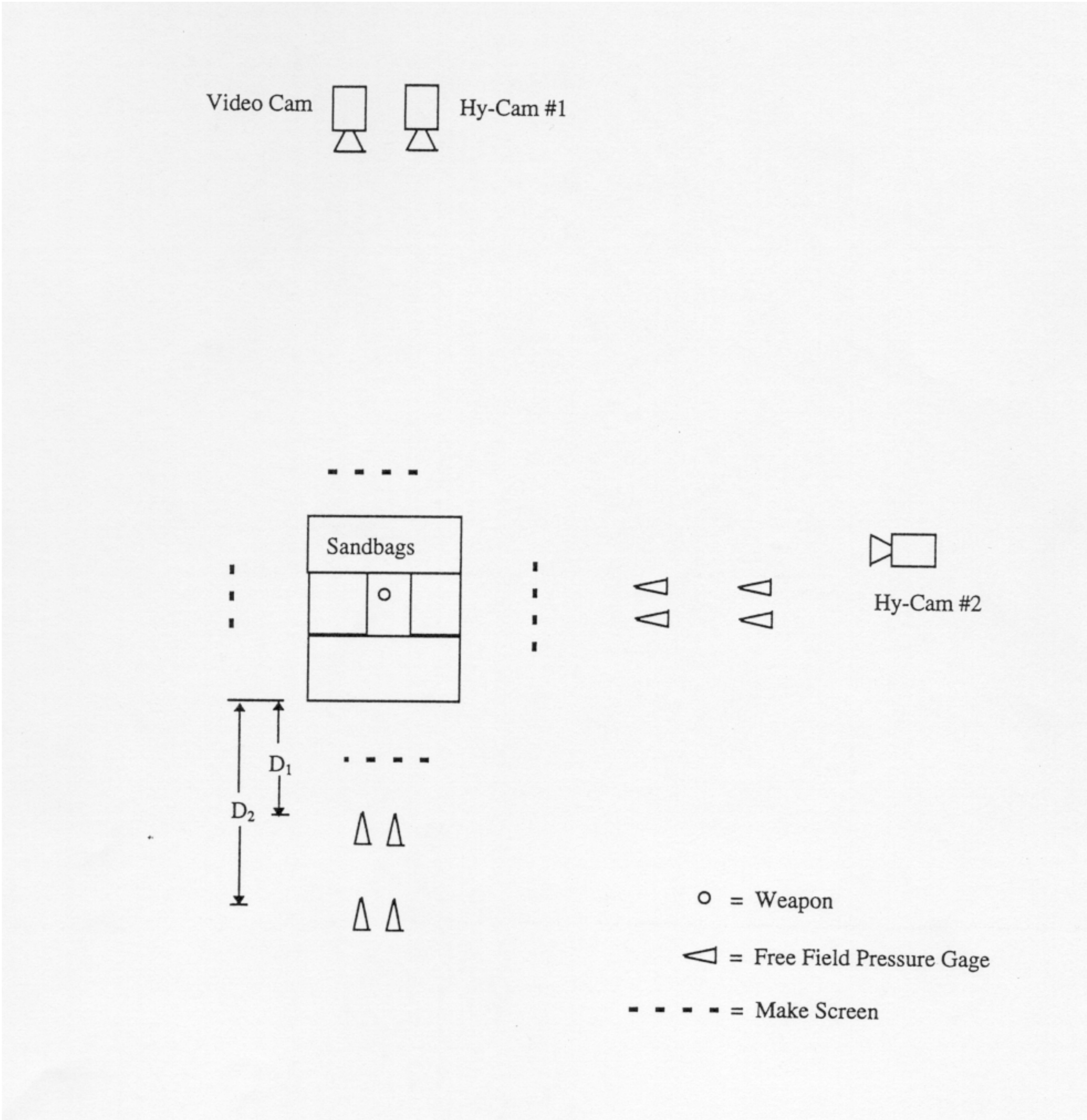


Figure 1 – Site Layout for Tests of Sandbag Enclosures

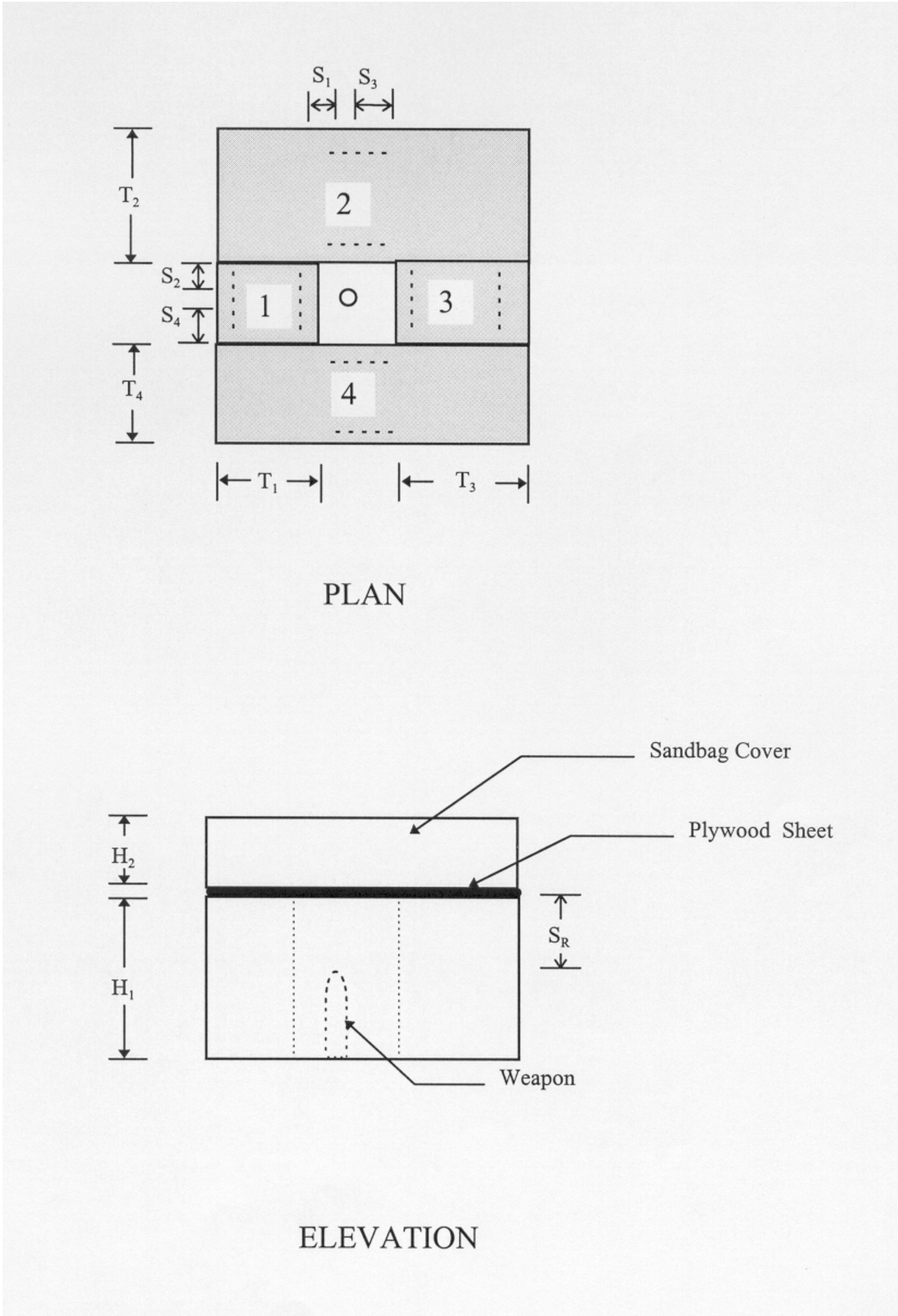


Figure 2 – Sandbag Enclosure Configuration for Vertical Weapon Tests

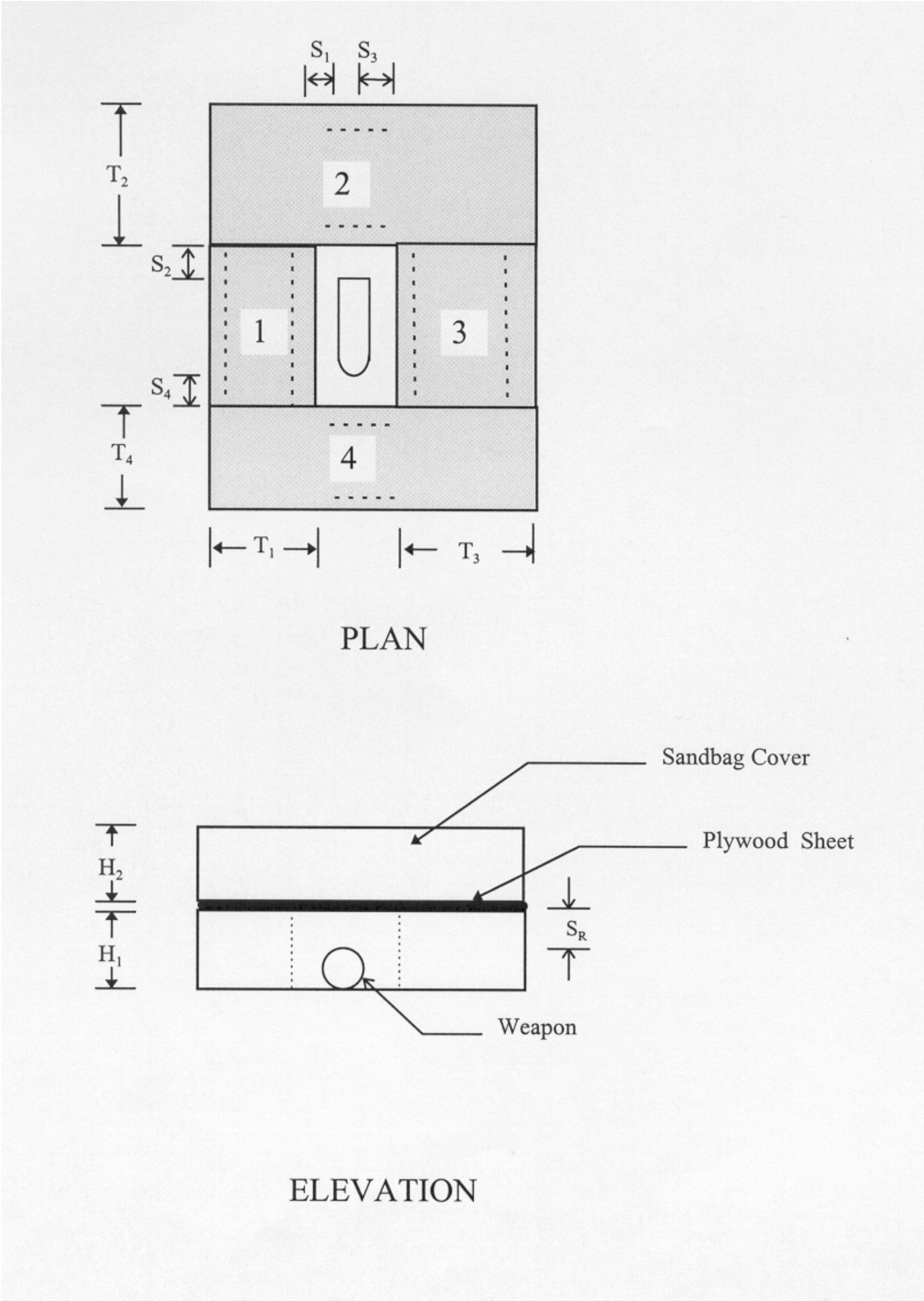


Figure 3 – Sandbag Enclosure Configuration for Horizontal Weapon Tests

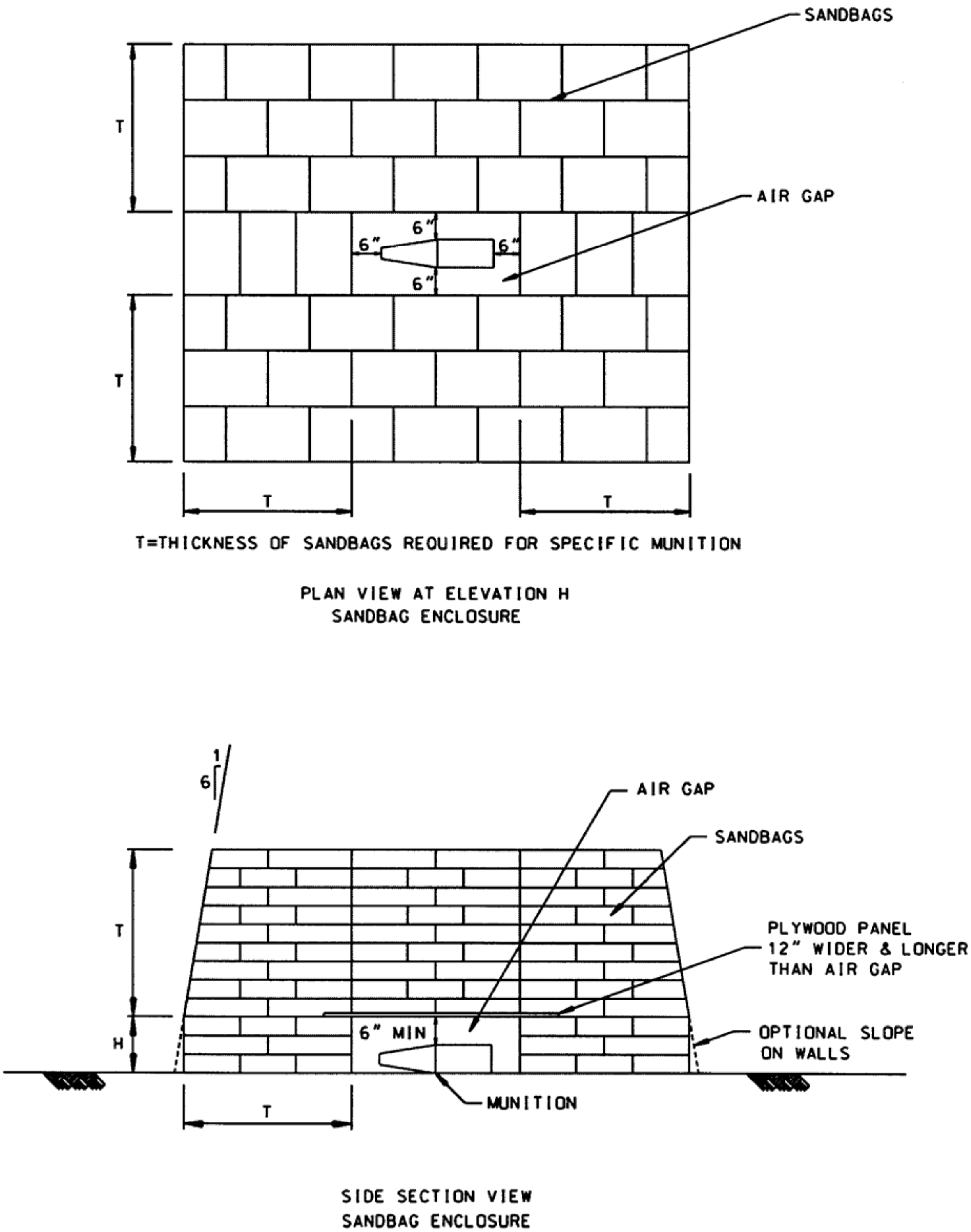
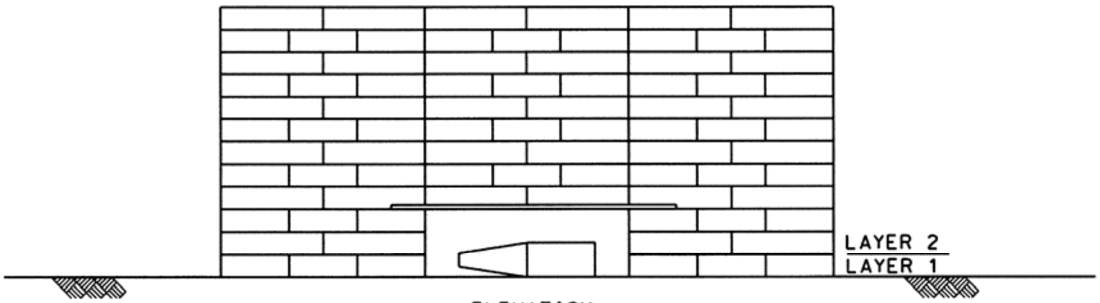
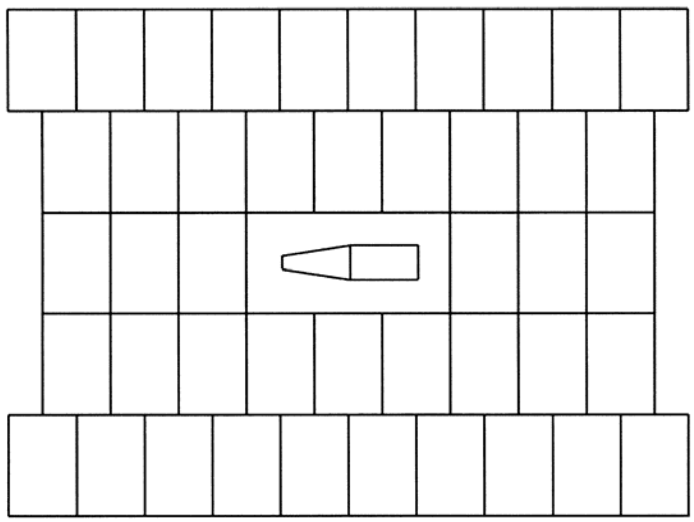


Figure 4 - Typical Sandbag Enclosure

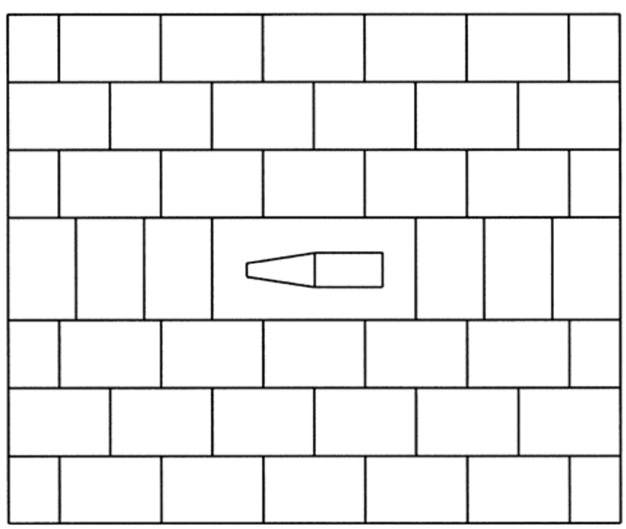
Figure 5 – Sandbag Enclosure for an 81 mm M374A2 mortar.



ELEVATION



LAYER 1



LAYER 2

Figure 6 - Interlocking Alternate Layers of Sandbags

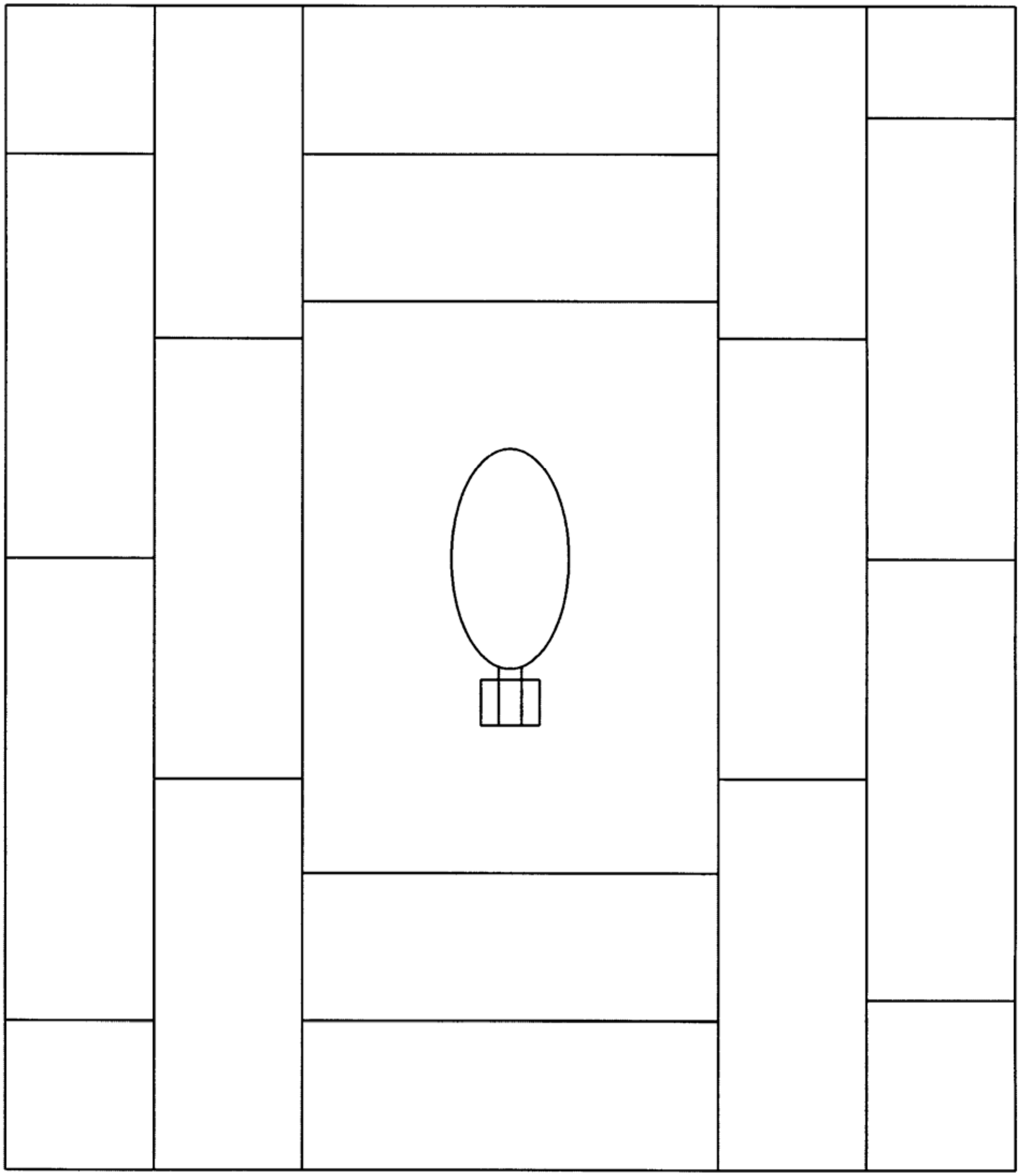


Figure 7 - Configuration for 12” Wall Enclosures

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

HNC-ED-CS-S-00-3
SEPTEMBER 2000

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331-0600

DDESB-KT

2 7 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

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

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Reviewed by: ______________________________

WILLIAM H. ZEHRT, PE DATE

Chief, Structural Branch

Approved by: ______________________________

PAUL M. LAHOUD 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, 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 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.

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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, 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.

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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.

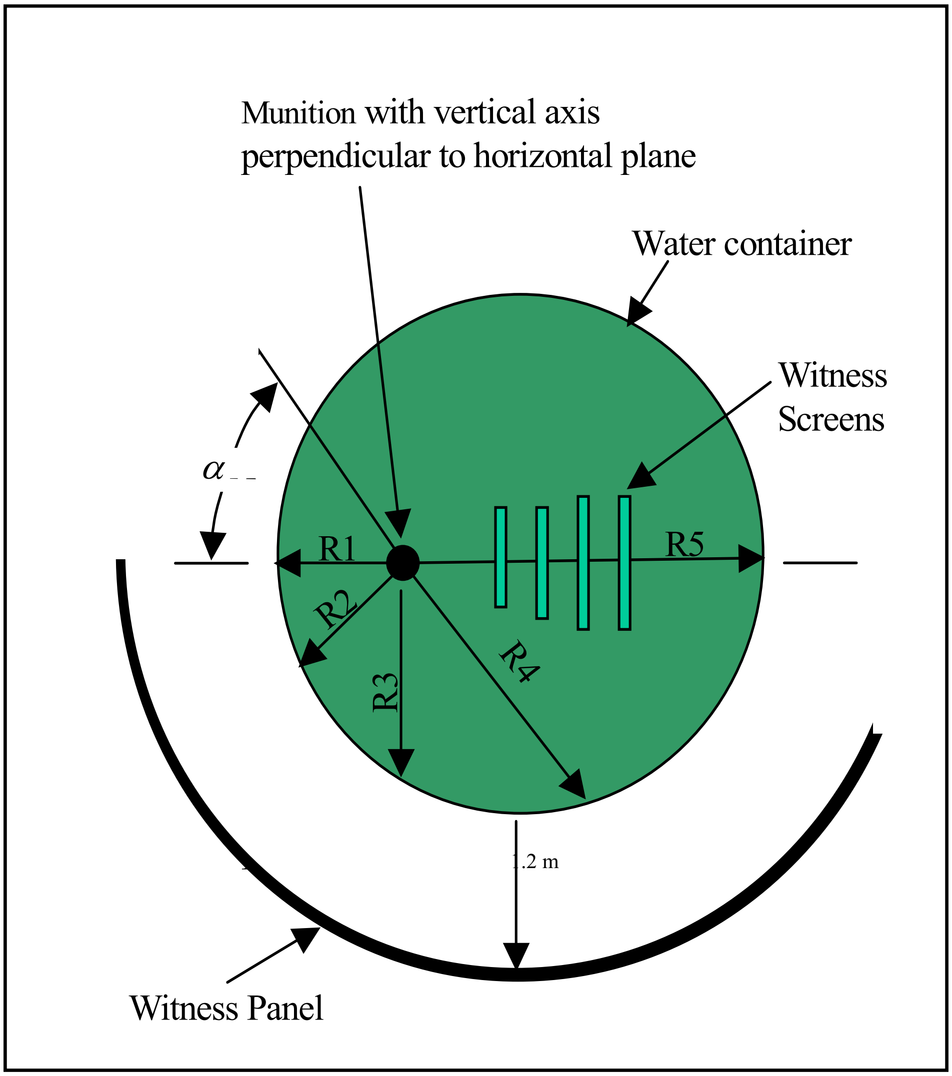

FIGURE 1 – Test Layout for Phase One Tests

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.

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 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.

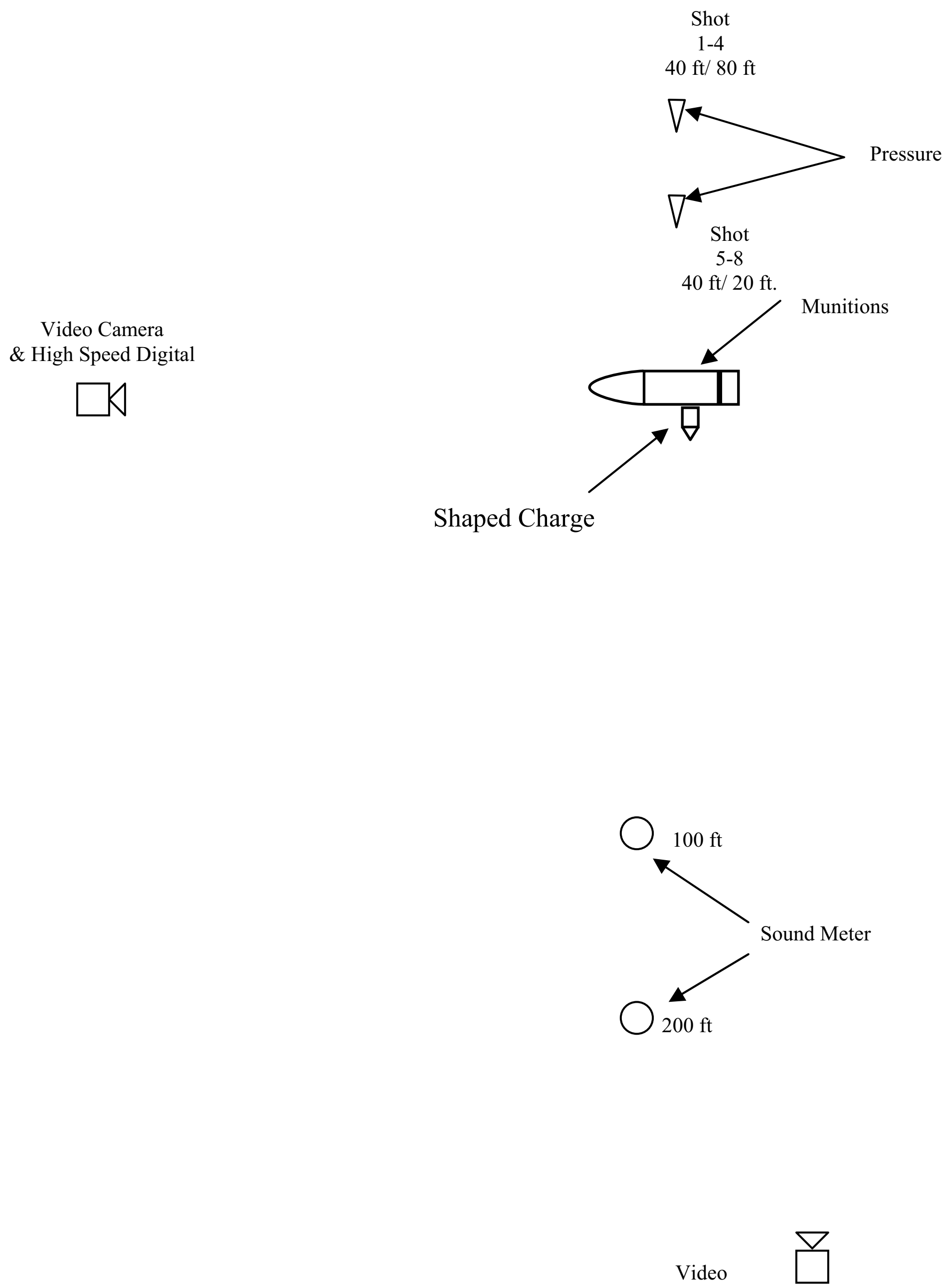

FIGURE 2 – Instrument and Camera Layout for Phase Two Tests

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.

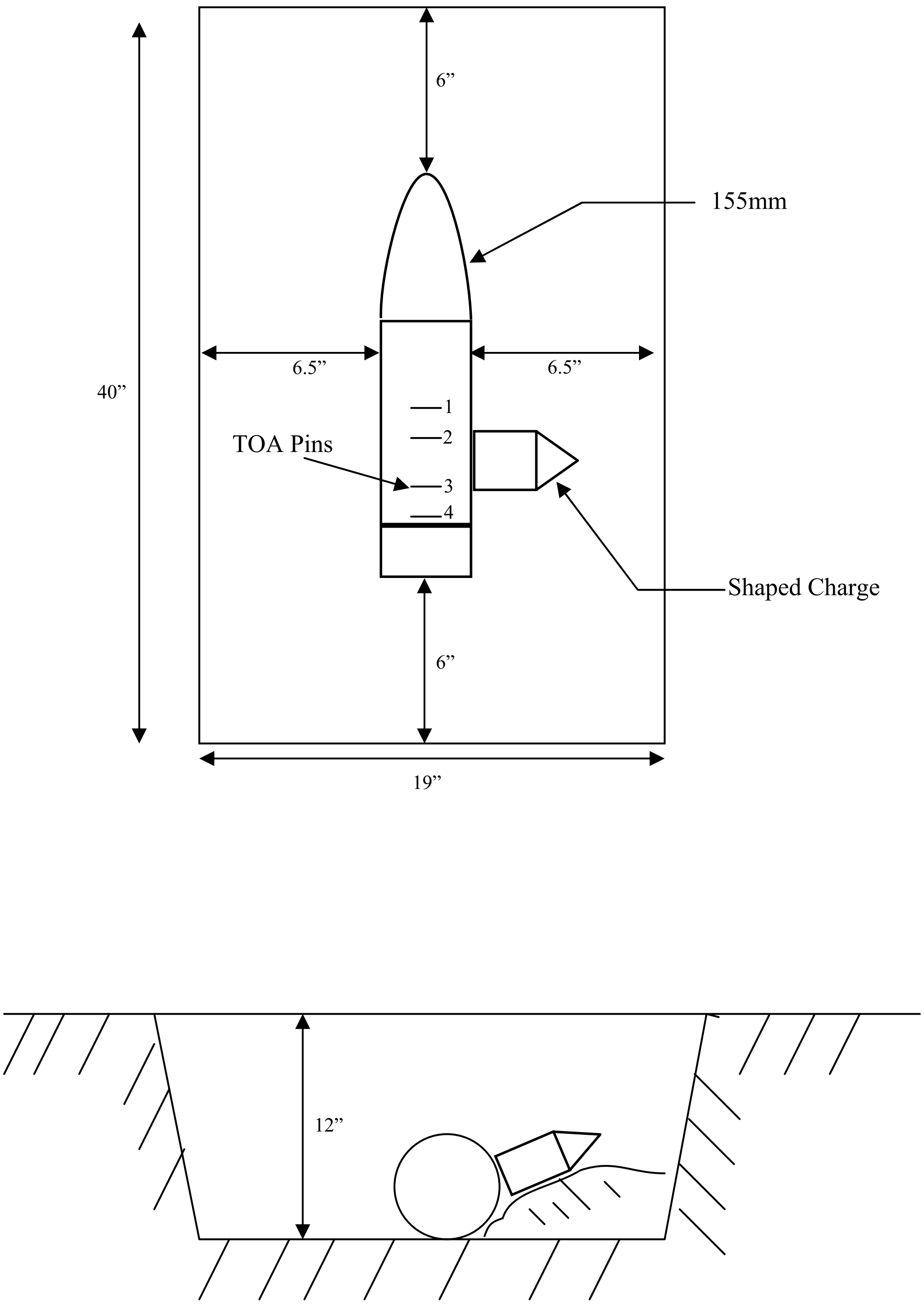

FIGURE 3 – Munition and Initiator Placement for 155 mm M107 Projectiles

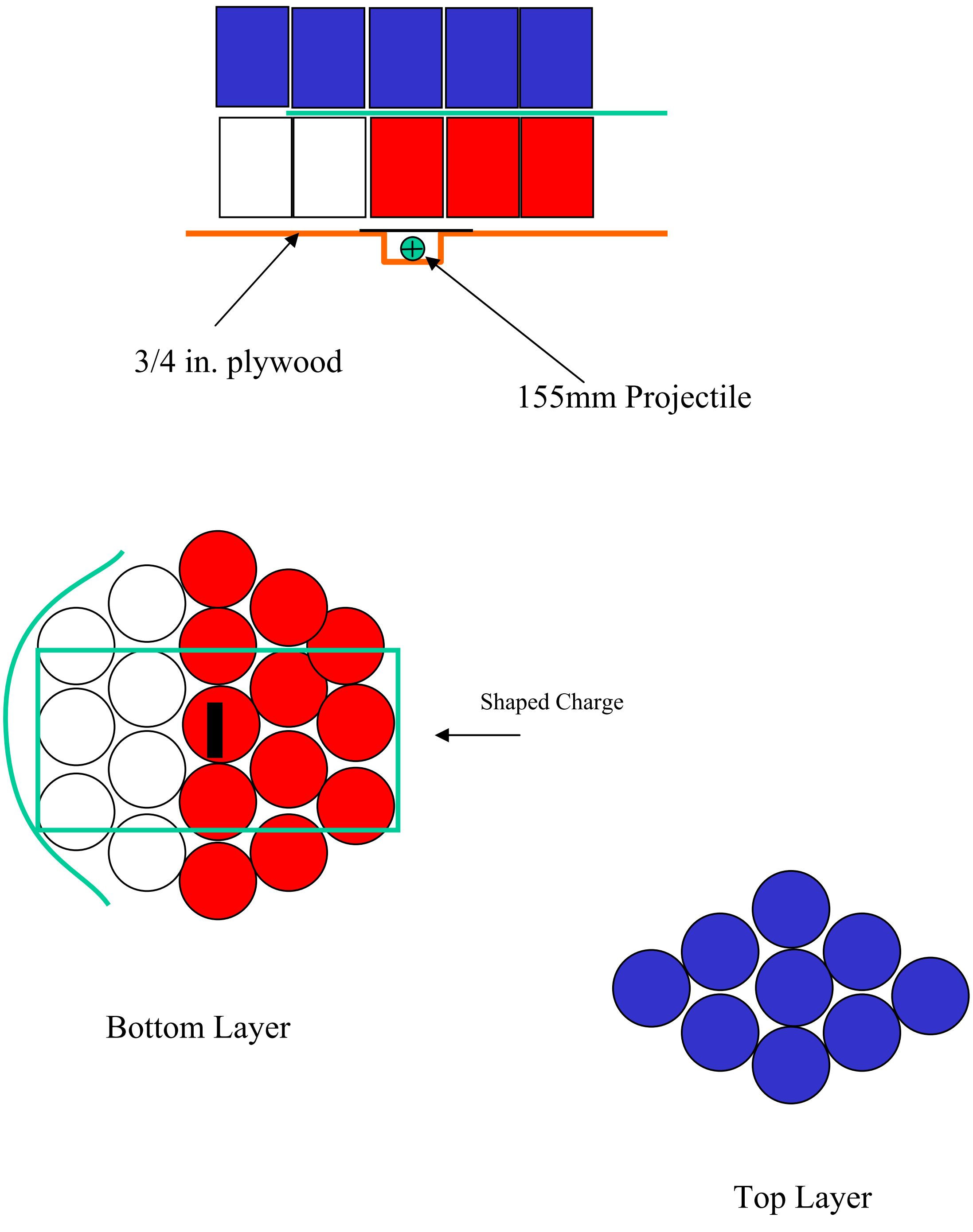

FIGURE 4 – Test Layout for 155 mm M107 Under 55 Gallon Drums

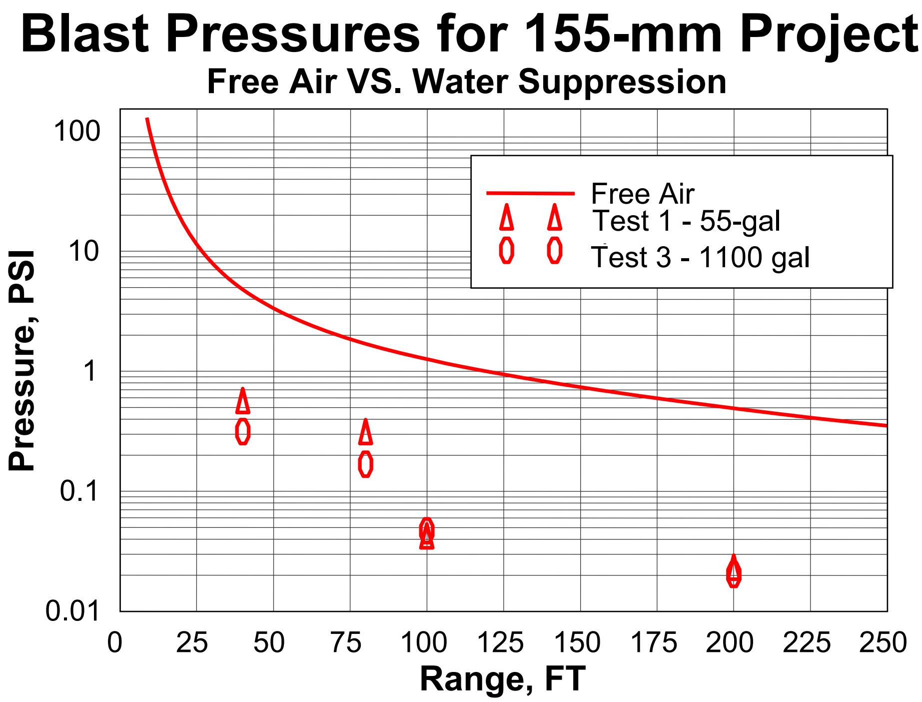

FIGURE 5 – 155 mm M107 Blast Pressures

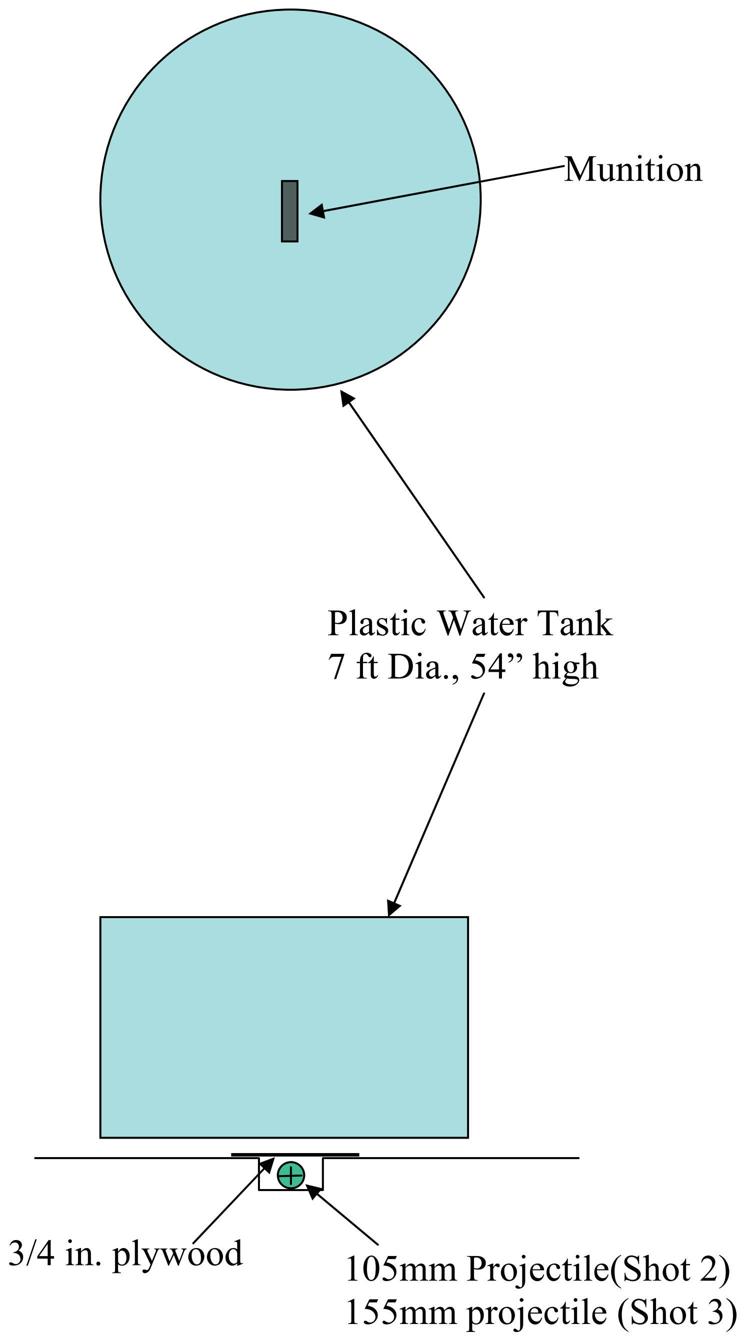

FIGURE 6 – Layout for Tests Using 1100 Gallon Agricultural Tank

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.

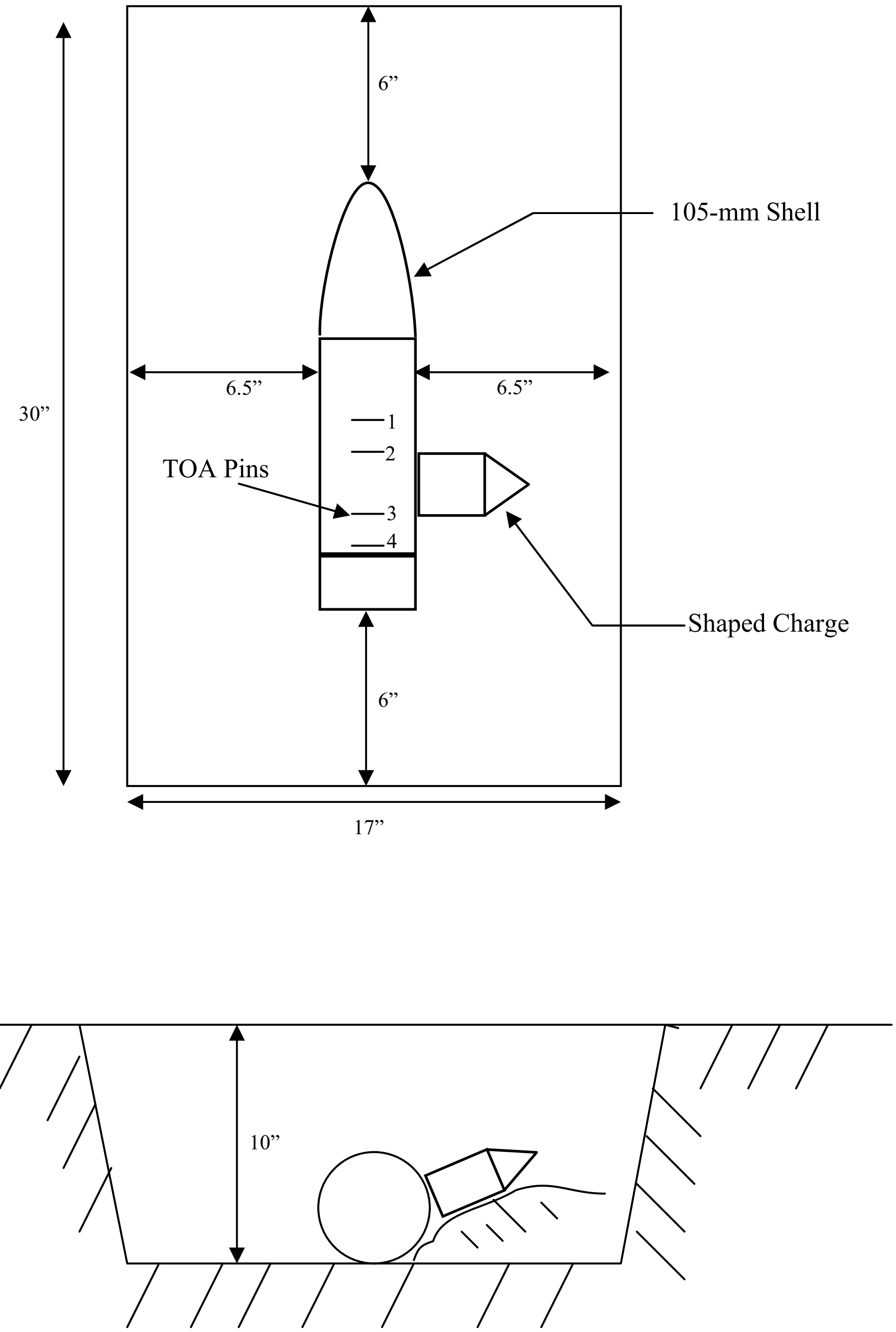

FIGURE 7 – Munition and Initiator Placement for 105 mm M1 Projectiles

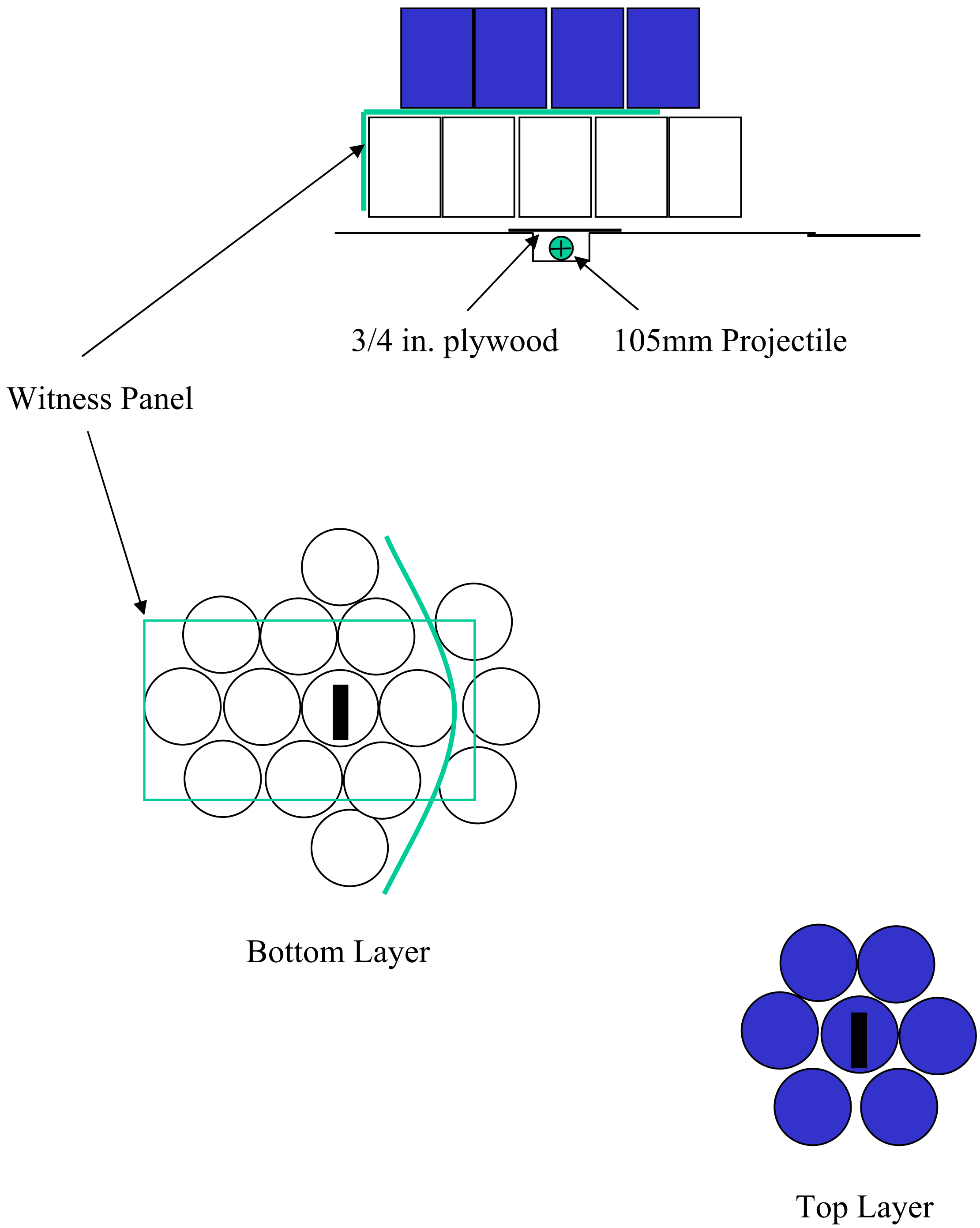

FIGURE 8 - Test Layout for 105 mm M1 Under 55 Gallon Drums

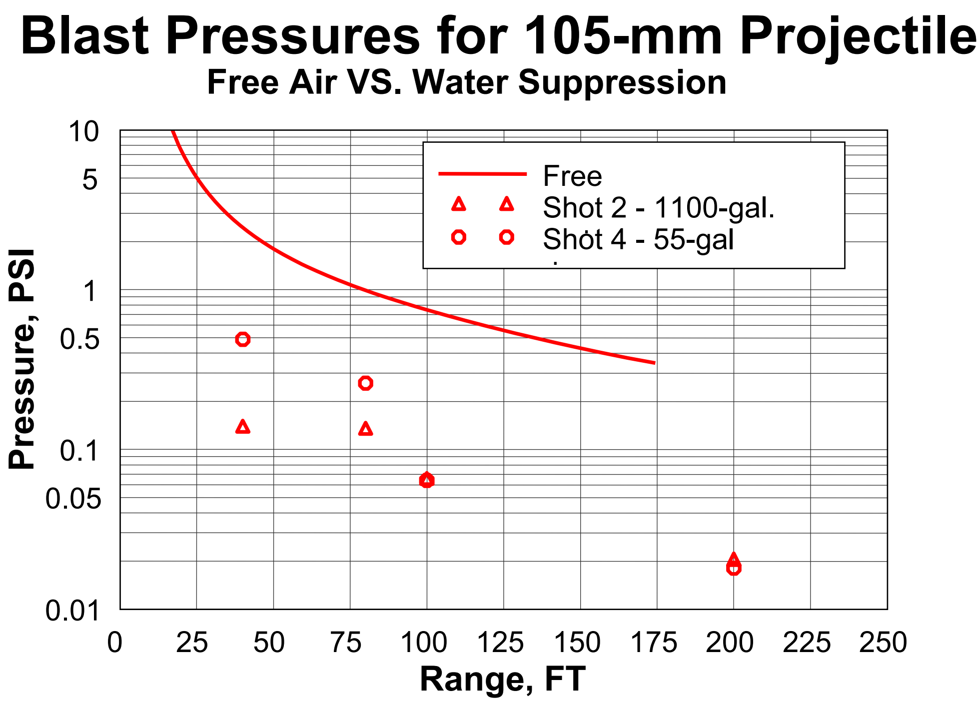

FIGURE 9 - 105 mm M1 Blast Pressures

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

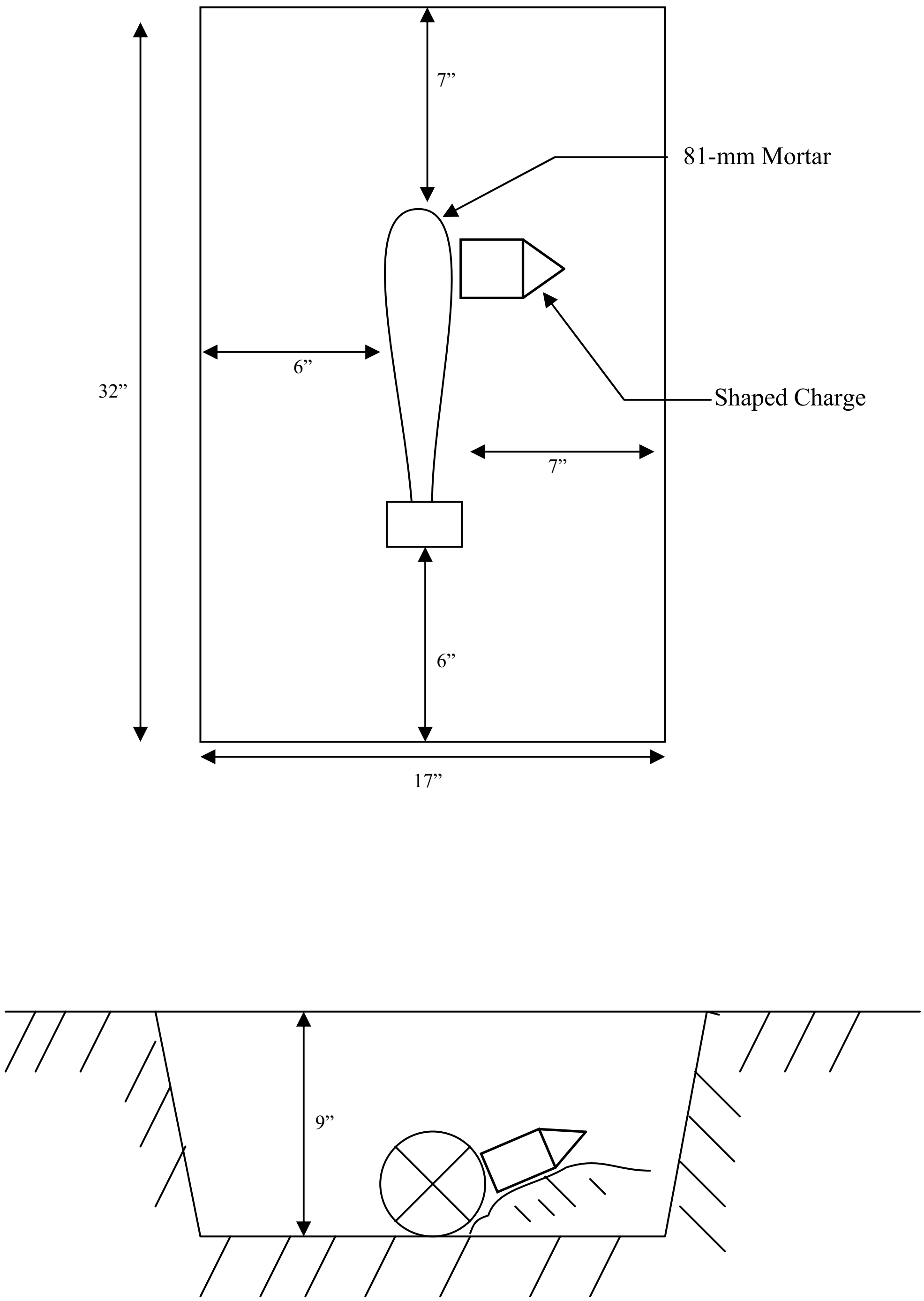

FIGURE 10 – Munition and Initiator Placement for 81 mm M362A Mortars

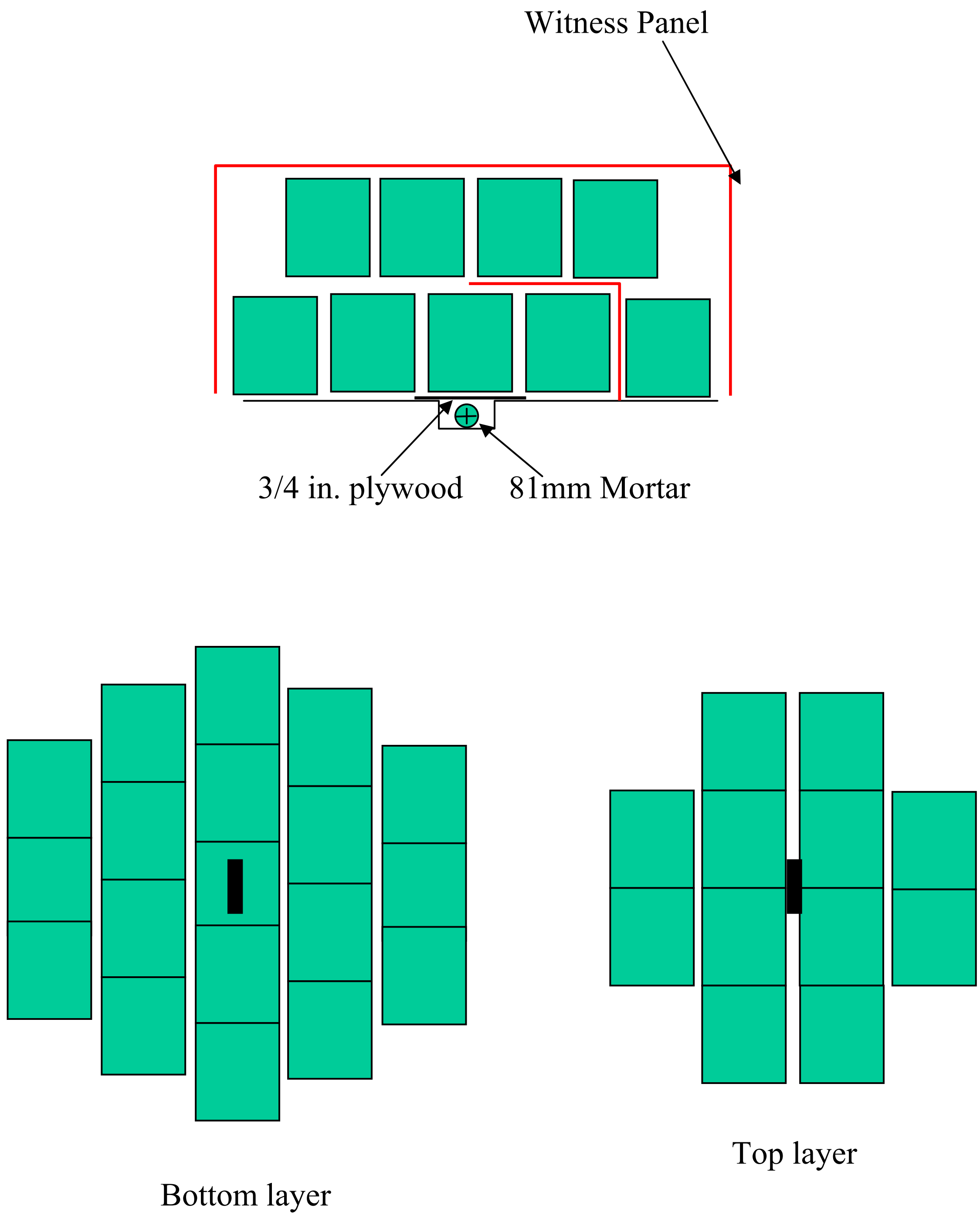

FIGURE 11 - Test Layout for 81 mm M362A Under 5 Gallon Carboys

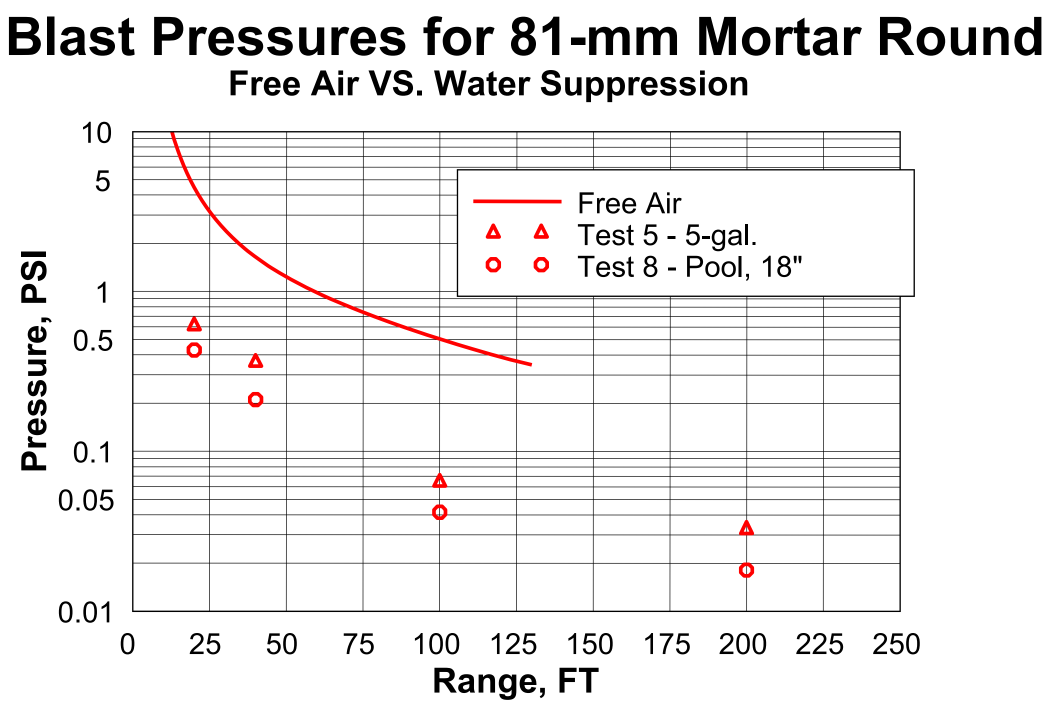

FIGURE 12 - 81 mm M362A Blast Pressures

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.

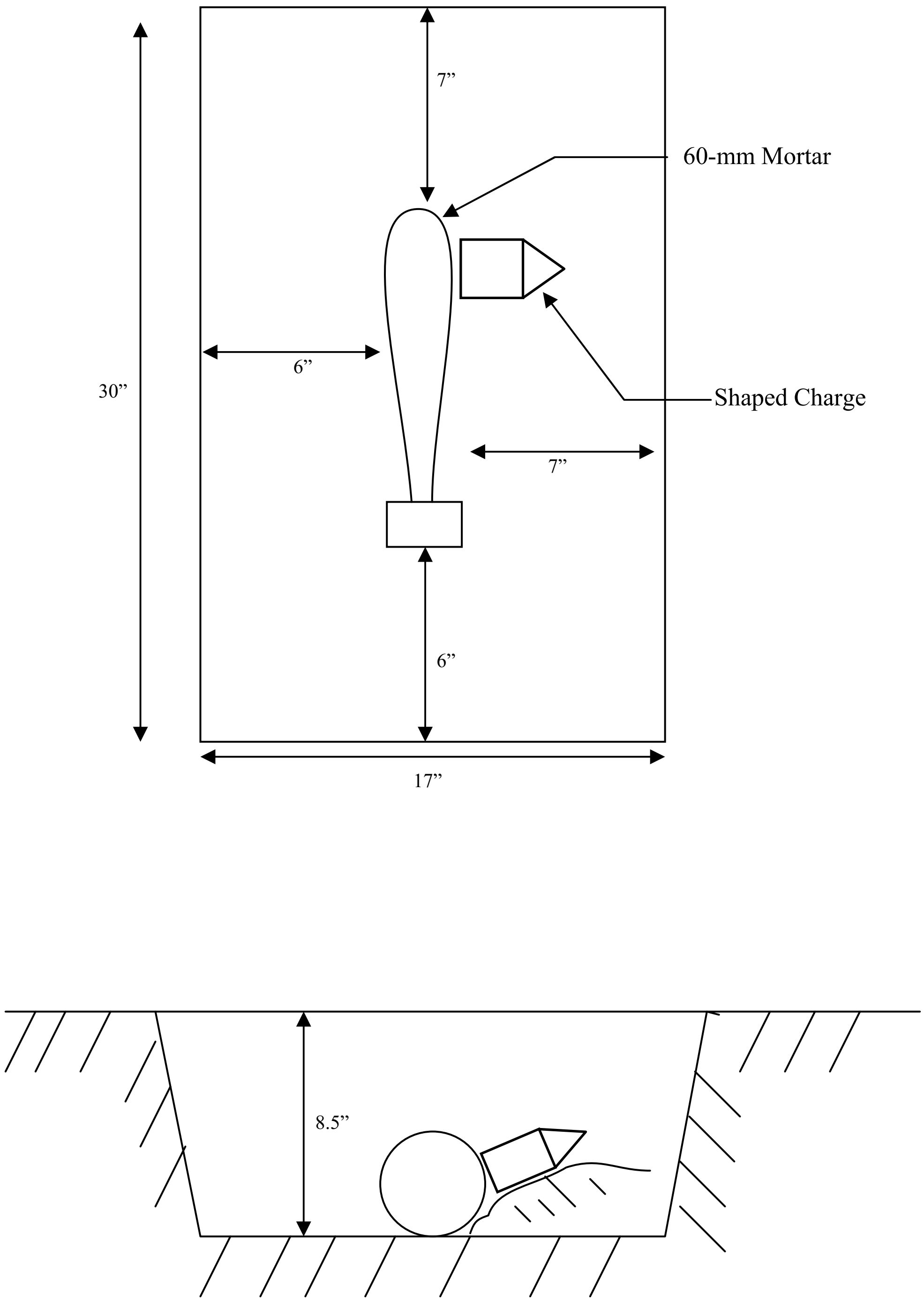

FIGURE 13 – Munition and Initiator Placement for 60 mm M49A4 Mortars

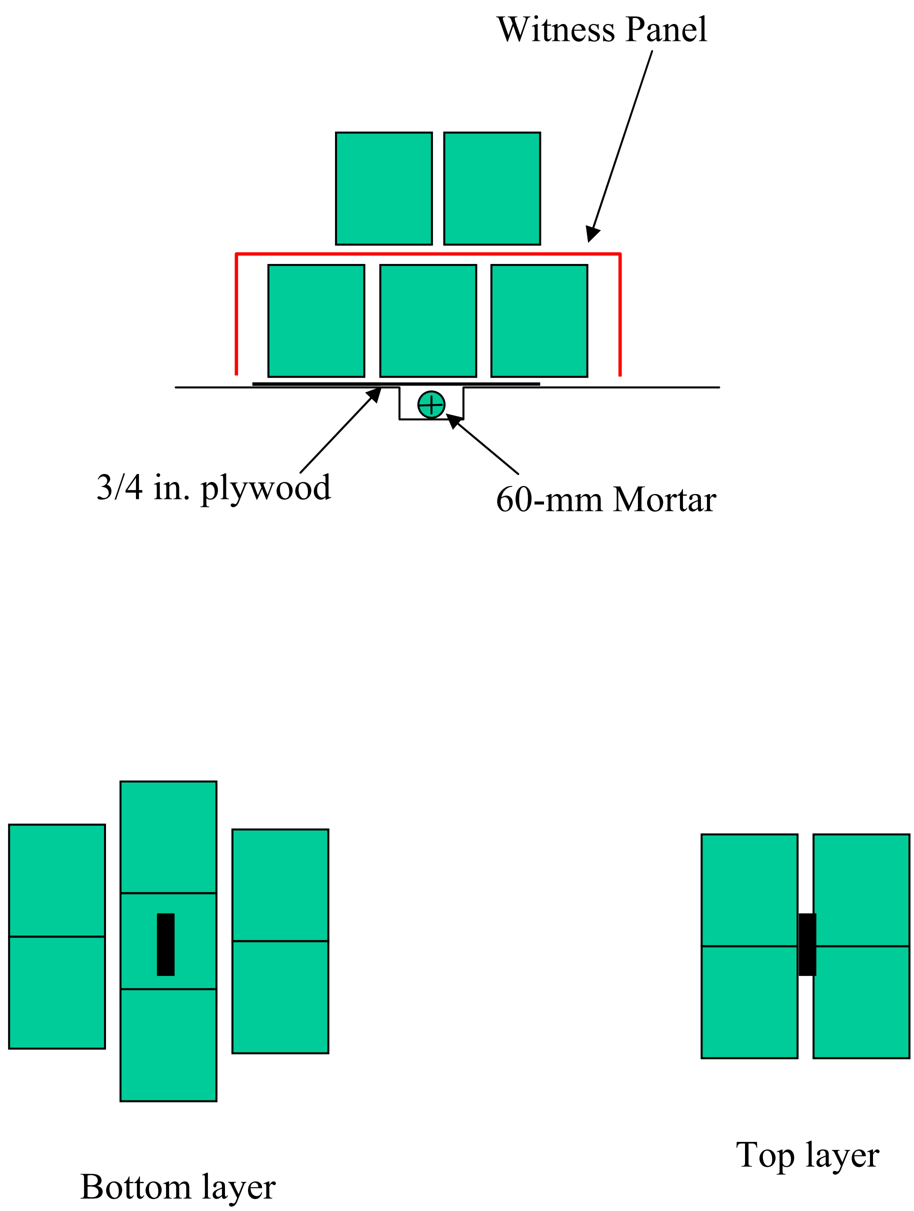

FIGURE 14 - Test Layout for 60 mm M49A4 Under 5 Gallon Carboys

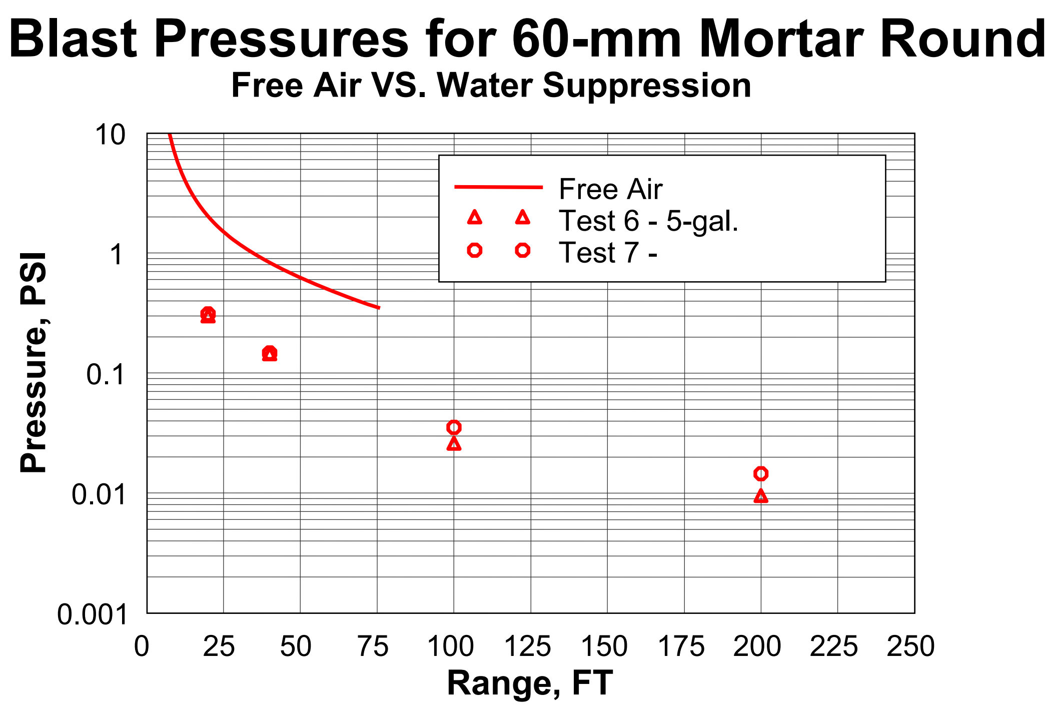

FIGURE 15 - 60 mm M49A4 Blast Pressures

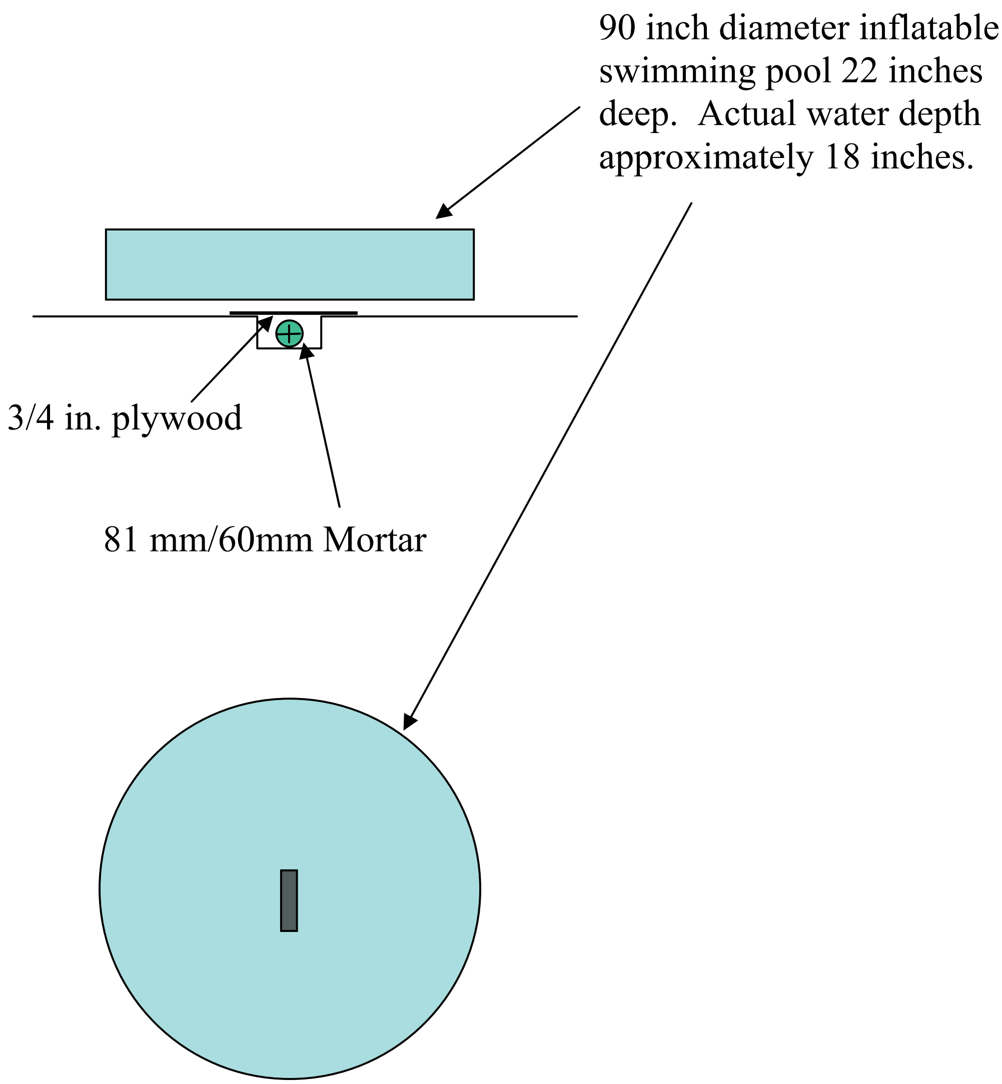

FIGURE 16 - Test Layout for 81 mm M362A and 60 mm M49A4 Under Inflatable Pool

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:

(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.

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.

TABLE 8 – Water Containment System and Minimum Separation Distance

Munition	Max Fragment Weight (lb)	Critical Fragment Velocity (fps)	Equivalent Weight Kinetic Energy 10^6 ($lb\text{-}ft^2/s^2$)	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

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 ($lb\text{-}ft^2/s^2$)	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.

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

C.2 PROJECT FORMS

TETRA TECH

MRP FF.1

SAP Worksheet #4 (Field Personnel)

Project Personnel Sign-off Sheet

Facility/Location: ____

Site(s): ____

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: ________________________________

Site(s): ____

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

Detector Aided Surface Surveys:

Target Reacquisition:

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: ________________________________

Site(s): ____

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:**

Updated: 3/31/2011

TETRA TECH

MRP FF.3
DAILY EQUIPMENT CHECKLIST

Facility/Location: ___________________________

Site(s): ____________________________________

	Initial Condition Out of the Box Acceptable (Y/N/NA)		
Equipment:			
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: ______________________________

Site(s): ____

DATE	Time		PRINT NAME	SIGNATURE	ORGANIZATION	PHONE #	RAC
	In	Out					

Last Revised: 3/31/2011

TETRA TECH

MRP FF.5
Photographic Log

Facility/Location: ____________________

Site(s): ______________________________

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: ____________________________

Site(s): _____________________________________

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: ____________________________

Site(s): _____________________________________

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: ______________________________

Site(s): ______________________________

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)				

* 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: ____________________________________

Sites(s): ____

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:		

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

Last Revised: 3/31/2011

MRP FF.10

Facility/Location: ________________________________

Site(s): ____

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) ☐ Transferred ☐ Transported ☐ Left In Place ☐ Destroyed ☐ BIP ☐ Other : __________ | Date:

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: ______________________________________

Site(s): ____

Location or Anomaly Number (1)	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) Coordinates supplied by GPS

Signature: ______________________________________ Date:______________

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

Facility/Location: ____________________

Site(s): ____________________

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.)

Last Revised: 3/31/2011

Tetra Tech
MRP FF.13
MDAS Addition Form

Facility/Location: ______________________________Site(s): ___________________________

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: ________________________

Site(s): ________________________________

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: ___________________________________

Site(s): ____

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	☐ GPS Positional Data	☐ Demobilization
☐ Site Preparation (incl. mobilization)	☐ DGM Equip. Cal./Main./Test./Insp.	☐ Final Report Prep
☐ Site Survey	☐ GSV	☐ Other:
☐ Vegetation Management	☐ Digital Geophysical Mapping	☐ Other:
☐ UXO Detector-aided Surface Survey	☐ Geophysical Data Processing	☐ 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. 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?

Facility/Location: ___________________________________

Site(s): ____

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

Facility/Location: ___________________________________

Site(s): ____

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
- ☐ Excavation Observation/Operations
- ☐ Identification of MEC/MPPEH
- ☐ Safety Meetings
- ☐ Documentation Control
- ☐ Field Data Entry
- ☐ UXO Escort/ Avoidance Operations
- ☐ MEC Transfer to EOD
- ☐ Mobilization
- ☐ Document Review
- ☐ MEC Subsurface Excavation
- ☐ MEC Surface Sweep
- ☐ MEC Disposal/Treatment
- ☐ Demobilizaiton
- ☐ 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?

Facility/Location: ___________________________________

Site(s): ____

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

Facility/Location: ______________________________

Site(s): ________________________________

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	☐ Digital Geophysical Mapping	☐
☐ Site Preparation (incl. mobilization)	☐ Geophysical Data Processing	☐
☐ Site Survey	☐ Demobilization	☐
☐ Vegetation Management	☐ Final Report Prep	☐
☐ UXO Detector-aided Surface Survey	☐	☐
☐ GPS Positional Data Collection	☐	☐
☐ DGM Equip. Cal./Main./Test./Insp.	☐	☐
☐ GSV	☐	☐ 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: ______________________________

Site(s): ______________________________________

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: ________________________________

Site(s): ____

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: ______________________________________

Site(s): ____

	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: ______________________________

Site(s): ______________________________

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: ____

Site(s): ____

	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: ______________________________

Site(s): ______________________________

Date: ______________________

Name	Signature	Position

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

Facility/Location: ____________________________

Site(s): ______________________________________

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: ______________________________

Site(s): ____

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

Environmental Management Procedure (EMP) 4.4.6.8.1 Tab 1

Subject: DD Form 1348-1A Disposal Turn-In Document (DTID)

1. Purpose: This EMP establishes the procedures for the completing DD Form 1348-1A Disposal Turn-In Document (DTID).

2. References:

   A. TCFE Regulation 200-6, Environmental Management

   B. EMP Dictionary

3. Scope: This EMP applies to all Activities utilizing the HWAF for the turn-in of wastes.

4. Roles and Responsibilities:

   A. HWAF will:

      (1). Receives the completed 1348-1A during container pickups from TSS, SAS, or NHS.

      (2). Receives the completed 1348-1A during deliveries of wastes to the HWAF from the Activity.

      (3). Processes and completes the 1348-1A in preparation for waste shipments through DRMO.

   B. Activities will:

      (1). Complete the 1348-1A prior to scheduling an appointment with the HWAF for pickup of containers.

      (2). The 1348-1A must be typed. Under adverse circumstances hand written documents with information clearly printed may be accepted if all copies are legible.

      (3). If all copies are not legible, the materials will not be accepted.

5. Procedures:

   A. **ITEMS IN BOLD PRINT ARE TO BE COMPLETED BY THE ACTIVITY PRIOR TO TURN-IN.** Specific blocks of the DD Form 1348-1A must be completed as follows:

      (1). **Columns 23-24:** Enter the appropriate unit of issue (container);

         (a). "**DR**" = Drum
         (b). "**BX**" = Box
         (c). "**CN**" = Container
         (d). "**EA**" = Each

      (2). **Columns 25-29:** Enter the total number of containers being turned-in. Leading zeros must be entered. Example "00005"

      (3). **Columns 52-53:** Should always be "**21**" - standard code. (For all army units, other activities may need to use different code).

      (4). **Column 71:** Must contain "**H**".

(5). **Block 2 (Ship From):** Enter "**W26R1J**".
(6). **Block 3 (Ship To):** Enter "**DRMO**".

(7). **Block 4 (Mark For):** Must contain "**HW**".

(8). **Block 17 (Item Nomenclature):** Enter "**Common Name of material**" <u>(not DOT proper shipping name, hazard class, ID number, PG) or profile name</u> and "EPA waste codes". Example "**Paint, D001, D007, D008**".

(9). **Block 19 (No. Cont):** Enter total "**number of containers**". This number should be the same as in item b above **(Columns 25-29).**

(10). **Block 24 (Document Number & Suffix):** Enter "**W26R1J**" in the upper left hand corner of the block. Enter the "**first 4 digits of the stock number (FSC)**" of the waste in the upper left hand corner of the block. Full NSN is for serviceable products only, not for wastes. The FSC for spill debris is "**9999**". Example:

W26R1J

8010

(11). **Block 26 (RIC, UI, QTY):** Enter the following items with spacing as shown in the example, **"PROFILE:" "HIN:" & "ASD:"**. Example:

PROFILE:

HIN: **ASD:**

(12). **Block 27 (Additional Information):** Enter the following items with spacing as shown in the example, "**Activity Document Number**", "**Activity Address**", "**Hazardous Waste Coordinator Information and signature**", "**Description of outside containers**", "**Site Number**", "**HWAF O/H:**" & "**Container Numbers**".

Example:

	"Signature"	
W26J4X – 6335 - 0001	**John Q. Smith**	**2 - 55 gal 1A2**
6^{th} Trans Bn	**HWC**	**2 - 30 gal 1A2**
Fort Eustis, VA	**878-1234**	**1 - 5 gal 1H2**
Site Number: ET97001		**HWAF O/H:**
Container No. E500001, E500002, E500003, E500004, E500005		

B. See Figure example of a completed DD Form 1348 - 1A below:

Example of a completed DD Form 1348 - 1A

DD FORM 1348-1A, JUL 91 ISSUE RELEASE/RECEIPT DOCUMENT

Card columns / field	Entry
DOC IDENT (1-3) / RI FROM (4-6) / M&S (7) / UNIT ISS (23-24) / QUANTITY (25-29)	DR00005
SER (45) / SUPPLEMENTARY ADDRESS (46-50) / SIG (51) / FUND (52-53) / DISTRIBUTION (54-56) / PROJECT (57-59)	21
PRI (60-61) / REQD DATE (62-64) / ADV (65-66) / RI (67-69) / O/P (70) / COND (71) / MGT (72)	H
UNIT PRICE (DOLLARS / CTS)	

Block	Entry
1. TOTAL PRICE (DOLLARS / CTS)	
2. SHIP FROM	W26R1J
3. SHIP TO	DRMO
4. MARK FOR	HW
5. DOC DATE	
6. NMFC	
7. FRT RATE	
8. TYPE CARGO	
9. PS	
10. QTY. REC'D	
11. UP	
12. UNIT WEIGHT	
13. UNIT CUBE	
14. UFC	
15. SL	
16. FREIGHT CLASSIFICATION NOMENCLATURE	
17. ITEM NOMENCLATURE	Paint D001 D007 D008
18. TY CONT	
19. NO CONT	5
20. TOTAL WEIGHT	
21. TOTAL CUBE	
22. RECEIVED BY	
23. DATE RECEIVED	

24. DOCUMENT NUMBER & SUFFIX (30-44)

W26R1J

8010

25. NATIONAL STOCK NO. & ADD (8-22)

26. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) UP (74-80)

PROFILE:

HIN: ASD:

27. ADDITIONAL DATA

W26J4X - 6335 - 0001
6th Trans Bn6th Trans Bn
Fort Eustis, VA 23604 Fort Eustis, VA

John Q. Smith
HWC
878-1234

2 - 55 gal 1A2
2 - 30 gal 1A2
1 - 5 gal 1H2

Site Number: ET97001
Container No. E500001, E500002, E500003, E500004, E500005

HWAF O/H:

PREVIOUS EDITION MAY BE USED

USAPA V1.01

DD Form1348

SEND TO				REQUISITION IS FROM										
NAS SUPPLY DIVISION CUSTOMER SERVICE				B										
A NOMENCLATURE				DOC. IDENT	ROUTING IDENT	M&S	STOCK NUMBER FSC NIIN ADDIT				UNIT OF ISSUE	QUANTITY		
C														
DOCUMENT NUMBER					DEMAND	SERV	SUPLEMENTARY ADDRESS		SIG					
SERV	REQUISITIONER		DATE	SERIAL										
FUND	DISTRIBUTION (COG)		PROJECT	PRIORITY	**RETURNED STATUS**						**UNIT PRICE**		**TOTAL PRICE**	
													$0.00	
ADVICE														
	Z	**Z**		**A**	**A**									
65 66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

REQUEST FOR ISSUE AND TURN-IN OF AMMUNITION

For use of this form, see AR 710-2; the proponent agency is DCSLOG

1. ISSUE		3. DOCUMENT NO.	4. LOCAL USE	5. PAGE	6. FOR LOCAL USE
2. TURN-IN				OF	

7. SEND TO	8. REQUEST FROM	9. DATE MATERIEL REQUIRED *(YYYYMMDD)*	10. PRIORITY	11. ALLOCATION PERIOD	12. DODACC
		13a. REQUESTED BY	13b. DATE	13c. SIGNATURE	
		14a. APPROVED BY	14b. DATE	14c. SIGNATURE	

15. ITEM	16. DOCIC	17. NSN	18. NOMENCLATURE	19. UI	20. QTY REQUESTED/ TURNED IN	21. TEC	22. ACTION CODE	23. QTY ISSUED/ RECEIVED	24. LOT/SERIAL NO.	25. CC	26. POSTED BY	27. DATE *(YYYYMMDD)*

28. REMARKS	29. RELATED DOCUMENT SERIAL NOS.

30a. ISSUED BY	30c. DATE *(YYYYMMDD)*	31a. RECEIVED BY	31c. DATE *(YYYYMMDD)*	32. TAMIS CONTROL NO.
30b. SIGNATURE		31b. SIGNATURE		

AMMUNITION CONSUMPTION CERTIFICATE

For use of this form, see AR 710-2-1, the proponent agency is DCS, G-4.

UNIT		RANGE AND LOCATION
DOCUMENT NO.	DATE	

ITEM	DODIC	NOMENCLATURE	LOT NUMBER	QUANTITY CONSUMED

CERTIFYING OFFICIAL

I certify that I saw the above items consumed during training on *(indicate date)* →	DATE
NAME *(Typed or Printed)*	SIGNATURE
UNIT	POSITION

C.3 MEDEP CHAPTER 305 PERMIT BY RULE, SECTION 12 (RESTORATION OF NATURAL AREAS)

12. Restoration of natural areas

A. Applicability

(1) This section applies to the restoration of an altered portion of a coastal wetland, freshwater wetland, great pond, river, stream or brook to its pre-existing natural condition through the removal of fill, structures or debris which is located in, on over, or adjacent to the natural resource.

(2) This section applies to the removal of non-native species and the planting of natural vegetation in any protected resource.

(3) This section applies to the retrieval of sand from below the normal high water line for redistribution on an existing adjacent sand beach on a great pond.

(4) This section applies to the restoration of the natural grade within a dredged area of a freshwater or coastal wetland.

(5) This section does not apply to:

(a) Restoration or replacement of a structure or unnatural condition such as the installation of a dam structure;

(b) Conversion of existing natural wetlands to wetland of a different type through flooding, inundation or other means;

(c) Dredging of silt, sand or soil materials which have been naturally deposited from a great pond, river, stream or brook, coastal wetland or freshwater wetland except that eroded sand may be retrieved from a great pond for redistribution on an existing adjacent sand beach;

(d) Mining of gravel or other mineral materials from a river, stream, or brook;

(e) Replacement of eroded soil material in areas above, below and adjacent to the normal high water mark of a great pond, river, stream or brook, freshwater wetland, or coastal wetland, except that sand may be regraded on an existing sand beach;

(f) Removal of a man-made dam structure;

(g) Draining of a freshwater wetland to convert an area to upland; or

(h) An activity occurring within a coastal sand dune system.

(6) This section does not apply to an activity that is not or will not be in compliance with the terms and conditions of permits issued under the Site Location of Development Law, 38 M.R.S.A. Sections 481 to 490, the Storm Water Management Law, 38 M.R.S.A. Section 420-D, or the Natural Resources Protection Act, 38 M.R.S.A. Sections 480-A to 480-Z.

(7) This section does not apply to an activity that will not conform to the local shoreland zoning ordinance.

NOTE:

(1) Contact the local Code Enforcement Officer for information on local shoreland zoning requirements.

(2) A permit will be required from the US Army Corps of Engineers for the following types of projects:

(a) Any activity involving impacts (direct and secondary) to freshwater wetlands;

(b) Any activity within a coastal wetland;

(c) Any activity within an open water area;

(d) Any activity within a river, stream or brook between October 2 and July 14; or

(e) Any activity involving work in waterways designated as Essential Fish Habitat for Atlantic salmon including all aquatic habitats in the watersheds of the following rivers and streams, including all tributaries to the extent that they are currently or were historically accessible for salmon migration: St. Croix, Boyden, Dennys, Hobart Stream, Aroostook, East Machias, Machias, Pleasant, Narraguagus, Tunk Stream, Patten Stream, Orland, Penobscot, Passagassawaukeag, Union, Ducktrap, Sheepscot, Kennebec, Androscoggin, Presumpscot, and Saco River.

A copy of the PBR notification form and original photographs, not photocopies, should be submitted to the Corps of Engineers for these activities (US Army Corps of Engineers, 675 Western Avenue, Suite #3, Manchester, ME 04351. Tel. (207) 623-8367).

B. Submissions

(1) The applicant is required to submit photographs of the area in which this activity is proposed.

(2) Photographs showing the finished activity must be submitted within 20 days of the activity's completion. The photographs must be sent with a copy of the notification form or labeled with the applicant's name and the town in which the activity took place.

(3) For an activity occurring in tidal waters, notice of approval of timing from the Department of Marine Resources must be submitted to the DEP with the notification form.

C. Standards

(1) The following measures must be taken to prevent erosion of soil or fill material from disturbed areas into the proposed resource:

(a) Staked hay bales or silt fence must be properly installed between the area of soil disturbance and the resource before the activity begins;

(b) Hay bales or silt fence barriers must be maintained until the disturbed area is permanently stabilized;

(c) Within 7 calendar days following the completion of any soil disturbance, and prior to any storm event, mulch must be spread on any exposed soils;

(d) All disturbed soils must be permanently stabilized; and

(e) Within 30 days of final stabilization of the site, any silt fence must be removed.

NOTE: For guidance on erosion and sedimentation controls, consult the Maine Erosion and Sediment Control BMPs, dated March 2003. This handbook and other references are available from the DEP.

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(2) Disturbance of wetland vegetation must be avoided if possible. If wetland vegetation must be disturbed during the activity, it must be reestablished immediately upon completion of the activity and must be maintained.

(3) Non-native wetland plants may not be planted in disturbed areas.

(4) Only material that has been placed in a natural resource by persons may be removed from these waterbodies except for debris deposited within the previous 12 calendar months, and sand that will be regraded onto existing adjacent sand beaches.

(5) Sand may be regraded from below the normal high water line, but machinery may not operate in the water. Equipment operating on shore may reach into the water with a bucket or similar extension. Areas covered by vegetation, either aquatic or terrestrial, may not be disturbed during any beach regrading.

(6) Any activity involving the regrading of an existing sand beach must include the installation of permanent erosion control devices, such as water bars and diversion ditches, that prevent future erosion of the sand from upland runoff. The erosion control devices must be installed prior to the regrading of the beach.

(7) Vegetation and soil material used in restoring wetland areas must be similar to the vegetation and soil materials occurring under pre-existing natural conditions.

(8) No fill other than soil material used to restore natural elevations within a dredged area of a coastal or freshwater wetland may be placed in or adjacent to a natural resource. Sand may not be brought in from off-site to replenish an existing beach.

NOTE: Erosion of sand from beaches may be due to wave action or the action of overland water flows. Contact the DEP, the local Soil and Water Conservation District, or the local lake association for assistance with identifying sources of beach erosion.

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(9) Wheeled or tracked equipment may not operate in the water. Equipment operating on the shore may reach into the water with a bucket or similar extension. Equipment may cross streams on rock, gravel or ledge bottom.

(10) All wheeled or tracked equipment that must travel or work in a vegetated wetland area must travel and work on mats or platforms in order to protect wetland vegetation.

(11) All excavated material must be stockpiled either outside the wetland or on mats or platforms. Hay bales, silt fence or mulch must be used, where necessary, to prevent sedimentation.

(12) If the activity occurs within tidal waters, the activity must occur during the time period approved by the Department of Marine Resources.

D. Definitions. The following terms, as used in this chapter, have the following meanings, unless the context indicates otherwise:

(1) Dam. Any man-made artificial barrier, including appurtenant works, the site on which it is located and appurtenant rights of flowage and access, that impounds or diverts a river, stream or brook or great pond.

(2) Dredge. To move or remove, by digging, scooping, or suctioning any sand, silt, mud, gravel, rock, or other material from the bottom of a water body or wetland surface.

(3) Fill. a. (verb) To put into or upon, supply to, or allow to enter a water body or wetland any earth, rock, gravel, sand, silt, clay, peat, or debris; b. (noun) Material, other than structures, placed in or adjacent to a wetland or water body.

(4) Debris. Non-mineral materials (including but not limited to wood, brush or flotsam) deposited by wind, wave action, flooding or wild animals within the last 12 months. This term includes beaver dams, but does not include beaver or muskrat houses or nests of wild birds such as wading birds or waterfowl.

(5) Restoration. An activity returning a great pond, coastal wetland, freshwater wetland, river, stream or brook from a disturbed or altered condition with lesser acreage or fewer functions to a previous condition with greater acreage or functions.

(6) Structure. Anything built for the support, shelter or enclosure of persons, animals, goods or property of any kind, together with anything constructed or erected with a fixed location on or in the ground. Examples of structures include buildings, utility lines and roads.

(7) Non-native wetland plants. Wetland grasses, forbs, shrubs, or trees not native to the State of Maine, for example, common reed (*Phragmites communis*) and purple loosestrife (*Lythrum salicaria*).

13. Habitat creation or enhancement and water quality improvement activities

A. Applicability

(1) This section applies to an alteration in or adjacent to a protected natural resource by a public natural resource agency. This rule also applies to an alteration in the same types of resources by a public utility, the Department of Transportation, owner of a federally licensed hydropower project, a conservation group, or a municipality in conjunction with and under the supervision of a public natural resource agency, exclusively for the purpose of:

(a) Creating or enhancing habitat for fisheries or wildlife; or

(b) A water quality improvement project.

APPENDIX D

QC INFORMATION

Project Documents and Records Table

Document/Record	Producer	Related Work Aspect	Frequency of Completion	Where Maintained
Project Personnel Sign-off Record	Technical Lead	Mobilization/Site Preparation	One time	SAP, PF
ESS	UXO Manager	Mobilization	One time	PF
Field Checklists	Field UXO Personnel	All Field Activities	Field collection days	AAR/PF
MEC Accountability Log	SUXOS	All Field Activities	As needed	AAR/PF
Demolition Explosives Accountability Log	SUXOS/UXOQCS	MEC Treatment	As needed/weekly	SAP, MRP SOP 07, PF
Daily Reports	SUXOS	All Field Activities	Field collection days	AAR/PF
Medical and OSHA Clearance Letter	HSM and PM	All	As needed	AAR/PF
Daily Safety Meeting Sign-In	SSO	All	Daily	AAR/PF
Medical Data Sheet	SUXOS	All	As needed	PF
Surface Survey Maps	SUXOS	UXO Detector-Aided Surveys	Field collection days	AAR/PF
Detector-Aided Survey Data	UXO Personnel	Detector-Aided Survey data collection	Field collection days	AAR/PF/NIRIS
Dig Sheet/ Intrusive Operation Survey Data	UXO Personnel	Intrusive Operations	Field collection days	SAP, PF
Field notes (detailing equipment and procedure)	Field UXO Personnel	All Field Activities	Field collection days	AAR/PF

Document/Record	Producer	Related Work Aspect	Frequency of Completion	Where Maintained
Assessment findings and corrective actions	Various (see below)	All	As needed	AAR/PF
Quality Control Surveillance Report	UXOQCS	All Field Activities	minimum of once per phase for each definable feature of work	AAR/PF
Daily Quality Control Report	UXOQCS	All Field Activities	Daily	AAR/PF
Photographs (may be included in report)	Field UXO Personnel	All Field Activities	As needed	AAR/PF
Field Change Request forms	SUXOS	All Field Activities	As needed	AAR/PF
Field Audit Checklist (if an audit is conducted)	Tetra Tech PM	All Field Activities	As needed	AARI/PF
After Action Report	Tetra Tech Personnel	All Project Work	One time	AAR/PF
Investigation Report	Tetra Tech Personnel	Investigation project work	One time	SAP/PF, Long-term third-party professional document storage firm utilized

AAR – After Action Report

PF – Project File

SAP – Sampling and Analysis Plan

NIRIS – Naval Installation Restoration Information Solution

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

All data and information generated as part of the MEC Investigation/Clearance will be presented in the After Action Report and/or will be available in pdf format on CD.

Planned Project Assessments Table

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	SUXOS	UXO Manager	UXO Manager	QAM PM
Accident/Incident Reporting	Per event	Internal	Tetra Tech	SSO	Project Safety Officer	HSM PM	HSM
Preventative Maintenance	Daily	Internal	Tetra Tech	UXOQCS	SUXOS	UXO Manager	PM
Communications Equipment Inspection	Daily	Internal	Tetra Tech	UXO Team Leader	SUXOS	SUXOS	UXO Manager PM
Safety Inspections	Daily (inspection); Weekly (formal surveillance)	Internal	Tetra Tech	SSO	SUXOS	SUXOS	UXO Manager PM
Brush Cutting and Vegetation Management	As needed to support operations	Internal	Tetra Tech	SUXOS	UXO Team Leader	UXO Team Leader	PM

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)
IVS - Assessment	Twice daily	Internal	Tetra Tech	SUXOS	UXO Team Leader	UXO Team Leader	PM
UXO Escort/Avoidance Operations	As needed to support operations	Internal	Tetra Tech	UXOSO	SUXOS	SUXOS	UXO Manager
Detector-Aided Survey	Blind seeds in each lot of work	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Manager PM
Surface/ Subsurface UXO Clearance	Daily –all hand dig locations (inspection); Weekly (formal surveillance)	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Manager PM
Blind Seed Items	Daily (inspection); Weekly (formal surveillance)	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Manager
Surveying and Mapping Operations	Initial, then Weekly	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Manager

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)
UXO/MEC Accountability	Daily, As needed	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Manager PM
MEC Disposal	As needed, formal observation	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Manager PM
MPPEH Certification	As needed, formal surveillance	Internal	Tetra Tech	UXOQCS	SUXOS	SUXOS	UXO Manager PM
Visitor Briefing	Initial then as needed to support operations	Internal	Tetra Tech	Project Safety Officer	SSO	SSO	HSM
Site-Specific Training	Once at start of fieldwork and at start of each definable feature of work	Internal	Tetra Tech	SUXOS UXO Manager PM	As designated by PM	As designated by PM	PM
Hazard Assessment – Risk Analysis	At start of each definable feature of work, then as needed to	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)
	support operations						
Field Work Systems Audit	One per contract year	Internal	Tetra Tech	QAM	UXO Manager PM	QAM UXO Manager	QAM PM
Site-Specific Training	One at start of fieldwork, at start of each definable feature of work, then as needed to support operations	Internal	Tetra Tech	SUXOS UXO Manager PM	As designated by PM	As designated by PM	PM

1 Tetra Tech personnel unless otherwise noted.

Assessment Findings and Corrective Action Responses

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/verbal	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Immediately upon discovery	e-mail/verbal	Linda Klink – PM, Tetra Tech	Prior to initiation of task
Accident/Incident Reporting	Accident/Incident Report Form	Linda Klink – PM, Tetra Tech Matt Soltis – HSM, Tetra Tech	Immediately	Dependant upon accident/incident	Linda Klink – PM, Tetra Tech Ralph Brooks - UXO Manager, Tetra Tech Matt Soltis – HSM, Tetra Tech	Within 24 hours
Preventive Maintenance	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours
Communications Equipment Inspection	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours
Safety Inspections	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, 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
Brush Cutting and Vegetation Management	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours	e-mail	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours
IVS - Assessment	Oral	SUXOS – TBD Linda Klink – PM, Tetra Tech	Within 24 hours	E-mail	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours
UXO Escort/Avoidance Operations	e-mail/verbal	Ralph Brooks UXO Manager Tetra Tech Linda Klink - PM, Tetra Tech	Within 24 hours	e-mail/verbal	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink - PM, Tetra Tech	Within 24 hours
Detector-Aided Surface Survey	QC Checklist	Ralph Brooks UXO Manager Tetra Tech Linda Klink - PM, Tetra Tech	Within 1 business day of assessment	Updated QC Checklist	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink - PM, Tetra Tech	Within 24 hours
Surface/ Subsurface UXO Clearance	Field Forms	Ralph Brooks UXO Manager Tetra Tech Linda Klink - PM, Tetra Tech	Within 24 hours	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink - PM, Tetra Tech	Within 24 hours
Surveying and Mapping Operations	e-mail	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours	Updated e-mail	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, 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**
UXO/MEC Accountability	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours	Updated field forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours
MEC Disposal	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Immediately	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Immediately
MPPEH Certification	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Immediately	Field Forms	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Immediately
Visitor Briefing	e-mail	SUXOS – TBD Linda Klink – PM, Tetra Tech	Within 24 hours	Updated e-mail	SUXOS – TBD Linda Klink – PM, Tetra Tech	Within 24 hours
Site-Specific Training	e-mail	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Upon Completion of Training	Updated e-mail	Ralph Brooks - UXO Manager, Tetra Tech Linda Klink – PM, Tetra Tech	Within 24 hours
Hazard Assessment – Risk Analysis	e-mail	Linda Klink – PM, Tetra Tech Matt Soltis – HSM, Tetra Tech	Within 24 hours	Updated e-mail	Linda Klink – PM, Tetra Tech Matt Soltis – HSM, Tetra Tech	Within 24 hours
Field Work Systems Audit	Letter Report	Linda Klink – PM, Tetra Tech	Within 5 business days of assessment	Letter Report	Linda Klink – PM, Tetra Tech	Within 10 business days of receipt

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
		Tom Johnston – QAM, Tetra Tech			Tom Johnston – QAM, Tetra Tech	

QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Project Monthly Progress Report	Monthly (written) for duration of the project	Monthly	PM Tetra Tech	Navy RPM BRAC PMO
Field Status Reports	Daily (oral or e-mail), during the course of fieldwork	TBD	SUXOS Tetra Tech	PM Tetra Tech UXO Manager Tetra Tech
Daily QC Report (Detector-Aided Survey, Intrusive manual excavations)	Daily (e-mail)	TBD	UXOQCS Tetra Tech	PM Tetra Tech UXO Manager Tetra Tech
QC Meeting or Teleconference Minutes	Twice per month during project performance	TBD	UXO Manager Tetra Tech	PM Tetra Tech
Rework Items List	Twice per month during project performance Daily for UXO work	TBD	UXOQCS Tetra Tech	PM Tetra Tech
Project QC Letter Report	Internal draft, draft, and final (Appendix to After Action Report)	TBD	PM Tetra Tech	Navy RPM BRAC PMO

Verification (Tier I) Process Table – Preparatory and Initial Inspections

A preparatory phase inspection will be performed prior to beginning each definable feature of work. The purpose of this inspection is to review applicable specifications and verify the necessary resources, conditions, and controls are in place and compliant before start of work activities. An initial phase inspection will be performed at the beginning of each definable feature of work. The purpose of this inspection is to observe/review the application of procedures to ensure their adequacy, ensure adequate resources are applied to the activity and 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.

Definable Feature of Work	Description	Internal/ External	Responsible for Verification (name, organization)
Project Readiness/Work Plan Review	Project readiness review to be performed by Tetra Tech PM and Navy RPM including Work Plan review.	Internal/External	Linda Klink – PM, Tetra Tech Todd Bober - Navy RPM
Pre-Operational Team Training Review	Prior to field crew(s) mobilizing to the field for on-site data collection, the Tetra Tech PM will review resumes and training records, including those for UXO field personnel to ensure that all required training and experience requirements identified in the Work Plan have been completed for each crew member.	Internal	Linda Klink – PM, Tetra Tech
Mobilization/Site Preparation	Review of mobilization and site preparation activities such as equipment setup and checkout, installation of IVS, and investigation area survey and layout.	Internal	Linda Klink – PM, Tetra Tech Ralph Brooks – UXO Manager, Tetra Tech
Brush Cutting and Vegetation Clearance	Brush clearing and vegetation management (regarding work areas, equipment laydown areas and access ways) will be conducted in accordance with SOP 06 (Vegetation Management).	Internal	Preparatory: Ralph Brooks – UXO Manager, Tetra Tech Initial Inspection: UXOQCS
IVS	Prior to collection of data at IVS, review MRP SOP 08 (UXO Documentation).	Internal	Ralph Brooks – UXO Manager, Tetra Tech
Site Surveying	Prior to the start of field work, the site boundaries (regarding work areas, equipment laydown areas, and accessways) will be established.	Internal	TBD – SUXOS, 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	Internal	TBD – SUXOS, Tetra Tech

Definable Feature of Work	Description	Internal/ External	Responsible for Verification (name, organization)
	least six satellites are available. Ensure that sub-meter post processes accuracy estimate is being achieved by checking that GPS positioning is compared to two known locations at least twice daily.		
UXO Detector-Aided Surveying	Review of SOP-01 (UXO Detector-Aided Surface Surveys) and SOP-02 (MEC Management and Accountability) which document methodology to be utilized during surveys and quality control procedures.	Internal	Ralph Brooks - UXO Manager, Tetra Tech TBD – SUXOS TBD – UXOQCS
	Review of SOP-01 (UXO Detector-Aided Surface Surveys) and SOP-02 (MEC Management and Accountability). And SOP-08 (UXO Documentation) which include procedures for data collection and transcription. The SUXOS will verify that the data collected during the first lot of field work contains all the elements required by the scope of work and do not contain questionable data or error points.	Internal	Ralph Brooks - UXO Manager, Tetra Tech TBD – SUXOS
Surface/Subsurface UXO Clearance	Review MMRP SOP 01 (UXO Detector-Aided Surface Surveys) and MMRP SOP 02 (MEC Management and Accountability), which document methodology to be used during UXO sweeps 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. Review of the Work Plan (Sections 2.0 and 5.0) which documents the procedures and depths of placement of blind seed items	Internal	Ralph Brooks - UXO Manager, Tetra Tech TBD - SUXOS TBD - UXOQCS
Donor Explosives Handling	Review MRP SOP 07 (UXO Demolition/Disposal Operations), which documents procedures to be used during UXO demolition operation and includes checklists and field forms.	Internal	Ralph Brooks – UXO Manager, Tetra Tech TBD – SUXOS, Tetra Tech
MEC Management	Review MRP SOP 07 (UXO Demolition/Disposal Operations),	Internal	Ralph Brooks – UXO Manager,

Definable Feature of Work	**Description**	**Internal/ External**	**Responsible for Verification** (name, organization)
(Treatment)	which documents procedures to be used during UXO demolition operation and includes checklists and field forms.		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.	Internal	Ralph Brooks – UXO 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.	Internal	Ralph Brooks – UXO Manager, Tetra Tech TBD – SUXOS
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.	Internal	Linda Klink – PM, Tetra Tech Ralph Brooks – UXO Manager, Tetra Tech
Demobilization	Review of demobilization activities such as: removal of ITS; completion of field forms, return or equipment; and, forwarding all field documentation to PM.	Internal	Linda Klink – PM, Tetra Tech Ralph Brooks – UXO Manager, Tetra Tech
Site-Specific Final Report Preparation and Approval	Verify that all data and documentation have been acquired for report preparation	Internal	Linda Klink – PM, Tetra Tech Ralph Brooks – UXO Manager, Tetra Tech

(Tier 2) Process Summary Table – Follow-Up Inspections

Follow-up inspections are conducted to ensure that procedures are being correctly performed, no changed conditions exist which may impact the quality of work, and 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. Previous tables describes actions to be taken in the event that nonconforming conditions are observed during the QC inspections.

Definable Feature of Work	Frequency of Inspection	Supporting QC Document(s)	Responsible for Validation (name, organization)
Project Readiness/Work Plan Review	NA/upon completion of SI field work	No follow-up required for Project Readiness. Verify that the Work Plan was implemented and carried out as written and that any deviations are documented. Prepare FCR as needed to document changes as they occur.	Linda Klink – PM, Tetra Tech Todd Bober - Navy RPM
Pre-Operational Team Training Review	NA	No follow-up required for this definable feature of work.	NA
Mobilization/Site Preparation	NA	No follow-up required for this definable feature of work.	NA
Brush Cutting and Vegetation Clearance	Daily	Checklists and Field Forms, SOP 06 (Vegetation Management), which document equipment utilized and progression of brush cutting and vegetation clearing activities.	TBD – SUXOS, Tetra Tech Ralph Brooks - UXO Manager, Tetra Tech
IVS	Daily	Review results of IVS.	Ralph Brooks – UXO Manager, Tetra Tech TBD – SUXOS, Tetra Tech TBD – UXOQCS, Tetra Tech
UXO Detector-Aided Surveying	Minimum of once per day surveys are conducted or more frequently as necessary	Checklists and Field Forms which document equipment utilized, grids swept and grids checked for quality control purposes.	Ralph Brooks - UXO Manager, Tetra Tech TBD – SUXOS TBD – UXOQCS
	As needed, prior to data entry	Prior to entering data (field forms and electronic data) from the detector-aided surveys into the permanent project database, the UXO Manager or designated representative will review the filed	Ralph Brooks - UXO Manager, Tetra Tech

Definable Feature of Work	Frequency of Inspection	Supporting QC Document(s)	Responsible for Validation (name, organization)
		forms to ensure that all required information is provided as required by SOPs -01 (Detector-Aided Surface Surveys) and -02 (MEC Management and Accountability). Verify 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.	TBD - SUXOS
Surface/ Subsurface UXO Clearance	Minimum of once per day clearance activities are conducted or more frequently as necessary	Checklists and Field Forms, which document surface/subsurface clearance activities, have been completed and checked for quality control purposes. See MRP SOP 01 (UXO Detector-Aided Surface Surveys), MRP SOP 02 (MEC Management and Accountability), and QC Follow-Up Report Verify all blind seed items have been located during collection and surveying activities.	Ralph Brooks - UXO Manager, Tetra Tech TBD – SUXOS TBD – UXOQCS
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 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	Ensure that MRP SOP 07 (UXO Demolition/Disposal Operations) and the Work Plan (Section 2.12) have been followed and verify that all MEC disposal activities and documentation have been completed.	Ralph Brooks - UXO Manager, Tetra Tech TBD – SUXOS TBD – UXOQCS
MPPEH Management (Inspection)	Daily	Ensure that the MRP SOP 02 (MEC Management and Accounting) and Work Plan (Section 2.13) has been followed.	Ralph Brooks - UXO Manager, Tetra Tech TBD – SUXOS TBD – UXOQCS

Definable Feature of Work	Frequency of Inspection	Supporting QC Document(s)	Responsible for Validation (name, organization)
MPPEH Management (Certification)	Daily	See MRP SOP 02 (MEC Management and Accounting) and QC Follow-Up Report and verify that all MPPEH certification activities and documentation have been completed.	Ralph Brooks – UXO Manager, Tetra Tech
MPPEH Management (Disposal)	Daily	See MRP SOP 02 (MEC Management and Accounting) and QC Follow-Up report and the Work Plan (Section 2.12) have been followed and verify that all MPPEH disposal activities and documentation have been completed.	Ralph Brooks – UXO Manager, Tetra Tech
GPS Positional Data Collection	Twice on each day of GPS use (am and pm)	Verify GPS positional accuracy, background levels, and static response (SOP-05, GPS).	TBD – SUXOS Ralph Brooks – UXO Manager, Tetra Tech
Demobilization	Once upon completion of each phase of project/site	Verify that all demobilization activities, as applicable to phase of work, have been completed.	Linda Klink – PM, Tetra Tech Ralph Brooks - UXO Manager, Tetra Tech
Site-Specific Final Report Preparation and Approval	Once upon completion of the project/site activities	Verify that all activities have been documented and reported as applicable to each phase of work and have been included in the report.	Linda Klink – PM, Tetra Tech Todd Bober – Navy RPM, BRAC PMO NE

Analytical Data Validation (Steps IIa and IIb) Summary Table

Step IIa / IIb[1]	Matrix	Analytical Group	Validation Criteria	Data Validator (Title and organization)
IIa	Surface Soil	Detector-Aided Survey	a) Discover and record all blind seeds placed in transects. b) Between 1 and 6 blind seed items per daily lot of work .	TBD SUXOS Tetra Tech TBD UXOQCSS Tetra Tech
IIa	Surface and Subsurface Soil	MEC Clearance Operations	Verification that all clearance activities have been completed per the Work Plan.	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.
TBD – To be determined

APPENDIX E

MSDS FOR DONOR CHARGES

DYNO
Dyno Nobel

MATERIAL SAFETY DATA SHEET
DYNO NOBEL INC.
2650 Decker Lake Boulevard, Suite 300
SALT LAKE CITY, UTAH 84119
PHONE: 801-364-4800 FAX: 801-328-6452
E-MAIL: DNNA.HSE@AM.DYNONOBEL.COM
FOR 24 HOUR EMERGENCY CALL
CHEMTREC 800-424-9300 CANUTEC 613-996-6666

MSDS# 1124

DATE: 01/24/05

Replaces MSDS
1124 10/20/04

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): NONEL® LEAD LINE

Product Class: Shock Tube

Product Appearance & Odor: Hollow plastic tubing (normally yellow) with dusty inner coating of HMX and aluminum. No detectable odor.

DOT Hazard Shipping Description: Articles, explosive, n.o.s. (HMX) 1.4S UN0349 II.
For 10,000 ft spools with Wire Lock Terminations only, Not regulated as an explosive, 0000

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

			Occupational Exposure Limits	
Ingredients:	**CAS#**	**% (Range)**	**OSHA PEL-TWA**	**ACGIH TLV-TWA**
Cyclotetramethylene Tetranitramine (HMX)	2691-41-0	0.35	None[1]	None[2]
Aluminum (dust)	7429-90-5	0.04	15 mg/m^3 (total) 5 mg/m^3 (respirable)	10 mg/m^3

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m^3 ; respirable fraction, 5 mg/m^3.
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m^3 ; respirable part., 3 mg/m^3.
Note: The above hazardous dust mixture is present at approximately 15 mg per meter of tubing.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable

Vapor Pressure: Not Applicable

Vapor Density: Not Applicable

Density: Not Applicable

Melting Point: HMX decomposes violently at melting pt., about 278°C

Solubility in Water: Not Soluble

Evaporation Rate (Butyl Acetate = 1): Not Applicable

Percent Volatile by Volume: Not Applicable

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable

Flammable Limits: Not Applicable

Extinguishing Media: Water, inert powder, CO_2

Special Fire Fighting Procedures: For shock tube only, consider initial isolation of at least 15 meters (50 feet) in all directions. Fight fire with normal precautions and methods used for plastic fires from a reasonable distance. IF DETONATORS OR OTHER EXPLOSIVES ARE PRESENT, DO NOT FIGHT FIRE.

Unusual Fire and Explosion Hazards: May burn vigorously with localized detonations and projection of fragments, with effects usually confined to the immediate vicinity of packages. Toxic smoke from combustion of the plastic material may be emitted. If product functions, high heat and pressure are released from the end of the tube if not covered or enclosed, typically by a metal device.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

This is a packaged product that will not result in exposure to hazardous ingredients (inner coating materials) under normal conditions of use.

Eyes: Not a likely route of exposure. Dust particles may be irritating.

Skin: Not a likely route of exposure. Dust particles may cause skin irritation.

Ingestion: Not a likely route of exposure. Ingestion of large amounts of the reactive powder (HMX) is poisonous and may cause cardiovascular collapse.

Inhalation: Not a likely route of exposure. Breathing dust can cause respiratory irritation. During manufacture and at processing temperatures, irritating fumes may evolve.

Systemic or Other Effects: None known.

Carcinogenicity: No constituents are listed by NTP, IARC or OSHA.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.

Skin: Wash with soap and water.

Ingestion: Not Applicable

Inhalation: Not Applicable

Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable

Conditions to Avoid: Keep away from heat, flame, impact, friction, ignition sources and strong shocks. Also avoid stretching to failure.

Materials to Avoid (Incompatibility): Incompatible with strong oxidizers and acids.

Hazardous Decomposition or Combustion Products: Hazardous carbon monoxide (CO), nitrogen oxide (NO_X) gases and products of plastic decomposition produced.

Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 50 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, repackage undamaged devices in original packaging, accounting for every device. If the ends or tube wall have been opened such that powder may have been released from the tube, isolate the spill area. Contamination of the HMX/Aluminum powder with sand, grit or dirt will render the material more sensitive to detonation. Carefully wet down and clean "loose" powder spills using a damp sponge or rag, avoid applying friction or pressure to the explosive, and place in a (Velostat) electrically conductive bag. Follow applicable Federal, State, and local spill reporting requirements.

Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: None normally required. Provide enhanced ventilation if used in underground mines, indoors or other enclosed areas.

Respiratory Protection: None normally required. Extended testing of the product indoors or in enclosed areas may necessitate respiratory protection.

Protective Clothing: None normally required. Wear chemical-resistant gloves during post-detonation cleanup or spill cleanup operations.

Eye Protection: Safety glasses or goggles are recommended for handling, testing or cleanup.

Other Precautions Required: None

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Keep away from heat, flame, ignition sources and strong shock. Only properly qualified and authorized personnel should handle and use Shock Tube.

Precautions to be taken during use: Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.

Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	% By Weight
None		

Remington Arms *Material Safety Data Sheet*

This Material Safety Data Sheet has been prepared in compliance with Federal OSHA Hazard Communication Standard 29 CFR 1910.1200, ANSI Z400.1-1993 and the ISO Safety Data Sheet Standard. This product may be considered to be a hazardous chemical under 29 CFR 1910.1200. This information is required to be disclosed for safety in the workplace. ***This MSDS is applicable only to the product identified herein and only when used properly.***

NOTE: Refer to Section XVII for ***List of Acronyms.***

I. PRODUCT IDENTIFICATION

Product: COMPONENT PRIMERS AND PERCUSSION CAPS (CENTERFIRE/SHOTSHELL/MUZZLELOAD)

HMIS Rating
Health: 2
Flammability: 0
Reactivity: 1

IN EVENT OF EMERGENCY
(Spill, Leak, Fire, Exposure, Accident)
CALL CHEMTREC DAY OR NIGHT
(800) 424-9300
In Arlington, VA 741-5000
Outside Continental U.S.A. (703) 741-5000

II. HAZARDOUS COMPONENT INFORMATION

Primers and Percussion Caps (Centerfire, Shotshell, and Muzzleload) contain the hazardous chemicals listed, along with the percent by weight of the hazardous ingredients in the Primers and Percussion Caps (Centerfire, Shotshell, and Muzzleload).

1. **Primer** Copper, Zinc, Iron, Antimony, Barium, Lead Styphnate, Tetrazene
2. **Percussion Cap:** Copper, Zinc, Antimony, Barium, Lead Styphnate, Tetrazene

Hazardous Ingredients	Percent by Weight	CAS Number	Exposure Limits (PEL)
Copper	1-67%	7440-50-8	None established
Zinc	Less than 1-29%	7440-66-6	TWA (fume) 0.1 mg/m³ TWA (dust, mist) 1.0 mg/m³
Antimony	0.3-7.8%	7440-36-0	TWA 0.5 mg/m³
Arsenic	Less than 0.1%	7440-38-2	TWA 0.5 mg/m³
Iron	0-98%	1309-37-1	TWA 10 mg/m³
Barium	Less than 1-29%	7440-39-3	TWA 0.5 mg/m³
Lead Styphnate Lead Trinitroresorcinate	Less than 1-26%	63918-97-8	None established
Tetrazene	Less than 0.1-3.3%	109-27-3	None established

III. HAZARDS IDENTIFICATION

Emergency Overview: Accidental fire may cause low energy fragments to be emitted thus causing potential eye injury.

Potential Human Health Effects:

Skin Contact: May cause allergic reaction (sensitization) in susceptible individuals.

Eye Contact: Dust and fumes can irritate the eyes causing redness and discharge.

Inhalation: Inhalation of dust or fumes may cause irritation to nose, throat, upper respiratory tract and lungs. Irritation may lead to bronchitis, headache, lowering of blood pressure and weakness.

Ingestion/Absorption: Ingestion may cause severe headache, nausea, vomiting, abdominal pain, fatigue, diarrhea, trembling, ringing in ear and salivation.

Carcinogenicity Information: This product is not classified a carcinogen by IARC, OSHA, NTP or EPA. Lead and Arsenic are classified a carcinogen by IARC.

IV. FIRST AID MEASURES

Skin Contact: Wash affected area thoroughly with soap and water. Remove contaminated clothing. Wash clothing thoroughly prior to reuse. Discard any contaminated leather items (i.e. shoes, etc.).

Eye Contact: If wearing contacts, immediately remove contact lenses. Hold eyelids apart and flush eyes thoroughly with water for at least 15 minutes. Obtain medical attention immediately.

Inhalation: Immediately remove to fresh air. Administer artificial respiration, if necessary. If breathing is difficult, administer oxygen. Obtain medical attention immediately.

Ingestion/Absorption: If conscious, drink large amounts of water. Induce vomiting. Immediately contact a physician or Poison Control Center. ***Never*** induce vomiting or give anything by mouth to an unconscious person.

V. FIRE HAZARDS

Flammable Properties: May ignite if heated to 250°F. Will ignite when exposed to flame and high temperatures. Be cautious of low energy fragments.

Extinguishing Media: Flood fire with water to fight fire and cool components. If no water is available, use carbon dioxide, dry chemical or earth.

Fire-Fighting Instructions: Evacuate area immediately. ***Product may mass detonate.*** Deluge area with water. Wear full fire-fighting protective gear including face shield or SCBA to protect from fragments.

VI. ACCIDENTAL RELEASE MEASURES

Safeguards: Remove from all sources of ignition.

Spill Cleanup: Use non-sparking equipment to clean up spill. If disposal is necessary, refer to *XIII. DISPOSAL CONSIDERATIONS*.

Accidental Release: See above.

VII. HANDLING AND STORAGE

Personnel Handling: Use non-sparking equipment to clean up and store primers and percussion caps. Handle with care. Always wash hands thoroughly after handling.

Storage: Store in original containers in a cool, dry, well-ventilated area away from all sources of ignition. Do not subject to mechanical shock. Keep out of reach of children. This product ***must not be stored*** with acids, strong oxidizers or caustics.

VIII. PERSONAL PROTECTION/EXPOSURE CONTROLS

Engineering Controls: Local exhaust ventilation is recommended if significant dusting occurs. Otherwise, use general exhaust ventilation.

Personal Protective Equipment: Safety glasses recommended when handling or firing rounds.
Hearing protection recommended when firing rounds.
Use of a NIOSH/MSHA-approved respirator is recommended when concentrations to fumes and/or dust exceed the PEL or TLV.

Exposure Guidelines: Keep product away from sources of accidental ignition.

Exposure Limits: Exposure limits listed with each hazardous chemical.

IX. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DATA

Form:	Solid	**Vapor Density:**	N/A
Color:	Variable	**Evaporation Rate:**	N/A
Odor:	None	**Melting Point:**	100°C-400°C
Boiling Point:	N/A	**Solubility in Water:**	N/A
Specific Gravity:	N/A	**pH:**	N/A
Vapor Pressure:	N/A		

X. STABILITY AND REACTIVITY

Chemical Stability: Stable under normal use conditions. Will not react with water.

Other Hazards:
- **Incompatibility:** Incompatible with acids, strong oxidizers and caustics.
- **Polymerization:** Will not occur.

Conditions to Avoid: Flames, sparks, percussion, shock, static, high temperatures (266°F or 130°C, or above) and electric arcs.

XI. TOXICOLOGICAL INFORMATION

Oral LD 50: No available data.
Dermal LD 50: No available data.
Inhalation LC 50: No available data.
Irritation: Not a skin or eye irritant.

XII. ECOLOGICAL INFORMATION

Aquatic Toxicity:
Lead (LC 50) to Bluegill: 2-5 mg/l
Barium to Stickleback: 400 mg/l
Barium Nitrate to Stickleback: 760 mg/l

Environmental Impact:

When used and disposed of properly, there is no known environmental impact.

XIII. DISPOSAL CONSIDERATIONS

This product is considered a characteristic hazardous waste per 40 CFR 261.24 ***for disposal purposes only***. Dispose of as required by local, state and federal laws and regulations.

EPA Hazardous Waste Code: D008 (lead)

XIV. TRANSPORTATION INFORMATION

SHIPPING INFORMATION
- **Proper Shipping Name:** Primers, Cap Type
- **Hazard Class:** 1.4S
- **UN/NA No:** UN0044
- **Packing Group:** II
- **Shipping Label:** None required.
- **Special Information:** May be reclassified internationally as:
  - Hazard Class: 1.4S
  - UN/NA No.: UN0044
  - Packing Group: II
  - Shipping Label: 1.4S label

XV. REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS

TSCA Inventory Status: Included on list.

This product contains a toxic chemical or chemicals subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

XVI. OTHER INFORMATION

NFPA Rating: Not established.

HAZARD CLASSIFICATION

Chronic Health:	Headache, nausea, weakness
Acute Health:	Anemia, embryotoxin.
Fire Hazard:	0 (per *HMIS Rating*)
Pressure Hazard:	Sudden release of pressure.
Reactivity Hazard:	1 (per *HMIS Rating*)

NPCA-HMIS Ratings:

Health:	2
Flammability:	0
Reactivity:	1

References:

Code of Federal Regulations, Monthly Summary, CFR 1910.1200(g) and Appendix E (B.), Regulations Management Corporation, Bloomington, Indiana, July 1, 1994.

Hazardous Chemical Desk Reference: Third Edition, Richard J. Lewis, Sr., Van Nostrand Reinhold, Copyright 1993.

American National Standards Institute, Z400.1-1993

International Standards Organization Safety Data Sheet Standard.

XVII. LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA WEEL	American Industrial Hygiene Association-Workplace Environmental Exposure Level
ANSI	American National Standard Institute
BEI	Biological Exposure Indexes
CAS	Chemical Abstract Service
CFR	Code of Federal Regulations
CL	Ceiling Limits (not to be exceeded)
DSL	Domestic Substances List
EPA	Environmental Protection Agency
HMIS	Hazardous Materials Identification System
IARC	International Agency for Research on Cancer
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ISO	International Standards Organization
LC	Lethal Concentration
LD	Lethal Dose
MITI	Ministry of International Trade and Industry (Japan)
MSHA	Mine Safety and Health Appliance
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NTA	National Transportation Agency (Canada)
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
ORM	Other Regulated Materials
PEL	Permissible Exposure Limit (OSHA)
SCBA	Self-contained Breathing Apparatus
STEL	Short-Term Exposure Limit
TLV	Threshold Limit Values (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
UN/NA	United Nations/North American (Identification number)
SARA	Superfund Amendments and Reauthorization Act
RCRA	Resource Conservation and Recovery Act

For additional information, please contact:

Remington Arms Company, Inc.
P.O. Box 700, 870 Remington Road
Madison, NC 27025-0700
(800) 243-9700

HELIX Liquid

Material Safety Data Sheet

OMNI EXPLOSIVES

Section I - Company Information

Manufacturers Name *Omni Distribution, Inc. Explosive Products Division*

Address *PO Box 171154*

Emergency Phone *Chem Tel: 800-255-3924*

City, State, and Zip *Memphis, TN 38117*

Other Info Call *800-277-6664*

Contact Name: *D. Nixon*

Prepared date *14OCT2002*

Section II - Hazardous Material(s) Identification

Hazardous Component(s) / Chemical & Common Name(s) Wt / % Exposure Limits CAS NO.

Common Name: NITROMETHANE Synonyms: Nitrocarbinol, NM

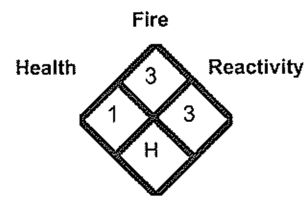
Chemical Family: Aliphalic Hydrocarbons

CAS No. 75-25-5

Chemical Formula: CH3 NO2

Percent Present: 99.9

DOT Hazard Class: Flammable Liquid



DOT No., Class & Label

Flammable Liquid
UN1261, 3.3, PGII

Section III - Physical & Chemical Characteristics

Boiling Point *214 degrees F / 101 degrees Celsius*

Vapor Density (Air-1) *Not Determined*

Melting Point *-20 degrees F / -29 degrees Celsius*

Percent Volatiles (Wt.%) *100*

Vapor Pressure (mm Hg) *36.66 mm Hg @ 25 degrees Celsius*

Specific Gravity (H20=1) *1.14*

Solubility in Water *11.1% wt. @ 25 degrees Celsius*

Evaporation Rate *1.4 (BuAc = 1)*

Appearance and Odor *Clear, light green liquid with mild fruity odor* *pH of 0.01 M aqueous solution = 6.4*

Section IV - Fire & Explosion Hazard Data

Flash Point *95 F / 35 C*

Method Used *Tag Closed Cup*

Flammable Limits (Vol %) **LEL** *7.3%* **UEL** *unknown*

Auto Ignition Temp *785F / 418C*

Extinguisher Media *Foam, C02, & Heylon. Water may be ineffective in extinguishing fire.*

Fire & Explosion Hazards *Vapor is heavier than air - may travel to ignition source and flashback. Decomposes explosively at critical temp of 599 F and critical pressure of 915 psig*

Fire Fighting Procedures *Wear self contained breathing apparatus. Fight fire from an explosion-resistant distance. Cool boxes with water spray and continue to cool after fire is extinguished. Stay upwind and out of low areas. If tank or truck is involved in a fire isolate for 1/2 mile in all directions. Dike area to contain fire. Control water for later disposal.*

Omni Distribution, Inc.
800-277-6664
Memphis, TN
Explosive Products Division
fax: 800-508-8584

HELIX Liquid

Material Safety Data Sheet

OMNI EXPLOSIVES

Section V - Reactivity Data / Physical Hazards

Stability: Stable at normal temps

Conditions to avoid: *Unstable at elevated temps and pressures. Rapid heating to high temp may cause explosion. Mixing with other materials may increase instability. May be detonated under very strong confinement by powerful explosives.*

Materials to avoid: *Incompatible with amines, strong acids, alkalies (lie, caustic), strong oxidizers, metal oxides, hydrocarbons, and other combustible materials. Lead, copper and their alloys.*

Hazardous Decomposition Products *Carbon Monoxide, Carbon Dioxide, Nitrogen Oxides, Carbon Oxidase*

Hazardous Polymerization *Will not occur*

Section VI - Health Hazard Data

☐ Acute Hazard ☒ Chronic Hazard ☒ Irritant ☐ Corrosive ☐ Oxidizer ☐ Lachrymator ☐ Known Carcinogen ☐ Reproductive

Toxicity: *Mildly irritating to eyes. Prolonged / repeated skin contact may cause skin irritation. High air concentrations may cause eye and respiratory irritation. Oral LD50 for rats is 1210 mg/kg + 322 mg/kg. Acute/Chronic exposure has caused liver damage and some kidney effects in animal studies. Weak narcotic. Strong odor >100ppm and irritating at 200 ppm*

Emergency & First Aid Procedures *Mildly irritating to eyes. Prolonged / repeated skin contact may cause skin irritation. High air concentrations may cause eye and respiratory irritation. Oral LD50 for rats is 1210 mg/kg + 322 mg/kg. Acute/Chronic exposure has caused liver damage and some kidney effects in animal studies. Weak narcotic. Strong odor >100ppm and irritating at 200 ppm.*

Routes of Entry / Effects of Exposure

1. **Inhalation** *Inhalation: Yes. Irritation. Possible liver or kidney damage. Remove from contaminated atmosphere. Call physician if necessary.*
2. **Eyes** *Eyes: ND. Irritation, Teary, Stingy, Redness. Flush with H2O for 15 minutes. Contact physician immediately.*
3. **Skin** *Skin: No known skin absorbtion. Irritation. No known illness from skin contact. Flush with H2O, contact physician if needed.*
4. **Ingestion** *Ingestion: Yes. Toxic. Drink H20. Induce vomiting if conscious. Do not induce if unconscious. Seek medical aid immediately.*

Section VII - Special Protection Info

Respiratory Protection *Use pressure type full face supplied air or self contained breathing apparatus. Do not use cartridge type respirators.*

Ventilation *If necessary to control exposure, local explosion proof exhaust ventilation is recommended. Dilution ventilation is NOT recommended as a sole control mechanism.*

Protective Gloves: *Neoprene, natural rubber, polyethylene or polyvinyl chloride gloves*

Eye Protection *Goggles, Safety Glasses.*

Other Protective Clothing or Equipment

Impervious clothing if possibility of body contact exists

Work/Hygenic Practices *Check for vapor accumulation before entering a confined space. Wash thoroughly after handling. Wash contaminated clothing before reuse. Launder separately from family clothes. Check gloves for leaks before use. Transfer equipment must be around.*

Omni Distribution, Inc.
800-277-6664

Memphis, TN

Explosive Products Division
fax: 800-508-8584

Section VIII - Special Precautions

Storage & Handling

Store in cool, dry, well ventilated structure and according to local, state and federal laws. Do not store with explosives.

Other Precautions

Use common sense when handling.

Waste Disposal Methods *U.S. - Dispose of pure product as a waste according to 40CFR261 by classifying & labeling as follows: EPA Haz Code: Ignitable. HazWaste No. D001*

Canada - Dispose of waste in accordance with local, provincial and national regulations.

Material Spills/Release

Eliminate Ignition sources. Evacuate nonessential personnel. Ventilate area. Use protective equipment as stated above. Absorb spilled liquids using an inert material.

Section IX - Miscellaneous

Exposure Limits:
ACGIH TLV = 100 ppm TWA
OSHA PEL = 100 ppm TWA
NIOSH IDLH = 1000 ppm - Immediately dangerous to life or health.

HMIS Rating: Health = 2, Flammability = 3, Reactivity = 3, Personal Protective Equipment = H (do not use air purifying respirator)

U.S. TSCA Listing: All components are listed in the U.S. EPA TSCA listing.
U.S. SARA Classification: Immediate (acute) health hazard. Delayed (chronic) health hazard. Fire Hazard. Sudden release of pressure hazard. Reactive hazard.

SARA Title III, 40CFR372 Reportable Quantities: None
Canadian Shipping Info: Nitromethane, 3.3 PIN 1261, II
Canadian Hazard Class and Division: Class B, Division 2. Class D. Division 1B, Class F

Not a hazardous substance under 40CFR116, toxic pollutant (40CFR129) or "priority pollutant" pursuant to the Federal Water Pollution Control Act sections 311

Minimally photochemically reactive.

Omni Distribution, Inc.
800-277-6664

Memphis, TN

Explosive Products Division
fax: 800-508-8584

HELIX Activator

Material Safety Data Sheet

Section I - Company Information

Manufacturers Name	*Omni Distribution, Inc. Explosive Products Division*		
Address	*PO Box 171154*	**Emergency Phone**	*Chem Tel: 800-255-3924*
City, State, and Zip	*Memphis, TN 38117*	**Other Info Call**	*800-277-6664*
Contact Name:	*W.P. Nixon*	**Prepared date**	*28OCT2002*

Section II - Hazardous Material(s) Identification

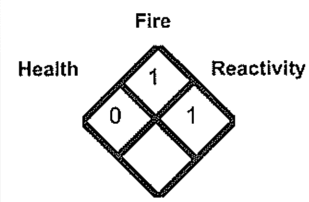
Hazardous Component(s) / Chemical & Common Name(s) Wt / % Exposure Limits CAS NO.

Aluminum 95-100%, OSHA 5mg/m3 respirable 15mg/m3 dust, ACGIH, 5mg/m3 fume 10mg/m3 7429-90-5

Proprietary Activator Mixture 0-5%

(May contain 0-5% of the following: Sodium Potassium Aluminum Silicate (Microballoons), Fumed Silica, Trimethyl Benzene, 1-Heptadecanecarboxylic Acid, N-Nonane, Aluminum Oxide, Carbon, PTFE)

Appearance: Gray paste with slight petroleum solvent odor. May be ignited by static discharge and burn at extremely high temp. Explosive when suspended in a dust-laden air cloud. Do not use H20 to clean spills. Use only non-sparking tools. Reacts violently with halogenated hydrocarbons and with oxidizers to produce heat. Aluminum is a nuisance dust.



DOT No., Class & Label

Aluminum Powder, Coated, UN 1309, 4.1, PG II

Section III - Physical & Chemical Characteristics

Boiling Point	*N/A*	**Vapor Density (Air-1)**	*N/A*
Melting Point	*N/A*	**Percent Volatiles (Wt.%)**	*ND*
Vapor Pressure (mm Hg)	*N/A*	**Specific Gravity (H20=1)**	*2.7*
Solubility in Water	*Insoluble*	**Evaporation Rate**	*N/A*

Appearance and Odor

Gray Paste with slight petroleum solvent odor VOC=0.40

Section IV - Fire & Explosion Hazard Data

Flash Point *ND* **Method Used** *NA*

Flammable Limits (Vol %) **LEL** *40mg/L* **UEL** *ND*

Auto Ignition Temp *ND*

Extinguisher Media *Class D extinguishing media or dry sand. DO NOT use class A,B or C fire extinguishers.*

Fire & Explosion Hazards *Explosive when suspended in a dust-laden air cloud.*

Fire Fighting Procedures *Use only non-sparking tools. Aluminum dust may be ignited by static discharge and burn at extremely high temperature. In bulk form, it is ignited by static discharge with difficulty. Once suspended in a dust-laden air cloud, it is readily ignited and very explosive. Aluminum dust is explosive over a fairly wide range of loadings depending on particle size, surface area, and other factors.*

HELIX Activator

Material Safety Data Sheet

OMNI EXPLOSIVES

Section V - Reactivity Data / Physical Hazards

Stability: Stable under normal conditions of use

Conditions to avoid: *Aluminum powder oxidizes when heated at a temperature dependent rate. It reacts violently with halogenated hydrocarbons and with oxidizers to produce heat. It reacts with water and slowly generates heat and hydrogen. Hydrogen gas forms from the reaction with some acids and alkalis.*

Materials to avoid: *Water, Mineral Acids such as nitric and sulfuric, strong oxidizing agents, alkalis, and halogenated compounds.*

Hazardous Decomposition Products *Carbon Dioxide, Carbon Monoxide, Aluminum Oxide*

Hazardous Polymerization *None*

Section VI - Health Hazard Data

☐ Acute Hazard ☐ Chronic Hazard ☒ Irritant ☐ Corrosive ☐ Oxidizer ☐ Lachrymator ☐ Known Carcinogen ☐ Reproductive

Toxicity: *This material is not known to be hazardous as defined by OSHA's Highly Hazardous Process Safety Standard, 29CFR 1910.119. Not listed by OSHA, IARC, or NTP as carcinogen. Medical conditions Aggravated by exposure: Pre-existing upper respiratory and lung diseases.*

Emergency & First Aid Procedures *Eyes: Immediately flush with water for 15 minutes. Seek medical attention if irritation persists. Skin: Wash with soap and water. Ingestion: Seek medical attention. Inhalation: Remove to fresh air.*

Routes of Entry / Effects of Exposure

Route	Effect
1. Inhalation	*Inhalation is the Primary route of entry. High exposure may cause irritation. Treat as nuisance dust.*
2. Eyes	*Eyes: High exposure may produce irritation.*
3. Skin	*Skin: None*
4. Ingestion	*Ingestion: High exposure may produce irritation of digestive tract.*

Section VII - Special Protection Info

Respiratory Protection *If exposure limits (TLV's PEL's etc) are exceeded, use NIOSH/MSHA approved respirator for dusts, fume, mist.*

Ventilation *Local Exhaust:* *Mechanical:* *Special:* *Other: Aluminum dust may accumulate in ventilation ducts and cause explosion hazard.*

Protective Gloves: *As needed. Neoprene or nitrile.*

Eye Protection *Safety glasses, goggles, face shield as needed.*

Other Protective Clothing or Equipment

If needed, recommend FR 8 or equivalent full length pants and jackets along with static conductive safety shoes.

Work/Hygenic Practices

Wash clothing separately. Do not dry in dryer. Use common sense precautions.

Section VIII - Special Precautions

Storage & Handling
When handling, avoid creating a dust cloud and avoid static electricity. Store in original shipping containers and boxes. Keep tightly sealed. Avoid contact with water or moisture. Store in a cool, dry, secure, location.

Other Precautions
This material, when discarded or disposed of is considered a hazardous waste as defined in 40 CFR Part 261 with hazardous waste number D001. Waste aluminum powder should be transported and disposed of by a licensed hazardous waste transportation and disposal company in accordance with all local, state and federal regulations.

Waste Disposal Methods *For disposal of this material as non-hazardous, consult state and local industrial solid waste regulations or contact their implementing authorities for guidance.*

Material Spills/Release
Ecotoxicological info: Though undetermined, this product may cause adverse environmental effects. Avoid contact with stormwater, waterways.

Section IX - Miscellaneous

DOT Shipping Name: Aluminum Powder, Coated. 4.1 Flammable Solid, UN 1309, PG II.

SARA Title III: This product contains Aluminum in greater than de minimus quantities which are subject to the reporting requirements of Section 313 of Title III of the superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372.

RCRA Status: This product is "ignitable" and therefore classified as a hazardous waste under RCRA with designation D001.

State Regulations:
California Proposition 65: This product does not contain materials which the State of CA has determined to cause cancer, birth defects, or other reproductive harm.
New Jersey: Aluminum Powder is listed on the EHSL.
Pennsylvania: Aluminum powder is listed as an environmental hazard.

International Regulations:
Canadian Environmental Protection Act: This product complies with the requirements of the Canadian Environmental Protection Act for shipment to Canada. Canadian National Pollutant Release Inventory: Aluminum (dust or fume).
WHMIS Status: This product should be labeled and transported as a Class B, Division 4, Flammable Solid.

Omni Distribution, Inc.
800-277-6664

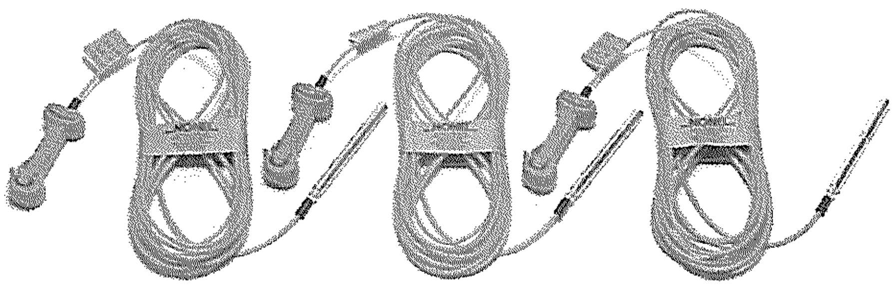
Memphis, TN

Explosive Products Division
fax: 800-508-8584

NONEL® EZ DET® 1.1B

Technical Information

Nonelectric Blast Initiation System



Product Description

NONEL® nonelectric delay detonator EZ DET® units consist of a length of orange shock tube with a surface detonator attached to one end and an in-hole, High Strength, detonator on the other. The surface detonator is inside a color-coded plastic EZ™ Connector block to facilitate easy connections to up to 6 shock tube leads. Easy-to-read, color-coded delay tags display the delay number and nominal firing time prominently.

NONEL EZ DET units can be easily connected to one another to satisfy basic blast design requirements in construction, mining, and quarry operations. They can also be used in combination with NONEL MS, NONEL EZTL™ and/or NONEL TD detonators to satisfy complex blast design requirements and minimize inventory of initiation system components.

Application Recommendations

For detailed application recommendations, ALWAYS request a copy of Dyno Nobel's *Product Manual: NONEL® and PRIMACORD®* from your Dyno Nobel representative.

- ALWAYS select a NONEL EZ DET unit having more than enough tubing length to extend from the planned primer location in the borehole to the collar of the next hole.

Properties

MSDS #1122

Net Explosive Content per 100 units 0.1125 kg
0.1782 lbs

Nominal Time (msec)	Nominal Time (msec)	Nominal Time (msec)	Connector Block Color
17 / 350	17 / 500	17 / 700	Yellow
25 / 350	25 / 500	25 / 700	Red
42 / 350	42 / 500	42 / 700	White
25 / 375			Red

Hazardous Shipping Description

Detonator assemblies nonelectric,
1.1B, UN 0360 PG II, EX 1993010191

DYNO
Dyno Nobel
Groundbreaking Performance

NONEL® EZ DET® 1.1B

Technical Information

INITIATION SYSTEMS

Application Recommendations (continued)

- ALWAYS protect the plastic EZ Connector block and all shock tube leads from impact or damage during the loading and stemming operations. Use care when placing blasting mats and cover material on top of the blasting circuit. The EZ Connector block contains a detonator and is subject to detonation caused by abuse such as impact. Shock tube which has been cut, ruptured or damaged may cause misfires.
- ALWAYS be sure that the shock tube(s) are securely inserted, one at a time, into the EZ Connector block. The head of the EZ Connector block should rise to accept the shock tube and return to a closed position with an audible click.
- ALWAYS ensure that individual shock tubes remain aligned side by side in the connector channel and do not cross one over the another on insertion.
- NEVER use NONEL EZ DET units with detonating cord. The low strength surface detonator will not initiate detonating cord and may cause misfires.
- NEVER attempt to disassemble the delay detonator from the plastic EZ Connector block or use the detonator without the connector.
- NEVER place more than 6 shock tube leads into the plastic EZ Connector block. Misfires may result.
- NEVER pull, stretch, kink or put tension on shock tube such that the tube could break.
- NEVER splice NONEL EZ DET shock tube together to extend between holes.
- NEVER connect NONEL EZ DET units together until all holes have been primed, loaded and stemmed and the blast site has been cleared.

Transportation, Storage and Handling

- NONEL EZ Det must be transported, stored, handled and used in conformity with all federal, state, provincial and local laws and regulations.
- For maximum shelf life (3 years), NONEL EZ Det must be stored in a cool, dry, well ventilated magazine. Explosive inventory should be rotated. Avoid using new materials before the old. For recommended good practices in transporting, storing, handling and using this product, see the booklet "Prevention of Accidents in the Use of Explosive Materials" packed inside each case and the Safety Library Publications of the Institute of Makers of Explosives.

Packaging

Length		Case Type	Quantity/ Case	
m	ft		case	subpack
3.5	12	D	200	100
4.5	16	D	180	90
7	24	D	150	75
9	30	DC	120	--
12	40	DC	120	--
15	50	DC	90	--
18	60	DC	90	--
24	80	DC	50	--
30	100	DC	40	--
37	120	DC	30	--

- Length rounded to nearest one-half meter.
- Case weight varies by length & delay; see case label for exact weight.

Case Dimensions

Detpak Case (DC)	48 x 45 x 26 cm	18 ¾ x 17 ¾ x 10 ¾ in
Detpak (D)		
subpack	44 x 22 x 25 cm	17 ½ x 8 ¾ x 10 in
strapped case	44 x 45 x 25 cm	17 ½ x 17 ⅝ x 10 in

Dyno Nobel Inc.
2650 Decker Lake Boulevard, Suite 300, Salt Lake City, Utah 84119 USA
Phone 800-732-7534 Fax 801-328-6452 Web www.dynonobel.com

APPENDIX F

HEALTH AND SAFETY PLAN/ACCIDENT PREVENTION PLAN

TO BE SUBMITTED AS A SEPARATE NAVY DOCUMENT FOR INTERNAL USE.

APPENDIX G

RESPONSES TO STAKEHOLDERS COMMENTS

RESPONSE TO MEDEP PROVIDED COMMENTS DATED JULY 7, 2011
DRAFT TIME CRITICAL REMOVAL ACTION WORKPLAN DATED JUNE 2011
QUARRY AREA AND SITE 12 EOD AREA
FORMER NAVAL AIR STATION BRUNSWICK (NASB), BRUNSWICK, MAINE

Note that where the comment response provides revised text, text additions are shown in bold italics and deleted text is shown as strikethrough.

GENERAL COMMENTS

1. **Comment:** MEDEP suggests that during this Time Critical Removal Action (TCRA) that the Navy complete the step outs overlooked in the 2010 removal action as noted by MEDEP in its letter of March 2, 2011. (Items S12-G1-38 (Gator Mine). S12-B7-16 (Bomb Nose Fuse) and S12-L2-02 (Fuse-unknown) were found on the edge of the investigated area, but it does not appear that the 100 foot step outs performed.)

   Response: In the case of Item S12-G1-38 (Gator Mine) an inert training aid, the survey area was extended approximately 40 feet from the item (about 10 feet to the west side of the perimeter road). It appears that this item was an isolated training aid and was not a safety issue because it was certified MDAS. No other evidence of munitions activities were identified within about 100 feet of this item which also suggests it was used as an isolated training exercise in this area.

   For Item S12-B7-16 (Bomb Nose Fuse) a step-out grid A7 was extended to the tree line south of the item to the edge of the cleared vegetation, which is approximately 80 feet from the item. This item was over 200 feet away from the nearest munitions related item and appears to be an isolated item.

   Item S12-L2-02 (Fuse-unknown) was found in the southeast corner of grid L2 near the grid boundary. Grid L2 was extended beyond the perimeter road to the northeast and the entire 100 foot by 100 foot grid was surveyed. Based on the location of the item near the inner southeast grid boundary and the lack of other items found northwest of the item beyond the road additional step-outs were not conducted.

2. **Comment:** All the laboratory and field data must be submitted in MEDEP's Electronic Data Deliverable (EDD) format (Version 5), including laboratory analytical data for all media. Laboratory analytical data should include field quality control sample results, surrogate recoveries in percent, and matrix spike/matrix duplicate recoveries in percent. Specific EDD formats and additional information can be found on MEDEP's Environmental and Geographic Analysis Database (EGAD) web page at http://www.maine.gov/dep/rwm/egad/. Any additional questions about the EDD should be referred to Diana McKenzie, the MEDEP's groundwater database manager at 207-287-5767. Also please provide a spread sheet with the co-ordinates of surveyed locations and reference point.

   Response: Agreed. Note no analytical data will be collected during this TCRA. Positional data will be collected via hand held GPS unit with submeter accuracy and

GIS data will be provided to MEDEP per Section 7.1 which has been clarified to state:,

"The recorded GPS information will be incorporated into the existing Environmental GIS (EGIS) established for the Former NAS Brunswick and will be provided to the regulatory agencies, ***in a spreadsheet containing the coordinates of each surveyed location and reference point*.**"

3. **Comment:** Please add to the workplan that the regulatory agencies will be notified at least two weeks in advance of any field work and that weekly summaries will be provided.

   Response: Agreed. Section 1.0 paragraph 3 now reads as follows;

   "The regulatory agencies, Maine Department of Environmental Protection (MEDEP) and the United Stated Environmental Protection Agency (USEPA), will be notified two weeks in advance of the start of any field work. In addition, a weekly summary of field tasks will be provided to the project team."

4. **Comment:** The document is a little confusing regarding the use of the term "Quarry Area", which MEDEP assumes is the originally identified area of concern but appears to be used interchangeably with Areas A, B and C. It is suggested that each of the areas be designated with a letter so there would be Quarry Areas A, B, C and D to avoid any confusion.

   Response: The term Quarry Area identifies the original area of concern, also denoted as the 2008 SI boundary or 2010 MEC Exploratory Investigation Boundary, as well as the site in general (i.e. Quarry Area ESS). However, the document has been reviewed and clarified to more consistently include specific areas when referencing tasks or assumptions. For example,

   Section 2.8.3.1 paragraph 1 now reads as follows:

   "Brush cutting required at the Quarry Area **(*Areas A, B, and C)*** to prepare for detector-aided surveys may include the following;"

   Section 2.10.3, paragraph 4 now reads as follows:

   "The UXO Team Leader will maintain a daily log recording, at a minimum, the location(s) excavated, the length, width, and depth of any manual excavations conducted at the Quarry Area ***(Areas A and B only)***, and a description of the MEC/MPPEH removed, including the estimated weight and number of pieces of other metallic debris."

5. **Comment:** It was unclear what if any activities were going to be performed in Quarry Area C. Please clarify.

<u>Response:</u> Section 1, paragraph 4, now includes the following text,

"No intrusive investigations will be completed in Area C. Intrusive investigation of the western area of the site (Area C) is not warranted at this time considering the sparse geophysical anomalies encountered during the 2008 SI and the absence of MEC/MPPEH at the ground surface and in the subsurface during the 2010 exploratory investigation. A detector-aided surface survey will be conducted for Area C to confirm the absence of surface MEC/MPPEH."

6. **<u>Comment:</u>** <u>Section 1.0, Site 12 EOD Area, para 1</u>: "…Maine Department of Environmental Protections (MEDEP) granted permission to perform…"

Under CERCLA, permits are not required to perform removals actions at Superfund Sites, however the Navy must meet the substantive requirements of State and Federal laws, therefore the Navy should cite the Title 38 M.R.S.A., §480, Natural Resources Protection Act (NRPA), Chapter 305 (Permit by Rule), Section 12 (Restoration of Natural Areas). MEDEP suggests including a copy of the standards in the workplan so that the contractor has a copy of the standards. Please revise.

<u>Response:</u> A copy of Chapter 305 (Permit by Rule), Section 12 (Restoration of Natural Areas), will be included as a new appendix (Appendix C-3). In addition, Section 1.0, Site 12 EOD Area, paragraph 1 has been revised as follows,

"In a comment letter dated March 2, 2011, on the Site 12 draft Interim After Action Report (IAAR), ~~Maine Department of Environmental Protection (~~MEDEP~~) granted permission~~ ***informed the Navy that clearance activities on all wetlands could occur and vegetation could be cut*** **"under the Permit by Rule standards, Natural Resources Protection Act-Restoration of a Natural Area"** ***(Title 38 M.R.S.A., §480, Natural Resources Protection Act [NRPA], Chapter 305 [Permit by Rule], Section 12 [Restoration of Natural Areas])*** ~~*to perform clearance activities on all wetlands and for the vegetation to be cut."*~~

The first sentence of Section 2.8.3.2 will be revised to read:

"***Although the Navy is not conducting removals that will significantly disturb the wetlands and it is anticipated that wetland vegetation will recover in one or two field seasons, s***~~S~~pecial consideration will be required for vegetation removal in the Site 12 EOD Area wetlands***, following the Intent of the Natural Resources Protection Act-Restoration of a Natural Area" (Title 38 M.R.S.A., §480, Natural Resources Protection Act [NRPA], Chapter 305 [Permit by Rule], Section 12 [Restoration of Natural Areas]).***

The following will be added to the Section 2.8.3.2 bullets:

- "***Prior to initiation of work, a biologist from Tetra Tech will assess site conditions in the wetland areas to help the munitions team plan for the fieldwork and minimize impacts to the wetland, etc.***"

7. **Comment:** Section 1.3.1, Quarry Area, para 6, last sentence: "Figure 5 in Appendix A shows the approximate location of the fence."

It appears from the figure that just Areas A and C are going to be fenced. What is the Navy's plan for Area B recently identified north of the access road?

Response: Figure 5 represents the approximate location of the land use control fence and the final fence design will be based on the results of TCRA. In addition, it is unlikely that Area B contains MEC/MPPEH. However, in the event that MEC/MPPEH are identified during the detector-aided survey or the intrusive investigation the Navy will consider fencing the area, at that time. Regardless, Area B would require a separate fence since the road separates it from the other two areas.

Section 1.3.1, paragraph 6 now reads as follows,

"Due to these findings, a perimeter fence will be installed, under a separate task order, around the accessible portions of the Quarry Area and *Areas A and C*, which will provide engineering controls for safety at the Quarry Area following base transfer. ***Area B is not expected to contain MEC/MPPEH items, however if MEC/MPPEH items are found during the TCRA a separate fence will be considered for this area considering the road separates Area B from Areas A and C."***

8. **Comment:** Section 1.3.2, Site 12 EOD Area: The conceptual site model (CSM) needs to be updated based on the 1978 aerial photo, sent with MEDEP's March 2, 2011 letter, that seemed to show that there was another historic berm located to the northeast of the present berm. That would have been prior to the known use of the Explosives Ordnance Disposal (EOD) area from 1981-2004.

Response: Agreed. The following was added to Section 1.3.2, Site 12 EOD Area,

"In a letter from MEDEP, dated March 2, 2011 another apparent historical berm location was identified in a 1978 aerial photograph located northeast of the current berm location. This berm indicated usage of the area prior to 1981 data indicated in the PA and is shown in Figure 3 in Appendix A."

9. **Comment:** Section 2.3.1, Off-Site MEC Disposal: Please identify where this off-site disposal will occur. If it does become necessary to dispose of MEC off site how will transport be handled?

Response: This section specifically relates to the rare event that munitions items identified are beyond the scope of the TCRA Work Plan; any item deemed beyond the capabilities of the Tetra Tech UXO personnel will be disposed of solely at the discretion of the military EOD component in Rhode Island. The transportation, treatment, and disposal of such an item will be at the discretion of EOD Mobile Unit 12 DET Newport Rhode Island. No change to the document is required.

10. **Comment:** Section 2.4.1, Quarry Area, para 1, bullet 4: Please discuss how the anomalies to be hand-dug will be selected.

Response: The anomalies to be hand-dug will be selected by the Tetra Tech project team. The minimum (30) anomalies to be investigated will be selected to provide adequate spatial coverage of Area A and Area B while the maximum (60) will allow for flexibility in the field should numerous MEC/MPPEH items need characterization.

Section 2.4.1, Quarry Area, para 1, bullet 4 has been expanded as follows;

"Subsurface manual (hand dig) investigation of a minimum ~~total~~ of 30 and maximum of 60 subsurface anomalies detected during the detector-aided survey and associated with suspected munitions burial trenches or pits in Areas A and B (minimum 15 hand digs in each area) to depths no greater than 2 feet bgs. ***Subsurface anomalies to be investigated will be determined by the Tetra Tech project team for adequate coverage of the suspect area."***

11. **Comment:** Figure 2: Please show on this figure the area of the Quarry that has already had the detector-aided surface survey and geophysical survey boundary performed in 2008.

Response: The Site Boundary (orange) identified in Figure 2 is approximately the extent of the detector-aided surface survey (2008) with the exception of the western edge of the boundary which overlaps with the wooded portion of the Area C. An additional boundary included in Figure 2 would make the figure hard to read. The geophysical data from the 2008 SI is presented in Figure 4 and the title of the figure has been expanded as follows,

"RESULTS OF **2008 SI** AND 2010 EXPLORATORY MEC INVESTIGATION"

12. **Comment:** Section 2.4.2, Site 12 EOD Area, para 1, bullet 3: MEDEP staff has walked this area with the Navy and while it may be too steep for a wheeled EM 61/31 unit, it appears that a hand held detector could be used.

Response: The decision to avoid the rocky slope was made by the Tetra Tech Site Safety Officer during the 2010 SI. The area will be reviewed during the TCRA and all portions of the area which can be surveyed safely will be with the Schonstedt GA-52Cx. All remaining areas will be visually inspected. In addition, GPS coordinates will be collected to more accurately reflect the areas which could not be safely surveyed. Section 2.4.2, Site 12 EOD Area, para 1, bullet 3 and 4 have been revised as follows,

- ***"Inspect the steep rocky slope for any changes to site conditions which may allow access to the area. Collect GPS coordinates of the boundary of inaccessible areas.*** Visual survey *of* ***any inaccessible areas*** of the steep rocky slope using binoculars or a similar visual aid.

- Surface investigation and surface MEC/MPPEH removal at the Site 12 EOD Area within the designated wetlands ***and any accessible portions of the steep rocky slope*****,** as necessary."

13. **Comment:** Section 2.4.2, Site 12 EOD Area, para 2, bullets 1 & 2: Please see comment 1 above and revise to include the areas that were identified as part of MEDEP's comment letter of March 2, 2011 needing further investigation to this list.

    Response: See response to Comment 1 above.

14. **Comment:** Section 2.4.2, Site 12 EOD Area, para 2, bullet 4: This appears to be two bullets. Please review and correct, as necessary.

    Response: Bullet 4 is correct as is; however, for clarification the following revision has been made,

    "The steep rocky slope was not investigated during the MEC TCRA in 2010 due to safety concerns. This area will be investigated during this TCRA by visual survey only. MEC/MPPEH will only be treated/removed from its original location if it is determined safe to do so based on ~~***site***~~***the slope*** conditions. Other observed items will be reported to the Navy POC for treatment."

15. **Comment:** Section 2.4.2, Site 12 EOD Area, para 2, bullet 6: MEDEP would prefer if any drums are found that they are left in place, logged in the field notes and recorded with a global positioning system (GPS) so that they can be investigated as part of the RI.

    Response: Agreed. Drums are not expected to be found on site since the 2010 surface clearance event took place and most all of the Site 12 ground surface has already been addressed; however, bullet 6 has been revised as follows;

    "Non-munitions items small enough to be moved by hand such as tire rims and shovel heads located during the detector-aided surface surveys will be moved to a nearby location, and marshalling and off-site disposal of non-munitions debris will be deferred to the Remedial Investigation (RI). ***Although unexpected, any drums identified at Site 12 will remain in place, documented, and location coordinates recorded.*** After removal of the non-munitions debris, a detector-aided surface survey will be conducted to ensure that no surface MEC/MPPEH are visible beneath the non-munitions item."

16. **Comment:** Section 2.8.2, Site Security: Please describe in more detail how the sites will be secured since the military no longer has a presence on the Base.

    Response: The sites will be secured during MEC/MPPEH clearance operation, which includes all vegetation management and UXO detector-aided surface surveys by the Tetra Tech UXO technicians. An exclusion zone will be set up using barricades, signs, and flags at access points to the area. Section 2.8.2 has been revised and expanded as follows;

"Site security will be maintained ***during MEC/MPPEH clearance operations*** to ensure that non-essential personnel do not access the area ~~during MEC/MPPEH clearance operations~~. A***n EZ intended to keep non-essential persons from being exposed to hazardous blast overpressure and fragments resulting from an unintentional detonation of the MGFD will be established at each site and controlled by barricades at each access point. Each barricade will be marked with the name and number of the person who can be contacted to request access. A red Bravo flag shall be displayed near main access points when MEC/MPPEH operations are in progress. Security for treatment and blow-in-place (BIP) operations will be set outside the EZ, and the area will be checked for the presence of staff and intruders.***"

The acronyms are previously defined in the section. However, for informational purposes, the acronym MGFD noted in the response is 'munition with the greatest fragmentation distance' and 'bravo flag' refers to a distinctive red colored signal flag displayed to warn of munitions operations in progress as a safety measure.

17. **Comment:** Section 2.10.1, Subsurface: Please see comment 10 above.

Response: See Response to Comment 10 above. The anomalies to be hand-dug will be selected by the Tetra Tech project team. Section 2.10.1, subsurface sentence 1 has been revised as follows;

"Subsurface anomalies ***chosen by the Tetra Tech project team*** ~~designated~~ for investigation **to provide adequate coverage** based on the results of detector-aided surveys conducted during TCRA activities in Areas A and B at the Quarry Area (see Figure 2 in Appendix A) will be cleared to a depth no greater than 2 feet bgs."

18. **Comment:** Section 2.10.3, General Techniques, para 1: "If an item cannot be treated on the same day it is discovered, the SUXOS will maintain security of the item…"

Please describe briefly how the item will be secured since the Base no longer has a military presence.

Response: Section 2.10.3 General Techniques, paragraph 1 states "Tetra Tech or third party security personnel will maintain security of the item until it is treated or until responsibility for its security is transferred to the Navy POC." Tetra Tech or a third party security personnel will remain at the site over night to ensure that no one disturbs the MEC/MPPEH item. No change to the text is required.

19. **Comment:** Section 2.12, Reporting and Disposition of MEC, para 1: "Detonation operations will be performed on the day an MEC item is discovered, if possible."

Section 2.10.3 states that all explosives will be ordered on demand, how does this reconcile with detonating MEC items the day they are found?

Response: Explosives will be procured from a local vender if possible enabling same day delivery and treatment if an item is identified early enough in the day. This is the preferred option. However, if explosives cannot be received same day or an item is located too late in the day to safely dispose of the item then per the response to Comment 18, Tetra Tech or third party security personnel will be tasked with remaining on site to secure the item, until it can be detonated as soon as possible the following day. Section 3 discusses the explosives acquisition and management. Note Section 3.2.1, paragraph 2 states “explosives will be purchased from a local vender, such as: Austin Powder Company”, which is a local vendor located in Hudson, Maine, approximately 2 hours away. No text change required.

20. **Comment:** Section 4.1, Ordnance and Explosives Areas: The minimum separation distances for the areas are: the Quarry Area - 195 feet and Site 12 - 132 feet. What is driving the Quarry Area to have a larger minimum separation distance than the EOD pit?

Response: The minimum separation distance is based on the munition item with the highest Hazardous Fragmentation Distance (HFD) expected to be found at each site. For the Quarry that item is the Mk 40 2.75 inch rocket motor which has an HFD of 195 feet. The Site 12 HFD is 132 feet and based on the 40mm MkII.

21. **Comment:** Section 4.3.2, Collection Points: “No detonation explosives or recovered MEC/MPPEH will be stored on site; all items will be addressed on a daily basis.”

The above statement appears to contradict Section 2.10.3 which states: “If an item cannot be treated on the same day it is discovered, the SUXOS will maintain security of the item…” Please clarify.

Response: No detonation explosives will be stored on site. Any explosives received on a given day will be used in a treatment detonation or clean up shot at the end of each day per section 4.4 Explosive storage magazines. Care will be taken to order the quantity required for a given day. As discussed in response to Comment 18, MEC/MPPEH items will be treated on the day they are found, if possible. If not, the item will be secured by Tetra Tech or a third party security personnel. However, there will be no planned storage of MEC/MPPEH on site in magazines or other storage device. No text change required.

22. **Comment:** Section 10.0, Quality Control Plan, Table:

a.) Site Preparation: In addition to notifying local authorities MEDEP suggests putting a notice in the local newspapers to alert neighbors of the potential of detonations during this removal action.

b.) Detector-Aided Survey, Site 12 EOD Area and Quarry Area: Do these activities include Area C of the Quarry Area?

Response:
a) Based on previous investigations, which addressed the primary areas of concern at the sites, only a few detonations of limited munitions-related items requiring treatment are expected during the TCRA. In addition, the use of engineering controls such as sand bags to tamp the detonation will be used to minimize the effects and noise resulting from detonation of donor charges. Therefore, no public notices are warranted.

b) Yes, a detector-aided survey of Quarry Area Area C will be performed. The task heading has been revised as follows;

"Site 12 EOD Area and Quarry Area **(*Areas A, B, and C)"***

23. **Comment:** Table 10-1, Detector-Aided Survey: See comment 4 above and please clarify which areas of the Quarry are being discussed.

Response: See responses to comments 4 and 22b above. Table 10-1, Detector-Aided Survey was revised as follows:

"UXO Technicians, supervised by the SUXOS, will complete a grid/target inspection to collect data on the type and location of MEC ***on the surface*** at the sites and will remove MEC/MPPEH from the surface within the Quarry Area ***(Areas A, B, and C)*** and Site 12 EOD Area.

For the Quarry Area ***(Areas A and B)*** generally determine the extent of the construction debris and landfilling operations; surface and subsurface and evaluate in real-time the results of detector-aided survey to locate suspected burial trenches, pits, or subsurface anomaly areas."

24. **Comment:** Appendix B, Project Specific Contact Information:

a.) Please identify the Navy's Point of Contact (POC) as that person's responsibilities are outlined in Section 11.0.

b.) Please correct the spelling of my last name in the email address to sait. (claudia.b.sait@maine.gov).

Response:
a) Navy's Point of Contact Robert LeClerc has been added to Appendix B-2.

b) The correction has been made.

25. **Comment:** Appendix B, Project Organization Chart: Please complete prior to finalizing the workplan and add the Navy's POC.

Response: The Navy's POC has been added and the chart finalized.

RESPONSE TO UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 1 PROVIDED COMMENTS DATED AUGUST 8, 2011
DRAFT MUNITIONS & EXPLOSIVES OF CONCERN TIME-CRITICAL REMOVAL ACTION WORK PLAN, DATED JUNE 2011
QUARRY AREA AND SITE 12 EOD AREA FORMER NAVAL AIR STATION BRUNSWICK (NASB), BRUNSWICK, MAINE

Note that where the comment response provides revised text, text additions are shown in bold italics and deleted text is shown as strikethrough.

1. **Comment:** **Figure 5 - Former Quarry Area Fence Layout**: Based on the results of the detector-aided surface surveys and shallow subsurface intrusive investigations that are planned for the former Quarry Area, the proposed fencing delineation depicted in this figure may need to be revised. Please note this somewhere within the document.

   Response: Figure 5 represents the approximate location of the land use control fence and the final fence design will be based on the results of TCRA. In addition, it is unlikely that Area B contains MEC/MPPEH. However, in the event that MEC/MPPEH are identified during the detector-aided survey or the intrusive investigation the Navy will consider fencing the area, at that time. Regardless, Area B would require a separate fence since the road separates it from the other two areas.

   Section 1.3.1, paragraph 6 now reads as follows,

   "Due to these findings, a perimeter fence will be installed, under a separate task order, around the accessible portions of the Quarry Area and *Areas A and C*, which will provide engineering controls for safety at the Quarry Area following base transfer**.** ***Area B is not expected to contain MEC/MPPEH items, however if MEC/MPPEH items are found during the TCRA a separate fence will be considered for this area considering the road separates Area B from Areas A and C."***

2. **Comment:** **Section 2.4.2 Site 12 EOD Area Technical Scope**: EPA recommends that in addition to the detector-aided surveys to be completed in the debris area identified north of the perimeter road, the Navy also conduct "step out" detector-aided surveys in the vicinity of the former gator mine location (S12-G1-38) and the former "fuse, unknown" location (S12-L2-02) given their proximities to the perimeter road which defined the extent of the previous survey area.

Response: In the case of Item S12-G1-38 (Gator Mine) an inert training aid, the survey area was extended approximately 40 feet from the item (about 10 feet to the west side of the perimeter road). It appears that this item was an isolated training aid and was not a safety issue because it was certified MDAS. No other evidence of munitions activities were identified within about 100 feet of this item which also suggests it was used as an isolated training exercise in this area.

Item S12-L2-02 (Fuse-unknown) was found in the southeast corner of grid L2 near the grid boundary. Grid L2 was extended beyond the perimeter road to the northeast and the entire 100 foot by 100 foot grid was surveyed. Based on the location of the item near the inner southeast grid boundary and the lack of other items found northwest of the item beyond the road additional step-outs were not conducted.

APPENDIX H

ADDENDUM TO TCRA WORKPLAN

APPENDIX H

MEC TCRA WORK PLAN ADDENDUM
QUARRY AREA
FORMER NAS BRUNSWICK
BRUNSWICK, ME

1.0 INTRODUCTION

This Time-Critical Removal Action (TCRA) Work Plan Addendum was prepared by Tetra Tech, Inc. (Tetra Tech) as an addition to the Munitions and Explosives of Concern (MEC) TCRA Work Plan for Quarry Area and Site 12 Explosive Ordnance Disposal (EOD) Area at former Naval Air Station (NAS) Brunswick, Maine (Tetra Tech, 2011) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-03-D-0057, Contract Task Order (CTO) 069.

The results of the 2011 MEC TCRA performed by Tetra Tech identified surface and subsurface MEC/munitions potentially presenting and explosive hazard (MPPEH) items within 100 feet of the 2011 TCRA Quarry Area investigation boundary (Figure 1). These discoveries have prompted additional investigation beyond the originally anticipated investigation boundary depicted first as orange (2010) and then later as pink (2011) lines in Figure 1. Additionally, during installation of the Quarry Area security fence that was performed at the conclusion of the 2011 MEC TCRA, an M28 rifle grenade was located during unexploded ordnance (UXO) escort operations. The item was located east of the Quarry rock face beyond the TCRA investigation scope and the perimeter of the Quarry Area security fence; therefore, EOD personnel from Newport, Rhode Island, responded and detonated the item. The scope presented in this addendum will primarily delineate the horizontal extent of MEC/MPPEH beyond the current MEC TCRA Quarry Area limits of investigation.

All operations will be performed in accordance with the following approved documents.

- MEC TCRA Work Plan for Quarry Area and Site 12 Explosive Ordnance Disposal Area at former Naval Air Station Brunswick (Tetra Tech, 2011),

- Department of Defense Explosives Safety Board (DDESB)-approved Explosives Safety Submission (ESS) (Tetra Tech, 2012), as amended based on the scope of work described in this Addendum, and

- Health and Safety Plan (HASP) for Exploratory MEC Investigation of Quarry Area, NAS Brunswick, Maine (October 2010).

The additional scope is outlined and will be performed as presented in this addendum.

2.0 SCOPE

The Quarry Area has been divided into multiple decision units (DUs) to facilitate the munitions constituents (MC) investigation, which will be detailed in a separate document and conducted following implementation of this TCRA MEC Addendum. The scope of the remaining MEC investigation involves four of the nine DUs, DU 1 (Grid A6 Completion), DU 3 (Northern Area Completion), DU 6 (Area East of the Rock Face), and DU 7 (Southern Area), as shown on Figure 1.

The scope of this addendum includes two general areas of investigation, inside the Quarry fence (DU 1 and DU 3) and outside the Quarry fence (DU 6 and DU 7). Inside the Quarry fence, DU 1 (Grid A6 Completion) is the remaining portion of Grid A6 that was not completed during the 2011 MEC TCRA and is shaded peach on Figure 1. Also inside the Quarry fence, DU 3 (Northern Area Completion) is north-northeast of the Quarry floor and east of the rock face and is shaded green on Figure 1. DU 6 (Area East of the Rock Face) extends 400 feet from the fence and 300 feet from Old Route 24 north. DU 6 is depicted by the blue transects on Figure 1. DU 7 (Southern Area) is located approximately 400 feet south of Old Route 24 and is depicted by purple transects on Figure 1.

The following activities are included in the approved scope of work for DU 1, DU 3, DU 6, and DU 7:

- Vegetation management
- UXO detector-aided surface surveys in all four DUs
- Flagging of suspect subsurface anomalies (except in DU3)
- Intrusive investigation of suspect anomalies within DU 1, DU 6, and DU 7
- Providing UXO escort operations during pending MC investigation activities

Figure 2 is a flowchart describing the technical approach for the work to be conducted under this amendment.

3.0 MOBILIZATION/DEMOBILIZATION

The field work is currently scheduled to begin in April 2012. It is anticipated that it will take approximately three 10-day shifts, including mobilization, to complete the field effort. The work will be conducted by six UXO-qualified technicians, as defined in DDESB Technical Paper (TP)-18. The UXO-qualified personnel will include one Senior UXO Supervisor (SUXOS), one UXO Safety Officer (UXOSO)/Quality Control Specialist (QCS), one UXO Team Leader, and three UXO Technicians. UXO personnel will review the 2011 MEC TCRA Quarry Area and Site 12 Explosive Ordnance Disposal Area Work Plan including this

Addendum, the site-specific HASP, and Amended ESS prior to field activities at the site. In addition, an orientation meeting will be held, prior to the start of field activities, to familiarize personnel with the scope of the field activities.

4.0 SCOPE – OUTSIDE QUARRY SECURITY FENCE, DU 6 AND DU 7

4.1 Site Set-Up

Step-out transects (DU 6 and DU7) will be established at 50-foot intervals running north and south to the existing 2011 MEC TCRA boundary (fence line). The location coordinates for the DU 6 and DU 7 step-out transects will be provided and recorded using a hand-held global positioning system (GPS) unit. Step-out transects will be located and marked using flagging tape and/or survey stakes (Figure 1).

4.2 Step-Out Transects

4.2.1 Vegetation Management – Step-Out Transects

Vegetation management will be performed first along step-out transects 0 to 200 feet from the extent of the previous investigation at 50-foot intervals (Figure 1 solid transect lines). Oversized material will be chipped. The brush cutting effort produced a large amount of brush; therefore, a wood chipper will be rented to aid in clearing the site. Wood chip piles will be formed outside of grid areas to the extent possible and within a grid only when absolutely necessary. Any wood chip piles within a grid will not exceed 2 to 3 inches in height and spreading will occur as necessary.

4.2.2 UXO Detector-Aided Surface Survey – Step-Out Transects

Detector-aided surface surveying will be performed along each step-out transect using a Schonstedt GA-52Cx ferrous metal detector and White's Spectrum XLT all-metals detector. If surface MEC/MPPEH are recovered during the detector-aided surface survey, the step-out transect will be extended in contingency 50-foot increment step-outs until one of the following occurs:

- A buffer of 100 feet from the last recovered MEC/MPPEH is established.
- The step-out investigation area boundary is reached (Figure 1 dashed transect lines).

A record will be kept of the number of subsurface contacts along the step-out transects. Up to 20 subsurface anomalies suspect for MEC/MPPEH per DU will be flagged (40 total) for intrusive investigation within the step-out transects. Locations for intrusive investigation will be chosen by the Tetra Tech project team. Coordinates for each flagged intrusive location will be logged using a hand-held GPS.

4.2.3 Intrusive Investigation – Step-Out Transects

Intrusive hand digs of up to 20 suspect subsurface anomalies per DU along transect lines, 40 total, will be completed. Each selected anomaly will be investigated until the excavation is clear of all detectable anomalies greater than 20 millimeters (mm) or until the hand excavation reaches a radius of 2 feet from the pin flag and a depth of 2 feet below ground surface (bgs). If anomalies potentially representing MEC/MPPEH are determined in the field to be deeper than the 2-foot-deep manual excavation, that information will be recorded in the logbook along with the location of the excavation. All transect UXO intrusive operations will be performed and recorded in accordance with the approved MEC TCRA Quarry Area and Site 12 EOD Area Work Plan. Results of the intrusive investigation will be documented with photographs and in the field log describing each anomaly source, size, and depth.

4.3 Step-Out Grids

4.3.1 Vegetation Management – Step-Out Grids

Vegetation management will be performed within all grids bound by step-out transects (including contingency step-out transects). The location coordinates for the DU 6 and DU 7 Grids will be provided and recorded using a hand-held GPS. Grids will be located and marked using flagging tape and/or survey stakes.

4.3.2 Detector-Aided Surface Survey – Step-Out Grids

Detector-aided surface surveying will be performed on each grid using a Schonstedt GA-52Cx ferrous metal detector and White's Spectrum XLT all-metals detector. A record will be kept of all subsurface contacts per grid. Up to 30 subsurface anomalies suspect for MEC/MPPEH per DU will be flagged (60 total) for intrusive investigation within the step-out grids during the detector-aided surface survey. The investigated anomalies will be selected by the Tetra Tech project team. Coordinates for each flagged intrusive location will be logged using a hand-held GPS.

4.3.3 Intrusive Investigation – Step-Out Grids

Intrusive hand digs of up to 30 subsurface anomalies per DU, 60 total, will be completed to a maximum depth of 2 feet bgs. Each selected anomaly will be investigated until the excavation is clear of all detectable anomalies greater than 20 mm or until the hand excavation reaches a radius of 2 feet from the pin flag and a depth of 2 feet bgs. If anomalies potentially representing MEC/MPPEH are determined in the field to be deeper than the 2-foot-deep manual excavation, that information will be recorded in the logbook along with the location of the excavation. All grid UXO intrusive operations will be performed and recorded in accordance with the approved MEC TCRA Quarry Area and Site 12 EOD Area Work Plan.

Results of the intrusive investigation will be documented with photographs and in the field log describing each anomaly source, size, and depth.

5.0 SCOPE – INSIDE QUARRY SECURITY FENCE, DU 1 AND DU 3

5.1 Site Set-Up

The location coordinates for the DU 1 and DU 3 non-investigated areas will be provided and recorded using a hand-held GPS. The DU boundaries will be located and marked using flagging tape and/or survey stakes (Figure 1). When performing operations within the vicinity of the Quarry rock face, deviation from the provided boundary may be necessary to ensure the safety of site personnel. Any changes or deviations from the provided boundary will be documented and reported. Personnel will work no closer than 4 feet from the Quarry rock face boundary. If an area cannot be physically accessed, a visual survey of the area will be performed to the extent possible. All three gates associated with the Quarry Area security fence will remain open during operations within the fence to allow for egress.

5.2 Vegetation Management

Vegetation management will be performed in the DU 1 and DU 3 areas as necessary.

5.3 Detector-Aided Surface Survey

5.3.1 DU 1

Detector-aided surface surveying will be performed in DU 1 using a Schonstedt GA-52Cx ferrous metal detector and White's Spectrum XLT all-metals detector. A record will be kept of the number of subsurface contacts per grid. Up to 10 subsurface anomalies suspected MEC/MPPEH in DU 1 will be flagged for intrusive investigation during the detector-aided surface survey to aid in determining the extent of the suspect historical detonation area. Locations for intrusive investigation will be chosen by the Tetra Tech project team. Coordinates for each flagged intrusive location will be logged using a hand-held GPS.

5.3.2 DU 3

A detector-aided surface survey will be performed in DU 3 in all accessible areas using a Schonstedt GA-52Cx ferrous metal detector and White's Spectrum XLT all-metals detector.

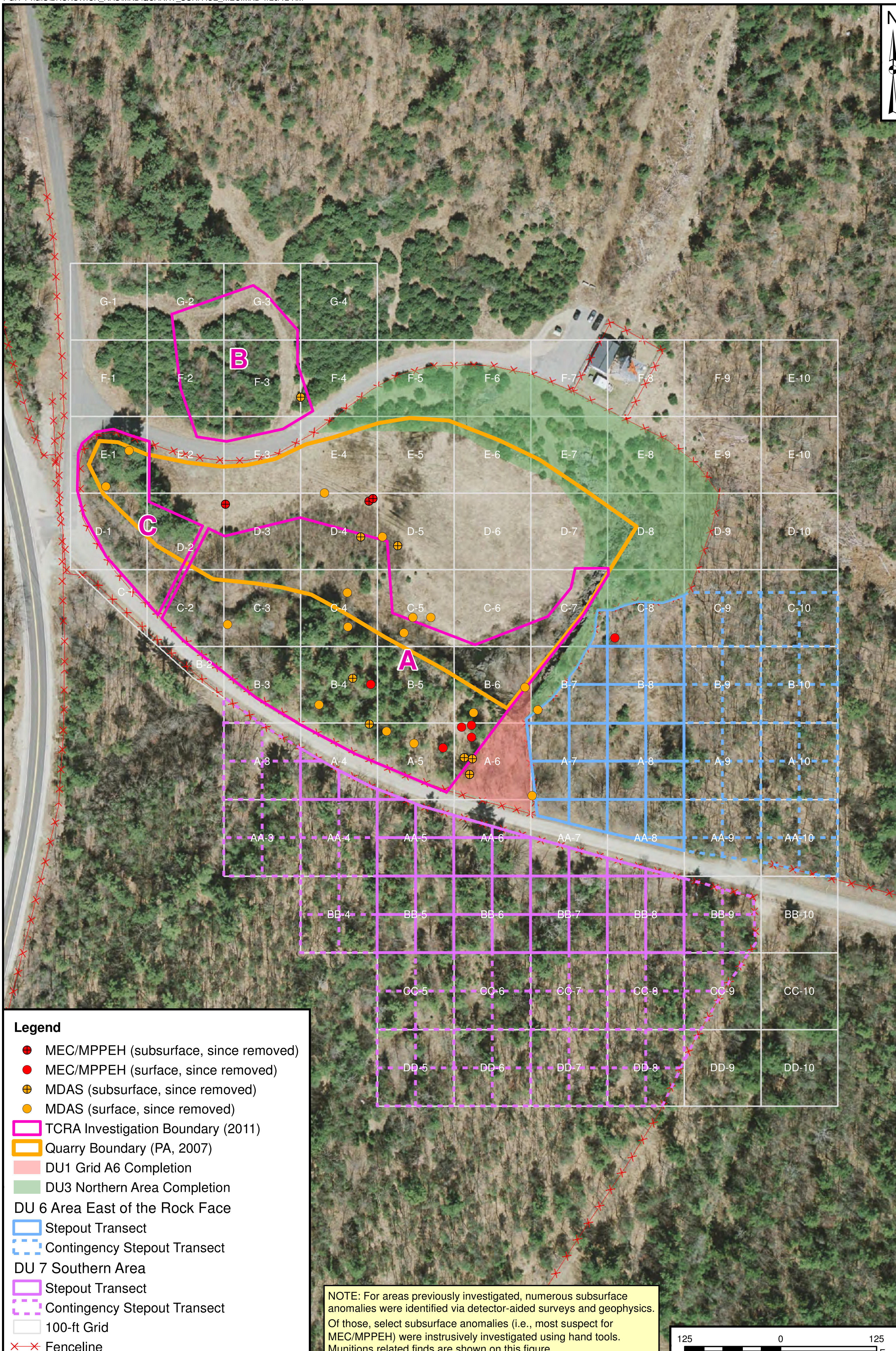
5.4 Intrusive Investigation – DU 1

Intrusive hand digs of up to 10 anomalies will be conducted in DU 1. Each selected anomaly will be investigated until the excavation is clear of all detectable anomalies greater than 20 mm or until the hand excavation reaches a radius of 2 feet from the pin flag and a depth of 2 feet bgs. If anomalies potentially representing MEC/MPPEH are determined in the field to be deeper than the 2-foot-deep manual excavation, that information will be recorded in the logbook along with the location of the excavation. All UXO intrusive operations will be performed and recorded in accordance with the approved MEC TCRA Quarry Area and Site 12 EOD Area Work Plan. Results of the intrusive investigation will be documented with photographs and in the field log describing each anomaly source, size, and depth.

6.0 SCOPE – UXO ESCORT OPERATIONS

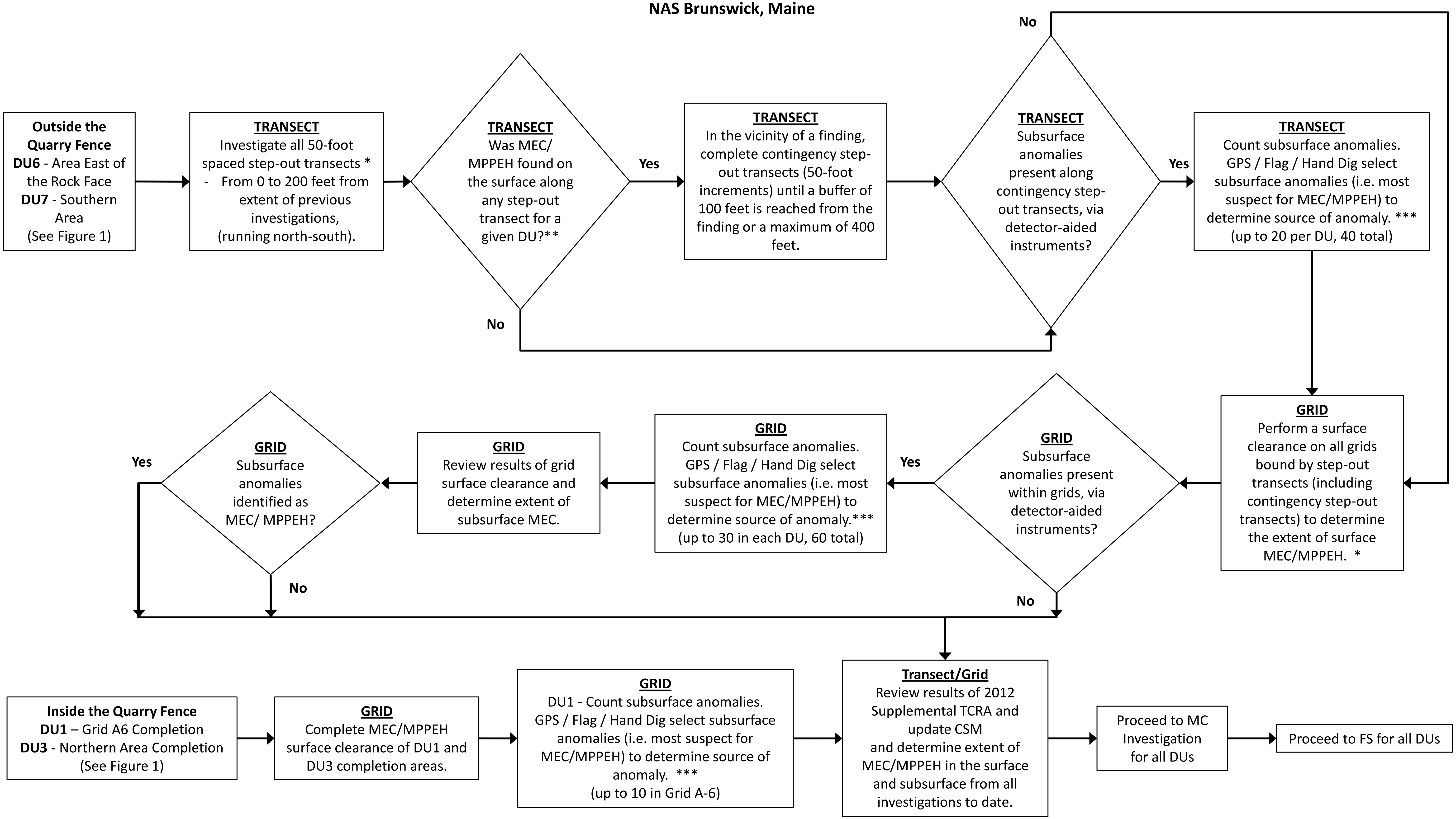
A UXO Technician will be assigned UXO escort/avoidance activities as needed during MC sampling activities to prevent accidental exposure to potentially hazardous ordnance items. The UXO Technician will meet the qualifications of a UXO Technician II at a minimum. The scope of the MC sampling will be provided in the Quarry Area MC Investigation Sampling and Analysis Plan (SAP), which is currently being prepared by Tetra Tech. The requirements of the UXO escort are provided in the DDESB-approved ESS Amendment (Tetra Tech, 2012).

PGH P:\GIS\BRUNSWICK_NAS\MXD\QUARRY_SURFACE_MEC.MXD 1/20/12 KM



DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
K. MOORE	1/11/12		___	069
CHECKED BY	DATE	2012 SUPPLEMENTAL MEC INVESTIGATION STRATEGY	APPROVED BY	DATE
E. LOVE	1/20/12	QUARRY AREA	___	___
REVISED BY	DATE	FORMER NAVAL AIR STATION BRUNSWICK	APPROVED BY	DATE
___	___		___	___
SCALE AS NOTED		BRUNSWICK, MAINE	FIGURE NO. 1	REV 0

Figure 2
2012 Supplemental TCRA MEC Investigation Strategy
Quarry Area
NAS Brunswick, Maine



* Clearance to the extent possible; trees and brush less than 2 inches will be cut.

** All MEC/MPPEH items identified during the MEC Investigation will be detonated and/or removed, as warranted.

*** Based on the results of the detector-aided surveys select subsurface anomalies (i.e., most suspect for MEC/MPPEH) will be identified and intrusively investigated using hand tools.