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Time Critical Munitions and Explosives of Concern Removal Action Work Plan for Site 12 Explosive Ordnance Disposal Area and Former Munitions Bunker West Area

Naval Air Station Brunswick
Brunswick, Maine

Naval Facilities Engineering Command Mid-Atlantic

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TIME CRITICAL MUNITIONS AND EXPLOSIVES OF CONCERN REMOVAL ACTION WORK PLAN FOR SITE 12 EXPLOSIVE ORDNANCE DISPOSAL AREA AND FORMER MUNITIONS BUNKER WEST AREA

NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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TABLE

NUMBER

10-1 Quality Requirements for UXO Support to the Navy at NASB, Brunswick, Maine

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
CY	cubic yard
DDESB	Department of Defense Explosive Safety Board
DID	Data Item Description
DoD	Department of Defense
DoN	Department of Navy
DOT	Department of Transportation
EFT	Equipment Function Test
EGIS	Environmental Geographical Information System
EM	Engineering Manual
EOD	Explosives Ordnance Disposal
EODT	Explosives Ordnance Disposal Technology
ESQD	explosive safety quantity distance
ESS	Explosive Safety Submission
EZ	exclusion zone
FAR	Federal Acquisition Regulations
FMBW	Former Munitions Bunker West
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

HFD	Hazardous Fragmentation Distance
HTRW	hazardous, toxic, or radiological waste
IBD	Inhabited Building Distance
ITS	Instrument Test Strip
MC	Munitions Constituents
MD	munitions debris
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	miles 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
NASB	Naval Air Station Brunswick
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEW	net explosive weight
NFA	no further action
NOSSA	Navy Ordnance Safety and Security Activity
OE	Ordnance and Explosives
OP	Operations Pamphlet
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
RCWM	Recovered Chemical Warfare Material
RI	Remedial Investigation
RPM	Remedial Project Manager

SAP	Sampling and Analysis Plan
SDZ	Surface Danger Zone
SI	Site Inspection
SOP	Standard Operating Procedure
SOW	Scope of Work
SUXOS	Senior Unexploded Ordnance Supervisor
Tetra Tech	Tetra Tech NUS, Inc.
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
USAESCH	United States Army Engineering and Support Center, Huntsville
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
UXOQC	Unexploded Ordnance Quality Control
UXOSO	Unexploded Ordnance Safety Officer

1.0 INTRODUCTION

This Time Critical Munitions and Explosives of Concern (MEC) Removal Action Work Plan describes the technical approach for performing MEC removal action activities to address the past use of MEC at Munitions Response Program (MRP) sites at Site 12 Explosive Ordnance Disposal (EOD) Area and Former Munitions Bunker West (FMBW) Area at Naval Air Station Brunswick (NASB), located in Brunswick, Maine. Tetra Tech NUS, Inc. (Tetra Tech) is performing this work under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62470-08-D-1001, Contract Task Order (CTO) WE09. This Work Plan was prepared in accordance with the CTO Scope of Work (SOW), identified in Appendix A. The SOW and activities addressed in this Work Plan and the Site-Specific Health and Safety Plan (HASP)/Accident Prevention Plan (APP), provided for Navy purposes as a separate internal document, will also be addressed in an Explosive Safety Submission (ESS), a separate internal document for Navy use and approval by Department of Defense Explosive Safety Board (DDESB), pending regulatory agency approval of this Time Critical MEC Removal Action Work Plan. Key MEC calculation sheets, explosive arc figures, and additional information associated with the pending ESS are contained in Appendices G and I.

The purpose of MEC removal action activities at Site 12 EOD Area and FMBW Area is to clear the surface from a munitions explosive hazard perspective, and to later proceed to munitions constituents (MC) sampling at these areas. The MEC removal action will 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 (CSM) for Site 12 EOD Area and FMBW Area and to plan future phases of investigation, including the Site Inspection (SI) for MC and the Remedial Investigation (RI) for MC and MEC.

At FMBW Area, this effort will also include subsurface clearance to allow for future unrestricted land use. Additional geophysical surveys are not necessary for FMBW Area. For FMBW Area, this investigation/clearance will provide a basis for a decision of no further action (NFA) or further limited response actions, and will allow the MC SI to proceed. At Site 12 EOD Area, as part of the Base Realignment and Closure (BRAC) property transfer process, construction of the Marine Corps Armed Forces Reserve Center, to be located north of the site (see Figure 8 of Appendix B), is scheduled to begin in Spring 2010, with various studies for the construction design to begin prior to that date. In order to ensure the safety of workers associated with the construction project, surface clearance will be performed to protect against potential exposure to MEC and other munitions-related items that may be on site at Site 12 EOD Area. For example, construction vehicles and foot traffic are expected in and around the construction effort associated with the proposed Marine Corps Armed Forces Reserve Center, and this

area may overlap Site 12 EOD Area. This effort will also aid in planning for follow-on geophysical surveys for areas outside of the historical/existing berm area [areas where MEC/material potentially presenting an explosive hazard (MPPEH) are discovered], intrusive investigation during a future RI [results of trenching activities will be used to gain a clear understanding of the type of subsurface MPPEH [material documented as safe (MDAS) and material documented as an explosive hazard (MDEH)], MEC, and non-MEC materials, soil characteristics, depth of burial of MEC, and general depths to bedrock and/or groundwater], and will allow the MC SI to later proceed at Site 12 EOD Area. Results of the MEC investigation, surface clearance, and trenching, such as types of MEC discovered, locations of discoveries, and physical condition and description of discoveries, will be used to focus MC sampling efforts in locations where MC are expected. MC sampling will be designed based on the results of the removal action and MEC SI results and will likely entail establishment of decision units (e.g., bermed area, area outside of berm area and within the perimeter road, pond) that will each be subject to a different sampling design to meet the specific data quality objectives. Multi-increment composite sampling is expected to be incorporated into part or all of the sampling design. A separate MC Uniform Federal Policy (UFP)-Sampling and Analysis Plan (SAP) will be developed with the Stakeholders involved during the planning process.

MEC removal action activities 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 time-critical removal action involving work in areas potentially containing MEC hazards will be conducted with approval from Navy Ordnance Safety and Security Activity (NOSSA) and will be performed in accordance with local, state, and federal regulations to include OPNAVINST 8020.15, NAVSEA Operations Pamphlet (OP) 5, NOSSAINST 8020.15B, DOD 6055.9-Std., Engineer Pamphlet EP-75-1-2, and all other Department of Navy (DoN) and Department of Defense (DoD) requirements regarding personnel, equipment, and procedures.

1.1 WORK PLAN OVERVIEW

This Work Plan text and 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 (USACE, 2002a). Sections referenced in the DID that are not applicable to this SOW are not included in this Work Plan.

1.2 SITE DESCRIPTION

NASB occupies approximately 3,200 acres in Brunswick, Cumberland County, Maine. NASB has been 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 with an operational closure date of September 15, 2011.

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, and the actual area where MEC is expected to be present is much smaller (i.e., bounded by the perimeter road).

FMBW Area is approximately 29 acres in size and is located west of the runways on the western half of the facility. The site has been part of the buffer area for the runways since 1943, with only minimal other uses over the years.

1.2.1 Site Location

The NASB 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 124 on the eastern side (see Figure 1 of Appendix B).

Site 12 EOD Area is located in a remote, open, upland area on Buttermilk Mountain (see Figure 2 of Appendix B).

FMBW Area is bordered by a section of the inner electronic deer fence that surrounds the runways to the east, Mere Brook to the north, the perimeter road (Ordnance Road) to the west, and munitions bunkers road to the south. The area is accessible via Ordnance Road located near the runways (see Figure 3 of Appendix B).

1.2.2 Installation History

NASB 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 NASB was an air scouting squadron. When the squadron began operations, the station consisted of only one-half 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 this 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, 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, one Fleet Aircraft Service Squadron, and 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 NASB 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 NASB. In March 1959, the Marine detachment became the Marine Barracks of NASB. The Marine Barracks eventually assumed full surveillance of the 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 NASB. 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 NASB. The facility was designated for closure by BRAC in 2005 with an operational closure date of September 15, 2011.

1.2.3 Munitions-Related Activities

The Site 12 EOD Area (see Figure 2 in Appendix B) 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 redesignated 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 NASB 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.

FMBW Area (see Figure 3 in Appendix B) was used sporadically between 1980 and 2000 by United States Marines stationed at the installation to conduct munitions-related security training. Blank small arms ammunition, practice grenades, and limited pyrotechnics (simulators and smoke devices) were used during the training. Reportedly, clearance sweeps of the areas where training took place were conducted following each training exercise. The types of munitions used during the training had explosives safety quantity distances (ESQDs) in the range of a few yards and thereby would not pose an explosives safety hazard to runway operations, storage magazines south of the site, or nearby local populations. The area is no longer used to conduct security training. The area was never formally established as a range at

NASB; the close proximity of the site to the runways, residential and commercial buildings, and current magazines made the area impractical to use as a formal range for significant live-fire munitions training or related uses.

1.3 PREVIOUS STUDIES OF EXTENT OF MEC CONTAMINATION

Information from the Supplemental Feasibility Study Report, Preliminary Assessment (PA) Report, PA Addendum, and MEC SI Report were used in the development of this Time Critical MEC Removal Action Work Plan. These investigations and studies are discussed below.

1.3.1 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). Six burns were conducted as training exercises at the site to destroy ordnance and explosives between 1984 and 1989, according to the study. According to NASB personnel, the dumpster, which 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 below ground surface (bgs) in two of the test pits; the third test pit was excavated to 6 feet bgs, bedrock was not encountered. During the excavations, an expended solid rocket-fuel booster ("JATO" bottle) was unearthed. Other similar devices were observed just outside the berm area.

A PA Addendum finalized by Malcolm Pirnie in July 2007 addressed the Site 12 EOD Area. The PA Addendum summarized the history of munitions use 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 an area 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 from kick-outs was approximately 1 foot bgs. A 4-foot bgs probable penetration depth was estimated for detonation areas within the berm site 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. EOD activities at NASB were officially terminated on June 1, 2004. 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. Historical aerial photographs of Site 12 EOD Area were reviewed. On two photographs dated May 1992 and November 1993, there appeared to be two areas surrounded by a berm: the existing berm area and one 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 which were most likely related to demolition operations that took place during this time.

SI field work was conducted at the FMBW Area and 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 Site 12 EOD Area inside and possibly outside of the historical and existing berm area. Suspect MEC items found on the ground surface in and near the detonation area included two smoke grenades, one cartridge case; an unidentified ordnance-related item (suspected to possibly be a JATO M8 rocket motor) was found just outside of the berm area and within the perimeter road. A gator mine was found in the detector-aided surface sweep transects outside of the berm area to the northwest. A munitions debris (MD) item, a rocket motor, and a frag item were also discovered during the detector-aided surface sweeps along with several areas of magnetic influence (response from the detector) 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 expanded SI geophysical survey boundary. Areas with several anomalies, located within close distance of one another, and also areas of general elevated response were identified during the geophysical survey, these areas could possibly include greater density of munitions-related metal, including MEC. However, without intrusive investigation, this cannot be determined. It may be that additional bermed areas were historically present and/or the area was disturbed when historical berms were knocked down at the end of their use.

1.3.2 Former Munitions Bunker West Area

A PA prepared by Malcolm Pirnie and finalized in February 2006 addressed the FMBW Area. Research indicated that between 1980 and 2000, United States Marines stationed at the installation used the FMBW Area sporadically to conduct munitions-related security training. Marines at NASB reported that sweeps of the area were conducted after each training exercise and that all debris was removed from the ground surface.

The potential for MEC was determined to be low due in part to the types of training conducted at the site and the reported procedure of clearing the area of debris after training activities. The entire 29 acre FMBW Area was designated a suspect MEC area based on the PA. All of the munitions reported to have been used at the site were deployed on the ground surface and were not designed to penetrate the ground surface.

SI field work was conducted at the FMBW Area and the Site 12 EOD Area in July and August 2008 (Tetra Tech, 2009). At FMBW Area, no munitions-related items were detected during the detector-aided surface sweeps. Several non-munitions-related scrap objects were detected, including a tire, rim, wire, steel fencing pile, etc. Also, several rocks were found to be naturally magnetic. In general, most of the surveyed area was found to be devoid of significant unexplained magnetic anomalies (e.g., underground utilities). During the subsurface geophysical survey, there were no large or high intensity anomalies that could not be explained by surficial non-munitions metallic debris. However, there can be no further determination of the causes of the anomalies unless further investigation such as excavations is performed.

1.4 TOPOGRAPHY

In the developed portion of the installation, the topography has been altered so that the area is relatively level. Elevations are in the range from 60 to 75 feet above mean sea level (msl). In undeveloped portions of NASB, 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 NASB 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 as one travels northward from Harpswell Cove.

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. The topography of the FMBW Area is relatively flat to gently rolling. However, the northern border of the site (Mere Creek) has a relatively steep cut back.

1.5 CLIMATE

The State of Maine is divided into three major climatic divisions, NASB 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 also 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 Fahrenehit (°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 the 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 during the year except in winter. On average, there are 57 days with heavy fog, defined as visibility less than one-fourth of a 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 under this SOW and follows the format, content, and preparation instructions specified in the USACE DID OE-005-02.01 (USACE, 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 time-critical removal action involving work in areas potentially containing MEC hazards will be conducted with approval from NOSSA and will be performed in accordance with local, state, and federal regulations to include OPNAVINST 8020.15, NAVSEA OP 5, NOSSAINST 8020.15B, DOD 6055.9-Std., Engineer Pamphlet EP-75-1-2, and all other DoN 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). Project-specific contact information and organizational chart is located in Appendix C.

Upon discovery of suspect materials, the responsible Unexploded Ordnance (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
- 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, 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 is discovered on site that is beyond the capabilities of the UXO personnel, Tetra Tech personnel will notify the POC at NASB and the Navy RPM who 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 NASB POC or military EOD. Military EOD will make a determination of how to handle and dispose of these MEC items. Although transportation is not anticipated, if it is necessary MEC/MPPEH will be transported by EOD in accordance with facility procedures (to include the use of designated explosive laden routes), US Department of Transportation (DOT), Code of Federal Regulations (CFR) 49, and AFT licensing requirements. The ESS will be reviewed and amended as needed in these cases. If amended, operations will not resume until the 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 at NASB and the Navy RPM who will notify the nearest military EOD component in Rhode Island (Appendix J-4) 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 time-critical MEC removal action are planned as follows (see Figures 4, 5, and 6 in Appendix B):

- Clearing and grubbing of site vegetation at both the Site 12 EOD Area and FMBW, as necessary, to conduct the task at hand.

- Detector-aided surface surveys of the Site 12 EOD Area within the perimeter road, 100 percent coverage, and meandering path detector-aided surface surveys within the FMBW wooded area, at approximately 100 foot spacing of paths.

- Surface investigation and surface MEC removal at the Site 12 EOD Area within the perimeter road and extension beyond the perimeter road, as necessary.

- Manual anomaly intrusive investigation to confirm the absence of MEC at the FMBW Area to an estimated maximum depth of 1 foot at targeted locations identified during the SI within the operational area and as necessary within the FMBW Area wooded area.

Certain assumptions have been made regarding the SOW and level of effort required to complete the proposed investigation/clearance activities. These assumptions are based on the results of the SI for each site and discussions with the Navy and regulators. The assumptions are as follows:

Site 12 EOD Area:

- The current boundary for the site is approximately 112 acres and is based on the surface danger zone (SDZ) provided in the PA report. Based on the SI results, the anticipated boundary for locating MEC is expected to be smaller. For the purposes of the proposed effort, it is assumed that approximately 23 acres (20 percent of the SDZ area) will be investigated and surface cleared of MEC. The SI investigated an area of approximately 1,000 feet by 1,000 feet via transect surveys. This SI investigation area used the perimeter road of the site as the boundary which will be the preliminary boundary for this surface MEC removal action, and should provide adequate coverage for the removal action. Coverage may be extended as necessary to establish a 100 foot buffer zone (100 feet in all directions, creating a box) in and around the area of the last MEC item discovered on site.

- During the SI for Site 12 EOD Area, brush cutting and detector-aided transect surface surveys were conducted in only part of the area outside of the existing and historical berms (transects spaced 50 to 100 feet apart in the non-wooded area). Moreover, no geophysical surveys were conducted in areas beyond 10 feet outside of the existing/former berm as part of the SI. During detector-aided surface sweeps, the SI identified a few MEC items at the ground surface and some areas of subsurface ferrous anomalies in the areas between the existing/former berm and the perimeter road. Therefore, it is planned to conduct brush cutting, and detector-aided surface investigation and removal activities across 100 percent of the area within the perimeter road of the site. Activities will extend across the road as necessary (in general, coverage will be extended horizontally 100 feet out from any MEC

finding outside the perimeter road boundary). Any surface MEC items found in the outer areas will be investigated and removed (MEC items discovered during the SI were not removed as part of the SI). It is estimated that up to 100 individual investigations/removals will be needed. Known subsurface anomalies within the existing/historical berm area and select transects in the outer area will not be investigated at this time, but will be investigated during a subsequent RI. Additionally, geophysics in the outer area will be completed during the RI; results of this MEC investigation and clearance will be used to aid in planning the RI geophysics investigation.

- The SI for Site 12 EOD Area identified several MEC items at the ground surface and 161 subsurface anomalies of varying sizes within the existing and historical berm areas. The anomalies were present over a more extensive area than expected prior to the SI because the anomalies were not only inside the existing berm area but between and outside the historical berm areas as well. The SI geophysical investigation area was expanded, but was still unable to determine the full extent of anomalies within the existing/historical berm areas within the SI scope; however, enough information was obtained during the SI to determine that additional investigation is needed to address MEC in this area. Trenching (12 total) will be needed to gain a clear understanding of the type of subsurface MPPEH (MDAS and MDEH), MEC, and non-MEC materials, soil characteristics, depth of burial, and general depths to bedrock and/or groundwater at Site 12 EOD Area. Figure 5 of Appendix B presents the proposed locations of the 12 trenches. If the water table or bedrock is encountered at a given location, trenching will be discontinued at depth. The trenching effort includes preparing the site prior to trenching and restoring the site, primarily associated with backfilling after trenching activities are complete.

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

- Non-MEC debris, for example, tire rims and shovel heads (non-MEC contaminated items), located during the detector-aided surface surveys will be moved to a nearby location; marshalling and off-site disposal of non-MEC debris will be deferred to the RI or addressed by NASB. After removal of the non-MEC debris, a detector-aided surface survey will be conducted to ensure that no surface MEC is now visible.

FMBW Area:

- The SI for FMBW identified no surface MEC and 111 subsurface anomalies during geophysical surveying. Based on the CSM presented in the MEC SI Report and the low intensity of subsurface anomalies encountered during geophysical surveying, it is assumed the anomalies are shallow, less than 1 foot bgs, and can be manually investigated using hand tools by the UXO Technicians.

Intrusive investigations are being conducted to confirm the absence of subsurface MEC at FMBW Area. Additional geophysical surveying is not necessary since previous geophysical surveying conducted during the SI is adequate. Global positioning system (GPS) units will be used to reacquire anomaly locations using dig sheet data developed during the SI. Limited brush cutting is anticipated for anomaly investigation/removal due to previous SI brush cutting efforts and the scope of the task.

- Wooded areas were not investigated during the SI because the focus was on potential source areas where munitions-related security training would have been conducted. A detector-aided surface survey of the wooded areas will be conducted during this MEC investigation and removal by UXO Technicians using meandering paths to confirm the absence of MEC. Little to no brush cutting and no tree removal are planned.

- Non-MEC debris, for example, tire rims and shovel heads (non-MEC contaminated items), will be moved to a nearby location prior to detector-aided survey operations and anomaly investigation/clearance operations occurring; marshalling and off-site disposal of non-MEC debris is deferred to the RI or addressed by NASB. A detector-aided survey of the cleared location(s) will be conducted to ensure that no anomalies underlie the non-MEC debris.

2.4.1 Detection Equipment, Methods, and Standards

A Schonstedt GA-52Cx, ferrous metal detector, or equivalent, will be used during the detector-aided surface surveys. The detector-aided surface survey at the Site 12 EOD Area will cover 100 percent of the accessible area within the perimeter road (see Figure 4 in Appendix B). The wooded areas of the FMBW Area not previously investigated during the SI will also be investigated during a detector-aided surface survey along meandering paths of approximate 100 foot spacing through accessible areas of the site. In addition to the Schonstedt, a White's Spectrum XLT all-metals detector, or equivalent, will be used during the surface surveys at the Site 12 EOD Area and FMBW Area to assist in the location of metal targets with little or no ferrous metal content. Each target on the dig sheet at FMBW Area will be reacquired with the Schonstedt and/or White's and then checked with both instruments before it is considered cleared of MEC hazards.

No additional geophysical surveys are planned during the MEC investigation and removal action at either site. However, anomaly targets identified on the geophysical dig sheets generated during the MEC SI at FMBW Area will be investigated as well as suspect shallow subsurface anomalies in the FMBW Area wooded area. The use of the detector-aided surface survey equipment, in conjunction with a visual survey for MEC, will be used to determine that each anomaly location at the FMBW area is cleared of all

MEC hazards and that no MEC remain at the site. The instruments described above are the best technology for this operation based on industry standards.

The selected detector-aided surface 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 nonferrous metals. Combined with the small size and thin-cased construction of the M204 Grenade Fuze (FMBW Area), the White's Spectrum XLT is estimated to detect target anomalies to approximately 8 to 12 inches.

To test the detector-aided surface survey instruments in accordance with the DID MR-005-05 standard, the UXO Quality Control (UXOQC) specialist will bury selected target items or surrogates in a location free from ferrous anomalies at depths up to 11 times the diameter of each item. The buried surrogates will be made of metal and have a similar diameter and aspect ratio as the selected target items. Inert grenade fuzes or surrogates will be buried at varying depths, up to 12 inches bgs, to test the capabilities of the White's Spectrum XLT and to refine field investigation techniques for the site conditions. The above will be conducted and tested in an Instrument Test Strip (ITS) discussed in Section 5.0. This ITS will be used to test equipment and procedures for both the FMBW investigation of anomalies on the dig sheets and investigation of anomalies discovered along the meandering paths in the woods, as well as supporting the Site 12 EOD Area detector-aided surface survey although no intrusive investigation will be conducted at Site 12 EOD Area at this time.

2.4.2 Navigational Equipment, Method, and Standards

A Trimble GPS, or equivalent, will be used for navigational data collection, corner grid stake location, and reacquisition of SI data, including target anomalies at FMBW and anomalies at Site 12 EOD Area where needed to aid in locating proposed trenches. Refer to Appendix J-3 for GPS coordinates. 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 assist GPS methods in meeting project objectives. Horizontal accuracy of reacquired anomalies (FMBW Area SI targets only) will be 95 percent of anomaly locations within a 1-meter radius of their original surface location as marked on the dig sheets generated during the SI. Horizontally, 95 percent of all items removed during the intrusive investigation will be within a 35-centimeter radius of their reacquired surface location as marked in the field after reacquisition. Sensor data will be correlated with navigational data based on a local "third-order" monument or survey marker. These standards were established using guidance from Engineering Manual (EM) 1110-1-4009 (USACE, 2007). If suspect MEC is encountered, its location will be recorded and/or marked using a GPS, tape measure, or other grid coordinate location system.

2.4.3 Equipment Checkout and Calibration

All UXO instruments used during this investigation and removal action operation will be checked at the start 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 UXOQC will record the results of the checks in the UXOQC logbook.

GPS instruments will be checked at the start of each day and midway through the work day by direct comparison to known monuments (per Standard Operating Procedure [SOP]-03 in Appendix F-1). Positional accuracy will be within 8 inches of the monument or survey marker.

The procedures presented in the SOPs 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.

2.4.4 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. All maps will be oriented to a coordinate system designated by NASB 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 is presented in Appendix C. The subsections below describe the responsibilities of site-specific personnel.

2.6.1 Project Manager

The Tetra Tech Project Manager (PM) shall 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) (i.e., for this project, the Senior UXO Supervisor [SUXOS]) will act as a liaison for the PM to the on-site personnel and ensure that all responsibilities of on-site personnel are being met. Although direct communication between on-site personnel and the NASB POC is necessary, the FOL will keep the PM informed of all directives from the NASB POC. The FOL has immediate stop work authority. The SUXOS 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

The SUXOS will direct daily implementation and enforcement of the SOW 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 direct subcontractors, the FOL (who will also be the SUXOS), 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 TP 18 (DDESB, 2004). Other responsibilities of the SUXOS include the following:

- Review of this Work Plan and initiate Field Change Requests as needed.
- Ensure 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.
- Ensure adequate communications.
- Ensure that site personnel are trained in accordance with the HASP/APP.
- Ensure that all notifications are given prior to beginning work.
- Ensure that required exclusion zones are established and maintained.

- Ensure that all intrusive operations are conducted in accordance with this Work Plan and state and federal regulations.
- Implement the approved UXO safety program in compliance with all federal, state, and local regulations.
- Analyze UXO and explosives operational risks, hazards, and safety requirements.
- Enforce personnel limits and safety exclusion zones for UXO operations.
- Conduct safety inspections to ensure compliance with UXO safety standards/regulations.
- Implement QC requirements including QC inspections of all UXO-related work.
- Direct and approve 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]/UXOQC, and reported to the Tetra Tech PM and NASB POC.

2.6.5 UXOSO/UXOQC

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

- Ensure that site personnel are trained in accordance with the HASP/APP (separate internal Navy document).
- Ensure adequate communications.
- Ensure that required exclusion zones are established and maintained.
- Ensure that intrusive operations are conducted in accordance with this Work Plan.

- Implement the approved UXO safety program in compliance with all federal, state, and local regulations.
- Analyze UXO and explosives operational risks, hazards, and safety requirements.
- Enforce personnel limits and safety exclusion zones for UXO operations.
- Conduct safety inspections to ensure compliance with MEC safety standards/regulations.
- Conduct quality control (QC) inspections to ensure compliance with this Work Plan.

The UXOSO/UXOQC 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 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 (DDESB, 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 direct other personnel resources 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 work day. Other responsibilities of the UXO Team Leader include the following:

- Make all required notifications prior to beginning work.
- Establish required exclusion zones and ensure they are maintained.
- Ensure that all MEC operations are conducted in accordance with this Work Plan and state and federal regulations.
- Implement the approved HASP and APP in compliance with all federal, state, and local regulations.

- Analyze MEC and explosives operational risks, hazards, and safety requirements.
- Enforce 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 NASB 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.

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 (DDESB, 2004) and have a valid UXO Training Certificate. These UXO Technicians will conduct UXO activities as directed by the UXO Team Leader and SUXOS. These UXO Technicians will conduct the anomaly investigation effort to clear all non-UXO items and to identify all UXO and munitions debris items. The UXO Technicians will meet the qualifications of a UXO Technician as stated in DDESB TP 18 (DDESB, 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 NASB, 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 Work Plan and HASP/APP (separate

document). 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. 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, removing non-munitions-related metallic debris and flagging all munitions-related debris and suspect MEC/MPPEH. Non-mechanized vegetation removal will be conducted, as necessary, to facilitate the 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 an exclusion zone (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, the 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 size of the EZs around UXO operations described in this Work Plan is K-40 or the HFD, whichever is greater. The distances in Tables 6-2 and 6-3 (Appendix I) of the pending ESS for the selected MGFDs will define the dimensions of the EZs.

The EZ for the Site 12 EOD Area will be established at a minimum of 131 feet from the outer edge of the designated investigation area, (see Figure 4 in Appendix B).

The EZ for the FMBW Area will be established at a minimum of 6 feet from the outer edge of the designated investigation area (See Figure 6 in Appendix B).

Once established, the EZs will be 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.

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. Protective barriers will be placed around open excavations/trench locations after duty hours to ensure that personnel do not accidentally encounter the excavations.

2.8.2 Site Security

Site security will be maintained to ensure that non-essential personnel do not access the area during MEC clearance operations.

2.8.3 Vegetation Management

Brush cutting will be required at the Site 12 EOD Area and FMBW Area to prepare for detector-aided surface surveys. Brush can hinder the performance of surface 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 following types of equipment/techniques that will be used for brush cutting, further detail is presented in SOP-04 (Appendix F-1).

- Hand-held brush cutters (string or blade) will be used to clear 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 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 cuttings will be left at the site of the area cleared. If this is impractical, a wood chipper will be utilized.

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; the brush cutting team will avoid these areas. 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. The 6 inch clearance will minimize the likelihood of accidental contact with smaller MEC/MPPEH items on the surface or partially buried that were not located during the initial inspection. Additionally, an UXO Escort will be provided at all times during vegetation management activities. The UXO Escort will be utilized 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.

The general methods, techniques, and processes to be used include UXO team support, equipment standardization, anomaly reacquisition, Quality Assurance (QA)/QC measures, field reporting, and records management.

2.9 SURFACE SURVEY INVESTIGATION

Tetra Tech plans to use an analog hand-held detector (such as the Schonstedt fluxgate magnetometer and White's Spectrum all-metals detector) to complete the 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 assist GPS methods in meeting project objectives. GPS accuracy will be checked by verifying position dilution of precision (PDOP) or horizontal dilution of precision (HDOP) and two known GPS points daily, before data collection. If the GPS reading is more than 2 feet from the point of known location, data will not be collected until more satellites are available and the accuracy is within 2 feet. This requirement has been modified so that the objectives of the Time-Critical MEC Removal Action can be accomplished but allows flexibility. If interference from the tree canopy is unacceptable, use of tape measures and a compass may be implemented.

The estimated daily lot of work for Site 12 EOD Area is eight grids, (two acres). The estimated daily lot of work for the wooded areas of the FMBW Area is ½ mile per UXO Technician conducting meandering path surveys.

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

2.10 INVESTIGATION TECHNIQUES

2.10.1 Low Density Anomaly Areas

Portions of the Site 12 EOD Area that are outside of the existing/historic berm area and the entire FMBW Area are considered low density anomaly areas (see Figures 4 and 6 in Appendix B). Surface anomalies discovered during the detector aided surface survey will be investigated and cleared at the Site 12 EOD Area. Surface and subsurface anomalies designated for investigation based on the results of geophysical survey conducted during the SI at FMBW (see Figure 6 in Appendix B) will be cleared to an anticipated maximum depth of 1 foot bgs. A total of 111 targeted subsurface anomalies were identified (see Appendix J-3). Surface anomalies discovered during the meandering path detector aided survey of the wooded area at FMBW will also be cleared. The instrumentation for the surface survey has capabilities to detect items in the shallow subsurface; therefore, select subsurface anomalies in the woods at FMBW will be investigated if suspicious [e.g., if signature is similar to surrogate signature from the ITS (see Section 5.0)] or will be investigated to the extent necessary (e.g., recognizing that anomalies may be attributable to natural ferrous rock, as suspected during the SI of the open areas) with an anticipated maximum depth of 1 foot bgs. 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 nonessential personnel are evacuated from the area. Surface anomalies only will be investigated at the Site 12 EOD Area. No subsurface investigation is planned at this time at the Site 12 EOD Area.

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 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 will be recorded in the field logbook and MEC Tracking Log (per SOP-02). Suspect MEC items that are not safe to move will be secured in place, and the SUXOS will coordinate for treatment of the item with a donor charge. Suspect MEC items determined by the SUXOS to be safe to move can be removed to a secure area at Site 12 EOD Area and the SUXOS will coordinate for treatment of the item before the end of the work day. This will allow site operations to continue. No item will be left untreated overnight. 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. Security of the item will be maintained until it is treated or until responsibility for its security is transferred to the Navy POC. To ensure complete clearance, non-MEC debris will also be removed and a detector-aided surface survey will be performed over these areas to ensure there are no underlying anomalies.

2.10.2 High Density Anomaly Areas

No areas at the FMBW Area are considered high density anomaly areas. The existing/historic berm area within the Site 12 EOD Area is considered a high density anomaly area and will require mechanical means to investigate potential MEC/MPPEH. Upon completion of detector-aided surface surveys and surface MEC removal, limited trenching (12 total) is planned for intrusive investigations of selected anomalies in the Site 12 EOD area (see Figure 5 in Appendix B). The goal of the trenching is to acquire data on the type, depth and volume of MEC within the high density anomaly area, soil characteristics, and general depths to bedrock and/or groundwater. The trenching operation is an explosive operation and will follow all applicable explosive-related procedural and safety requirements. The trenching team will initially consist of, at a minimum, a UXO Team Leader, a heavy equipment operator, (will be UXO qualified), and two UXO Technicians to remove, investigate, and clear MEC/MPPEH from the excavated material.

Upon completion of detector-aided surface surveys and surface MEC removal, trenching activities at Site 12 EOD Area will begin with soil excavation with a hydraulic excavator with a blast shield attached by an equipment operator (see Table 6-1, Appendix I). A Caterpillar 314D hydraulic excavator or equivalent will be used for excavation operations. During excavation activities, a UXO Technician will be present to observe the excavation process and identify any visible MEC. Soil and debris contents of the excavator bucket will be spread on the ground near the excavation, investigated and cleared of MEC/MPPEH and other debris larger than 20 millimeter (mm) in size (size of smallest MEC item) by UXO Technicians. During investigation and removal operations, approximately 1 cubic yard (CY) of soil will be spread on the ground at a time. The UXO Technicians will perform a 100 percent detector-aided surface survey of the spread soil. Each UXO Technician will work with a dig team partner. Each of the UXO Technicians will perform survey and investigation of any targets within the spread soil. Once MEC/MPPEH/scrap metal is

removed, the remaining soil will then be placed in the cleared soil pile. A piece of poly sheeting will be placed on the ground prior to the establishment of cleared soil pile(s) in order to minimize the introduction of small metallic items and small arms (<20mm), and the unintentional surface spreading of potentially MC contaminated subsurface soil into already cleared surface soil. Trenching excavation operations will continue in batches as described above until the end of the work shift or until the trench has been characterized.

The trenching operation at Site 12 EOD Area is not intended to remove all MEC items, but to acquire data on the type, depth and volume of MEC/MPPEH with in the selected trench area. Trench operations will be observed by two UXO Technicians from behind a blast shield. If MEC/MPPEH are observed in the excavated trench, the operation temporarily will stop. The UXO Technicians will investigate the MEC/MPPEH item and determine if it is safe to move. Personnel will not enter a trench greater than four feet deep for health and safety purposes. The depth of the trench will be determined in the field with the purpose of determining the approximate depth of buried MEC. Unfuzed safe-to-move items will be consolidated for later explosive treatment. Items determined to be unsafe to move will be treated with Blow-In-Place (BIP) procedures.

Upon completion of the excavation, the cleared soil will then be backfilled and compacted within the trench area, and the areas will be seeded with grass.

Depending on the amount of potential MEC-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 UXOQC will be called immediately for identification and disposition.

The UXO Team Leader will maintain a daily log recording, at a minimum, the length, width and depth of the excavated trench (and trench corners if possible), the location(s) excavated, and a description of the MEC/MPPEH removed along with the estimated weight and estimated number of other metallic debris. Estimated weight and number of expended cartridges and bullets (small arms MDAS) removed will also be documented (e.g., several hundred bullets were found in the eastern end of trench T3 from approximately 2 to 3 feet bgs). 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.

The trenching operation at Site 12 EOD Area will be self-performed by Tetra Tech with a team consisting of 6 personnel with responsibilities as follows:

- SUXOS will be responsible for general oversight of the entire operation.
- A UXOSO/UXOQC will be responsible for oversight of safety and QC.
- Two UXO Technicians (one Technician III and one Technician II or higher) will be responsible for conducting the detector-aided surface survey of the material and debris during excavation of the trench for the presence of MEC/MPPEH.
- One UXO Technician (Technician II or higher) will be responsible for observing the excavations for the presence of MEC/MPPEH.
- One UXO Technician (Technician II or higher with operator's certification) will be responsible for conducting excavator operations.

Essential personnel must be provided protection equal to that provided for an unintentional detonation, from both blast overpressure and fragments. The blast overpressure protection is provided by maintaining distances between the equipment operator and device contacting the MGFD, e.g., the excavator bucket, and between the UXO Technician observing the operation and the device contacting the MGFD. This distance must not be less than K24 (i.e., distance between the operator and excavator bucket striking a potential munitions item) for the selected MGFD (Appendix I, Table 6-3). The Caterpillar 314D hydraulic excavator planned for use at the site has a maximum reach of over 25 feet and can operate effectively at a reach beyond the K24 distance (14 feet) for the selected MGFD. The fragment protection is provided by placing equipment operators and UXO technicians observing the operation behind shields constructed of material with thicknesses not less than those shown in Table 6-1 of Appendix I for the selected MGFD. Shielding requirements only apply at the Site 12 EOD Area; mechanical operations are not planned for the FMBW Area.

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 ITS section (Section 5.0). In addition, blind seed items, (inert 20 mm projectiles, or surrogates) will be placed at the surface at locations throughout the Site 12 EOD Area prior to performance of the detector-aided surface survey. A 20mm item was selected because it is the smallest MEC item. At least one blind seed item, and no more than six, will be placed in

each estimated daily lot of work. The estimated daily lot of work for Site 12 EOD Area is eight grids, (2 acres).

The SUXOS, UXOQC, or UXO Team Leader will place the blind seed items. Blind seeds will be placed using the guidelines outlined in Chapter 9 of EM 1110-1-4009 (USACE, 2007). 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 UXOQC 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 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. Tetra Tech will transmit data to NASB personnel following completion of the project. All raw files will be available on site for QC checks to assure field and data processing procedures 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 the SUXOS concurs 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 the Site 12 EOD Area for recovered MEC/MPPEH that are determined safe to move and awaiting disposal. The temporary holding area will consist of 2 feet of sandbags placed on all four sides of each MEC/MPPEH item, with a plywood cover and 2 feet of sandbags on top. This area will be under the control of the UXO Team Leader until disposal operations have been completed. The ESQD arc created by the NEW for each temporary holding area will not extend beyond that established for the site. In order to prevent the spreading of MEC/MPPEH debris and related MC residues, items will be destroyed in “demolition areas” using engineering controls consisting of 2 feet of sandbags placed on all four sides of each MEC/MPPEH item, with a plywood cover and 2 feet of sandbags on top of the plywood. Demolition operations will be performed on the day the MEC item is discovered, if possible. NASB is a secure and guarded installation at this time. In the event that the item can not be disposed of on the day it is discovered, the item will be flagged, its location marked for disposal for the following day, and, NASB security personnel and the NASB POC will be informed of its location. The UXO Team will maintain security of the item until relieved by the NASB POC. Items encountered that are not safe to move will be treated by Tetra Tech using BIP procedures.

If the UXO team is unable to identify an MEC item, Tetra Tech personnel will notify the Navy POC at NASB and the Navy RPM who will request assistance from the nearest military EOD component in Rhode Island.

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 the operation, 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 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 to 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 free of explosives hazards and other visible liquid HTRW materials.

- Record the information 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 and 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 Site 12 EOD Area.

The UXOQC 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 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 final 100 percent inspection of all MDAS prior to certification and transport off site.

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

The SUXOS will:

- Ensure all documentation is completed for all MDAS.
- Perform random checks to satisfy that the MDAS are free from explosive hazards.
- Conduct 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 UXOQC.
- Certify all MDAS as free of explosive hazards and other visible liquid HTRW materials.
- Be responsible for ensuring that MDAS are secured in a locked, labeled, and sealed container.
  - The container will be closed and clearly labeled on the outside with a unique identification.

  - The container will be closed in such a manner that a seal must be broken in order to open the container. A seal will bear the same unique identification number as the container or the container will be clearly marked with the seal's identification if different from the container.

  - A documented description of the container will be provided with the following information for each container: contents, approximate weight of container, location where contents were obtained, contractor name, names of certifying and verifying individuals, unique container identification, and seal identification.

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 located in EM 1110-1-4009, Chapter 14 (USACE, 2000b) and DoD Instruction 4140.62 (DoD, 2008).

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 does not work). This information will be added to the data collected for the sites.

If MPPEH is determined to be MDEH, it will be disposed of similar to MEC and will be consolidated and treated with donor charges, if possible. 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 MPPEH 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 (DoD, 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 MDAS has been 100 percent properly inspected and to the best of his/her knowledge and belief, is free of explosive hazards. The UXOQC will verify that the MPPEH inspection process has been followed in accordance with this work plan and 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 UXOQC, 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 turn over of MDAS and will be signed by the SUXOS and UXOQC:

"This certifies that the material 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 Maintaining the Chain of Custody and Final Disposition

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

- Upon receiving the unopened labeled containers each with its unique identified and unbroken seal ensuring a continued chain of custody, and after reviewing and concurring with all the provided supporting documentation, sign for having received and agreeing with the provided documentation that the sealed containers contained no explosives when received.

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

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

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

If any organization breaks the MPPEH chain of custody, the affected MPPEH must undergo a second 100 percent inspection, a second 100 percent 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 F-2. The UXOSO/UXOQC will attach the completed Lessons Learned Report Form(s) to daily and weekly QC reports. The UXOSO/UXOQC 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 (USACE, 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, Alcohol Tobacco and Firearms Pamphlet (ATFP) 5400.7, DoD 6055.9-STD (DoD, 2008), Department of Transportation (DOT) regulations, and applicable NASB guidance documents.

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

3.2 EXPLOSIVES ACQUISITION AND MANAGEMENT

3.2.1 Acquisition

The quantity of explosives to be used will be kept to a minimum determined by the storage capabilities of the NASB-supplied magazine (126-C or –D) and the anticipated needs of the UXO Team. Initially, sixteen blasting caps, one roll of Nonel, and 24 sticks of Helix binary explosives are planned for purchase for this project. Nonel is a non-explosive shock tube and the binary explosive is not explosive during storage, it becomes an explosive only after it is mixed when it is ready for use; therefore, the blasting caps are the only NEW that will be added to the bunker. No more than 100 pounds NEW of demolition explosives will be stored at any one time during MEC removal operations. This is an upper limit and the actual NEW will depend on the exact type of demolition explosives procured.

- Explosives will be purchased from a local vender such as:

  Austin Powder Company
  Hudson Hill Road
  Hudson, ME 04449
  TEL. 207-327-1390

- All explosives will be used and stored at NASB. Based on discussion 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, ATF 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, ME 04333-0052
nelson.e.collins@maine.gov
Tel. 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 NASB POC before receipt and transportation of explosives to the site.

The NASB POC will provide Tetra Tech with a copy and an understanding of all facility explosives management requirements before the transportation of any explosives and will provide access to a NASB bunker for the storage of 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

NASB will provide explosives storage facilities and will also provide for physical security of explosives storage facilities. A magazine has been assigned for temporary storage of explosives within the Weapons Compound (126-C or –D).

3.2.4 Transportation

Transportation of explosives by a local vendor will comply with the use of designated explosive laden routes and US DOT, CFR 49, 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. Explosives and MEC/MPPEH will be transported from either the storage facility or FMBW Area to disposal locations at the project sites in accordance with facility procedures (to include the use of designated explosive laden routes), US DOT,

CFR 49, and ATF licensing requirements. All MEC/MPPEH will be placed in containers or sandbagged to prevent movement during transportation. Incompatible explosive items will be separated by sandbags to prevent sympathetic detonation. The transportation vehicle will have a wooden bed liner and will be equipped to secure the containers in the vehicle. Additionally, the vehicle will be equipped with fire extinguishers and any other applicable safety equipment.

Transportation of explosives or MEC will be coordinated with the installation to ensure that the installation's existing explosive laden routes are followed. Delivery of explosives will be coordinated with the installation to ensure that explosive laden routes are followed and that an escort meets and guides the delivery truck along the correct route. Existing routes run from the FMBW Area to the Site 12 EOD Area from the south of the runway into the site. Delivery trucks will report to the back gate and be escorted by weapons storage personnel along the appropriate route to the ammunition magazine.

3.2.5 Receipt Procedures

Each item of explosives will be receipted from initial delivery to NASB 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 and during each week's inventory. Any discrepancies will be documented by the SUXOS and reported to the Tetra Tech UXO Manager, Tetra Tech PM, NASB POC, 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, NASB POC, and others as required by law. Inventories of explosives in stock will be conducted weekly, at a minimum.

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, NASB POC, and Navy Remedial Project Manager (RPM) by telephone and follow up with a written report within 24 hours.

2. Report within 24 hours of discover, by telephone, 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 ME, phone 207-780-3324) in accordance with the instructions on the form.

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

Any explosives not expended during daily demolition operations will be returned to the storage facility and added to the receipt document.

All explosives remaining in storage at the end of the project will be issued and used during a final cleanup shot. The final cleanup shot will not exceed the 25-pound explosive limit for Site 12 EOD Area. 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 F-2 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 SOW.

4.1 ORDNANCE AND EXPLOSIVES AREAS

The minimum separation distance for non-essential personnel during MEC operations (unintentional detonation) at the Site 12 EOD Area will be an arc of 131 feet from the outermost boundary of the area of operation as shown on Figure 4 of Appendix B (based on DDESB TP 16, 2005, and the known/suspected munitions). This separation distance will be maintained during all UXO operations, unless engineering controls are used.

The minimum separation distance for non-essential personnel during MEC operations (unintentional detonation) at the FMBW Area will be an arc of 6 feet from the outermost boundary of the area of operation as shown on Figure 6 of Appendix B (based on DDESB TP 16, 2005, and the known/suspected munitions). This separation distance will be maintained during all UXO operations, unless engineering controls are used.

If munitions with a greater HFD or K40, other than the 40 mm MK 2 projectile (Site 12 EOD Area) or the M204 Grenade Fuze (FMBW Area) anticipated are identified or encountered during operations, all work will cease and the Navy RPM and NASB POC will be notified. No further work will be conducted unless authorized by designated explosives safety personnel.

4.2 PLANNED OR ESTABLISHED DEMOLITION AREAS

The Site 12 EOD Area is the planned demolition area. MEC items from the FMBW Area that are acceptable to be handled will be transported and disposed of within the existing berm area of Site 12 EOD Area. The existing berm area was selected because contamination is already expected to exist at this location and future MC sampling will be conducted in any case at this location; note, however, that he donor explosives are expected to be completely consumed during detonation and not result in additional soil contamination. MEC items that are unacceptable to handle will be treated using BIP procedures. Future MC sampling will likely be conducted at BIP locations both to investigate a release at the location and to investigate whether the BIP detonation resulted in soil contamination. In all areas used for demolition operations, both BIP and items safe to move for consolidated explosive treatment, the location(s) will be recorded using a GPS and/or tape measure from a known point so that future MC sampling of these areas can take place as part of RI field investigations. Post demolition procedures will

include a check of the demolition location with a magnetometer and removal of large fragmentation to ensure that there are no remaining MEC/MPPEH debris or related residues, any MEC items, failing to be properly disposed of, which are discovered during the 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 will be used to establish an EZ for intentional detonations. The intentional detonation EZ for the 40 mm MK 2 projectile is 1,095 feet. The intentional detonation EZ for the M204 Grenade Fuze is 78 feet. See Table 6-4, Appendix I.

4.3.2 Collection Points

No demolition explosives or recovered MEC/MPPEH will be stored on site, but will be addressed on a daily basis. A temporary holding area will be established to hold 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 the UXO Technician unless relieved by military security.

4.3.3 Consolidated Shots

Consolidated shots consisting of multiple MEC/MPPEH items may be required (see Table 6-4, Appendix I). Consolidated shots will be performed in accordance with the United States Army Engineering and Support Center, Huntsville (USAESCH) publication titled Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites, dated March 2000. A copy of this report will be available on site.

4.4 EXPLOSIVES STORAGE MAGAZINES

Demolition explosives (donor charges) will be stored in existing magazines at NASB using the established ESQD arcs for the appropriate operation.

4.5 SITE MAPS

See Appendix B for site maps.

5.0 SURFACE SURVEY INSTRUMENT TEST STRIP

5.1 OBJECTIVE

The UXO team will construct one ITS. The ITS will be performed prior to intrusive investigation at FMBW and will be used to establish and evaluate the techniques and personnel to be used for this investigation. The ITS will only need to be conducted prior to detector-aided surveying by each operator using his/her given equipment: in addition, the ITS will be used daily for FMBW Area surface/subsurface investigation in wooded areas conducted via detector-aided survey. If a new operator or new instrument is necessary, then that operator and equipment will be tested on the ITS. Figure 7 in Appendix B shows the location for the ITS. ITS will be seeded with inert munitions or surrogates that represent the expected MEC items at the sites, or with surrogates when inert items cannot be obtained, to test their detection.

The ITS will consist of an area along an individual survey line to search for seed items. Site-specific technical approaches and survey designs have been developed for each MEC area as presented in Section 2.0.

All UXO detector-aided surface survey and avoidance activities will be carried out in accordance with all local, state, and federal regulations including general guidance from applicable USACE DID requirements, including Engineer Pamphlet EP-75-1-2 (USACE, 2004b), Engineer Manual EM 1110-1-4009 (USACE, 2007c), DID MR-005-01.01 (USACE, 2002a), MR-005-05.01 (USACE, 2007a), and MR 005 07.01 (USACE, 2007b).

The specific objectives for the ITS will be as follows:

- System Operations: Demonstrate that the UXO detection instruments and navigational equipment are operating properly. Evaluate average speed to detecting the target items. Applicable to Site 12 EOD Area and FMBW Area.

- Detection of Known Objects: Provide a safe area with a known set of isolated objects (e.g., inert munitions or munitions surrogates) to evaluate equipment and operator performance under controlled conditions. Based on a review of available information, and to the extent practical, Tetra Tech will seed inert or surrogate items of similar size, shape, and mass to MEC items suspected at the sites. Applicable to Site 12 EOD Area and FMBW Area.

- Evaluate Instrument Sensitivity: Evaluate detection of seed items (20 mm diameter and larger) buried within the maximum detection depth determined using USACE's 11 times rule (maximum detection

depth is 11 times the diameter of the munition), The UXOQC will determine whether the ITS performance is acceptable. Applicable to FMBW Area only.

Additional details are located in Appendix J-1.

5.2 PERSONNEL QUALIFICATIONS

The ITS will be managed by the UXOQC. At least one UXO Technician II or higher will be present throughout the ITS installation to provide UXO avoidance support.

5.3 ITS SURVEY PROCEDURE

The operators and equipment used for detector-aided surface surveys at Site 12 EOD Area and the FMBW Area intrusive investigations must first be tested and approved based on the results of the ITS. The test area was chosen in cooperation with the Navy to avoid areas potentially containing clutter, utilities, or landfill materials. An area near the FMBW Area boundary will be used for the ITS (see Figure 7 in Appendix B). A utility mark-out request or dig permit will be requested from the base prior to this ITS survey to provide safety for the intrusive investigation and trenching activities.

The UXO team will perform a detector-aided surface survey of the selected test strip area using both a Schonstedt ferrous metal locator and a White's all-metals detector prior to seeding with the test items to further verify that the selected plot area is suitable for use (relatively free of metal).

A variety of seed items, inert MEC items, or surrogates suspected to be at the sites, will be buried blind to the UXO team in the test area. Seed items will be buried at various depths, not exceeding 11 times the diameter of each item, and in various orientations up to 1 foot bgs.

The location of the test strip, and test seed items will be accurately documented. Depths, orientations, and physical descriptions of each of the test seed items will also be noted and provided to the UXOQC. Photographs of the seed items will also be taken.

5.3.1 Test Strip Seeding

The test strip will be seeded by Tetra Tech. At least one UXO Technician II (or higher) will be on site during the seeding to perform anomaly avoidance. The UXO Technician(s) will utilize a Schonstedt GA-52Cx or similar equipment to provide MEC avoidance.

Individual seed items in the ITS anticipated at FMBW Area will be buried blind to the UXO team at various depths bgs, not exceeding 11 times the diameter of each item following guidance in the USACE EM 1110-1-4009 (USACE, 2007), which states that generally speaking, an intact munition can typically be detected to a maximum depth of 11 times the diameter of the munition. The planned items to be buried in the test strip in one straight line include the following:

Item and Burial Depth	11x depth	Ferrous/Non-ferrous
One 20 mm projectile at 2 inches bgs	11x D = 8.7 inches	ferrous object
One Grenade fuze at 6 inches bgs	NA	non-ferrous object
One 20 mm projectile at 8 inches bgs	11x D = 8.7 inches	ferrous object
Ten brass cartridge cases at 12 inches bgs	NA	non-ferrous object
One 20 mm projectile at 1 inch bgs	11x D = 8.7 inches	ferrous object
One 20 mm projectile at 4 inches bgs	11x D = 8.7 inches	Scored ferrous object

The seed items will be spaced at least 6 feet apart to distinguish each item's anomaly signature during survey interpretation. The locations of the test strips and seed items will be accurately measured and documented. Depths, orientations, and physical descriptions of each of the test seed items will also be noted and provided to the UXOQC to provide understanding of the seed items in relation to their anomaly signatures. Photographs of the seed items will also be taken.

5.3.2 Equipment Standardization

UXO detectors (Schonstedt and Whites), support equipment, navigation equipment, and operator performance will be tested at specific intervals and must meet the appropriate acceptance criteria. One of these tests will be a daily Equipment Function Test (EFT). The table presented below lists additional tests or checks, their required frequencies, and acceptance criteria. Initially, before the ITS is performed, out-of-box tests are planned as described in Section 5.4.3.2.

Data Type	Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
GPS Positional Data	Real-time accuracy	HDOP and number of satellites	HDOP <3, number of satellites at least six	Ongoing
	Accuracy	GPS positioning - comparison with two known locations	Comparison to known coordinates	Daily

Data Type	Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
ITS	Sensitivity	Detection capabilities test using representative seed items	Vertical Detection of individual inert munitions items or surrogates (20 mm diameter) within USACE 11x rule for maximum depth Horizontal Detected items positioned between 0 and 1 meter horizontal accuracy	Once at beginning of project and after change in equipment or operators and daily for FMBW Area surface/subsurface investigation in wooded areas conducted via detector-aided survey
EFT	Sensitivity	Instrument response to metallic targets	Anomalous response to all test targets response for each work site	Daily

5.3.2.1 Equipment Function Test

The EFT will be implemented on a daily basis after the ITS is completed to provide a simple test of equipment functionality over a few metallic targets representing suspected MEC items for the project. The primary objective is to demonstrate that the survey equipment is responding normally to a controlled set of objects (equipment is functioning properly); the objective is not to duplicate the ITS. To make the test practical three to six targets will be placed on the ground, spaced 10 feet apart and in the same orientation for each test. Site conditions (i.e., soil) may differ between areas of the site, and this could create differences in response. All tests should be conducted in an area free of metal. Field notes will be kept on each test and included in the After Action Report.

5.3.2.2 Out-of-Box Tests

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

5.3.3 Anomaly Avoidance

Anomaly avoidance will be practiced during the ITS. 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 ITS.

5.3.4 ITS Disassembly

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

6.0 GEOPHYSICAL INVESTIGATION PLAN

6.1 GENERAL

Geophysical investigations are not planned at the Site 12 EOD Area or FMBW under this SOW. Geophysical investigations will be conducted as part of the RI to be conducted at Site 12 EOD Area after the Time-Critical MEC Removal Action has been completed. No future geophysical investigations are planned for FMBW Area.

6.2 TARGET LIST DEVELOPMENT

Target lists for FMBW Area were developed during the SI (Tetra Tech, June 2009) in accordance with DID MR-005-05.01 (USACE, 2007a).

6.3 ANOMALY REAQUISITION

Tetra Tech will perform anomaly reacquisition and verification at FMBW Area and Site 12 EOD Area (in support of trenching effort) with the Schonstedt and or the White's along with the same positioning and grid system used during SI data collection. The Trimble GPS unit, or equivalent, will be used. All measurements after reacquisition will be recorded on the target list sheet, see Section 2.4.2 for additional details. The GPS will be tested twice daily.

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 Time-Critical MEC Removal Action are consistent with the GIS maintained for NASB.

7.1 GENERAL

The recorded GPS information will be incorporated into the existing Environmental GIS (EGIS) established for NASB and will also be provided to MEDEP, and geo-referenced maps showing all coordinates and MEC/MPPEH findings will be included in the After Action Report.

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). Locational information as well as information on 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 this 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 the 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. The After Action Report will present 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 NASB and will also be provided to MEDEP to record and manage areas of concern, and detail the location of each MEC/MPPEH item found/removed. 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 NASB and MEDEP mapping. The After Action Report will also provide observations made by the UXO Team and recommendations for future maintenance activities, if appropriate.

7.4 UNEXPLODED ORDNANCE SAFETY PROVISIONS

During all initial fieldwork and all intrusive activities, a UXO Technician II or higher will accompany the survey crew. The UXO Technician II will conduct visual surveys for surface ordnance prior to the survey crew entering a suspected area, and will conduct a magnetometer survey of each intrusive activity site to ensure that the sites are anomaly free prior to the surveying crew setting monuments or driving stakes. The UXO Technician II will not be assigned additional survey tasks that would interfere with the MEC safety aspects of area clearance for driving stakes, iron pins, establishing monuments or other survey controls, that will penetrate the surface in a potentially MEC contaminated area. The UXO Technician II may not be required on a full-time basis for non-intrusive activities.

8.0 WORK, DATA, AND COST MANAGEMENT PLAN

The technical reports and submittals under this SOW may include Project Work Plans, Corrective Action Reports, HASPs (separate document), permit applications, Regulatory Compliance Reports, and After Action Reports. 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 SOW. 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 SOW 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 located in Appendix F-1, the project forms located in Appendix F-2, and the QC and Assessment tables located in Appendix J-1.

Definable Feature of Work	Tasks
Mobilization/Site Preparation/Site Security	• Work Plan Preparation • Verify Personnel Qualifications • Setup Administrative Areas • Set up Exclusion Zones • Equipment Setup and Checkout • Installation of ITS • Detector Aided Surface Survey Layout • Vegetation Management • Surface Removal of Non-Munitions Related Debris, as applicable
UXO Escort/Avoidance to Identify Potential MEC and Warn Non-UXO Personnel of Hazards	• Detector Aided Surface Survey • Mark Paths of Entry • Mark MEC Hazards • Brief Non-UXO Personnel
Site-Specific Training/ITS Certification	• Initial Orientation and Training • ITS Review and Approval
Detector-Aided Surface Surveys	• Surface Surveys • Record Location (GPS and Photograph MEC) and Observations • Report MEC • Treat/Remove MEC/MPPEH • Remove Non-Munitions Metal Debris
Surface/Subsurface Clearance of FMBW	• Reacquire Targets • Investigate Targets • Record Location (GPS and Photograph MEC) and Observations • Report MEC • Treat/Remove MEC/MPPEH • Remove Non-Munitions Metal Debris

Definable Feature of Work	Tasks
Data Processing and Interpretation	• Provide Anomaly and MEC Location Mapping to Stakeholders to aid in MC Sampling Location Selection • Provide Target List to UXO Team
Disposal of MEC Discovered During the Removal Action Operations	• Establish EZ for Intentional Detonation • Position MEC • Apply Explosive Donor Charge • Initiate Detonation • Check Detonation Site
Staging of Non-MEC Metal Debris	• SUXOS Inspect Non-MEC Metal Debris • Release Non-MEC Metal Debris for Recycle
Demobilization	• Remove ITS • Remove Temporary Survey Markers • Complete all Field Forms • Close-Out Field Log Books • Return Equipment • Provide all Field Documentation to PM

The requirements presented in this QCP are intended as overall QA and QC requirements that are applicable to all administrative, engineering, and technical activities associated with the SOW. The requirements of this plan are applicable to all Tetra Tech personnel and their subcontractors unless an alternate QCP that is consistent with or exceeds the requirements of this document either in whole or in part is used.

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/UXOQC
- UXO Team Leader
- UXO Technicians

10.2 QUALITY REQUIREMENTS

A summary of the quality requirements associated with field activities in support of this SOW are defined in Table 10-1, more detail is presented in Appendix J-1. 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 NASB POC, 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 work day to monitor progress, safety, and/or QC.
  - Teams will not start operations until satisfactory checks have been achieved.
  - NASB Environmental Staff and Public Affairs Office will provide notifications as needed to the local community should demolition of MEC/MPPEH be required. This may include the local town manager, the local fire department, and the 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 filed on site and are available for Navy inspection.

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

- Review - The SUXOS and/or FOL 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, 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 UXOQC has the overall responsibility of verifying compliance with the 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 the SOW, this Work Plan, or applicable DIDs. During all field activities, Tetra Tech will use the following reporting forms:

- QC Daily Report
- QC Summary 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 After Action Report. 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 and/or FOL. After Action Reports will be signed by the Tetra Tech PM.

The QC Daily Reports and Summary Reports shall 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 non-conformances 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 POC 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.

EOD Technology (EODT) will provide oversight and audits directly for the Navy. EODT will be granted site access by appropriate personnel under the direct supervision of the Tetra Tech SUXOS or UXOQC. EODT will comply with all applicable training, safety briefings, and site security procedures. EODT will also be granted 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 NASB, BRUNSWICK, MAINE

Objective	Activity	Activity Quality Requirement	Quality Control Verification
Prepare Site	Mobilization and Site Preparation	Mobilize equipment and personnel, and prepare site as described in this Work Plan.	• Daily Site Health and Safety Meeting Report • Field Logbooks
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 reacquisition. 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	Surface/Subsurface UXO Clearance	UXO Technicians, supervised by the SUXOS, will remove MEC from the surface within the Site 12 EOD Area, targeted FMBW Area subsurface anomalies identified during the SI, surface MEC within the wooded FMBW Area, and selected FMBW Area subsurface anomalies in the wooded area. QC checks will be performed to ensure that the UXO Team removes all surface and subsurface MEC. 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 area cleared during surface clearance at Site 12 EOD Area. • QC 10% of target anomalies at FMBW Area. • QC 10% of transect meandering path at FMBW Area in woods.
Site Work	Trenching Operations	UXO Technicians, supervised by the SUXOS, will remove MEC from the excavated soil during trenching within the Site 12 EOD Area. 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

TABLE 10-1

QUALITY REQUIREMENTS FOR UXO SUPPORT TO THE NAVY AT NASB, BRUNSWICK, MAINE PAGE 2 OF 3

Objective	Activity	Activity Quality Requirement	Quality Control Verification
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
Site Work	UXO Surface Survey Operations	UXO Technicians, supervised by the UXO Team Leader, will complete a grid/target inspection to collect data on the type and location of MEC at the sites. QC checks will be performed to ensure that MEC have been located, identified, and data collected and reported. Fail criteria will be any MEC discovered in a grid/target that was not reported in the data logs.	• 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 grids for MEC (Site 12 EOD Area) • QC 10% of targets for MEC (FMBW)
Site Work	Blind Seed of Survey Areas	The SUXOS, UXOQC, or UXO Team Leader will place blind seed items that are representative of target MEC items at various locations throughout the survey areas from the surface (Site 12 EOD Area only). Blind seed items will be clearly marked with identifiers so that the UXOQC and SUXOS can record their location during placement, reacquisition, and investigation. Failure criteria will be failure to detect the blind seed items during survey activities	• 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

TABLE 10-1

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

Objective	Activity	Activity Quality Requirement	Quality Control Verification
Site Work	MEC Disposal	UXO Technicians supervised by the SUXOS will conduct MEC 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 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 of excavation for a given trench (each trench will be backfilled before beginning excavation at another trench location) and the flat topography. Moreover, operations will not be conducted during a rain event. However, if warranted based on site conditions, a silt fence may be placed around the Site 12 trenching areas prior to commencing excavation activities or during excavation activities (i.e., unlikely event that MEC/MPPEH item finding delays trench backfilling at the end of the day). As the excavation progresses, temporary berms may also be constructed with existing soil around the perimeters of the excavations to control water flows. In addition, if necessary, in areas of high water flows, hay bales may be utilized to collect sediment as necessary. Each trench will be backfilled before beginning excavation at another trench location. At FMBW Area, the excavations are small and will not remain open for long. Therefore, erosion and sediment control is not warranted.

Stockpiled Soil - Stockpiled soil will be staged as close 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 but may be employed, as necessary (i.e., Site 12 EOD Area trenching) to control storm water runoff. Each trench will be backfilled before beginning excavation at another trench location. A piece of poly sheeting will be placed on the ground prior to the establishment of cleared soil pile(s) in order to minimize the introduction of small metallic items and small arms (<20mm), and the unintentional surface spreading of potentially MC contaminated subsurface soil into already cleared surface soil. Covering of stockpiles will not be required.

Pollution Prevention – All project site work methods and procedures will be conducted in a manner to minimize pollution and control dust within reasonable limits. All vehicles utilized for this project will be operated at low rates of speed to reduce the dust emitted. Dust emissions will be controlled through the use of administrative controls such as speed limits.

Chemicals On Site –Chemicals associated with the donor explosives for this project will be stored in existing magazines at NASB (126-C or –D). Procedures which will be followed during handling of these chemicals are addressed in Appendix F-1 (SOP-05). Material Safety Data Sheets (MSDS) are provided as Appendix J-2.

Vehicles designated to travel on roads will be fueled at commercial filling stations, this will prevent and control potential spills during refueling. Fuel for use in vehicles (excavator) 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 shall first go out to NASB Security Department and personnel from the Environmental Department. The Environmental Department shall contact both the MEDEP and Paul Burgio/Todd Bober of the Navy. The Environmental Department shall contact both the MEDEP [Public Safety (all hours) 800-482-0777 and Southern Maine Regional Office (normal working hours) 207-287-7800] and the Navy BRAC PMO project personnel. It will be reported to the NASB POC immediately and 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 the ordnance related scrap recovered during the removal and trenching activities. As stated in Section 2.13.2, Maintaining the Chain of Custody and Final Disposition, ordnance related scrap that is certified and verified as MDAS will be released to a certified subcontractor. Additionally, Section 2.4, Technical Scope, states that non-MEC debris located during the detector-aided surface surveys will be moved to a nearby location (area designated by NASB); marshalling and off-site disposal of non-MEC debris will be deferred to the RI or addressed by NASB.

12.0 INVESTIGATIVE-DERIVED WASTE PLAN

An Investigative-Derived Waste Plan is not required for the performance of this SOW because the project team will not be generating investigation-derived waste. Scrap metal (non-MEC) removed from the site will be placed in an area designated by NASB for disposition by NASB. Non-MEC Debris handling requirements are described in Section 2.12 and 2.13.

13.0 INTERIM HOLDING FACILITY SITING PLAN FOR RCWM

No Recovered CWM (RCWM) is expected under this SOW, therefore, an RCWM Interim Holding Plan is not required.

14.0 PHYSICAL SECURITY PLAN FOR RCWM PROJECT SITES

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

15.0 REFERENCES

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APPENDIX A

TASK ORDER SCOPE OF WORK

APPENDIX A
TASK ORDER SCOPE OF WORK

Tetra Tech NUS has been scoped by the Navy to conduct the work specified in the subject Work Plan. The work was authorized under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62470-08-D-1001, Contract Task Order (CTO) WE-09 in accordance with Navy Scope of Work (SOW) dated December 23, 2008 under the Project Title, RI/FS, Munitions Clearance, and Decision Documents for Various Sites at Naval Air Station, Brunswick, Maine.

APPENDIX B

SITE MAPS

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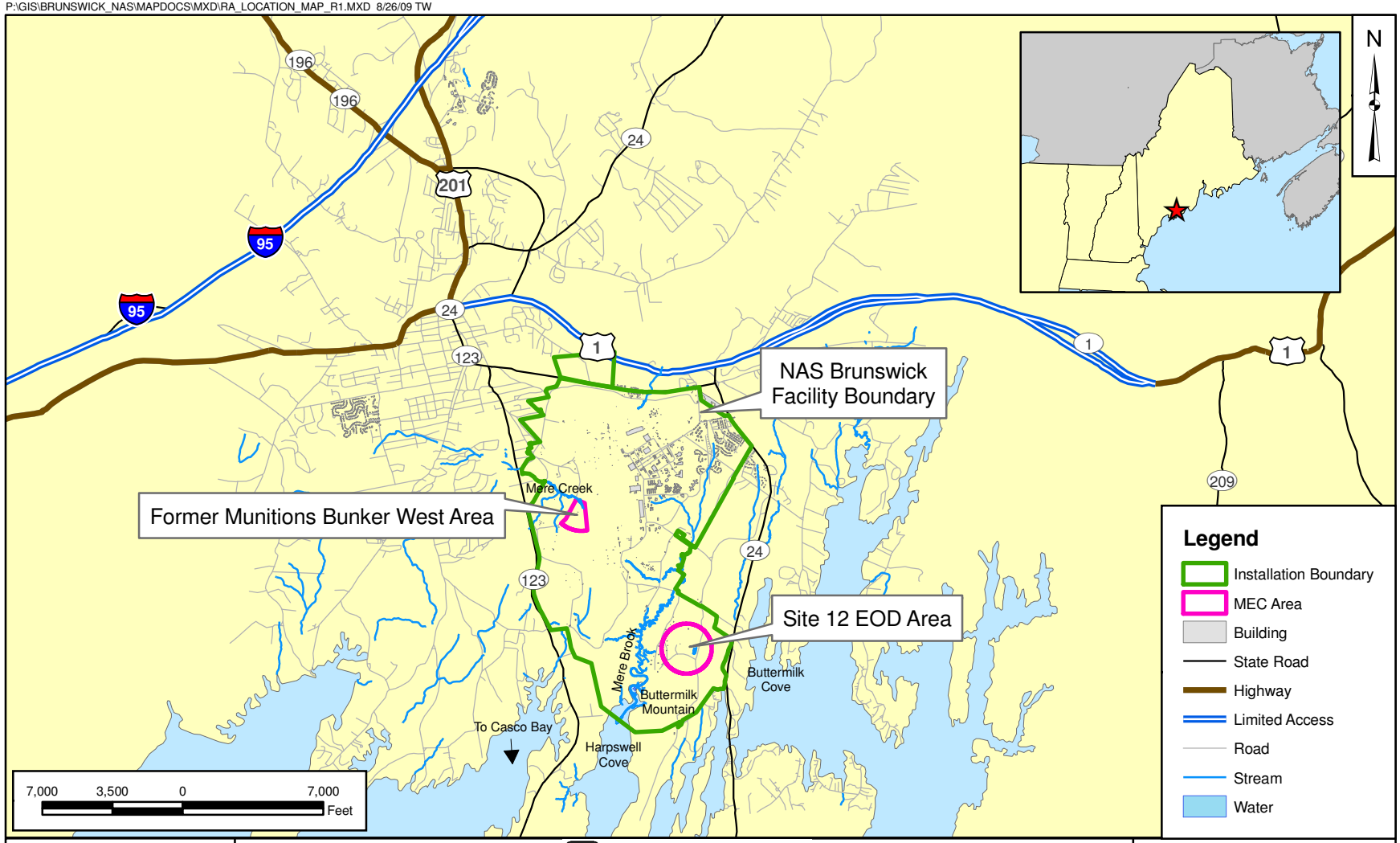
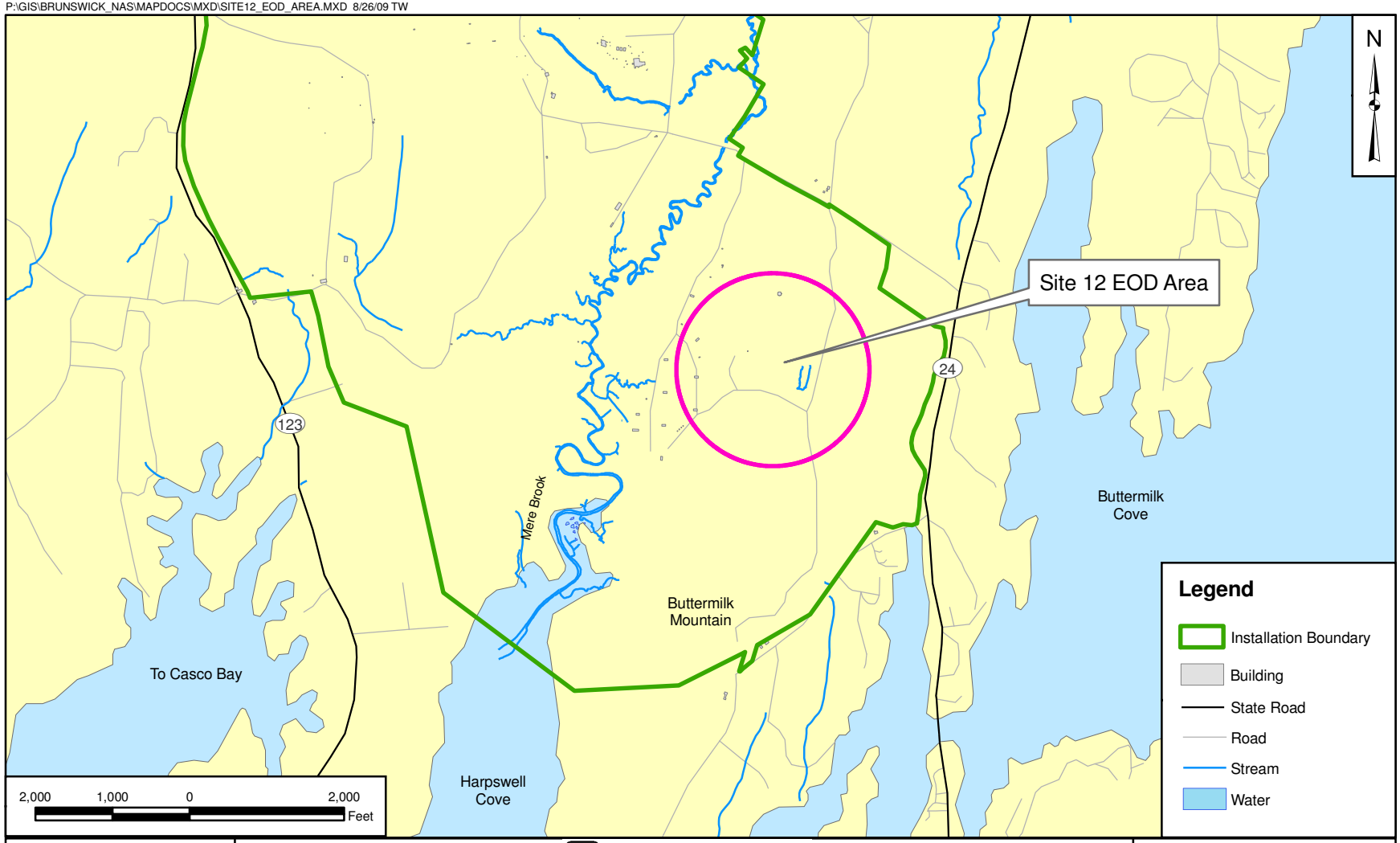


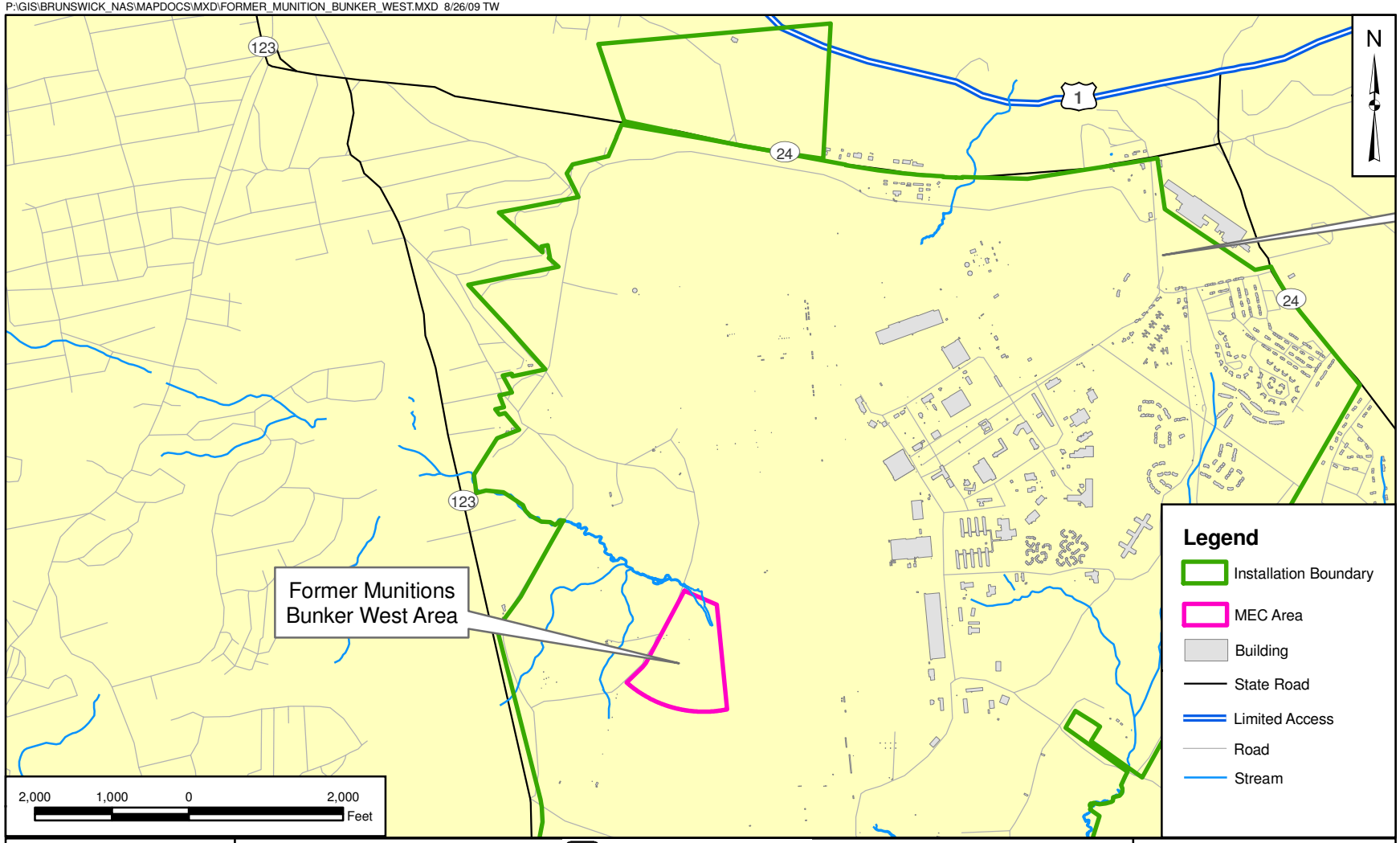
DRAWN BY T.WHEATON	DATE 8/26/09	Tetra Tech NUS, Inc.	CONTRACT NUMBER CTO WE09
CHECKED BY M. BLANKEN	DATE 8/26/09	REMOVAL ACTION SITE LOCATIONS NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 1 / REV 1

P:\GIS\BRUNSWICK_NAS\MAPDOCS\MXD\SITE12_EOD_AREA.MXD 8/26/09 TW



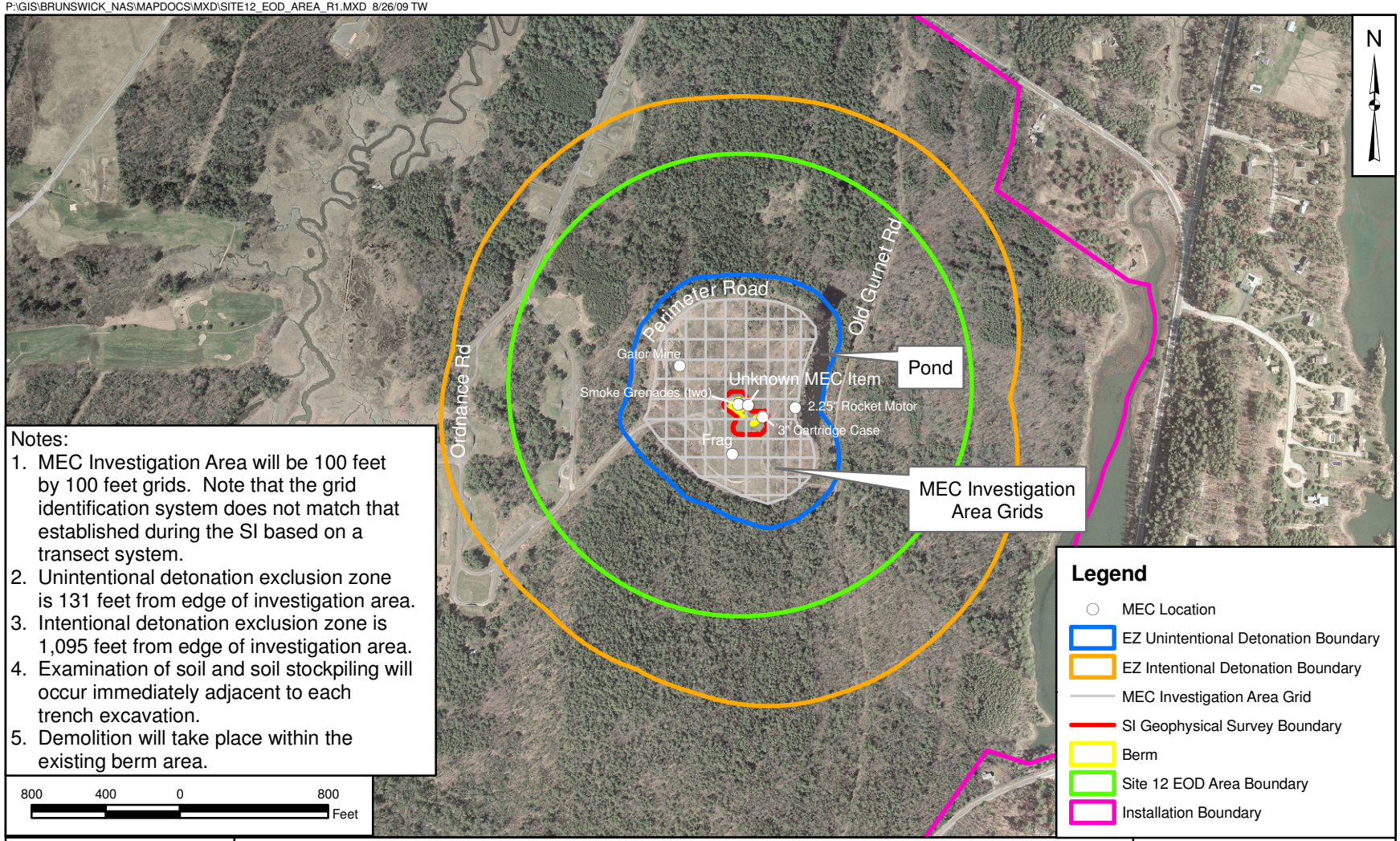
DRAWN BY S. STROZ	DATE 5/27/09	Tetra Tech NUS, Inc.	CONTRACT NUMBER CTO WE09
CHECKED BY M. BLANKEN	DATE 8/26/09	SITE 12 EOD AREA - SITE LOCATION NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 2 / REV 1

P:\GIS\BRUNSWICK_NAS\MAPDOCS\MXD\FORMER_MUNITION_BUNKER_WEST.MXD 8/26/09 TW



DRAWN BY T. WHEATON	DATE 8/26/09	Tetra Tech NUS, Inc.	CONTRACT NUMBER CTO WE09
CHECKED BY M. BLANKEN	DATE 8/26/09	FORMER MUNITIONS BUNKER WEST AREA - SITE LOCATION NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 3 / REV 1

P:\GIS\BRUNSWICK_NAS\MAPDOCS\MXD\SITE12_EOD_AREA_R1.MXD 8/26/09 TW



Notes:
1. MEC Investigation Area will be 100 feet by 100 feet grids. Note that the grid identification system does not match that established during the SI based on a transect system.
2. Unintentional detonation exclusion zone is 131 feet from edge of investigation area.
3. Intentional detonation exclusion zone is 1,095 feet from edge of investigation area.
4. Examination of soil and soil stockpiling will occur immediately adjacent to each trench excavation.
5. Demolition will take place within the existing berm area.

DRAWN BY T. WHEATON	DATE 8/26/09	Tetra Tech NUS, Inc.	CONTRACT NUMBER CTO WE09
CHECKED BY M. BLANKEN	DATE 8/26/09	SITE 12 EOD AREA MEC INVESTIGATION AND REMOVAL AREA NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 4 / REV 1

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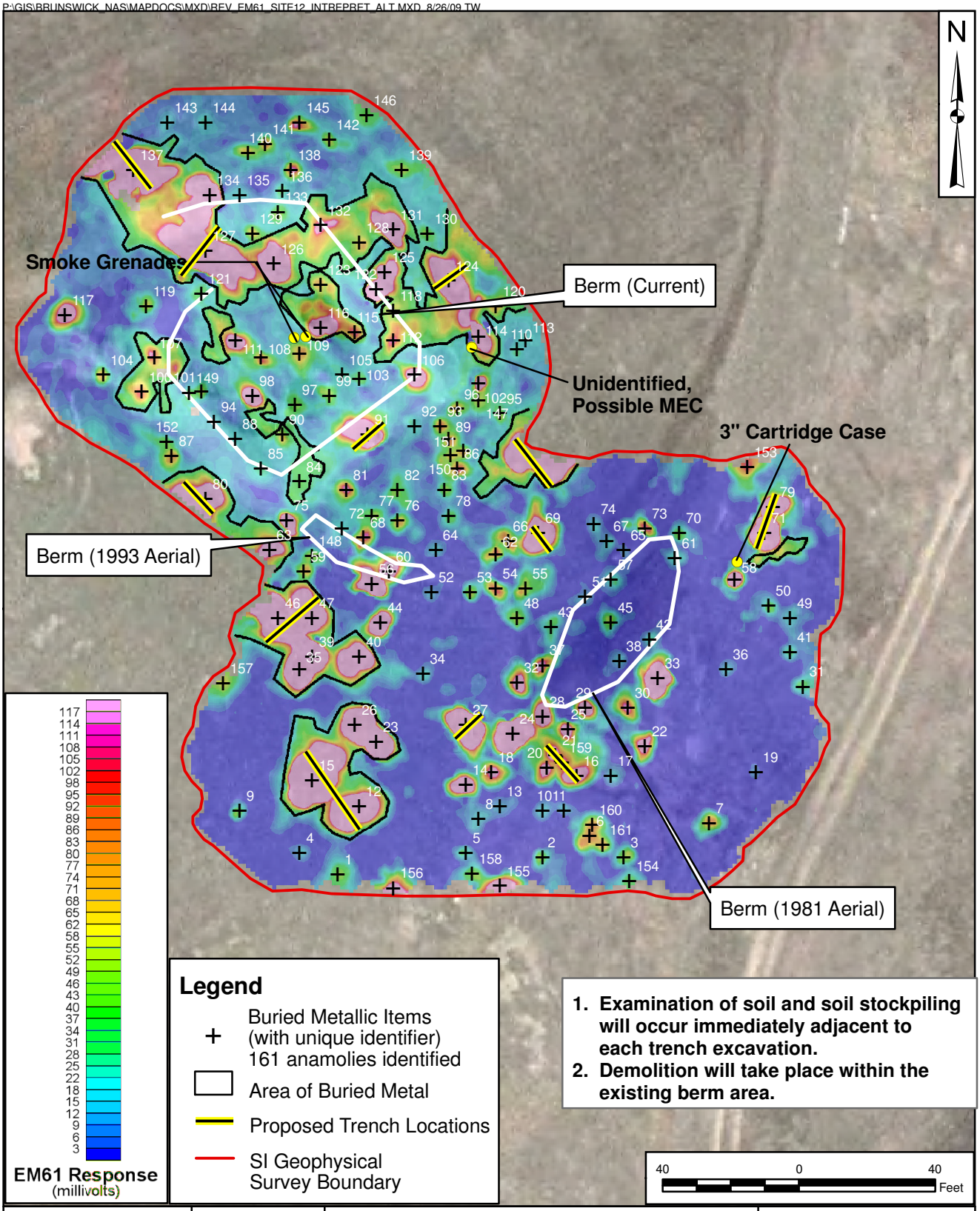
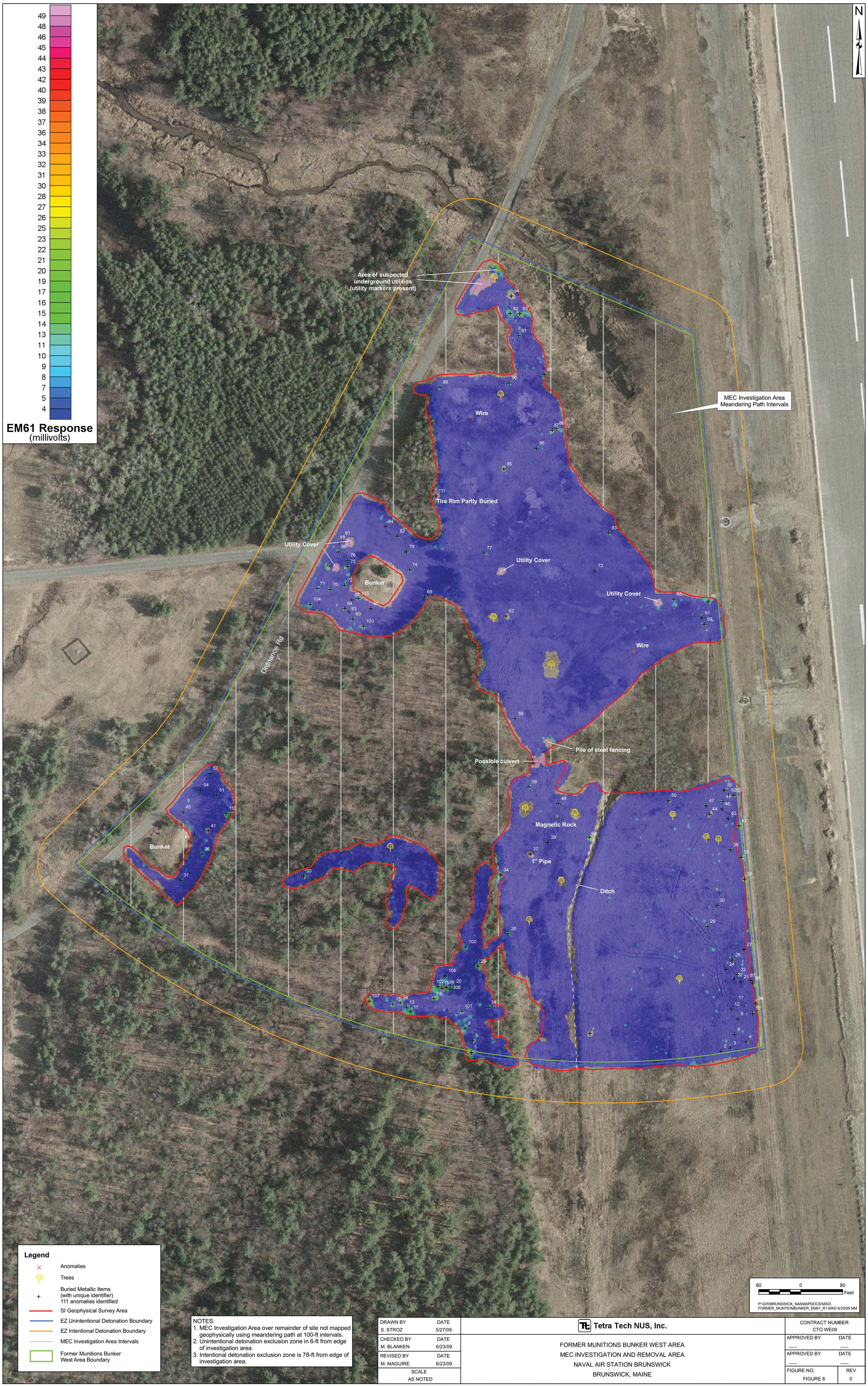


1. **Examination of soil and soil stockpiling will occur immediately adjacent to each trench excavation.**
2. **Demolition will take place within the existing berm area.**

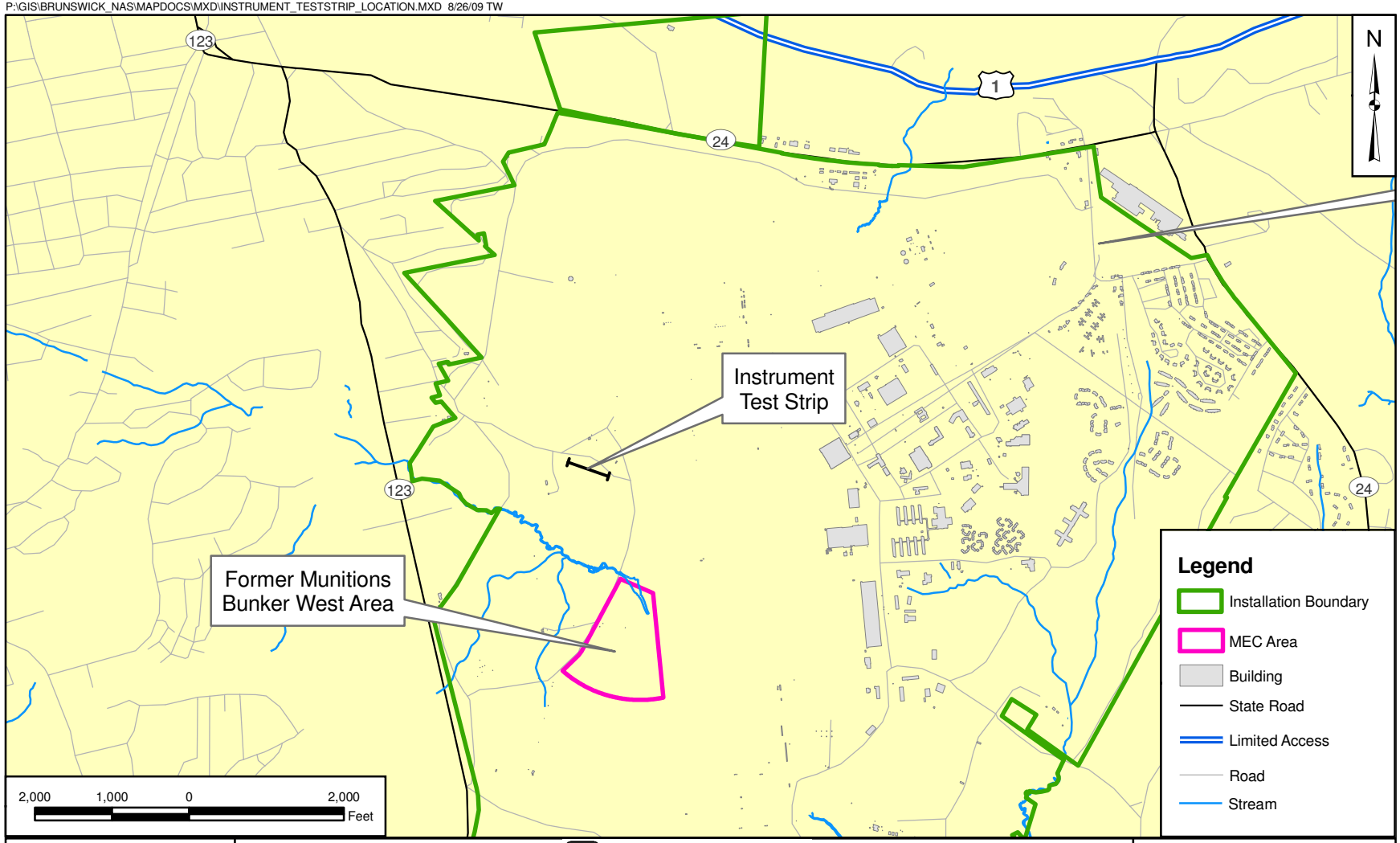
DRAWN BY T. WHEATON	DATE 8/26/09	SITE 12 EOD AREA PROPOSED TRENCH LOCATIONS NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	CONTRACT NUMBER CTO WE09
CHECKED BY M. BLANKEN	DATE 8/26/09		APPROVED BY ___ DATE
COST/SCHEDULE AREA			APPROVED BY ___ DATE
SCALE AS NOTED			FIGURE NO. FIGURE 5 / REV 1



NOTES:
1. MEC Investigation Area over remainder of site not mapped geophysically using meandering path at 100-ft intervals.
2. Unintentional detonation exclusion zone in 6-ft from edge of investigation area.
3. Intentional detonation exclusion zone is 78-ft from edge of investigation area.

DRAWN BY S. STROZ	DATE 5/27/09	Tetra Tech NUS, Inc.	CONTRACT NUMBER CTO WE09
CHECKED BY M. BLANKEN	DATE 6/23/09	FORMER MUNITIONS BUNKER WEST AREA MEC INVESTIGATION AND REMOVAL AREA NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
REVISED BY M. MAGUIRE	DATE 6/23/09		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 6 / REV 0

P:\GIS\BRUNSWICK_NAS\MAPDOCS\MXD\INSTRUMENT_TESTSTRIP_LOCATION.MXD 8/26/09 TW



DRAWN BY T. WHEATON	DATE 8/26/09	Tetra Tech NUS, Inc.	CONTRACT NUMBER CTO WE09
CHECKED BY M. BLANKEN	DATE 8/26/09	INSTRUMENT TEST STRIP LOCATION NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 7 / REV 1

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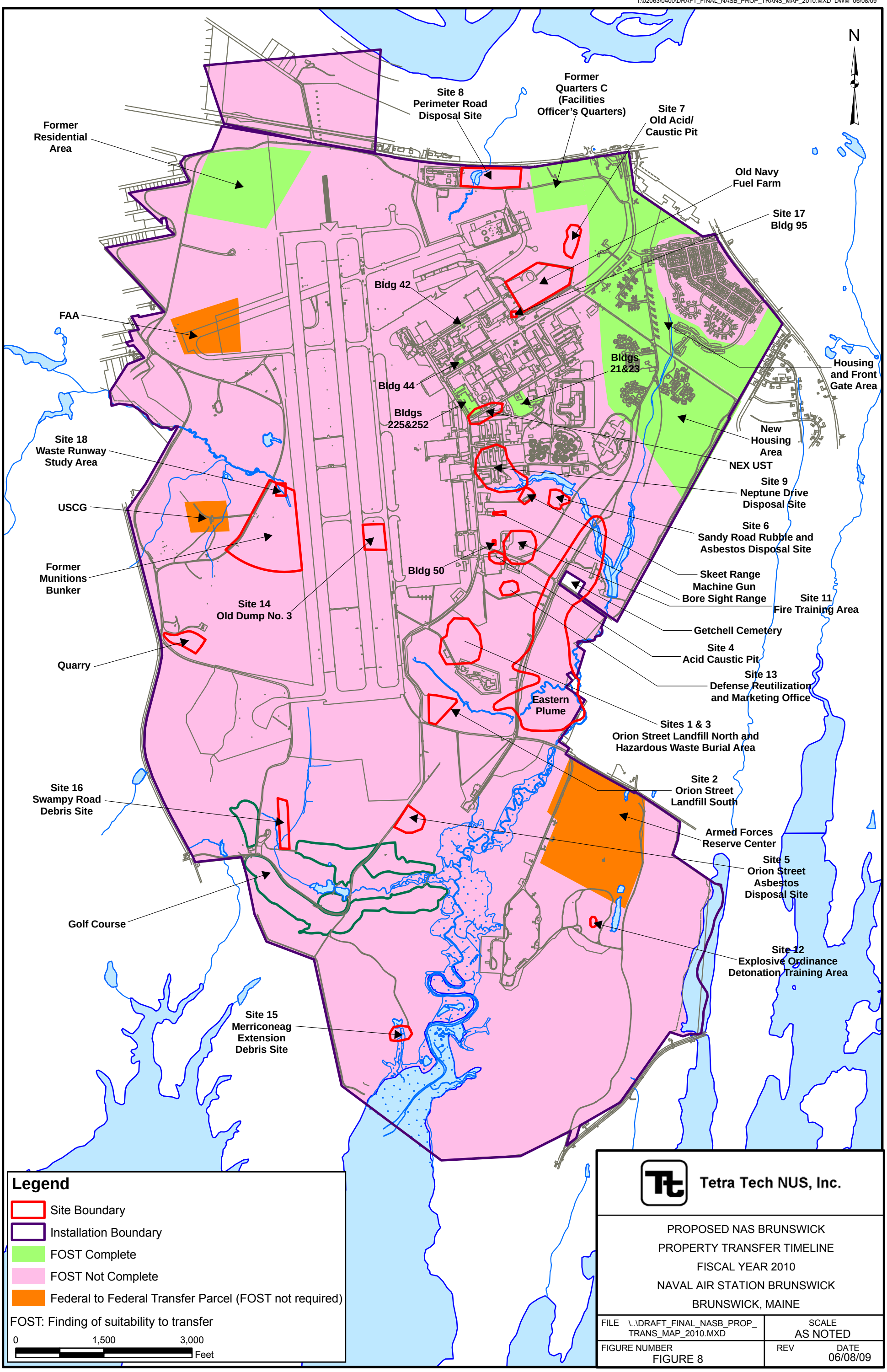


APPENDIX C

PROJECT CONTACT INFORMATION

C-1 EMERGENCY REFERENCE LOCAL POINTS OF CONTACT

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

CONTACT	PHONE NUMBER
NAS Brunswick Emergency Number for On-Base Fire and Police and Ambulance	**9-1-1** or (207) 921-1719
Fire Department (non-emergency)	(207) 921-1719
Police Department (non-emergency)	(207) 921-1719
Mid Coast Hospital	(207) 373-3635
BRAC PMO NE Remedial Project Manager (RPM): Todd Bober	(215) 897-4911
Explosives Safety Officer Brion Hall	(207) 921-1319
EOD Support	Contact the RPM and POC
NASB Point of Contact (POC) Michael Fagan Lisa Joy	 (207) 921-1719 (207) 921-1720
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

C-2 SITE SPECIFIC CONTACT INFORMATION

Project Specific Contact Information
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
Brian Helland	MRP Technical Support	NAVFAC Atlantic Attn: Code EV32 6506 Hampton Blvd Norfolk, VA 23508-1278	215-897-4912	brian.helland@navy.mil
Carolyn LePage	Technical Advisor to BASCE	LePage Environmental Services 731 Hotel Road Auburn, ME 04210	207-777-1049	calepage@adelphia.net
Jennifer Wright Amy Van Dercook	Environmental Technical Support	NAVFAC Atlantic Attn: Code EV32 6506 Hampton Blvd Norfolk, VA 23508-1278 Jen (Code EV32JW); Amy (Code EV32AV)	757-322-8428 757-322-4764	Jennifer.H.Wright@navy.mil Amy.vandercook@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 Fagan	NAS Brunswick IR Coordinator	NAS Brunswick Environmental Office 437 Huey Drive, Bldg. 53 Brunswick, ME 04011-5008	207-921-1717	Michael.Fagan1@navy.mil

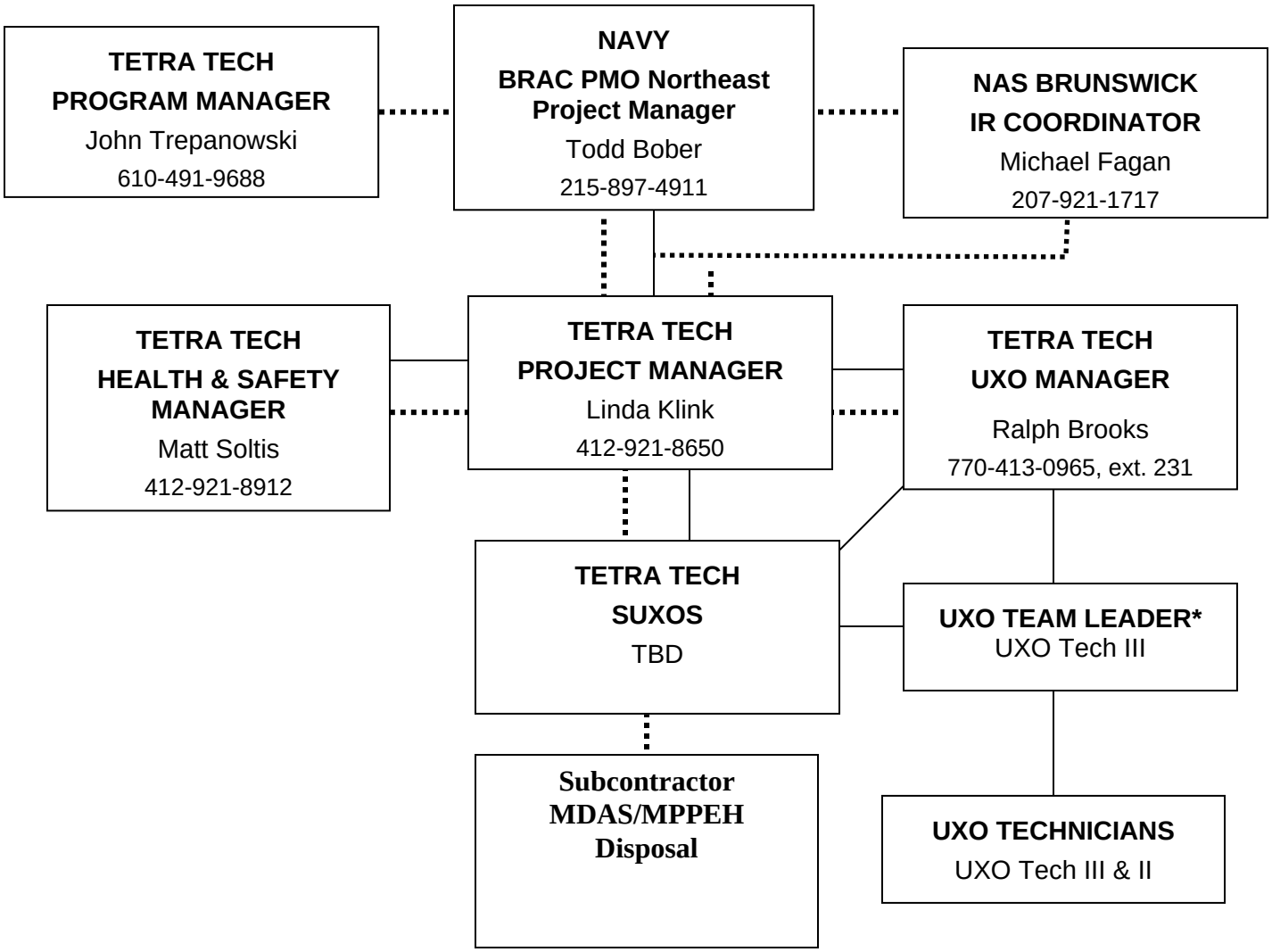
Name	Title/Role	Organization	Telephone Number (Optional)	E-Mail Address or Mailing Address
Lisa Joy Dale Mosher	NAS Brunswick Environmental Director	NAS Brunswick Environmental Office 437 Huey Drive, Bldg. 53 Brunswick, ME 04011-5008	207-921-1720 207-921-1719	lisa.joy@navy.mil dale.mosher@navy.mil
Michael 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
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.stait@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

C-3 ORGANIZATIONAL CHART

Project Organizational Chart

Lines of Authority ——— ····· Lines of Communication

PROJECT ORGANIZATION CHART



* - Dual-hatted position

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

APPENDIX D

HEALTH AND SAFETY PLAN/ACCIDENT PREVENTION PLAN

APPENDIX D
HEALTH AND SAFETY PLAN/ACCIDENT PREVENTION PLAN

To be submitted as a separate Navy document for internal use.

APPENDIX E

MC SAMPLING PLAN

APPENDIX E
MC SAMPLING PLAN

Not included in current scope.

APPENDIX F

STANDARD OPERATING PROCEDURES AND PROJECT FORMS

F-1 STANDARD OPERATING PROCEDURES

APPENDIX F-1

STANDARD OPERATING PROCEDURES

TABLE OF CONTENTS

SOP-01	UXO Detector-Aided Surveys
SOP-02	MEC Management and Accountability
SOP-03	Global Positioning System
SOP-04	Vegetation Management at MEC Sites
SOP-05	UXO Demolition/Disposal Operations

STANDARD OPERATING PROCEDURE
SOP-01

UXO DETECTOR-AIDED SURVEYS

1.0 SCOPE AND APPLICABILITY

This document is designed to set a standard operating procedure (SOP) for the UXO detector-aided 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 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 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 survey. UXO detector-aided survey operations may be used as a stand-alone method for site survey and assessment or in preparation for geophysical survey operations. UXO escort operations will be required during site visits (initial site assessments, planning, and stakeholders meetings), geophysical operations, and MC sampling operations and any other time where non-UXO trained personnel are conducting work at 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 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.

<u>UXO Senior UXO Supervisor (SUXOS)</u>

The SUXOS will have a minimum of ten years experience in all aspects of munitions response actions or range clearance activities. A minimum of five 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 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.

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 Technician 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 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 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 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 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 daily check for subsurface detector-aided survey operations will be the instrument test strip (ITS) *and for surface/subsurface investigation in FMBW Area wooded area*.

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 Survey Depth

The required depth of detection will be established during the DQO process and documented in the site specific work plan. Surface surveys will be conducted in accordance with the appropriate section below. Subsurface surveys will use the same procedures, except intrusive investigation of the anomalies are allowed in accordance with the approved ESS, and to the depth established in the DQO process. The approved ESS will establish the authorized handling/management of discovered MEC/MPPH, (see SOP-2 for MEC Management and Accountability Proceedures).

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-percent 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-percent 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 MD 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, a 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-percent 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 transect 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 Work Plan.

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 plan 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 survey of the transects/grid will be managed IAW the approved ESS and Work Plan. Only the SUXOS can declare a MEC item is safe to move. The facility POC will be notified of the presence of MEC and arrangements will be made by the SUXOS for proper disposition of the item(s). Documentation must be obtained to detail the date and method of disposition IAW SOP-2 MEC Management and Accountability.

Quality Control

The UXOQC will review the definable features of work prior to the start of work each day. A new definable feature of work will receive a preparatory phase QC inspection prior to the start of work. This inspection is recorded on the Quality Control Surveillance Report. Work started on a new definable feature of work will receive an initial phase QC inspection. This inspection is recorded on the Quality Control Surveillance Report. During the detector aided 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. These follow up phase QC inspections will be recorded on the Quality Control Surveillance Report. All work will be conducted in accordance with the MEC SAP and the SOPs attached to that MEC SAP. All requested changes to the approved MEC SAP will be documented on the Record-of-Change Form and submitted to the PM and UXO Manager for action/approval. The UXOQC will prepare a Daily Quality Control Report for each day worked summarizing the definable features of work inspected, the phase of that work, the locations, and personnel at the work site.

Detector-Aided Surface Survey for Geophysical Survey

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

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

TABLE 1

White's Spectrum XLT Settings		
Basic Adjustments:	**UXO 1**	
Target Volume	58	
Audio Threshold	23	
Tone (audio frequency)	226	
Audio Disc.	on	
Silent Search	off	
Mixed-Mode	on	
A.C. Sensitivity	60	Adjust at a test Grid. Compare with another White's
D.C. Sensitivity	30	Adjust at a test Grid. Compare with another White's
Backlight	0	
Viewing Angle	25	
Pro Options:		
"Audio"		
Ratchet Pinpointing	on	
S.A.T. Speed	7	
Tone I.D.	on	
V.C.O.	on	
Absolute Value	off	
Modulation	on	
"G.E.B/Trac"		
Autotrac	on	
Trac View	off	
Autotrac Speed	14	
Autotrac Offset	+1	
Trac Inhibit	on	
Coarse B.E.B.	54	These numbers are variable and will change automatically.
Fine G.E.B.	160	These numbers are variable and will change automatically.
"Discrimination"		
Disc. Edit	+95 Accept	
Block Edit	+95 Accept	
Learn Accept	off	
Learn Reject	off	
Recovery Speed	20	
Bottlecap Reject	20	
"Display"		
Visual Disc.	off	
Icons	on or off	
V.D.I. Sensitivity	55	

White's Spectrum XLT Settings		
Basic Adjustments:	**UXO 1**	
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	

STANDARD OPERATING PROCEDURE
SOP-02

MEC MANAGEMENT AND ACCOUNTABILITY

A. 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 Time-Critical MEC Removal Actions performed under the Munitions Response Program (MRP).

B. 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/clearance operations, subsurface geophysics investigations, UXO subsurface investigation/clearance operations, and UXO Escort operations. UXO detector-aided survey/clearance 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.

C. 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.

D. MEC MANAGEMENT AND ACCOUNTABILITY OPERATIONS

<u>UXO Detector-Aided Surface Survey/Clearance</u>

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. Each item will be marked given a unique ID number. ID numbers will start with a letter(s) corresponding to the site 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 or grid. These numbers will start at 01 and run consecutively. For example:

*The site name is **Former Munitions Bunker West (FMBW)**. The first transect, or grid within the Former Munitions Bunker West is **A1**. The first item encountered in transect, or grid A1 is item **01**. The ID number assigned to the item is **FMBW-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 until a positive ID of the item has been made to include fuse type by function and condition (armed or unarmed) and the physical state/condition of the fuse, i.e., burned, broken, parts exposed/sheared, etc.

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. Suspect MEC items that are not safe to move will be secured in place, and the SUXOS will coordinate for treatment of the item with a donor charge using Blow-In-Place (BIP) procedures. Suspect MEC items determined by the SUXOS to be safe to move can be removed to a secure area if one has been designated and is available. The SUXOS will coordinate for treatment of the item before the end of the work day. This will allow site operations to continue. No item will be left untreated overnight. 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 Project Manager (PM) and Facility POC. Security of the item will be maintained until it is treated or until responsibility for its security is transferred to the Facility POC.

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.

Subsurface Anomaly Investigation/Clearance

Subsurface anomalies designated for investigation based upon a response from hand-held survey instruments (e.g., Schonstedt or White's), or the results of geophysical survey, will be cleared to designated site/project specific depths. Excavations will be conducted using manual or mechanical

procedures until the sidewalls and bottom of each excavation are clear of anomalies. Excavated soils will be placed on the ground near the excavation site and surveyed for suspect MEC/MPPEH. If suspect MEC/MPPEH are observed within the excavation or the excavated soils, the UXO Technicians will investigate, record, report, and remove/treat the item as described above.

Mechanical excavation operations may be subject to shielding requirements as determined by the Munition with the Greatest Fragmentation Distance (MGFD) for the specific site/project. Shielding requirements and distances are detailed in the Explosive Safety Submission (ESS) approved for the specific site/project.

Detector-Aided Surface Survey for Geophysical Survey

The UXO Technician will conduct a detector-aided surface survey of the grid or transect prior to geophysical survey operations and record the location of each MEC item discovered, if any. Each item will be marked and recorded as described above. Depending upon the site specific SOW, MEC items encountered will be removed/treated as described above, or left in place and UXO avoidance will be practiced during the geophysical survey.

Explosive Safety Submission (ESS)

An Explosive Safety Submission (ESS) is required prior to the commencement of any MEC/MPPEH clearance activities or sub-surface anomaly investigation. The ESS details how explosives safety standards are applied to MRP sites and how the project will comply with applicable environmental requirements related to the management of MEC and MPPEH. No site operations will begin without an ESS in place that has been reviewed and approved by the Department of Defense Explosives Safety Board (DDESB).

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.

Quality Control

The UXOQC will review the definable features of work prior to the start of work each day. A new definable feature of work will receive a preparatory phase QC inspection prior to the start of work. This inspection is recorded on the Quality Control Surveillance Report. Work started on a new definable feature of work will receive an initial phase QC inspection. During MEC management and accountability the UXOQC, or Senior UXO Technician if there is no UXOQC, will recheck 25-percent 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. The initial phase QC inspection will be documented on the Quality Control Surveillance Report. 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-percent of each unit (grids or transects). If at any time a unit fails the quality control check, the complete unit will be reworked and the rechecks will be increased to 25-percent until four units in a row pass the recheck. These follow up phase QC inspections will be recorded on the Quality Control Surveillance Report. All work will be conducted in accordance with the MEC Work Plan and the SOPs attached to that MEC Work Plan. All requested changes to the approved MEC Work Plan will be documented on the Record-of-Change Form and submitted to the PM and UXO Manger for action/approval. The UXOQC will prepare a Daily Quality Control Report for each day worked summarizing the definable features or work inspected, the phase of work, the locations, and personnel at the work site.

E. NOTIFICATIONS IF MEC IS ENCOUNTERED

Any MEC item discovered during a detector-aided surface survey/clearance, subsurface anomaly investigation, geophysical survey, or UXO escort operation will be addressed as follows:

(1) If a complete MEC item or ordnance related material is encountered that is believed to pose a hazard, is encountered at a given site, is encountered outside of the current established site boundaries, or is unknown, the UXO Team Leader, with support by UXO Technicians on site as necessary, will document the following information, as provided on Attachment 1, for reporting 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
- Final Disposition of the item (BIP, consolidated and treated w/ donor charge, MDEH/MDAS)

(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.

The following table lists contacts information.

Position	Name	Organization	Direct Dial Phone	Cell Phone
NASB Environmental Director	Lisa Joy	NAS Brunswick	207.921.1720	
Project Manager	Linda Klink	Tetra Tech	412.921.8650	
UXO Manager	Ralph Brooks	Tetra Tech	770.413.0965 x231	404.661.4916
NASB POC	Mike Fagan	NAS Brunswick	207.921.1717	206.780.1034
Navy Remedial Project Manager	Todd Bober	BRAC PMO NE	215.897.4911	
Remedial Project Manager	Claudia Sait	MEDEP	207.287.7713	
Remedial Project Manager	Michael Daly	USEPA Region 1	617.918.1386	

ATTACHMENT 1

MEC TRACKING LOG

NAS Brunswick

SITE:_____

ID #	ITEM IDENTIFICATION	UXO TECH NAME	ITEM COORDINATES	DATE/TIME FOUND	DIGITAL PHOTGRAPH NUMBER	ARMED / UNARMED	PHYSICAL CONDITION / APPEARANCE	DATE DESTROYED

STANDARD OPERATING PROCEDURE
SOP-03

GLOBAL POSITIONING SYSTEM

1.0 PURPOSE

The 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 update existing Geographic Information System (GIS) data. This SOP is specific to GIS quality data collection for Trimble-specific hardware and software.

If possible, the Trimble GeoXM or GeoXH 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 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 shape files, data points, background images, and correct coordinate systems can be uploaded into the unit.

Tetra Tech NUS, Inc.
Attn: John Wright
661 Anderson Drive, Bldg #7
Pittsburgh, PA 15220

2.0 REQUIRED EQUIPMENT

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

2.1 Required GPS Hardware

- Hand-held GPS Unit capable of sub-meter accuracy (i.e. Trimble GeoXM or Trimble GeoXH). This includes the docking cradle, a/c adapter, stylus, and USB cable for data transfer.

Optional Accessories:

    - External antenna
    - Range pole
    - Hardware clamp (for mounting Geo to range pole)
    - GeoBeacon
- Indelible marker
- Non-metallic pin flags for temporary marking of positions

2.2 Required 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 4.2 or later. Download to personal computer from: http://www.microsoft.com/windowsmobile/en-us/downloads/eulas/eula_activesync45_1033.mspx?ProductID=76

- 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.

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.

3.1 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.

1) Coordinate System
   a. Tap on the Coordinate System.
   b. 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.
   c. Tap on the Units.
   d. 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.
   e. Tap Real-time Settings.
   f. 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.
   g. The GPS unit is now configured correctly for your specific project.

4.0 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.

5.0 COLLECTING NEW DATA IN THE FIELD

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. If the integral keyboard does not appear, tap the small keyboard icon at the bottom of the screen.

4) After entering the file name, tap Create to create the new file.

5) 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).

6) The Choose Feature screen appears.

5.1 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) **Do not 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, tap on Point_generic as the Feature Name.

5) Tap Create to begin data logging.

6) In the Comment Box enter sample ID or location-specific information.

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.

5.2 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.

5.3 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.

4) Highlight the file you want to view and select Map from the Main Menu.

5) To add data points to this file, tap on Main Menu and select Data. Continue to collect additional data points.

6.0 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.

7.0 PULLING IN 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".

8.0 DATA TRANSFER

This section provides instructions on how to transfer stored data on the handheld GPS unit to a personal computer. Prior to transferring data from the GPS unit to a computer, Microsoft ActiveSync and Trimble Data Transfer Utility software must be downloaded to the computer from the links provided in Section 2.2 (Required GPS Software). If a leased computer is utilized in which the operator can not download files, see the Note at the end of Section 8.0.

1) See Attachment A at the end of this SOP for instructions on how to transfer data from the GPS to a personal computer.

Note: If you are unable to properly transfer data from the GPS unit to a personal computer, the unit should be shipped to the project-specific contact listed in Section 1.0 where the data will be transferred and the GPS unit then shipped back to the vendor.

9.0 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.

ATTACHMENT A

How to Transfer Trimble GPS Data between Data Collector and PC
original 11/21/06 (5/1/08 update) – John Wright

Remember – Coordinate System, Datum, and Units are critical!!!

Trimble Data Collection Devices:
Standard rental systems include the Trimble ProXR/XRS backpack and the newer handheld GeoXT or GeoXH units. Some of the older backpack system may come with either a RECON "PDA-style" or a TSCe or TSC1 alpha-numeric style data collector.

The software on all of the above units should be Trimble TerraSync (v 2.53 or higher – current version is 3.20) and to the user should basically look and function similar. The newer units and software versions (which should always be requested when renting) include enhancements for data processing, real-time display functions, and other features.

Data Transfer:
Trimble provides a free transfer utility program to aid in the transfer of GIS and field data. The Data Transfer Utility is a standalone program that will run on a standard office PC or laptop.

To connect a field data collector such as a RECON, GeoXM, GeoXT, GeoXH, or ProXH, you must first have Microsoft ActiveSync installed to allow the PC and the data collector to talk to one another. A standard USB cable is also needed to connect the two devices.

A CD or USB drive is provided with the data collector for use in data transfer. If needed, these programs are also available without charge via the web at:

• **Trimble Data Transfer Utility** (v 1.38) program to download the RECON or GeoXH field data to your PC: http://www.trimble.com/datatransfer.shtml

• **ActiveSync** from Microsoft to connect the data collector to the PC. The latest version (v4.5) can be found at: http://www.microsoft.com/windowsmobile/activesync/default.mspx
(see page 2 for data transfer instructions)

To Transfer Data Collected in the Field:

• Install the Data Transfer and ActiveSync software installed on your PC
• Connect the RECON or GeoXH to your PC via an A/B USB cable (blade end and square end type "HP printer" style)
• ActiveSync should auto-detect the connection and recognize the data collector
• Make sure the data file desired is CLOSED in TerraSync prior to transfer
• Connect via ActiveSync as a guest (not a partnership)
• Run the Trimble Data Transfer Utility program on your PC
• Select "***GIS Datalogger on Windows CE***" or similar selection
• Hit the green connect icon to the right - the far right area should say "***Connected to ....***" if successful
• Select the "***Receive***" data tab (under device)
• Select "***Data***" from file types on the right
• Find the file(s) needed for data transfer. You can sort the data files by clicking on the date/time header
• Select or browse to a C-drive folder you can put this file for emailing
• When the file appears on the list, hit the "***Transfer All***"
• Go to your Outlook or other email, send a message to: John.Wright@tetratech.com (or GIS department)
• Attach the file(s) you downloaded from your C-drive. For each TerraSync data file created you should have a packet of multiple data files. All need to be sent as a group – make sure you attach all files (the number of files may vary – examples include: ssf, obx, obs, gix, giw, gis, gip, gic, dd, and car)

To Transfer GIS Data from PC to the Field Device (must be converted in Pathfinder Office):

• Obtain GIS file(s) desired from GIS Department and have converted to Trimble extension
• Contact John Wright (John.Wright@tetratech.com) if needed for file conversion and upload support
• The GIS file(s) can be quickly converted if requested and sent back to the field user in the needed "Trimble xxx.imp" extension via email – then quickly downloaded from Outlook to your PC for transfer
• Install the Data Transfer and ActiveSync software installed on your PC
• Connect the RECON or GeoXH to your PC via an A/B USB cable (blade end and square end type "HP printer" style)
• ActiveSync should auto-detect the connection and recognize the data collector
• Connect via ActiveSync as a guest (not a partnership)
• Run the Trimble Data Transfer Utility program on your PC
• Select "***GIS Datalogger on Windows CE***" or similar selection
• Hit the green connect icon to the right - the far right area should say "***Connected to ....***" if successful
• Select the "**Send**" data tab (under device)
• Select "**Data**" from file types on the right (you can also send background files)
• Browse to the location of the data on your PC (obtain the file from Pathfinder Office or from the person who converted the data for field use)
• Select the options as appropriate for the name and location of the data file to go on the data collector (usually you can choose main memory or a data storage card)
• When the file(s) appears on the list, hit the "***Transfer All***"
• Run TerraSync on the field device and open the existing data files. Your transferred file should appear (make sure you have selected Main Memory, Default, or Storage Card as appropriate)

STANDARD OPERATING PROCEDURE
SOP-04

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 SOP-01, UXO Detector-Aided Surface Surveys, provide specific guidance for UXO survey operations and equipment. 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.

If the UXO escort is the only Tetra Tech UXO person on site, he/she will perform the functions of the UXOSO and UXOQC as stated below.

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.

Quality Control

The UXOQC will review the definable features of work prior to the start of work each day. A new definable feature of work will receive a preparatory phase QC inspection prior to the start of work. This preparatory phase inspection is recorded on the Quality Control Surveillance Report. Work started on a new definable feature of work will receive an initial phase QC inspection. During vegetation management the UXOQC, or Senior UXO Technician if there is no UXOQC, will recheck 25-percent 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. The initial phase QC inspection will be documented on the Quality Control Surveillance Report. 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-percent of each unit (grids or transects). If at any time a unit fails the quality control check, the complete unit will be reworked and the rechecks will be increased to 25-percent until four units in a row pass the recheck. These follow up phase QC inspections will be recorded on the Quality Control Surveillance Report. All work will be conducted in accordance with the MEC Work Plan and the SOPs attached to that MEC Work Plan. All requested changes to the approved MEC Work Plan will be documented on the Record-of-Change Form and submitted to the PM and UXO Manager for action/approval. The UXOQC will prepare a Daily Quality Control Report for each day worked summarizing the definable features or work inspected, the phase of work, the locations, and personnel at the work site.

5.0 VEGETATION DISPOSAL

Vegetation disposal must be coordinated with the facility environmental office and, as applicable, the facility natural resources 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, this briefing will be documented on the Tailgate Safety Briefing form;

- 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.

7.0 REPORTS

The Senior UXO Technician on site will complete a Field Activity Daily Log for each day work is conducted. The log will be used to document and report significant events, logbook entries, phone calls, visitors, and other items of interest to the PM and UXO Manager. This report will be submitted as soon as possible at the end of the work day. The Field Activity Weekly Log is a summary of the week's events.

STANDARD OPERATING PROCEDURE
SOP-05

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 *demolition area using engineering controls consisting of 2 feet of sandbags placed on all four sides of each MEC/MPPEH item, with a plywood cover and 2 feet of sandbags on top of the plywood* ~~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 NASB Environmental Staff and Public Affairs Office* ~~the SUXOS~~, who in turn will report it to the UXO PM and Facility POC. *If complaints are received, they will be assessed on an individual basis by NASB Environmental Staff and Public Affairs Office. The Tetra Tech UXO specialists will be available to the NASB POC to provide technical advice as needed.*

- 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, *to include location of shot*, 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 one minute duration, five minutes prior to the shot and again one 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.

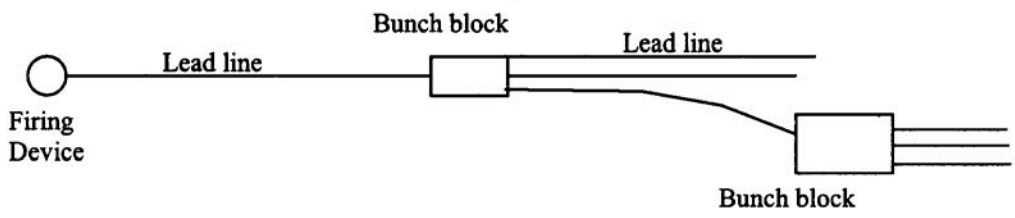


Figure 1

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.

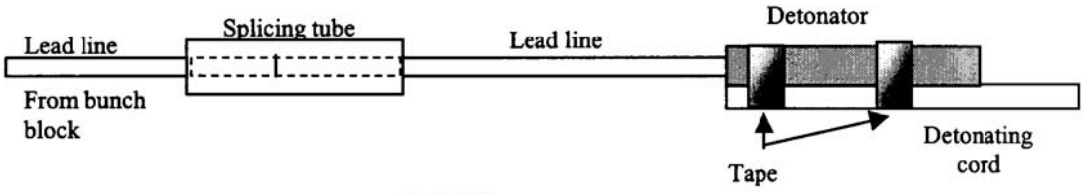


Figure 2

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 six inches off the end of the time/safety fuse roll and place the six inch piece in the time/safety fuse container.

- If quantity allows, accurately measure and cut off a six 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, stop watch 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 one 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 one-minute duration warning signal, using a bullhorn or siren, five minutes prior to detonation, and again at one 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 six 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 gets blown out of the firing device without activating, cut off six 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 one-hour waiting period prior to going downrange.

- After the one-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 till 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, *grid location(s) of items 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.

11.0 SAFETY AND PPE REQUIREMENTS

The following safety measures and personal protective equipment shall be used in preventing or reducing exposure to the hazards associated with MEC demolition/disposal operations. These requirements will be implemented unless superseded by site specific requirements stated in the Accident Prevention Plan (APP):

- Steel-toed safety boots will not be worn by demolition team personnel conducting demolition/disposal operations, unless a toe crush hazard exists, in which case personnel will wear boots with plastic or fiber toed safety toes;

- Unless a serious head, eye or face hazard exists, demolition team personnel will not be required to wear hard hats, safety glasses or face shields when conducting operations involving the handling of demolition explosives or MEC, except as stated previously; and

- In the event that a serious head, eye or face hazard does exist, demolition team personnel will wear the required PPE, but positive restraining means shall be required to secure the PPE to the head, face etc. and prevent it from falling and causing an accidental detonation.

12.0 AUDIT CRITERIA

The following items related to demolition/disposal operations on an MEC contaminated site will be audited to ensure compliance with this SOP:

- The Demolition Shot Record
- The Site Daily Operational and Safety Logs;
- The MEC Operations Daily/Weekly Report;
- The Safety Training Attendance Forms, for the initial site hazard training;
- The Safety Training Attendance Forms, for the Daily Tailgate Safety Briefings;
- The Daily Safety Inspection and Audit Log.

13.0 ATTACHMENTS

The following attachment to this SOP will be reviewed by all UXO-qualified personnel participating in demolition/disposal activities.

- Attachment 1 "Procedures for Demolition of Multiple Rounds Consolidated Shots on Ordnance and Explosives (OE) Sites"

- Attachment 2 Use of Sandbags for Mitigation of Fragmentation and Blasts Effects due to Intentional Detonation of Munitions (HNC-ED-CS-S-98-7)

- ~~Attachment 3 Use of Water for Mitigation of Fragmentation and Blasts Effects due to Intentional Detonation of Munitions (HNC-ED-CS-S-00-3)~~

US Army Corps of Engineers
Engineering and Support Center, Huntsville

Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites

AUGUST 1998 (Terminology Update March 2000)

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

OCT 27 1998

DDESB-KO

MEMORANDUM FOR DIRECTOR US ARMY TECHNICAL CENTER FOR EXPLOSIVES SAFETY (ATTENTION: SIOAC-ES)

SUBJECT: Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives Sites

References: (a) Memorandum from SIOAC-ESL to Chairman DDESB (ATTN: DDESB-KO), 14 September 1998, SAB

(b) M. Crull and Wayne Shaw, US Army Corps of Engineers, Huntsville, "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites" (August 1998)

The subject procedures forwarded by reference (a) and defined in reference (b) have been reviewed with respect to explosives safety criteria. Based on the information furnished, the procedures proposed in reference (b) for the demolition of consolidated ordnance at OE sites are approved.

Point of contact is Dr. Chester E. Canada, DDESB-KT2 (PH: 703-325-1369, FAX: 703-325-6227, E-MAIL: canadce@hqda.army.mil).

for DANIEL T. TOMPKINS
Colonel, USAF
Chairman

Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites

August 1998

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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.

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1. Placement of Munitions for Consolidated Shots 1

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.

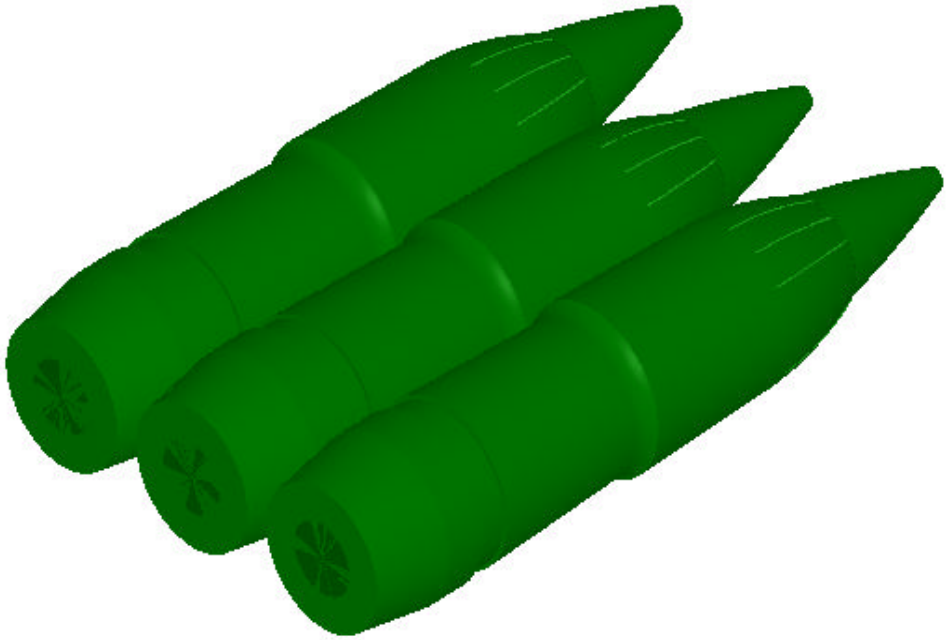

Figure 1 – Placement of Munitions for Consolidated Shots

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

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Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions

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August 1998

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PAUL M. LAHOUD, PE — Date
Chief, Civil-Structures Division

EXECUTIVE SUMMARY

The U.S. Army Engineering and Support Center, Huntsville (USAESCH) is currently engaged in projects which require the disposal of uncovered/discarded ordnance and explosives (OE) on public and private lands. The uncovered OE item is often detonated in place if it is too dangerous to move. In some cases, covering and tamping with loose earth is used to contain the blast and fragments. Another method to mitigate the fragmentation and blast effects is to cover the item with sandbags. However, traditionally there has been no method to determine the optimum configuration or the required thickness of such a sandbag enclosure.

The Structural Branch, USAESCH, sponsored a test program in 1997 to evaluate the use of sandbag enclosures for fragment and blast mitigation, for intentional detonations at Ordnance and Explosives (OE) sites. Southwest Research Institute (SwRI), under contract to USAESCH, performed a two phase test program of sandbag enclosures. In phase one, the preliminary explosive test phase, four tests on a 155-mm projectile were performed to refine and optimize the test procedure. This test procedure was used in phase two, the comprehensive explosive test phase. In phase two, a total of fourteen tests with five different munitions were performed to determine the thickness of sandbags required to capture all primary fragments. Measurements were made of the overpressures at various places, sandbag throw distances, depth of fragment penetration, and noise levels. High-speed film cameras, video recorders and digital cameras were used to visually record the events.

Required Wall and Roof Thicknesses for Sandbag Enclosures, with Expected Sandbag Throw Distances and Pressures, for Five Tested Munitions

Munition	Charge Weight, Comp B, lb	Required Wall and Roof Sandbag Thickness, in	Expected Maximum Sandbag Throw Distance, ft	Expected Peak Pressure @ 40 feet, psi	Expected Peak Pressure @ 80 feet, psi	Expected Sound Level @ 100 feet, dB
155-mm M107	15.4	36	220	0.18	0.09	115
4.2-in M329A2	8.17 (TNT)	24	125	0.16	0.06	116
105-mm M1	5.08	24	135	0.18	0.08	120
81-mm M374A2	2.1	20	125	0.14	0.05	119
60-mm M49A3	0.43	12	25	0.08	0.03	118

The results of these tests have been used to develop guidelines for the use of sandbag enclosures. The guidelines include required sandbag thicknesses, configuration and construction of the sandbag enclosures, and withdrawal distances based on the greater of sandbag throw distances or 200 ft. This document provides a summary of the test results and these guidelines.

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1.0 Introduction

The U.S. Army Engineering and Support Center, Huntsville (USAESCH) is currently engaged in projects which require the disposal of uncovered/discarded ordnance and explosives (OE) on public and private lands. The uncovered OE item is often detonated in place if it is too dangerous to move. In some cases, covering and tamping with loose earth is used to contain the blast and fragments. Another method to mitigate the fragmentation and blast effects is to cover the item with sandbags. However, traditionally there has been no method to determine the optimum configuration or the required thickness of such a sandbag enclosure.

The Structural Branch, USAESCH, sponsored a test program in 1997 to evaluate the use of sandbag enclosures for fragment and blast mitigation, for intentional detonations at Ordnance and Explosives (OE) sites. Southwest Research Institute (SwRI), under contract to USAESCH, performed a two phase test program of sandbag enclosures. In phase one, the preliminary explosive test phase, four tests on a 155-mm projectile were performed to refine and optimize the test procedure. This test procedure was used in phase two, the comprehensive explosive test phase. In phase two, a total of fourteen tests with five different munitions were performed to determine the thickness of sandbags required to capture all primary fragments. Measurements were made of the overpressures at various places, sandbag throw distances, depth of fragment penetration, and noise levels. High-speed film cameras, video recorders and digital cameras were used to visually record the events.

The results of these tests have been used to develop guidelines for the use of sandbag enclosures. The guidelines include required sandbag thicknesses, configuration and construction of the sandbag enclosures, and withdrawal distances based on the greater of sandbag throw distances or 200 ft. This document provides a summary of the test results and these guidelines.

2.0 Test Program

2.1 Fragmentation Characteristics of Munitions

Prior to beginning this test program the fragmentation characteristics of a variety of munitions frequently encountered during OE site operations were determined. The fragmentation characteristics were calculated in accordance with procedures outlined in TM5-1300, “Structures to Resist the Effects of Accidental Explosions” [1] and detailed in CEHNC-ED-CS-S-98-1, “Methods for Predicting Primary Fragmentation Characteristics of Cased Explosives” [2]. The fragmentation characteristics were used to predict preliminary thicknesses of sand required to prevent perforation for the five munitions tested.

Optimally, the fragments from the munition will strike the sandbags before the blast wave so that the fragments are penetrating undisturbed sand. To ensure that this will occur it is necessary to reduce the coupling between the explosive charge and the

surrounding soil. This coupling is dependent on the separation distance between the charge and the soil. Full coupling implies that the maximum amount of energy, or velocity, is transferred from the explosive into the soil immediately adjacent to the charge. If an explosive charge is placed in a cavity, so that an air gap exists between the charge and the walls of the cavity, coupling between the explosive and soil is reduced. Therefore, a standoff of some distance is required to reduce the coupling effect. Calculations to determine the velocity of sand particles from a buried explosion were performed. The velocity of the sand particles was compared to the velocity of the design fragment through sand. These calculations suggest that at a distance between 6 and 12 inches from the explosion, the fragment velocity exceeds the particle velocity. Therefore, the initial standoff distances for the tests were 6 and 12 inches.

2.2 Preliminary Explosive Test Phase

In the preliminary explosive tests, four tests of statically detonated 155-mm M107 projectiles were performed. These tests provided the data needed to specify the amount and configuration of sandbags that are required to safely detonate a 155-mm projectile in place, verified that the general test procedure was satisfactory, and defined the instrumentation and data acquisition systems for the subsequent comprehensive explosive tests. Figure 1 shows the site layout for the tests of sandbag enclosures. Although, munitions are rarely oriented vertically for demolition in place, the vertical orientation provided the opportunity to evaluate a greater number of combinations of wall thicknesses and standoff distances. Figures 2 and 3 show the sandbag enclosure configurations for vertical and horizontal weapon tests.

The test matrix for the preliminary explosive tests is shown in Table 1. Two tests were run with the 155-mm in the vertical orientation and two in the horizontal orientation. Each test allowed five standoff distances and five sandbag thicknesses to be evaluated.

The sandbags were made of woven polypropylene, as is commonly used by explosives and ordnance disposal (EOD) personnel, and the volume/weight of the sandbags was either 0.5 ft^3/50 lbs for the large bags or 0.25 ft^3/25 lbs for the small bags. The small bags were used for test two. No additional information was provided by using the small bags so these were not used for any other tests. The bags were filled with a “washed river” sand that was judged to be “typical” by a local soil consultant (Fugro-McClelland Southwest, Inc.).

To determine the sandbag throw distribution some of the sandbags in the first two tests were filled with sand colored with dye. The dye did not improve the quality of the test results. Spray paint was used in the subsequent tests to mark each bag with its original position in the sandbag enclosure. A different color was used to indicate the wall or the roof and numbers were used to indicate the layer in which the sandbag was located.

Detailed descriptions of all tests and results are provided in “Evaluation of Sandbags for Fragment and Blast Mitigation” by Southwest Research Institute [3].

Table 1 – Test Matrix for Preliminary Explosive Tests

Test No.	Orientation	Standoff, in.					Wall Thickness, in. (Bag Size)				Wall Height, in. (Bag Size)	
		S_1	S_2	S_3	S_4	S_R	T_1	T_2	T_3	T_4	H_1	H_2
155-1	Vertical	12	6	6	12	6	32	32.5	45	43	32	20
155-2	Vertical	6	6	6	6	6	18(s)	54	18(s)	53(s)	32	22
155-3	Horizontal	6	6	6	6	6	30	48	24	24	12	30
155-4	Horizontal	6	6	6	6	6	35	36	34	36	12	36

Note: All walls were constructed with large bags, except for those designated with an “s” for small bags.

2.2.1 Preliminary Explosive Test Results

For tests 1 and 2, the 155-mm M107 projectile was detonated using a donor charge of 200 g of C-4 placed in the fuze well and initiated with an Exploding Bridge Wire. For tests 3 and 4, the 155-mm M107 projectile was detonated using a well perforator shaped charge. This approach is typically used for on-site detonations. Time of arrival (TOA) pins were used for all tests to determine if a high order detonation was achieved.

All detonations were high order and results were obtained. The make screens and their frames and the assorted witness screens were scattered across the site. Where possible, each screen was identified and photographed and the number of fragment holes or the condition of the screen was recorded. The results of the first three tests suggested that a wall and roof thickness of 36 inches should be sufficient to contain all of the fragments and to reduce the overpressure levels. The dimensions of test 4 confirmed this configuration.

From the limited data collected on standoff distance, it appears that for standoffs of 6 and 12 inches there is no difference in the thickness of sandbags required to stop fragments. Test 2 showed that the size of the sandbag did not affect the fragment penetration. Test 3 showed that the horizontal orientation of the munition did not greatly effect the fragment penetration. Tests 3 and 4 showed that the base plate of the munition broke up and was stopped by 24 inches or less of sandbags.

The data collected showed that approximately 20 inches of sandbags will completely contain the fragments from the 155-mm M107 projectile. The only indications of fragments exiting the sandbag enclosure came from the two identical 18 inch walls of test 2 (external witness screens on sides 1 and 3 both registered fragment impacts). Internal witness screens at depths of 20 inches to 24 inches for all 4 tests did not indicate any fragment impacts. In tests 2 through 4, the roof witness screens also showed no penetrations for 20 to 36 inches of roof depth. The CONWEP software [4] predicts that 24 inches of sand will stop the design fragment from the 155-mm M107 projectile.

Sandbag throw distances were recorded in 10 foot increments from ground zero to the furthest sandbags. The maximum sandbag throw distances were 150 feet, 191 feet,

157 feet, and 150 feet for tests 1 through 4, respectively. All of the furthest thrown sandbags came from the roof. In most cases, the roof sandbags were found relatively intact while the wall sandbags were often disintegrated. The bulk of the sandbags fell within 100 feet with only a few beyond this distance. An examination of the sandbag throw distances show that the standoff, the size of the bag, and the weapon orientation did not affect the throw distance to any significant degree.

Blast overpressures were recorded for all 4 tests (see Table 2). As shown, the sandbag enclosures greatly reduced the magnitude of the pressure. In test 3, a digital sound meter was placed 100 feet from ground zero and the maximum sound level recorded was 114.7 decibels.

Table 2 – Blast Overpressures from Preliminary Explosive Tests

Test No.	Side 1				Side 4			
	P1 @ 40', psi	P2 @ 40', psi	P3 @ 80', psi	P4 @ 80', psi	P5 @ 40', psi	P6 @ 40', psi	P7 @ 80', psi	P8 @ 80', psi
155-1	0.67	0.71	ND	ND	0.37	0.38	ND	ND
155-2	1.31	1.18	ND	ND	0.74	0.97	ND	ND
155-3	0.16	0.16	0.07	0.06	0.16	0.18	0.09	ND
155-4	0.04	0.04	0.03	0.03	0.07	0.08	ND	0.05

ND = no data

2.3 Comprehensive Explosive Tests

An additional fourteen tests were performed: one more using 155-mm M107 projectiles, four using 105-mm M1 projectiles, three using 4.2-in M329A2 projectiles, four using 81-mm M374A2 mortars, and two using 60-mm M49A3 mortars. The test matrix for the comprehensive explosive tests is shown in Table 3. For all tests performed with the munition in the vertical orientation, detonation was achieved using a donor charge of 100 grams (50 grams for test 60-1) of C-4 in the fuze well. For all tests performed with the munition in the horizontal orientation, detonation was achieved using a well perforator. TOA pins were used for all tests to check if a high order detonation was achieved.

For each of the comprehensive explosive tests, woven polypropylene 0.5 ft^3 sandbags were filled with 50 lbs of washed river sand. The sandbags were painted and numbered as described in Section 2.2 to indicate their original position in the sandbag enclosure. Moisture content was not controlled nor monitored during the test program.

Pressure gages, a sound meter, high speed cameras, digital cameras and video cameras were used for data acquisition during each test. Internal and external witness screens were used to determine how deeply the fragments moved into the sandbag mass and whether any fragments exited the sandbag enclosure.

Table 3 – Test Matrix for Comprehensive Explosive Tests

Test No.	Orientation	Standoff, in.					Wall Thickness, in.				Wall Height, in.	
		S_1	S_2	S_3	S_4	S_R	T_1	T_2	T_3	T_4	H_1	H_2
155-5	Horizontal	7	7	5	6	7	36	36	36	36	13	36
4.2-1	Vertical	5.5	5.5	5.5	5.5	6	20	24	31	36	19	24
4.2-2	Horizontal	6.5	6.5	6	6	7	24	25	24	24	11	24
4.2-3	Horizontal	6	5	5	6	7	24	25	25	24	11	24
105-1	Vertical	5.5	5.5	5.5	5.5	6	20	26	31	35	25	24
105-2	Vertical	0	0	4	6	6	29	25	19	25	26	23
105-3	Horizontal	7	5	5	5	9	24	24	24	24	13	24
105-4	Horizontal	6.5	6	5	6	7	25	25	24	24	11	23
81-1	Vertical	5	5	6	6	6	12	19	23	30	15	18
81-2	Horizontal	7	6	5.5	7	6	18	24	18	24	9	18
81-3	Horizontal	7	6	5	6	7	18	19	18	19	10	18
81-4	Horizontal	6	5.5	5.5	5.5	8	19	20	19	20	11	18
60-1	Vertical	6	6	6	6	6	13	19	23	30	11	12
60-2	Horizontal	6.5	3	5.5	3	6	12	12	12	12	8	13

All detonations were high order and results were obtained. The assorted witness screens were scattered across the site. Where possible, each screen was identified and photographed and the number of fragment holes or the condition of the screen was recorded. Sandbag throw distances were recorded in 10 foot increments from ground zero to the furthest sandbags. Blast overpressures were recorded for all tests at 40 feet and 80 feet from ground zero. A digital sound meter was placed 100 feet from ground zero. A summary of the results is shown in Table 4.

The final test for each munition was a confirmation test. These included tests 155-5, 4.2-3, 105-4, 81-3 and 60-2. The purpose of the confirmation tests was to model as closely as possible the actual use of sandbags in field conditions. In each test the internal witness screens were omitted. Sandbags were staggered both horizontally and vertically. External witness screens were placed over the roof and the two sides facing away from the pressure gages. After each test, the external witness screens were recovered and inspected for fragment penetrations. No such penetrations were identified. Therefore, the sandbag thicknesses defined in Table 4 are those used in the confirmation tests. For two munitions, the penetration data from internal witness panels suggests that somewhat smaller sandbag thicknesses may be sufficient to capture all fragments. As stated above for the 155-mm M107, internal witness screens show no fragment penetrations for sandbag thicknesses of about 24 inches or more. For the 4.2-inch M329A2 mortar, the internal witness screens show no fragment penetrations deeper than about 18 inches. However, the thicknesses of 36 inches for the 155-mm M107 and 24 inches for the 4.2-inch M329A2 are retained for use in the field, since sandbag throw distances are based on these thicknesses. While possibly thicker than necessary from capturing fragments, the increased total mass of the sandbags results in reduced sandbag throw distances.

Detailed descriptions of all tests and results are provided in “Evaluation of Sandbags for Fragment and Blast Mitigation” by Southwest Research Institute [3].

3.0 Guidelines for Use of Sandbags

3.1 Enclosure Geometry

Table 5 summarizes the results of the tests. This table specifies the minimum thickness of sandbag walls and roof that is needed to completely contain the fragments for the five munitions that were tested in this project. It also gives the expected maximum sandbag throw distances, the peak pressures at 40 feet and 80 feet, and the sound level at 100 feet, for the five munitions. For safety and conservatism, the expected sandbag throw distances are approximately 10% larger than the largest distances actually measured in the tests. Thus, the expected sandbag throw distances given in Table 5 are conservative in two ways: first, the largest measured sandbag throw distance from all tests of a particular round is used and second, this value is increased by 10%. Due to the already low values of peak pressures, a similar increase in the expected peak pressures was not deemed necessary or justified.

Table 4 – Summary of Results from Comprehensive Explosive Tests

Munition	Sandbag Thickness (in) to Defeat Fragments	Max. Sandbag Throw Distance (ft)		Max Peak Overpressure (psi) @ 40 ft		Max Peak Overpressure (psi) @ 80 ft		Max Noise Level (dB) at 100 ft
		Side of Round	Nose/Tail of Round	Side of Round	Nose of Round	Side of Round	Nose of Round	
155-mm M107	36	200	130	0.06	0.12	0.04	0.05	114.7
4.2-in M329A2	24	110	70	0.12	0.14	0.04	0.06	115.8
105-mm M1	24	120	50	0.17	0.18	0.07	0.08	119.3
81-mm M374A1	20	110	30	0.14	0.08	0.05	0.03	118.3
60-mm M49A3	12	20	20	0.06	0.08	0.02	0.03	117.3

Obviously, the five munition types do not cover all of the munitions that may be encountered. To determine the minimum wall and roof thickness for a particular shell other than those found in Table 5, the approach is as follows:

(1) Determine the initial fragment velocity (V_F) in ft/s, the maximum fragment weight (W_F) in pounds, and the kinetic energy ($W_F V_F^2/2$) in lb-ft^2/s^2 for the particular munition.

(2) Identify the munition with the next largest kinetic energy, from Table 6.

(3) Use the sandbag wall and roof thickness from Table 5 for the munition with the next largest kinetic energy shown in Table 6.

Table 6 provides the maximum fragment weight, the initial fragment velocity, and the resulting kinetic energy for the 5 munition types. The maximum fragment weight and the initial fragment velocity values were determined with the Mott and Gurney equations, as presented in TM 5-1300 [1] and detailed in HNC-ED-CS-S-98-1 [2].

Table 5 - Required Wall and Roof Thicknesses for Sandbag Enclosures, with Expected Sandbag Throw Distances and Pressures, for Five Tested Munitions

Munition	Charge Weight, Comp B, lb	Required Wall and Roof Sandbag Thickness, in	Expected Maximum Sandbag Throw Distance, ft	Expected Peak Pressure @ 40 feet, psi	Expected Peak Pressure @ 80 feet, psi	Expected Sound Level @ 100 feet, dB
155-mm M107	15.4	36	220	0.18	0.09	115
4.2-in M329A2	8.17 (TNT)	24	125	0.16	0.06	116
105-mm M1	5.08	24	135	0.18	0.08	120
81-mm M374A2	2.1	20	125	0.14	0.05	119
60-mm M49A3	0.43	12	25	0.05	0.03	118

Table 6 - Maximum Fragment Weight, Initial Fragment Velocity and Kinetic Energy for Five Tested Munitions

Munition	W_F, Maximum Fragment Weight, lb	V_F, Initial Fragment Velocity, ft/s	Kinetic Energy, 10^6 lb-ft^2/s^2
155-mm M107	0.467	4667	5.085
4.2-in M329A2	0.079	6391	1.613
105-mm M1	0.155	4870	1.868
81-mm M374A2	0.031	6721	0.700
60-mm M49A3	0.033	3605	0.214

As an example, for a shell such as the 3-in Stokes Mortar Round, the maximum fragment weight and initial fragment velocity are 0.0436 lb and 6189 ft/s, respectively. The resulting kinetic energy is 0.835 x 10^6 lb-ft^2/s^2. The next largest fragment kinetic energy in Table 6 is the 4.2-in M329A2 round. Therefore, a sandbag enclosure with a roof and wall thicknesses of 24 inches should be used to contain the fragments and suppress the blast overpressures. The maximum sandbag throw distance is 125 ft. Therefore, the withdrawal distance is 200 ft.

Based on this procedure, a more complete list of typical munitions is given in Table 7. This table includes the required sandbag wall and roof thicknesses and maximum expected sandbag throw distances to be used for each munition. For other munitions not listed in Table 7, the procedure given above can be used. The procedure should not be used to extrapolate sandbag thicknesses or sandbag throw distances for munitions larger than the 155-mm M107.

3.2 Enclosure Construction Method

The enclosure construction method follows the procedure that was used to build the test enclosures, with a few modifications. Figure 4 illustrates a typical enclosure. Figure 5 shows a photograph of a sandbag enclosure for an 81 mm mortar.

The sandbag fabric should be woven polypropylene. Each bag should have a nominal volume of 0.5 ft^3 and an approximate weight when full of 50 lb. The bags should be filled with washed sand, either dry or in saturated surface dry (that is, slightly moist) condition. Wet sand should not be used. Prefilled sandbags should be protected from the rain by storage on pallets, off the ground surface, and by covering them with a plastic tarpaulin or similar cover to prevent them from becoming saturated with water. The gradations and physical composition of the sand are not critical but it should be at least typical of local construction practice for sand used in foundations and backfill. Minor inclusions of clay or soils materials can be permitted. However, no rocks or stones should be placed in the sandbags. Typically, the sand used for the tests had a density of about 100 pounds per cubic foot and a moisture content of 6-7%.

Four walls of identical thickness should surround the munition. The minimum wall thickness should be the thickness determined using the procedure in Section 3.1 above. The sandbag walls should be stacked to maintain a clear standoff distance of 6 inches between the shell and the inside face of each wall. The interior face of each wall should be vertical but the exterior face can be built with a 1:6 slope (2" horizontal to 12" vertical). If a sloped outer face is used, the thickness of the wall, at the nominal “top” of the wall, 6 inches above the top of the munition, must be no less than the specified required thickness

The sandbags should be placed tightly against each other. All vertical joints should be staggered, so there is no clear line of sight from the munition to the exterior. As the wall is built, each new layer of sandbags should run in opposite direction to the layer below, so that the layers are interlocked (see Figure 6).

At a minimum, a double layer of sandbags shall be used. For example, when a 12” thickness is required, the sandbags should be oriented so that two sandbags are necessary to achieve this thickness (see Figure 7).

After the walls are constructed to a height of 6" above the upper surface of the munition, the shaped charge or other initiator should be placed on the shell. Ideally, the use of shaped charges, such as oil well perforators, is recommended. These add very little to the total charge weight for each detonation, given the highly directional nature of the effects of the shaped charge. Also, the use of shaped charges for initiation parallels test procedures. The shaped charge should be located either on top of the munition or on its side. If it is located on the side of the round, the charge should be tilted downward sufficiently to ensure that the shaped charge jet penetrates the round and is directed into the ground, rather than into the opposite sandbag wall. Generally, a small mound of sand next to the round can be used to establish this orientation.

A sheet of 3/4-inch thick Douglas Fir (or equivalent) plywood should be cut to the dimensions of the cavity between the walls, plus 12 inches in each direction. The plywood sheet is then centered on the walls so that it bears on 6" of each wall. The additional sandbags that make up the roof of the enclosure are then placed on top. As with the side walls, the roof sandbags should be stacked with staggered horizontal joints and alternating directions in each layer. The exterior sides of the roof may also be vertical or have a 1:6 slope. The thickness of the sandbag roof, above the plywood panel, must be the same as the required wall thickness.

After the sandbag layers of the roof have been placed to the correct height, the enclosure is complete and the munition may be detonated.

Table 7 - Required Wall and Roof Thicknesses for Sandbag Enclosures, with Expected Sandbag Throw Distances and Pressures, for Tested and Non-Tested Munitions

Munition	Charge Weight (lb)	W_F, Maximum Fragment Weight, lb	V_F, Initial Fragment Velocity, ft/s	Kinetic Energy, 10^6 lb-ft^2/s^2	Required Wall and Roof Sandbag Thickness, in	Expected Maximum Sandbag Throw Distance, ft	With-drawal Distance, ft
155mm M107*	15.48	0.467	4667	5.086	36	220	220
4.7-in Mark I	6.07	0.591	3566	3.761	36	220	220
105mm M1*	5.08	0.155	4870	1.840	24	135	200
4.2-in M329A2*	8.165	0.079	6391	1.607	24	125	200
4-in Stokes	7.92	0.078	6336	1.570	24	125	200
75mm M48	1.47	0.153	3471	0.922	24	125	200
3-in Stokes	2.1	0.044	6189	0.835	24	125	200
2.75-in M229 Rocket	4.8	0.050	5569	0.777	24	125	200
81mm M374*	2.1	0.031	6721	0.696	20	125	200
37mm MK II	0.53	0.030	5758	0.490	20	125	200
60mm M49A3*	0.42	0.024	5114	0.310	12	25	200
FMU 54A/B	0.357	0.006	9031	0.263	12	25	200
40mm MK2 Mod 0	0.187	0.033	3605	0.215	12	25	200
MK II Grenade	0.125	0.014	3425	0.083	12	25	200
25mm M792	0.096	0.005	5736	0.081	12	25	200
M67 Grenade	0.40625	0.001	7006	0.029	12	25	200
20mm M56A4	0.0264	0.0000011	4941	0.004	12	25	200

* = tested munitions

3.3 Withdrawal Zone

A withdrawal zone is necessary for any detonation. This withdrawal zone applies to everyone, both public and operational personnel. The withdrawal zone is the maximum of the sandbag throw distance, the distance to a sound level of 140 db, or 200 ft. For all munitions tested, the sound level at 100 ft was substantially less than 140 db. At 200 ft. the sound level will be even lower. The withdrawal zones are also listed in Table 7.

4.0 Summary and Conclusions

A test program has been performed to determine the effects of sandbag enclosures for mitigating fragments and blast effects due to an intentional detonation of a munition. A total of eighteen tests on five different munitions were performed. A summary of the test procedures and results are presented in this document.

The results of these tests have been used to develop guidelines for the use of sandbag enclosures to mitigate the fragments and blast effects due to an intentional detonation of a munition. Methods for determining the required sandbag thickness and the resulting sandbag throw distance are detailed in Section 3.0. Figures 4, 5, 6 and 7 show the resulting sandbag enclosures.

5.0 References

1. TM5-1300, “Structures to Resist the Effects of Accidental Explosions”, Departments of the Army, the Navy, and the Air Force, November 1990.

2. HNC-ED-CS-S-98-1, “Methods for Predicting Primary Fragmentation Characteristics of Cased Explosives”, M. Crull, U.S. Army Engineering and Support Center, Huntsville, January 1998.

3. “Evaluation of Sandbags for Fragment and Blast Mitigation”, D. Stevens, Southwest Research Institute, San Antonio, TX, January 1998.

4. “User’s Guide for Microcomputer Programs CONWEP and FUNPRO Applications of TM 5-855-1. “Fundamentals of Protective Design For Conventional Weapons””, Revision 2, D. Hyde, US Army Corps of Engineers Waterways Experiment Station, February 1989.

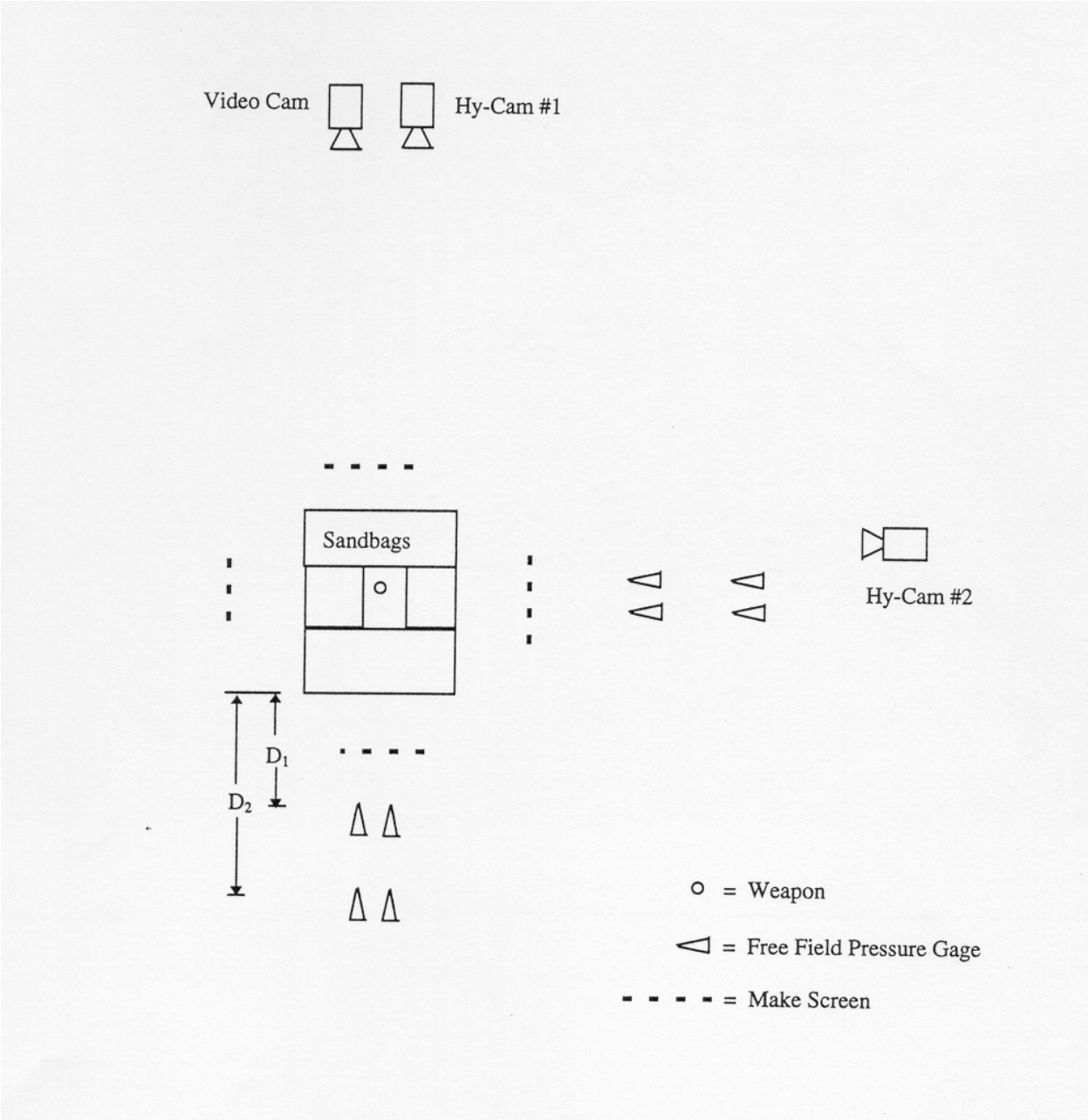

Figure 1 – Site Layout for Tests of Sandbag Enclosures

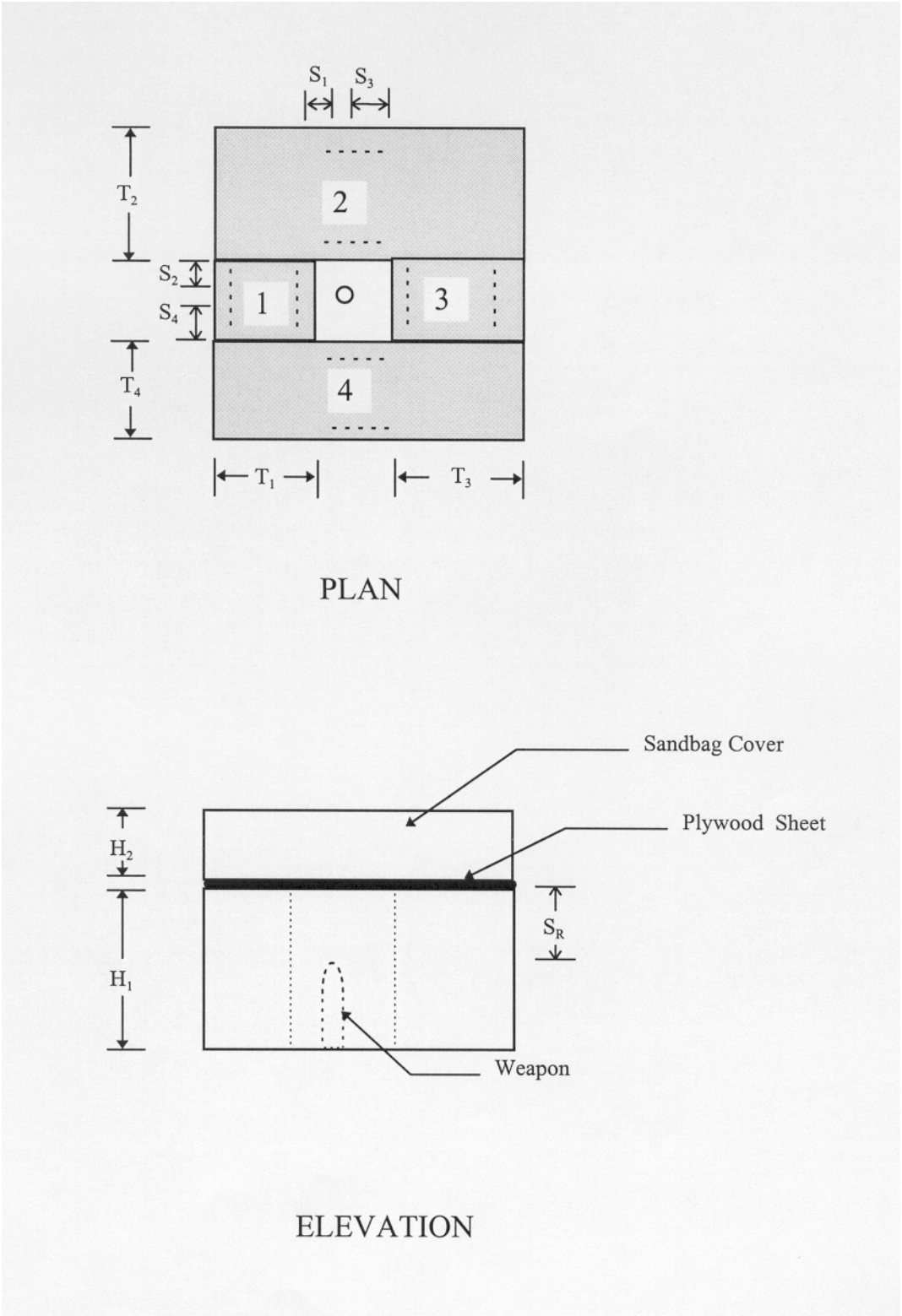

Figure 2 – Sandbag Enclosure Configuration for Vertical Weapon Tests

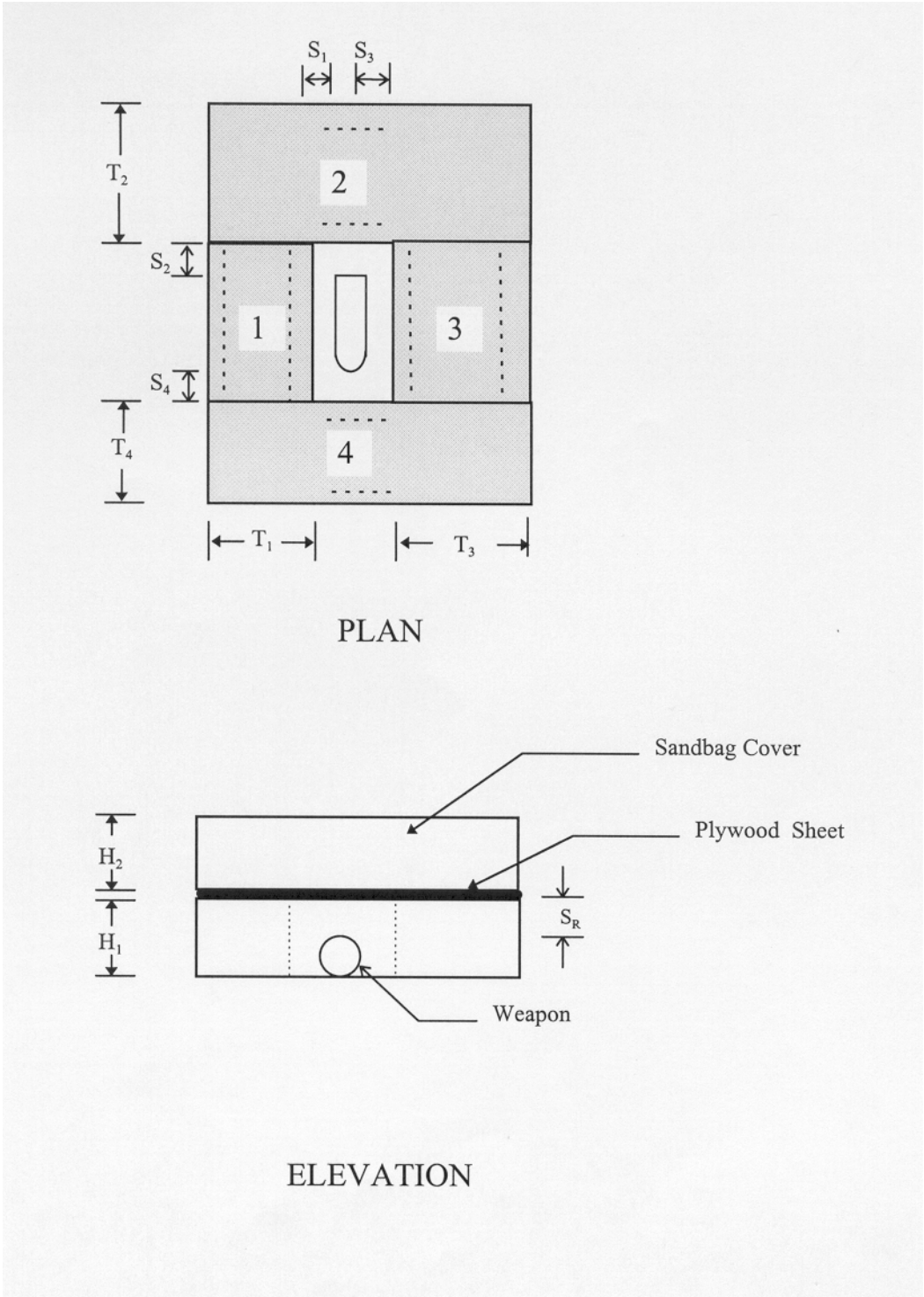

Figure 3 – Sandbag Enclosure Configuration for Horizontal Weapon Tests

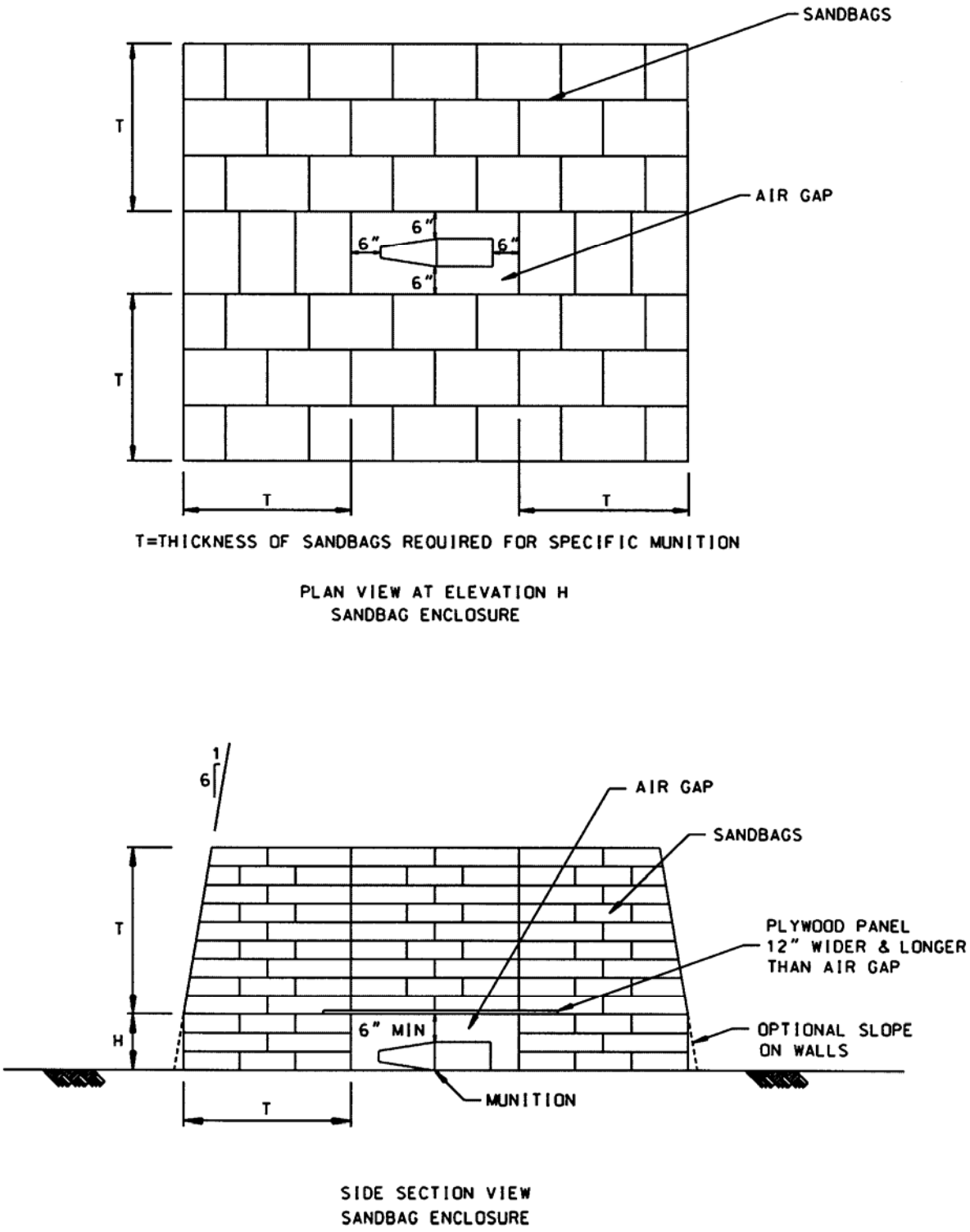

Figure 4 - Typical Sandbag Enclosure

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

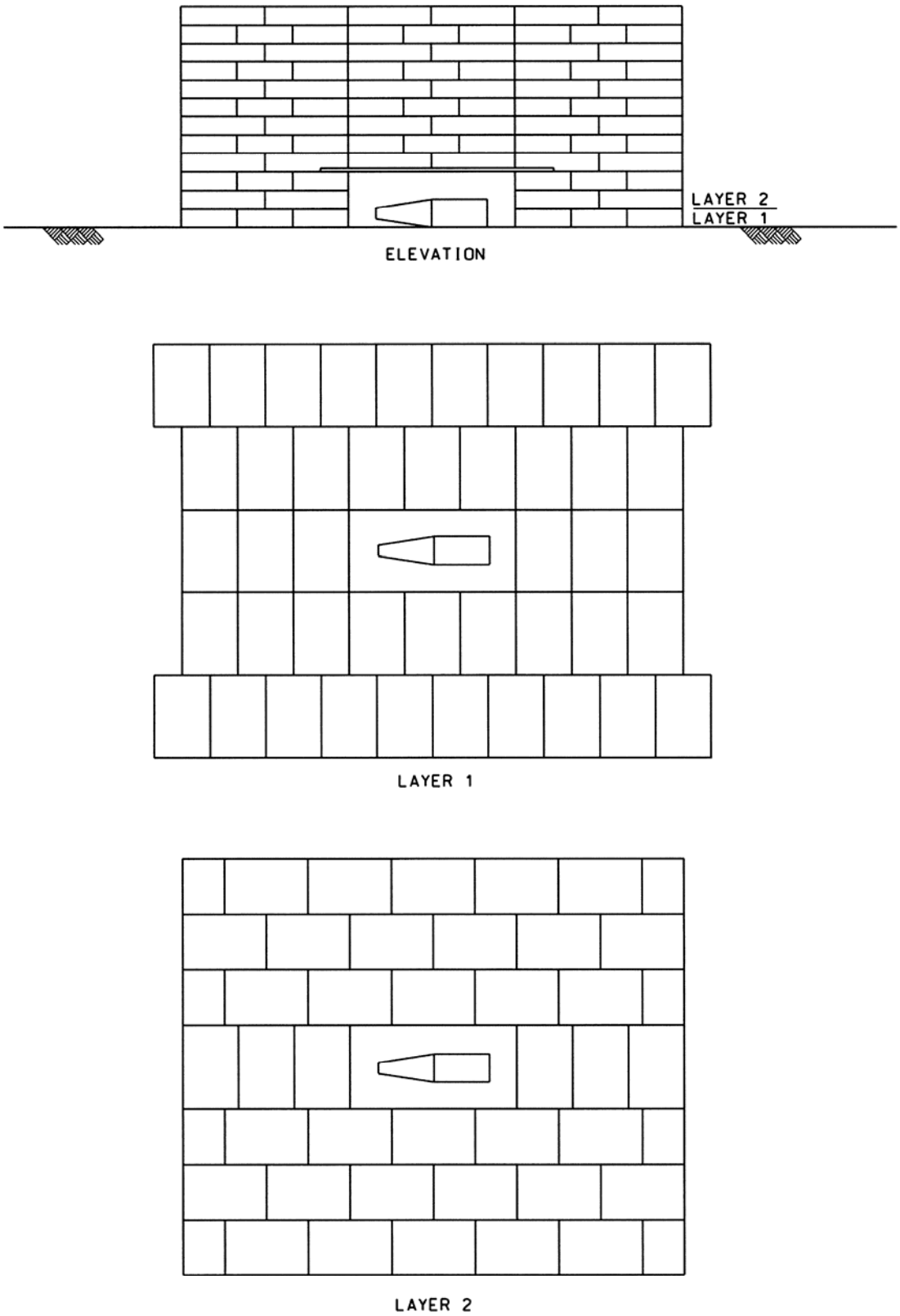

Figure 6 - Interlocking Alternate Layers of Sandbags

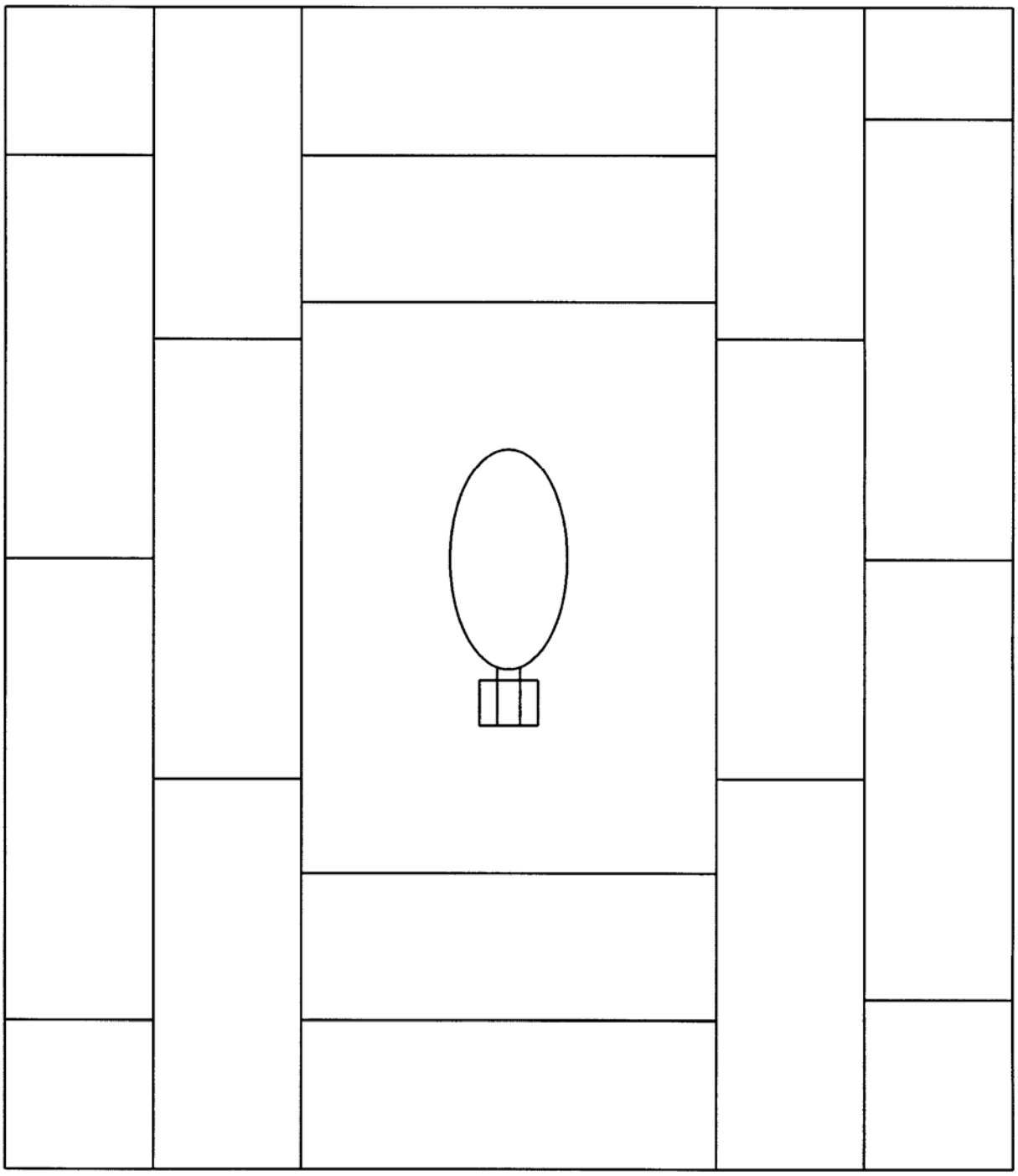

Figure 7 - Configuration for 12” Wall Enclosures

US Army Corps of Engineers
Engineering and Support Center, Huntsville

USE OF WATER FOR MITIGATION OF FRAGMENTATION AND BLAST EFFECTS DUE TO INTENTIONAL DETONATION OF MUNITIONS

Not Applicable

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

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

DDESB-KT

27 FEB 2001

MEMORANDUM FOR US ARMY DEFENSE AMMUNITION CENTER
(ATTENTION: SMAAC-ESL)

SUBJECT: Use of Water for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonations of Munitions, Report HNC-ED-S-00-3 (December 2000)

Reference: SMAAC-ESL (CESO-E/19 Dec 00) (385[A]) 1st End dated 21 December 2000, Subject: Explosives Safety Submission (ESS) for Use of Water for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonations of Munitions, HNC-ED-S-00-3, September 2000

The Department of Defense Explosives Safety Board (DDESB) Secretariat has reviewed the mitigation technology described in the subject report as requested by the reference. Based on the information furnished in the report the water mitigation techniques for intentional detonations defined in Section 3.0 of the report are approved for field use in Ordnance Explosives (OE) removal action projects.

A copy of this memorandum of approval must be included with a DDESB approved site plan, and be available at OE sites where intentional detonations are conducted that use the approved water mitigation technique.

The DDESB point of contact for this action is Dr. Jerry M. Ward, Director, Technical Programs Division, DSN: 221-2525, Commercial phone: (703) 325-2525; Fax: (DSN) 221-6227 and E-mail: Jerry.Ward@hqda.army.mil.

DANIEL T. TOMPKINS
Colonel, USAF
Chairman

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USE OF WATER FOR MITIGATION OF FRAGMENTATION AND BLAST EFFECTS DUE TO INTENTIONAL DETONATION OF MUNITIONS

HNC-ED-CS-S-00-2

FEBRUARY 2000

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WILLIAM H. ZEHRT, PE DATE
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Chief, Civil-Structures Division

Not Applicable

EXECUTIVE SUMMARY

The U.S. Army Engineering and Support Center, Huntsville (USAESCH) is currently engaged in projects which require the disposal of uncovered/discarded ordnance and explosives (OE) on public and private lands. The uncovered OE item is often detonated in place if it is too dangerous to move. In some cases, covering and tamping with loose earth is used to contain the blast and fragments. Another method to mitigate the fragmentation and blast effects is to cover the item with sandbags. However, both of these methods result in secondary fragments (earth clumps or sandbags) being thrown some distance from the blast. Preliminary tests show that water can be used to mitigate the fragmentation and blast effects and, depending on the method used to contain the water, there may be no hazardous secondary fragments. In addition, the water quenches the fireball and there is no fire hazard associated with the detonation. This last observation is especially important when working in a high fire hazard area.

The Structural Branch, USAESCH, sponsored a test program in 1999 to evaluate the use of water for fragment and blast mitigation, for intentional detonations at Ordnance and Explosives (OE) sites. The U.S. Army Engineer Research and Development Center (USAERDC), with USAESCH performed a two-phase test program of water mitigation of blast and fragmentation. In phase one, tests were conducted using four different munitions to determine the depth of water required to defeat the fragments. In phase two, different water containment systems were tested for these munitions.

For phase one, the munitions were suspended vertically in an aboveground pool in an off-center position. Thus the fragments were dispersed through varying thicknesses of water. Witness panels of 0.032” aluminum were used to record any fragments that might exit the pool. Witness screens were placed in the pool at various distances from the munition to determine if the fragments had penetrated that far.

Once a required water thickness was determined for each of the four munitions in phase one, containers were selected to test for use in actual disposal situations. The points considered in this selection were adaptability to munition size, transportability (empty or pre-filled with water), debris producing potential, adaptability to uneven terrain, and cost. The water containment systems tested were 55-gallon plastic drums, 1100-gallon plastic agricultural chemical tanks, 5-gallon stackable plastic carboys, and inflatable plastic wading pools.

These tests showed that water is a feasible means of mitigating fragments and blast effects from an intentional detonation. The containers that are made of heavy plastic produce secondary fragments that may be thrown some distance from the blast. The inflatable swimming pools did not produce any significant secondary fragments. Some small pieces of these pools were found around the site but, since the pool was made of thin flexible plastic, these pieces were very

Not Applicable

lightweight and not hazardous. High-speed photography of the tests shows that there is no fireball. Therefore, there is no fire hazard associated with the detonation.

The results of these tests have been used to develop guidelines for the use of water to mitigate fragments and blast effects due to an intentional detonation of a munition. Methods for determining the required water containment system and the resulting minimum separation distance are detailed in this report. Figures are provided to show the resulting munition/initiator configuration and water containment systems.

Not Applicable

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Not Applicable

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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Once a required water thickness was determined for each of the four munitions in phase one, containers were selected to test for use in actual disposal situations. The points considered in this selection were adaptability to munition size, transportability (empty or pre-filled with water), debris producing potential, adaptability to uneven terrain, and cost. The water containment systems tested were 55-gallon plastic drums, 1100-gallon plastic agricultural chemical tanks, 5-gallon stackable plastic carboys, and inflatable plastic wading pools.

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site but, since the pool was made of thin flexible plastic, these pieces were very lightweight and not hazardous. High-speed photography of the tests shows that there is no fireball. Therefore, there is no fire hazard associated with the detonation.

2.0 TEST PROGRAM

The munitions used in both phases of the tests are the 60 mm M49A4 mortar, the 81 mm M362A1 mortar, the 105 mm M1 projectile and the 155 mm M107 projectile.

2.1 Phase One Tests

Commercially available aboveground swimming pools were used to contain the water in the phase one tests because they were easily obtainable and relatively inexpensive. Different size pools were used for different munitions. In the phase one tests the munitions were suspended vertically in the pool at a specified distance from the edge of the munition to one edge of the pool (off-center). Window screens were suspended from 2”x2” wood beams 180 degrees from the nearest edge of the pool at specified distances from the munition. These were used as witness panels in the pool. Witness panels of 0.032” aluminum were placed around the outside of the pool to record any fragments that might leave the pool. The test layout is shown in Figure 1 and the dimensions of the pool and placement of the munition and witness screens are shown in Table 1. The detonations were initiated using C-4 packed in the fuze well.

TABLE 1 – Phase One Test Parameters

Munition	Pool Diameter	Distance, R1 Edge of Pool	Expected Penetration	Pool Depth	Munition Distance from		Munition to Screen Distance			
					Bottom	Surface	S1	S2	S3	S4
60mm	90"	6"	8"	18"	2"		5"	10"	15"	20"
81mm	90"	12"	18"	24"	2"		10"	15"	20"	25"
105mm	12'	24"	30"	24"	3.5"	3"	30"	30"	40"	50"
155mm	18'	36"	48"	46"	4"	15"	40"	50"	60"	70"

2.1.1 155 mm M107 Projectile

The 155 mm M107 projectile contains 15.4 lbs of Comp B. For the phase one test, the booster was removed and the fuze well was packed with C-4. An 18 ft diameter, 4 ft deep pool was used for this test. The projectile was placed base down to make sure the base plate did not become airborn. Fragments were found all around the pool. One section of the metal pool wall from the near blast region was wrapped in a witness panel and thrown over 200 feet from ground zero.

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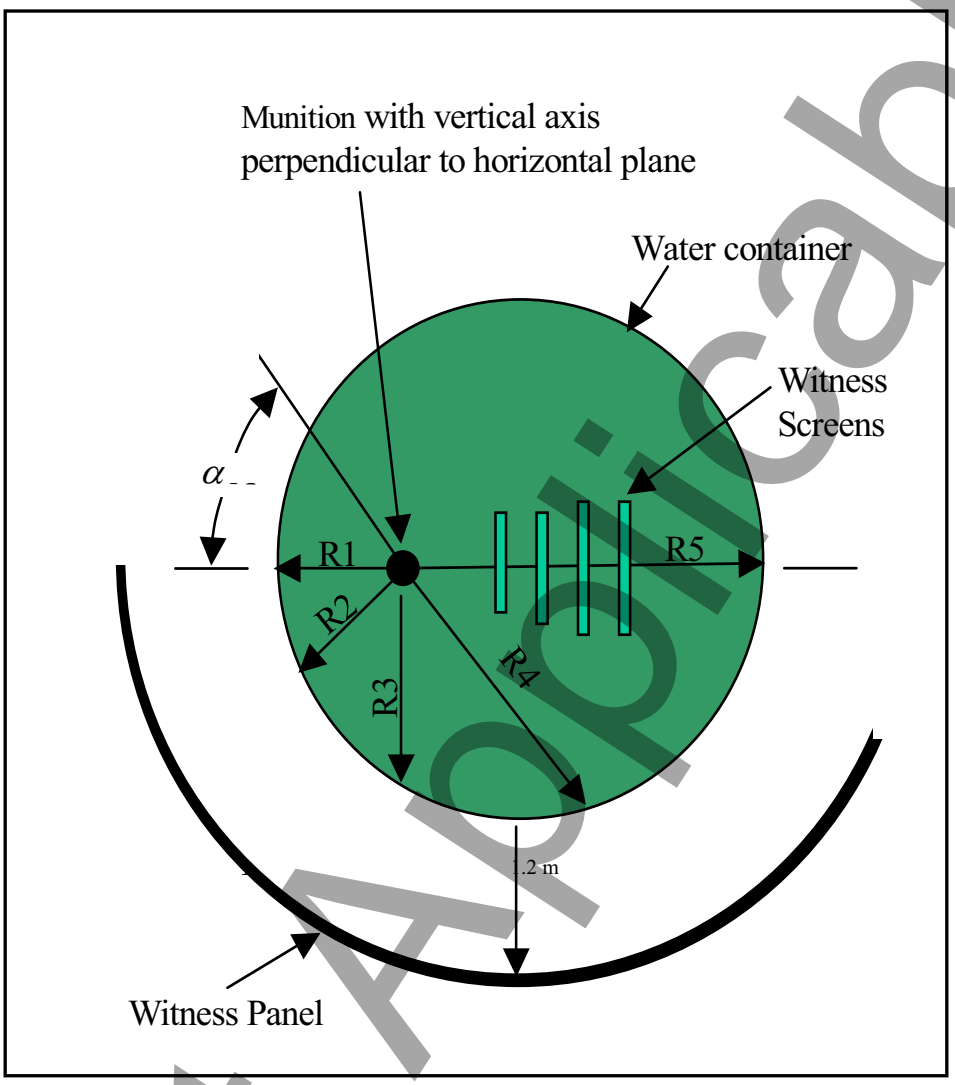

FIGURE 1 – Test Layout for Phase One Tests

Not Applicable

TABLE 2 – 155 mm M107 Phase One Results

Perforation of Pool			Fragment Size		Comments	Witness Screens	
Angle A, degrees	Distance D, in.	Height, in.	Length, in.	Width, in		Screen No.	Distance, in.
40.54	70.31		2	1.5		1	24
59.93	96.46		4	2		2	30
66.45	104.96		1	0.125		3	40
						4	50
						5	60
						6	70

Note: Fragment penetrated 5th screen but not 6th.

2.1.2 105 mm M1 Projectile

The 105 mm M1 projectile contains 5.07 lbs of Comp B. For the phase one test the fuze well was packed with C-4. A 12 ft diameter, 2 ft deep pool was used for this test. The projectile was placed base down to make sure the base plate did not become airborn. Fragments were recovered out to a distance of approximately 75 feet from the pool. There were no penetrations in the side or rear of the pool or witness panels, so the explosive mass apparently lofted these fragments along with the water.

TABLE 3 – 105 mm M1 Phase One Results

Perforation of Pool			Fragment Size		Comments	Witness Screens	
Angle A, degrees	Distance D, in.	Height, in.	Length, in.	Width, in		Screen No.	Distance, in.
25.97	38.87	28	5	1		1	30
47.96	53.83	12	6	1	Tear?	2	42
						3	54
						4	66
						5	80

Note: Fragment penetrated 1st screen only.

2.1.3 81 mm M362A Mortar

The 81 mm M362A mortar contains 2.1 lbs of Comp B. For the phase one test the fuze well was packed with 113 grams of C-4. A 90 inch diameter, 24 inch deep pool was used for this test. The mortar was placed nose down in the pool with the nose 2 inches off the bottom. No fragments penetrated the rear side of the pool. The tail fin was recovered 42 feet from the pool. One fragment was recovered 130 feet from the pool.

Not Applicable

TABLE 4 – 81 mm M362A Phase One Results

Perforation of Pool			Fragment Size		Comments	Witness Screens	
Angle A, degrees	Distance D, in.	Height, in.	Length, in.	Width, in		Screen No.	Distance, in.
2.56	12.12	17	2.5	0.25		1	10
2.56	12.12	17	1.5	0.125	Dent	2	15
1.79	12.06	36	0.25	2		3	20
7.62	13.05	7	4	2		4	25
7.34	12.97	5	1	0.25	Dent		
7.62	13.05	9	0.75	0.5			
8.46	13.28	12	1	0.5	3 together		
9.61	13.63	14	0.25	0.25	Frag imbedded		
7.62	13.05	22	0.5	0.25			
7.34	12.97	33	2	1			
7.89	13.12	36	1	0.5			
10.50	13.92	9	3	1			
10.80	14.02	37	0.75	0.75			

Note: Fragment penetrated 3rd screen but not 4th.

2.1.4 60 mm M49A4 Mortar

The 60 mm M49A4 mortar contains 0.42 lbs of Comp B. For the phase one test the fuze well was packed with 65.2 grams of C-4. A 90 inch diameter, 18 inch deep pool was used for this test. The mortar was placed nose down in the pool with the nose 2 inches off the bottom. The pool was filled to the top (22 inch depth) but no effort was made to level the ground under the pool. As a result the low side of the pool began to sag before the test. Sandbags were used to prop up this side. No fragments penetrated the rear of the pool, but were found in the bottom of the pool. Fragment holes were found in the lower portion of the witness panel. Several fragments were found 30 to 40 feet from the pool, but the fragment field extended only 30 degrees off a line running through the center of the munition to the nearest point on the side of the pool. No fragments were found in the same region behind the witness panel side, although several fragments penetrated the witness panel.

TABLE 5 – 60 mm M49A4 Phase One Results

Perforation of Pool			Fragment Size		Comments	Witness Screens	
Angle A, degrees	Distance D, in.	Height, in.	Length, in.	Width, in		Screen No.	Distance, in.
2.97	7.32	10	1.75	1.25		1	5
6.07	8.26	4	2.25	0.25		2	10
6.07	8.26	12	0.5	0.125		3	15
6.67	8.49	4	1	0.125	dent	4	20

Note: Fragment penetrated 1st screen but not 2nd.

2.1.5 Phase One Summary and Conclusions

Open front barricade tests using the 60 mm and 81 mm mortars and the 105 mm projectile were also conducted at this test range during this time. The

Not Applicable

detonations were all initiated by packing the fuze wells with C-4. It was observed that the fragments from the water tests were significantly larger than those from the barricade tests. This is most likely due to the confinement of the water. Compared to the number of fragment impacts observed in the barricade tests, a very small number of fragments penetrated the witness panels in the water tests. The water contained all but the most energetic fragments. A summary of the penetration distances is presented in Table 6. The screen distance is the distance of the first screen that was not penetrated by fragments. The panel distance is the longest travel distance through water of a fragment impacting the witness panel.

Because these fragments were larger than would be expected from the detonation of a munition not submerged in water, they probably penetrated a greater thickness of water than would be expected in an intentional detonation of a munition in the field. Consequently, in actual field conditions, the thickness of water required to contain munition fragments can be expected to be less than those shown here.

TABLE 6 – Water Penetration Distance, Phase One

Munition	Fragment Penetration, in.	
	Screen	Panel
60 mm M49A4	< 10	8.5
81 mm M362A	< 25	14
105 mm M1	< 42	53
155 mm M107	< 70	105

2.2 Phase Two Tests

Phase Two tests were set up in a manner simulating actual field conditions. For each test the munition was placed in a horizontal orientation in a hole with the top of the munition six inches below the ground surface. A piece of plywood was placed over the hole to keep the water containers from resting on the munition. The detonation was initiated using a GOEX oil well perforator charge containing 26 grams of RDX. The perforator was placed on the side of the munition so that the shaped charge was directed slightly downward. Pressure gages and sound meters were used to measure the blast effects. Video cameras and a high speed digital camera were used to record each test. The test setup is shown in Figure 2.

2.2.1 155 mm M107 Projectile

Two water containment systems were tested with the 155 mm M107 projectile. The first system was two layers of 55 gallon drums and the second system was a single 1100 gallon agricultural tank.

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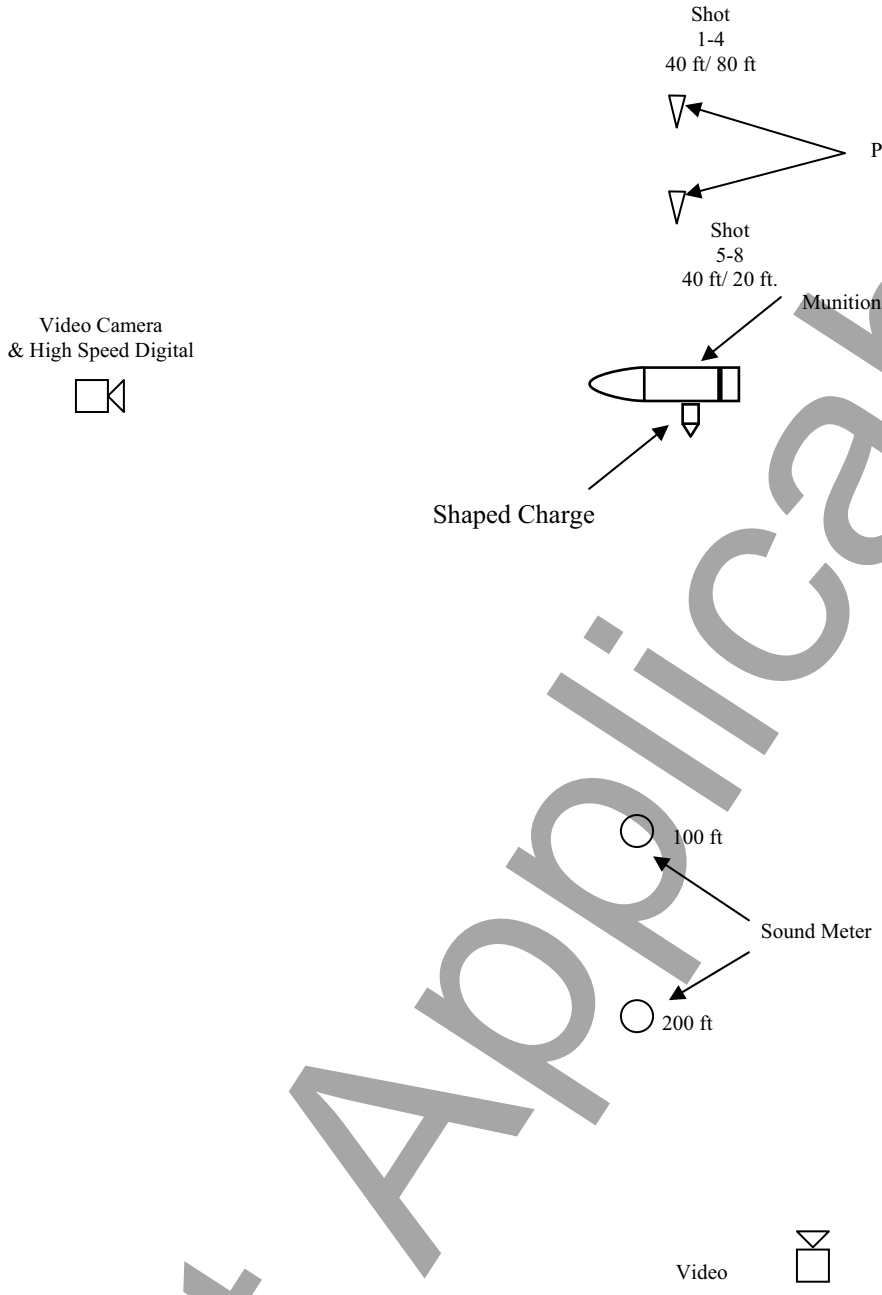

FIGURE 2 – Instrument and Camera Layout for Phase Two Tests

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2.2.1.1 Water Contained in 55 Gallon Drums

After placing the 155 mm M107 with the initiator in the hole (see Figure 3), a sheet of ¾ inch plywood was placed over the hole and two layers of 55 gallon drums were placed over the projectile. A total of 28 drums were used with a witness panel placed between the layers and around the outside of the drums. This layout is shown in Figure 4.

The barrels were thrown seventy feet into the air. One barrel, mostly intact, was recovered about 300 feet from ground zero. It had apparently rolled part of this distance. The rest of the barrels were recovered within 100 feet of the crater.

A partially destroyed barrel was recovered approximately 55 feet from the crater with a 3 inch long fragment embedded in the inside surface. Beside this barrel was another fragment about 2 inches long, which may have fallen out of the barrel as it rolled. A small fragment was found inside one of the barrels from the top layer. Several fragments were found between 30 and 40 feet from the crater.

A small fragment hole (about ¼ inch in diameter) was found in the witness plate that was between the layers of barrels. The penetration appeared in the gap between barrels indicating that at least part the fragments path was through air and not water. The top barrel directly over the charge was perforated on the bottom and a circular section over the charge was dented by fragments but not perforated at the top.

Airblast and sound pressure measurements (converted from decibels to psi) are plotted against open-air blast pressure curves for a 155 mm M107 projectile in Figure 5.

Fragments from the 155 mm M107 projectile can penetrate more water than the 3 ft height of the barrels. Because there are significant gaps between the barrels when they are stacked (even more so on uneven ground), a greater area must be covered with barrels to insure that fragments do not escape. This method is very time consuming. Several hours were required to stack and fill all the barrels with water.

2.2.1.2 Water Contained in 1100 Gallon Agricultural Tank

An 1100 gallon agricultural tank was placed over the munition and filled with water. The cylindrical tank was 7 feet in diameter and 58 inches tall. The opaque plastic was approximately 1/8 inch thick. The test layout is shown in Figure 6. The detonation tore the tank into large pieces. One piece was recovered approximately 250 feet from ground zero. One fragment was embedded in the inner side of a piece of the tank but no fragments penetrated the tank.

Not Applicable

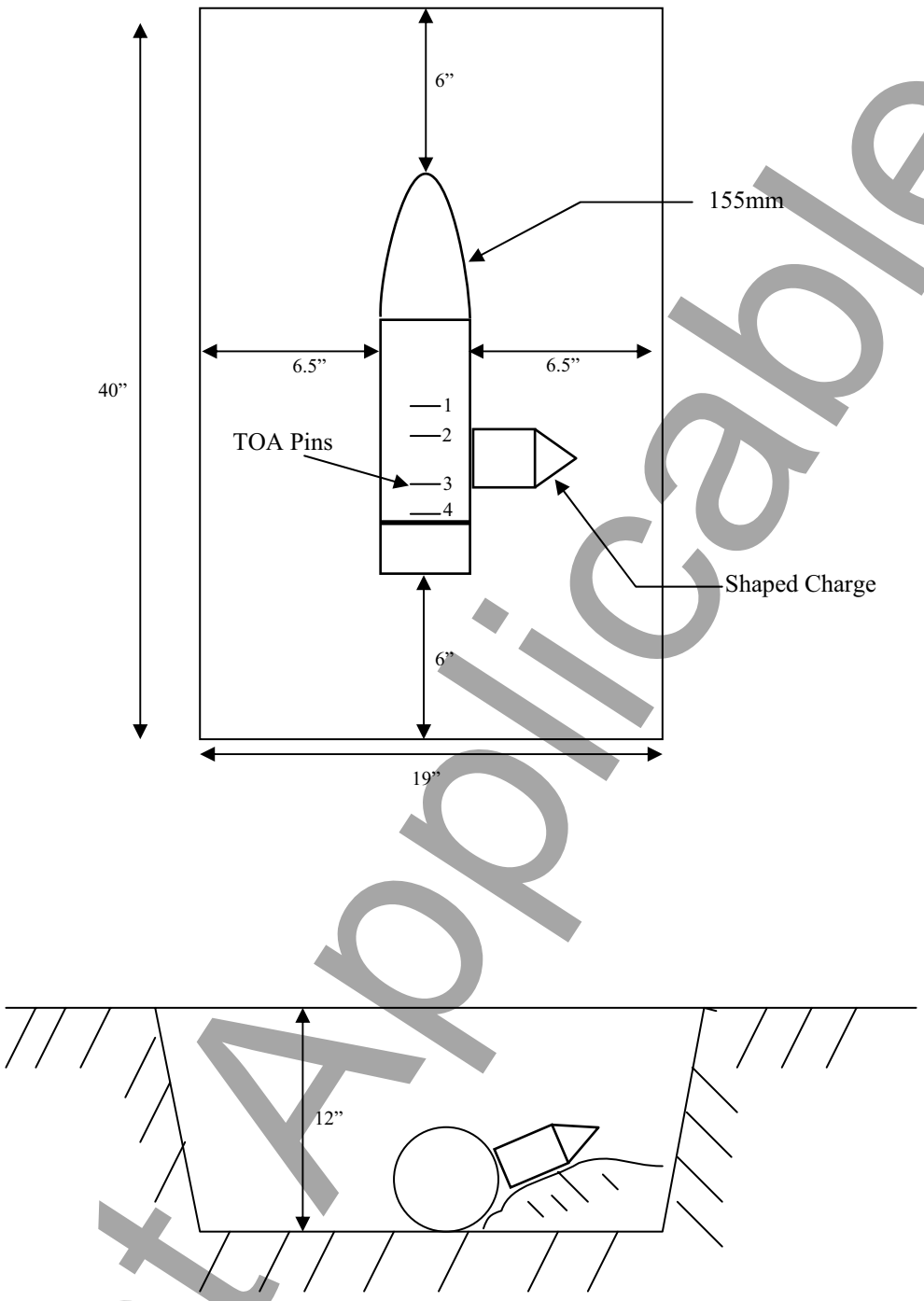
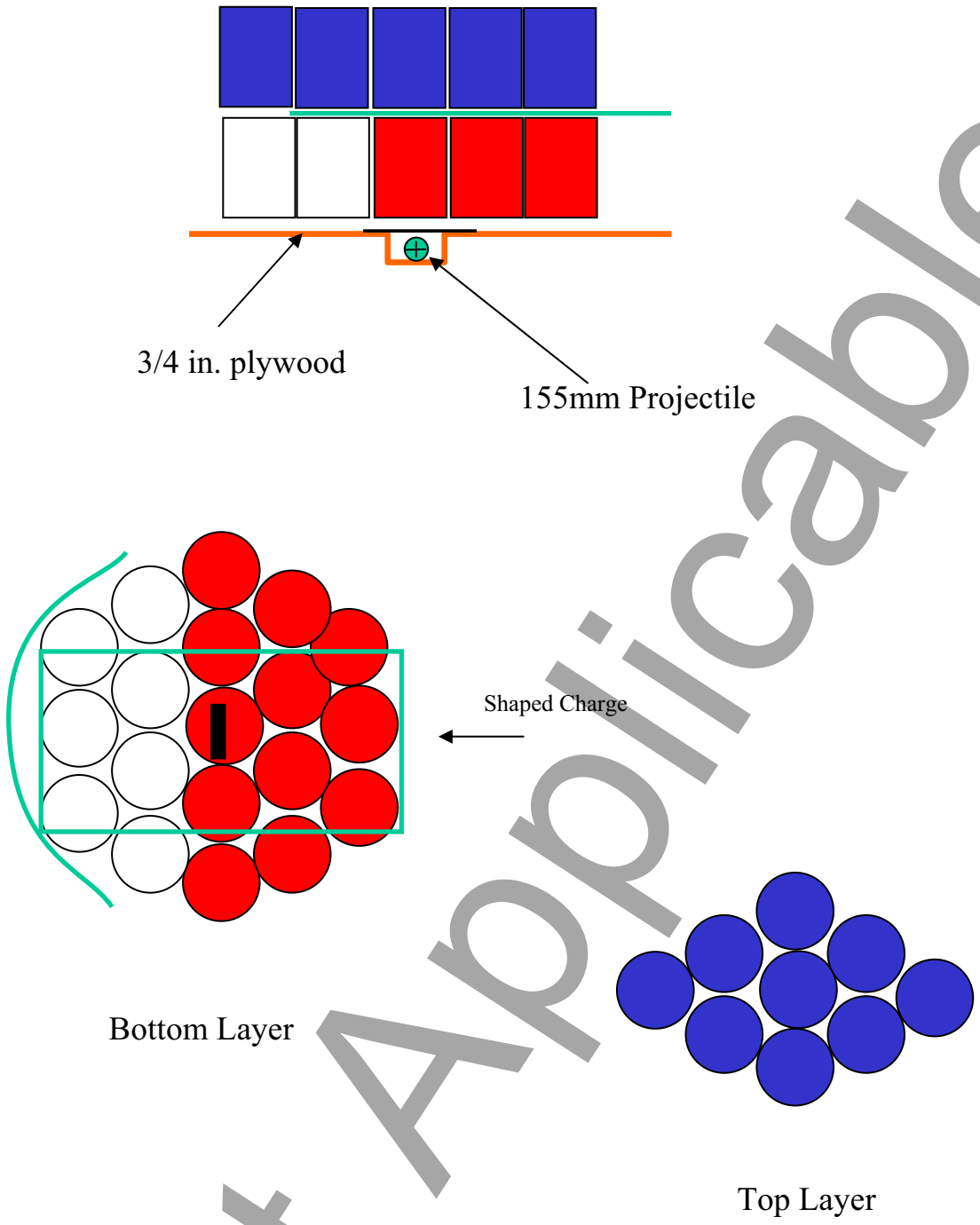


FIGURE 3 – Munition and Initiator Placement for 155 mm M107 Projectiles

Not Applicable



Not Applicable

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

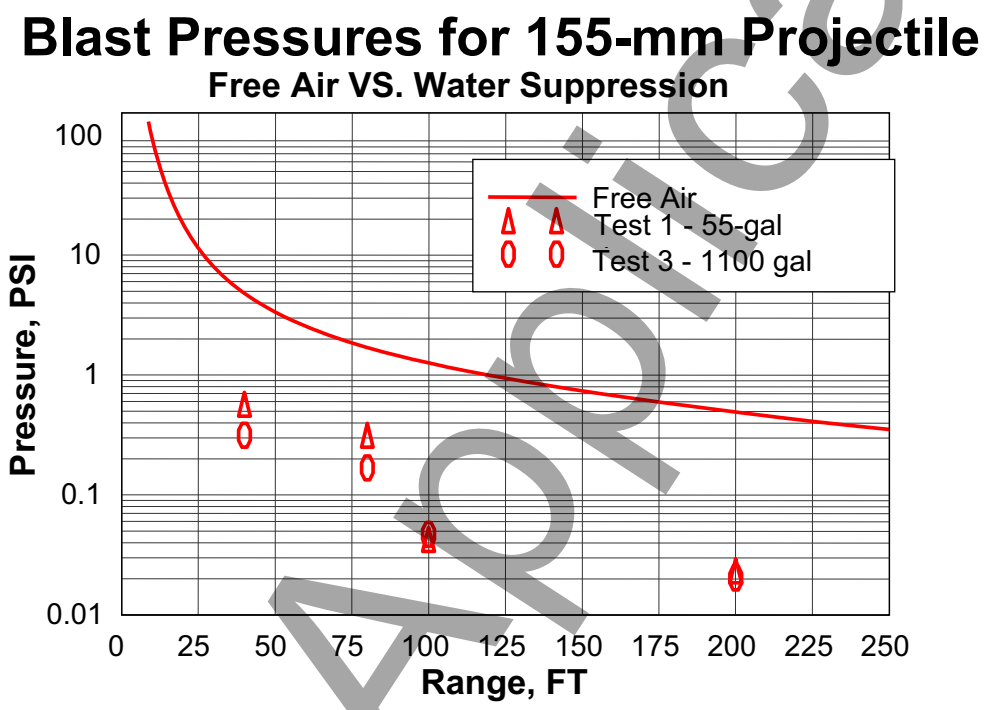


FIGURE 5 – 155 mm M107 Blast Pressures

Not Applicable

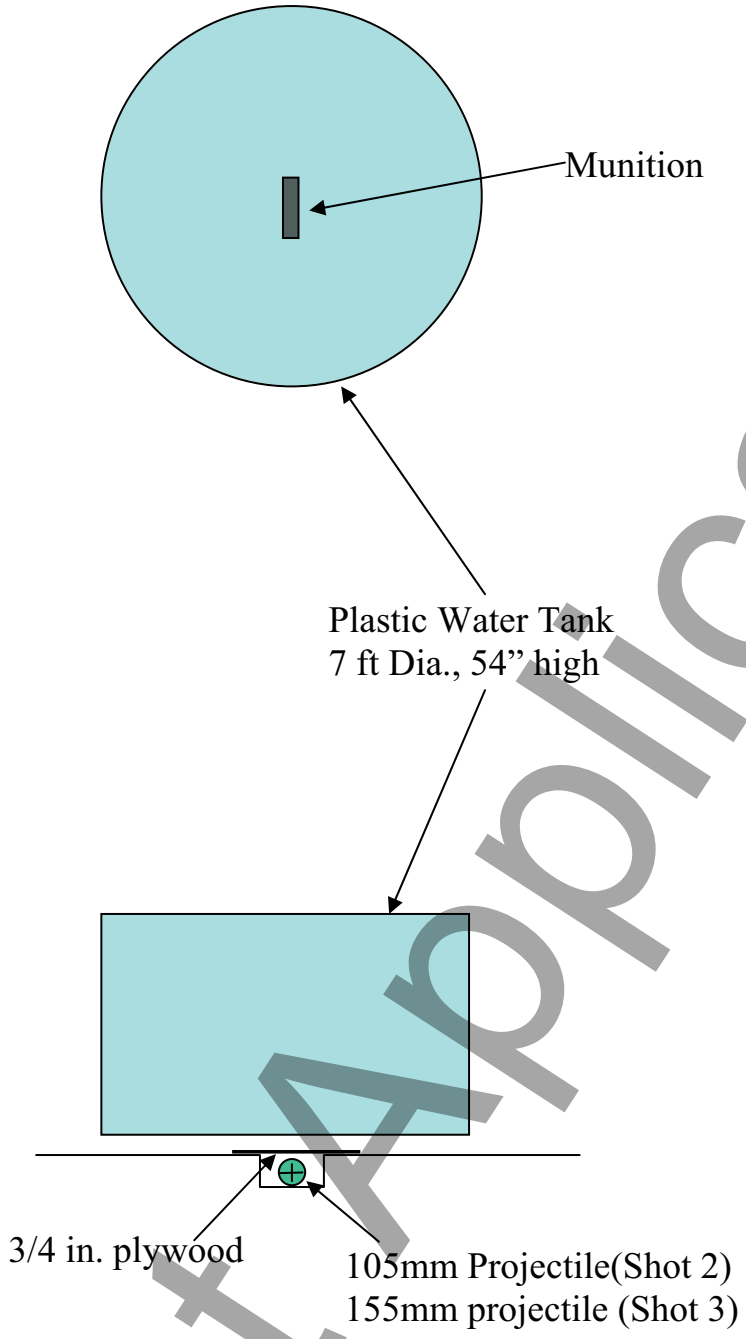


FIGURE 6 – Layout for Tests Using 1100 Gallon Agricultural Tank

Not Applicable

2.2.2 105 mm M1 Projectile

Two water containment systems were tested with the 105 mm M1 projectile. The first system was two layers of 55 gallon drums and the second system was a single 1100 gallon agricultural tank.

2.2.2.1 Water Contained in 55 Gallon Drums

After placing the 105 mm M1 with the initiator in the hole (see Figure 7), a sheet of ¾ inch plywood was placed over the hole and two layers of 55 gallon drums were placed over the projectile. A total of 22 drums were used with a witness panel placed between the layers and around the outside of the drums. This layout is shown in Figure 8.

Several fragments penetrated the witness panel between the layers of drums and there were a few dents where the panel was impacted but the fragments did not penetrate. As in the 155 mm M107 test, the fragments penetrating the witness panel were in the gaps between barrels.

The furthest drum was recovered 70 feet from ground zero. Most of the top layer of drums seemed to come straight back down and land in or near the crater. Two of the drums in the crater were undamaged and full of water.

Airblast and sound pressure measurements (converted from decibels to psi) are plotted against open-air blast pressure curves for a 105 mm M1 projectile in Figure 9.

2.2.1.2 Water Contained in 1100 Gallon Agricultural Tank

The test layout is shown in Figure 6. Most debris was within 35 feet of the crater. A number of fragments were found within 50 feet of ground zero, including a piece of the base plate at 50 feet off the base end of the munition. A large piece of the tank was found at 180 feet. A 6 inch long fragment was stuck in the plastic with the bulk of the fragment on the inside of the tank. There were several dents in the witness panels, but only one complete penetration and the fragment causing this penetration was found within a few feet of the panel. Only one obvious exit hole was found in the side of the tank.

The tank is light, easy to place and, because of a large filler hole, can be filled with water in just a few minutes. This container defeated essentially all of the fragments. The one or two that did penetrate the container had been slowed enough that they did not travel any distance. The container pieces traveled further than these primary fragments.

Not Applicable

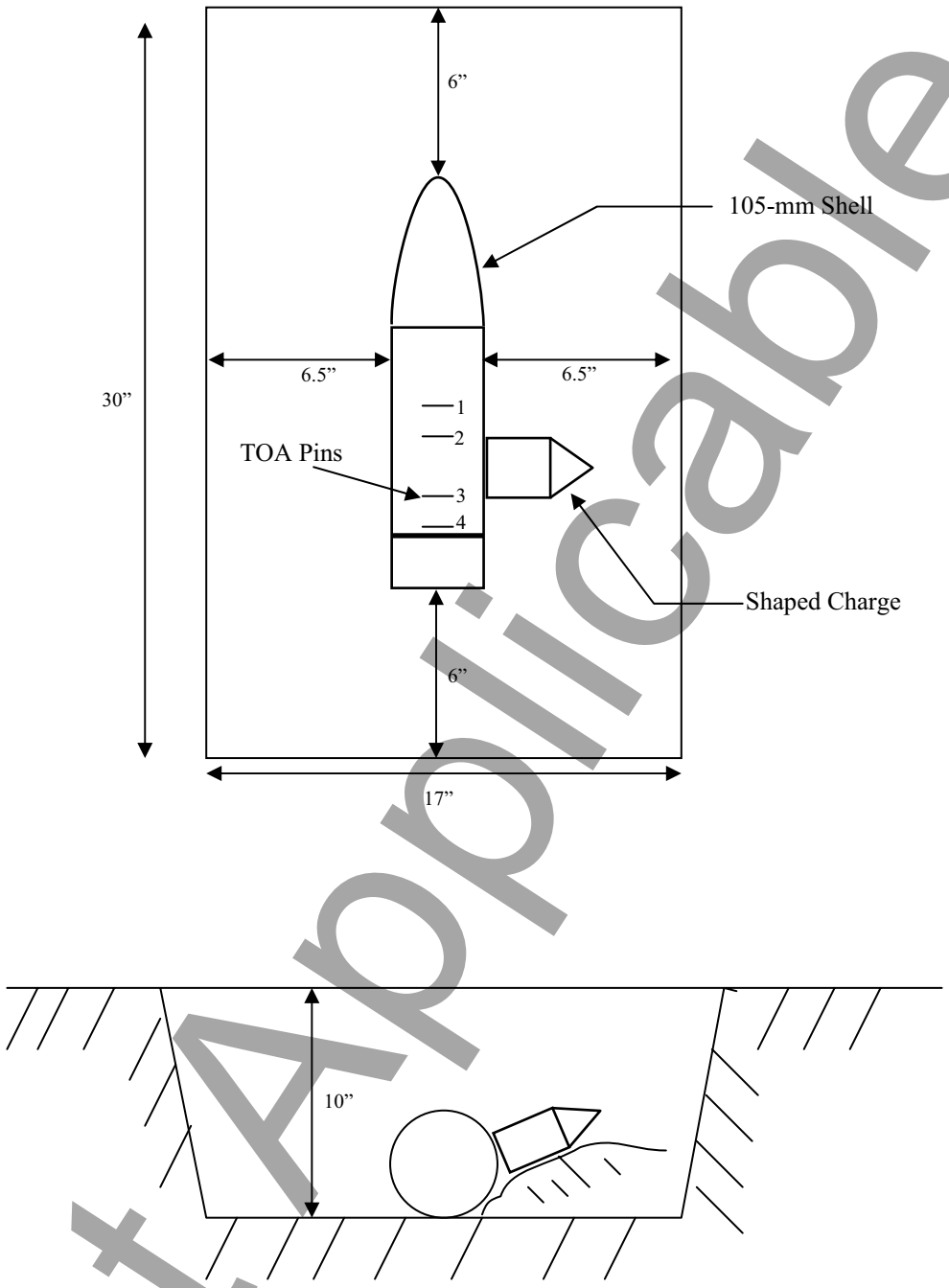
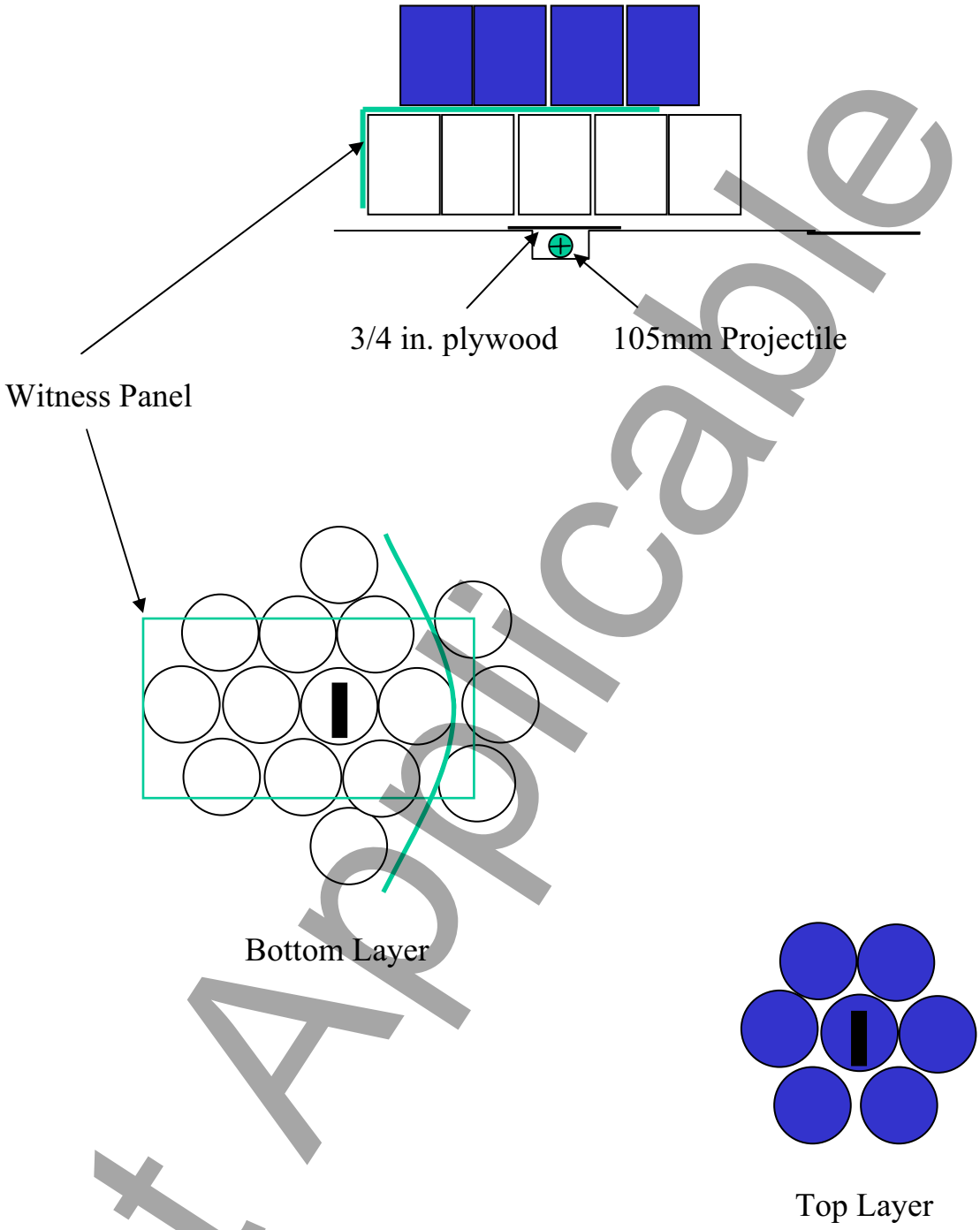


FIGURE 7 – Munition and Initiator Placement for 105 mm M1 Projectiles

Not Applicable



Not Applicable

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

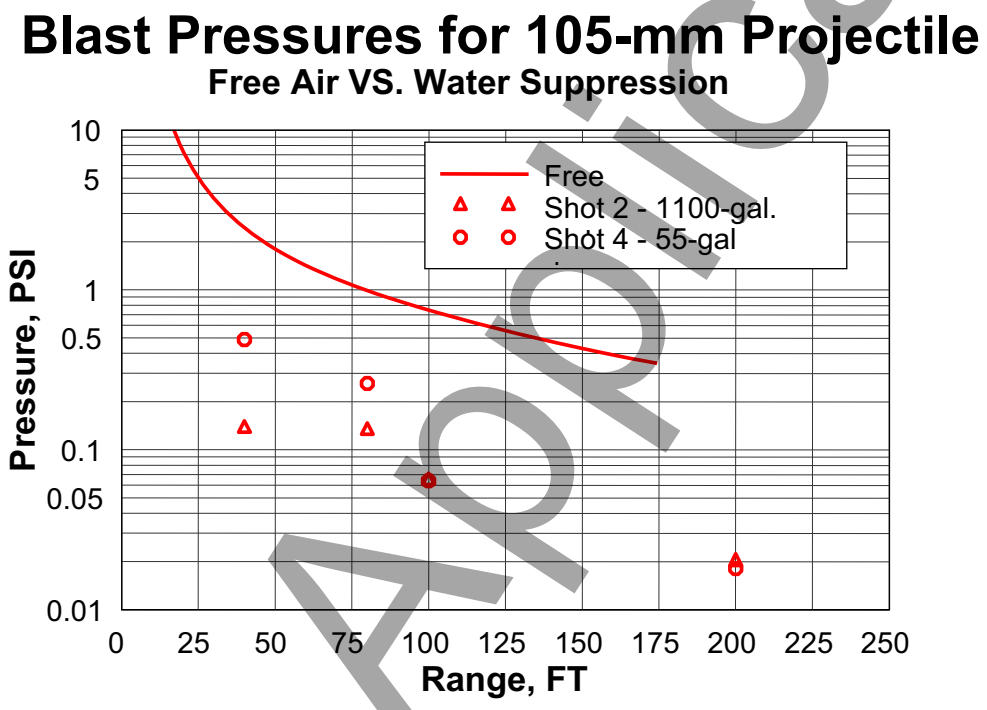


FIGURE 9 - 105 mm M1 Blast Pressures

Not Applicable

2.2.3 81 mm M362A Mortar

Two water containment systems were tested with the 81 mm M362A mortar. The first system was two layers of 5 gallon plastic carboys and the second system was a 90 inch diameter inflatable wading pool.

2.2.3.1 Water Contained in 5 Gallon Carboys

After placing the 81 mm M362A with the initiator in the hole (see Figure 10), a half sheet of ¾ inch plywood was placed over the hole and two layers of 5 gallon carboys were placed over the mortar. A total of 31 carboys were used with a witness panel placed between the layers and around the outside of the carboys. This layout is shown in Figure 11.

There was one small fragment hole in the witness panel over the bottom layer of containers and a larger hole about 3 inches long and an inch wide right behind the rear of the munition, probably made by the tail fin. One carboy was found off the side of the stack in the woods at 223 feet and another in a pond about 240 feet off the nose end of the munition. Several were found at distances near 100 feet. Many were still full of water. The tail fin of the mortar was recovered intact directly to the rear of the munition at a distance of 107 feet. Blast pressures from the 81 mm tests are shown in Figure 12.

2.2.3.2 Water Contained in 90 inch Inflatable Wading Pool

After placing the 81 mm M362A with the initiator in the hole, a half sheet of ¾ inch plywood was placed over the hole and a 90 inch diameter inflatable wading pool was placed over the mortar (see Figure 16). The water depth was 18 inches. A witness panel was placed over the pool.

The witness panel was thrown several feet into the air. A hole was blown in the bottom of the pool but the inflated perimeter of the pool was essentially intact. The side of the pool had a small puncture on the inside that caused it to slowly deflate. The witness panel was not perforated.

2.2.4 60 mm M49A4 Mortar

Two water containment systems were tested with the 60 mm M49A4 mortar. The first system was two layers of 5 gallon plastic carboys and the second system was a 90 inch diameter inflatable wading pool.

2.2.4.1 Water Contained in 5 Gallon Carboys

After placing the 60 mm M49A4 with the initiator in the hole (see Figure 13), a half sheet of ¾ inch plywood was placed over the hole and two layers of 5 gallon carboys were placed over the mortar. A total of 11 carboys were used with a

Not Applicable

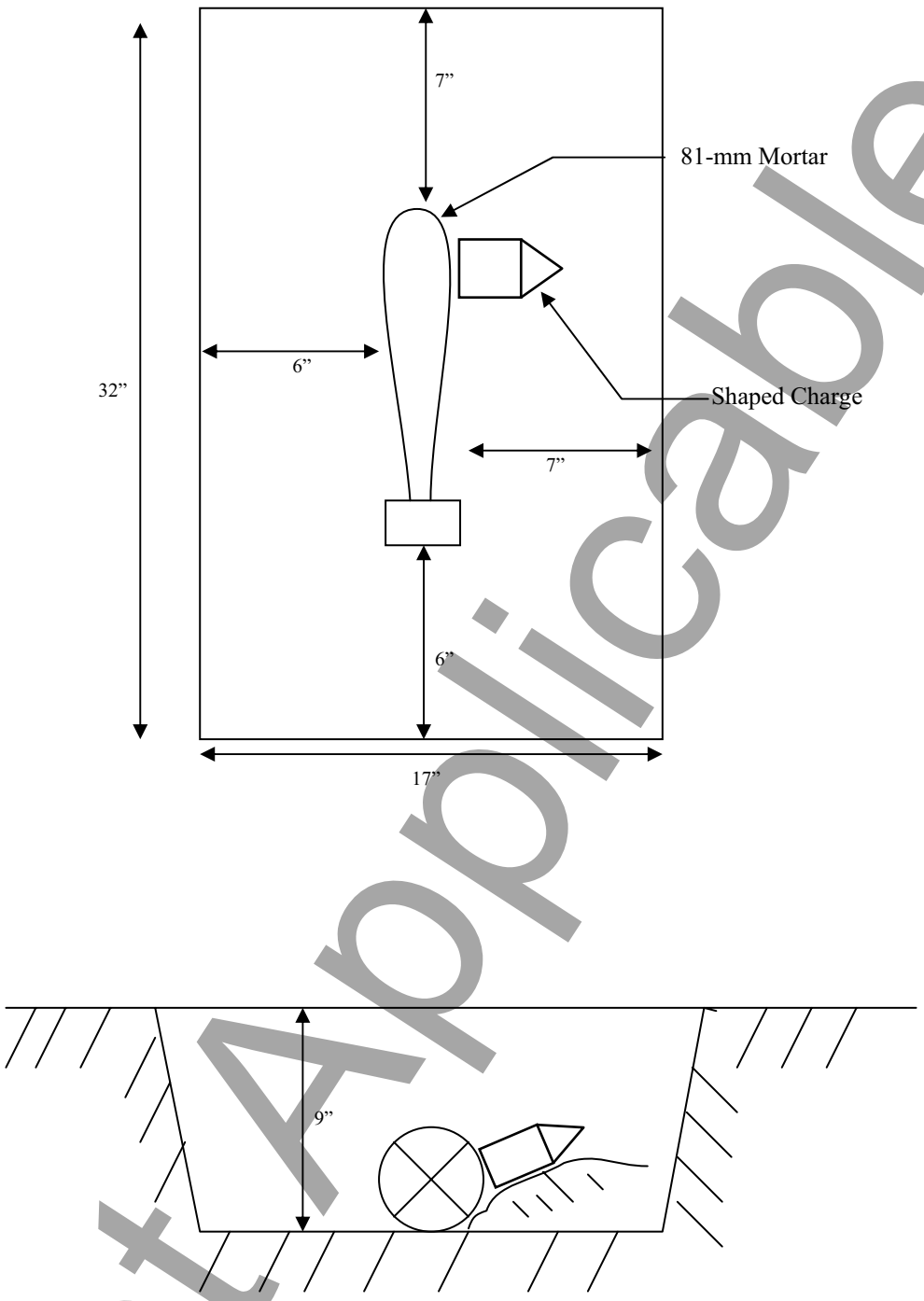
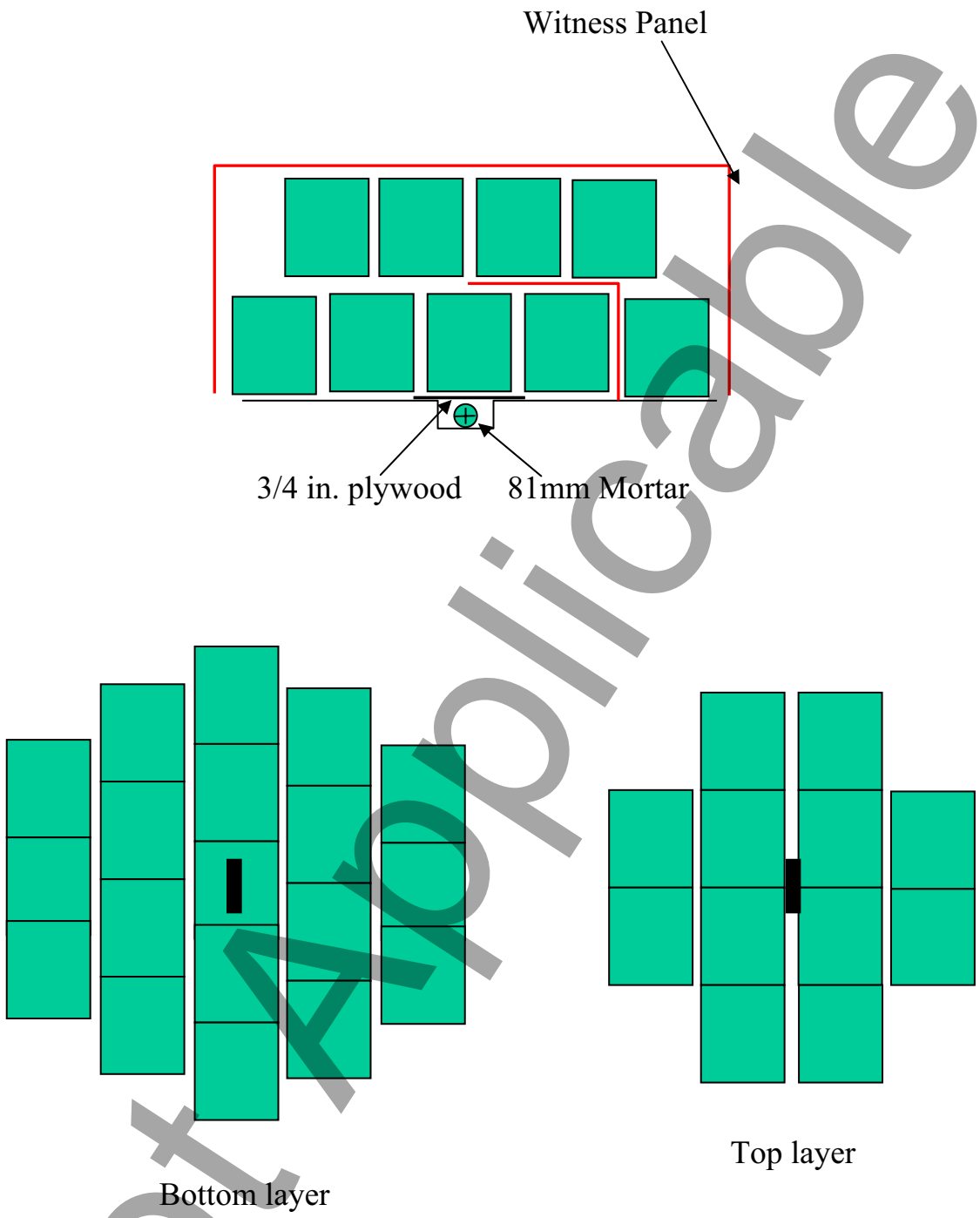


FIGURE 10 – Munition and Initiator Placement for 81 mm M362A Mortars

Not Applicable



Not Applicable

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

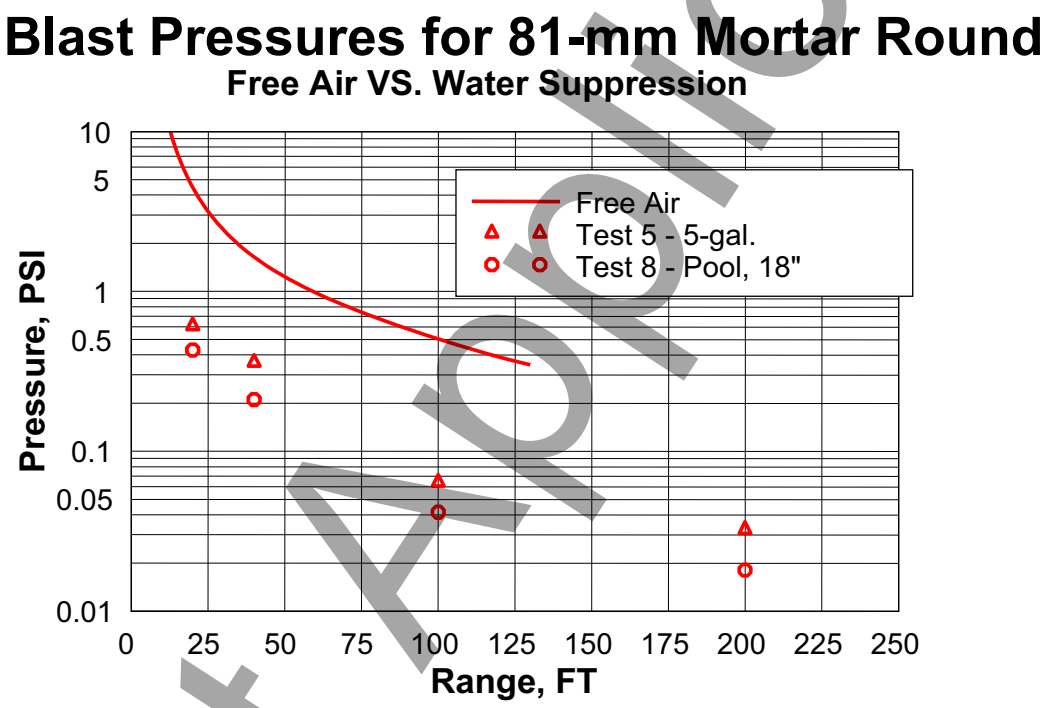


FIGURE 12 - 81 mm M362A Blast Pressures

Not Applicable

witness panel placed between the layers and around the outside of the carboys. This layout is shown in Figure 14.

The carboys were thrown more than 100 feet into the air. Those on top landed within 10 feet of the crater. It was observed that the containers on the outer layers are the ones thrown the furthest. The most distant carboy on this test was recovered 44 feet from the nose of the munition. There were no holes in the witness panels. The blast pressures for the 60 mm tests are shown in Figure 15.

2.2.4.2 Water Contained in 90 inch Inflatable Wading Pool

After placing the 60 mm M49A4 with the initiator in the hole, a half sheet of ¾ inch plywood was placed over the hole and a 90 inch diameter inflatable wading pool was placed over the mortar (see Figure 16). The water depth was 18 inches. A witness panel was placed over the pool.

The witness panel was thrown off of the pool. A hole was blown in the bottom of the pool but the inflated perimeter of the pool was not punctured. There were no perforations or even dents in the witness panel.

2.2.5 Phase Two Summary and Conclusions

Water is an excellent medium for mitigating blast and fragmentation due to the intentional detonation of unexploded ordnance. Test results show that noise due to detonation is reduced by the water and the fragments from the munitions can be defeated by water.

The best results were obtained using single containers for the water. When multiple containers are used fragments can travel through gaps between containers and the containers are thrown some distance by the blast. Also, containers that are not rigid seem to be a better option than rigid containers because the pieces of the non-rigid containers are smaller, lighter (non-hazardous) and don't travel as far. Non-rigid containers require a more level ground surface but the sides could be supported by soil or sandbags.

As the required thickness of water increases, rigid sides are necessary to contain the large volumes of water and the rigid sides may contribute to the secondary fragment distances. The small pools are readily available at local stores during the spring and early summer but may be difficult to obtain at other times. The agricultural tanks are available any time but may need to be ordered requiring advance planning.

Whenever possible a half sheet (4 ft x 4 ft) of plywood rather than a full sheet (8 ft x 8 ft) should be used under the charge. All of the plywood should be covered by the water container(s) to minimize debris from the plywood.

Not Applicable

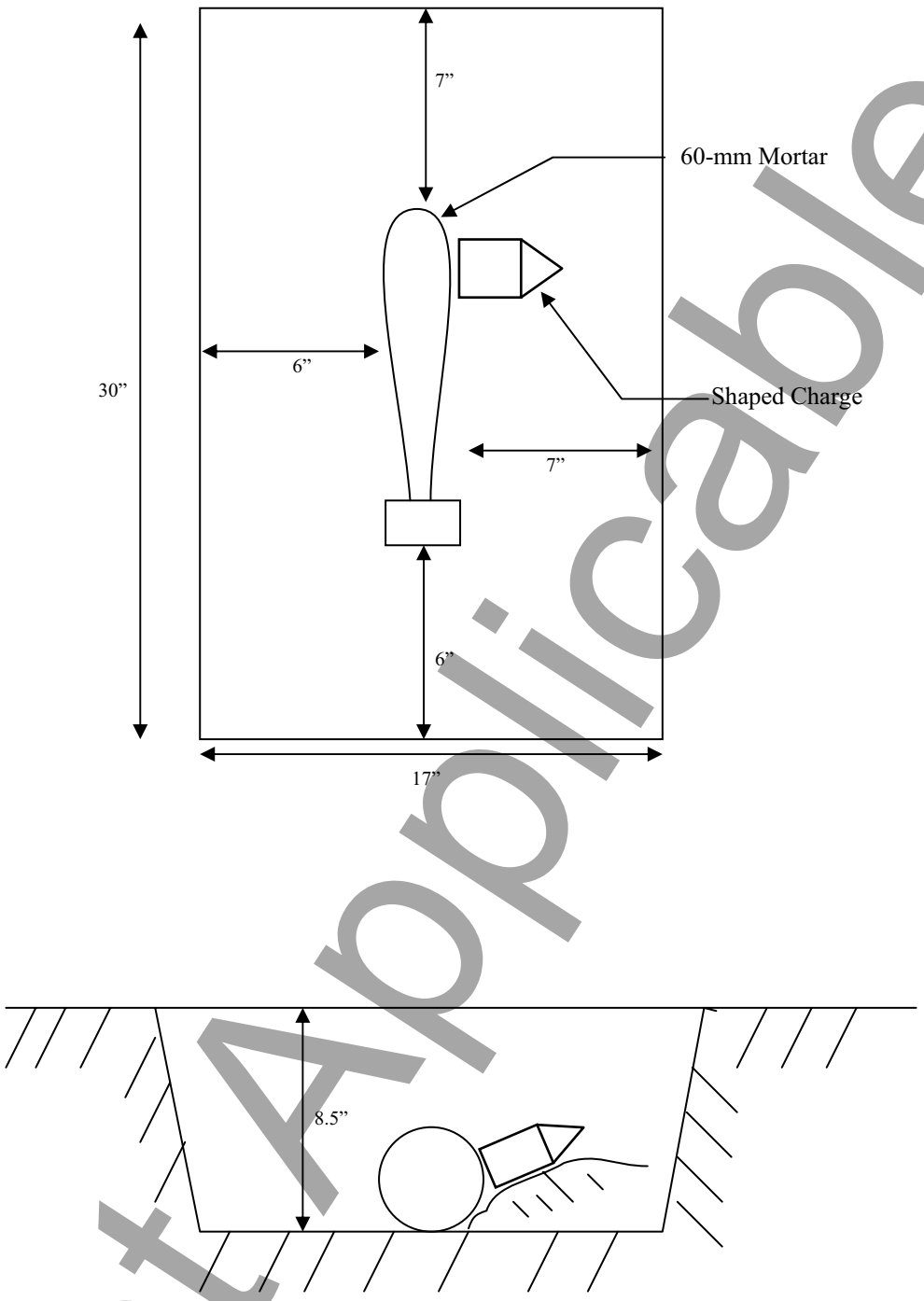
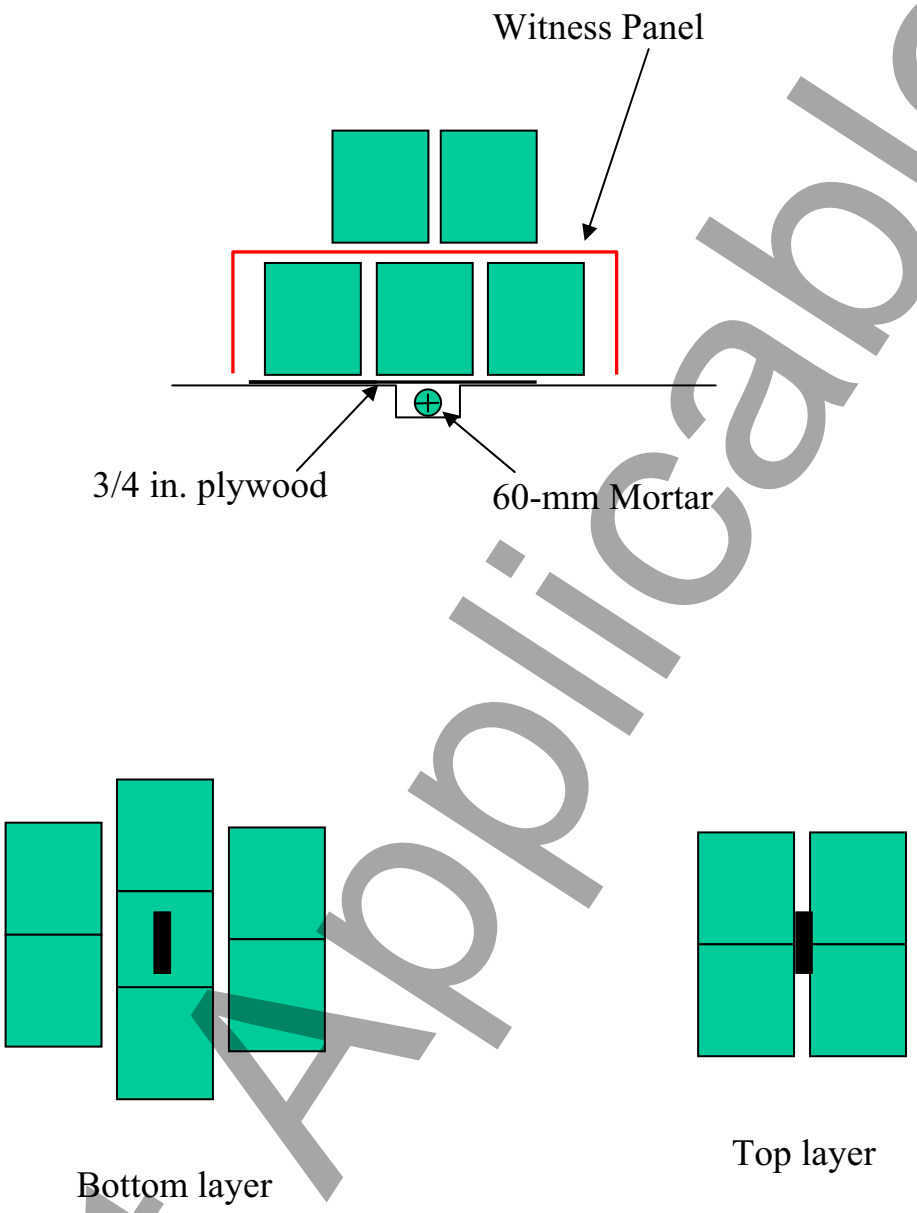


FIGURE 13 – Munition and Initiator Placement for 60 mm M49A4 Mortars

Not Applicable



Not Applicable

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

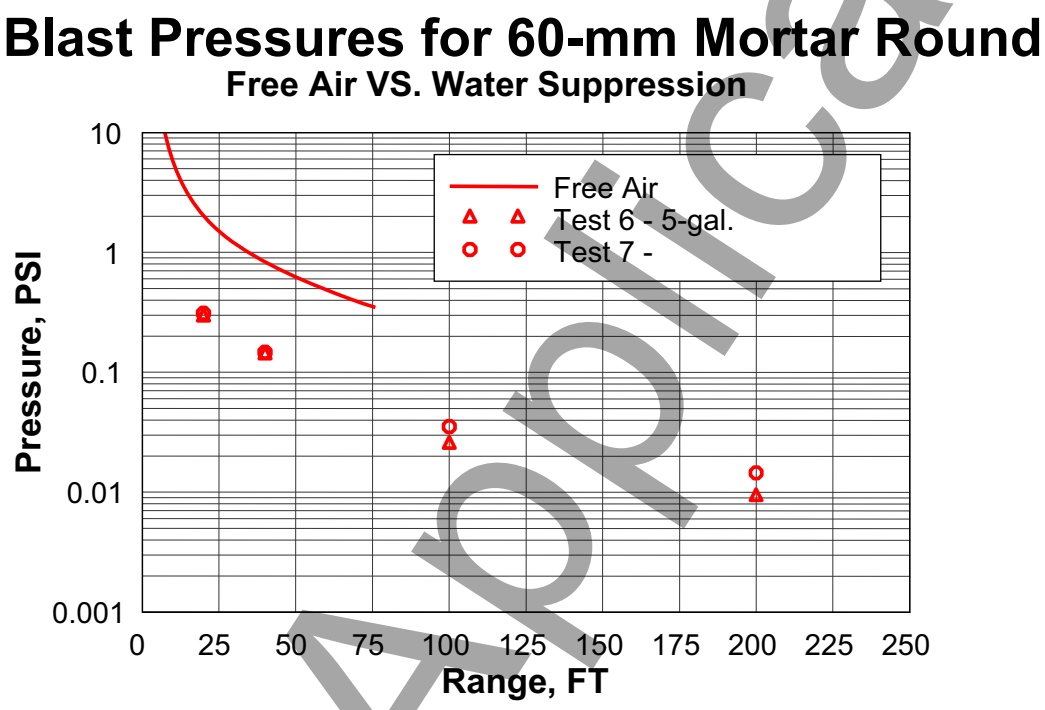


FIGURE 15 - 60 mm M49A4 Blast Pressures

Not Applicable

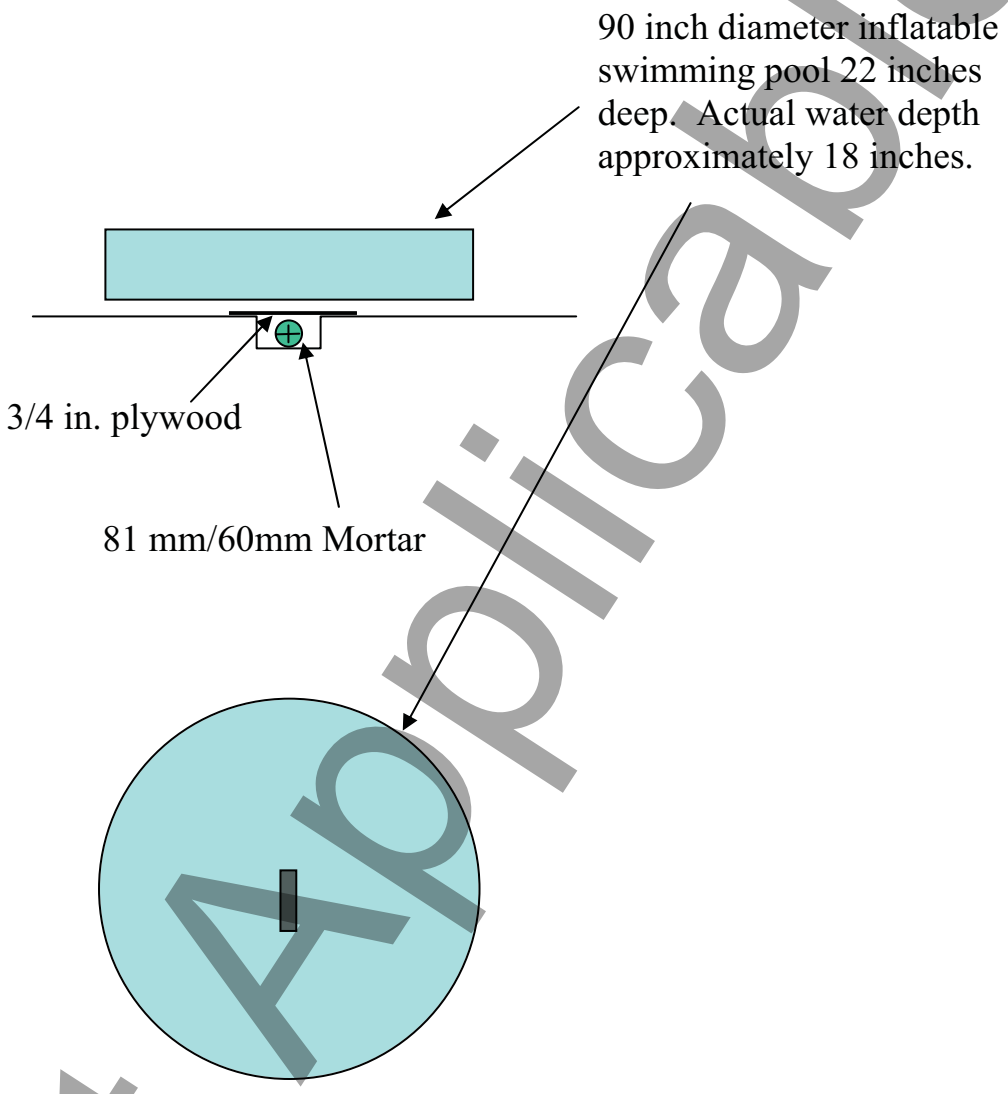


FIGURE 16 - Test Layout for 81 mm M362A and 60 mm M49A4 Under Inflatable Pool

Not Applicable

Care should be taken to insure that there are no water spills of sufficient volume to the hole in which the munition is located. This could lead to a misfire. Also, as observed in phase one, the water may cause sufficient confinement to increase fragment size and penetration capabilities.

3.0 Water Mitigation for Intentional Detonations

3.1 Water Containment System

Based on the results from the Phase Two tests, the fragments from an intentional detonation of a 155 mm M107 or a 105 mm M1 projectile are defeated using an 1100 gallon agricultural tank filled with water. The 55 gallon drums are not a viable system for defeating fragments from an intentional detonation because of the gaps between the cylindrical barrels. The fragments from an intentional detonation of an 81 mm M362A or a 60 mm M49A4 mortar are defeated using either a system of 5 gallon plastic carboys or a 90 inch diameter, 18 inch deep wading pool. The results of the Phase Two tests are summarized in Table 7. To be conservative, the maximum secondary debris throw distance shown in Table 7 is 10% greater than the measured maximum secondary debris throw distance. Due to the small values, the overpressures have not been increased from the measured values.

TABLE 7 – Summary of Results From Phase Two Tests

Munition	Water Containment System	Max. Secondary Debris Throw Distance (ft)	Max Peak Overpressure (psi)				
			@ 20 ft	@ 40 ft	@ 80 ft	@ 100 ft[A]	@ 200 ft[A]
155 mm M107	1100 gal. Tank	275		0.28	0.15	0.0415	0.018
105 mm M1	1100 gal. Tank	198		0.136	0.132	0.064	0.02
81 mm M362A	5 gal. Carboys	264	0.61	0.36		0.064	0.0325
81 mm M362A	Inflatable Pool	See note	0.43	0.21		0.0415	0.018
60 mm M49A4	5 gal. Carboys	48	0.29	0.14		0.0251	0.0092
60 mm M49A4	Inflatable Pool	See note	0.31	0.147		0.0352	0.0145

[A]Pressure calculated from measured sound level.
Note: Inflatable pool did not produce any hazardous secondary debris.

The four munition types tested do not cover all of the munitions that may be encountered. To determine the water containment system required for a particular munition other than those tested, the approach is as follows:

Not Applicable

(1) Determine the initial fragment velocity (v_f) in ft/s, the maximum fragment weight (W_f) in pounds, and the equivalent weight kinetic energy ($W_f v_f^2/2$) in lb-ft^2/s^2 for the particular munition.

(2) Identify the munition with the next largest kinetic energy from the four tested munitions.

(3) Use the water containment system from Table 7 for the tested munition with the next largest kinetic energy shown.

The maximum fragment weight, the initial fragment velocity, and the resulting kinetic energy for a variety of munitions are provided in Table 8. Table 8 also shows the suitable water containment system for these munitions. The munition/initiator placements and water containment systems are detailed in Figures 3, 6, 7, 10, 11, 13, 14, and 16. The maximum fragment weight and the initial fragment velocity values have been determined with the Mott and Gurney equations, as presented in TM 5-1300 [1] and detailed in HNC-ED-CS-S-98-1 [2]. This procedure should not be used to extrapolate water containment systems for munitions larger than the 155 mm M107 projectile.

3.2 Minimum Separation Distance

A minimum separation distance is required for any detonation. This minimum separation distance applies to everyone, both public and operational personnel. The minimum separation distance is the maximum of the debris throw distance, the distance to an overpressure of 0.065 psi (corresponds to K328 = $328W^{1/3}$, where W is the net explosive weight), or 200 ft. For all munitions tested the overpressure at 200 ft was substantially less than 0.065 psi. In some cases, the debris throw distance exceeds 200 ft. The minimum separation distances are listed in Table 8.

4.0 Summary and Conclusions

A test program has been performed to determine the effects of water for mitigating fragments and blast effects due to an intentional detonation of a munition. Tests were performed using four different munitions and two water containment systems for each munition.

The results of these tests have been used to develop guidelines for the use of water to mitigate fragments and blast effects due to an intentional detonation of a munition. Methods for determining the required water containment system and the resulting minimum separation distance are detailed in Section 3.0. Figures 3, 6, 7, 10, 11, 13, 14, and 16 show the resulting munition/initiator configuration and water containment systems.

Not Applicable

In addition to mitigating the fragments and the overpressure, water quenches the fireball due to an explosion. Therefore, this system insures that there in no fire hazard from an intentional detonation.

5.0 References

1. TM 5-1300, “Structures to Resist the Effects of Accidental Explosions”, Departments of the Army, the Navy, and the Air Force, November 1990.

2. HNC-ED-CS-S-98-1, “Methods for Predicting Primary Fragmentation Characteristics of Cased Explosives”, M. Crull, U.S. Army Engineering and Support Center, Huntsville, January 1998.

Not Applicable

TABLE 8 – Water Containment System and Minimum Separation Distance

Munition	Max Fragment Weight (lb)	Critical Fragment Velocity (fps)	Equivalent Weight Kinetic Energy 10^6 (lb-ft^2/s^2)	Water Containment System	Minimum Separation Distance (ft)
20 mm M56A4	0.00058	3183	0.0029503	5 gal carboys/ inflatable pool	200
25 mm M792	0.00820	4256	0.0742528	5 gal carboys/ inflatable pool	200
M31 Rifle Grenade[A]	0.000361	11642	0.0244643	5 gal carboys/ inflatable pool	200
VB Rifle Grenade Mark I	0.0078	3660	0.0522428	5 gal carboys/ inflatable pool	200
37 mm Mk I, LE Practice	0.034207	1368	0.0320079	5 gal carboys/ inflatable pool	200
37 mm MK II	0.02953	5758	0.4894774	5 gal carboys	264
				inflatable pool	200
40 mm M406	0.00036	4508	0.0036986	5 gal carboys/ inflatable pool	200
GP Grenade M42 (submunition)[A]	0.00035	5805	0.0058803	5 gal carboys/ inflatable pool	200
40 mm MK2 Mod 0	0.03306	3605	0.2148275	5 gal carboys/ inflatable pool	200
40 mm HEDP M433	0.00023	11313	0.0147821	5 gal carboys/ inflatable pool	200
M73 Submunition	0.00200	8059	0.0649475	5 gal carboys/ inflatable pool	200
57 mm Chinese	0.01940	5500	0.2933645	5 gal carboys/ inflatable pool	200
57 mm M306	0.01291	3495	0.0788236	5 gal carboys/ inflatable pool	200
MK II Grenade	0.014217	3425	0.0833871	5 gal carboys/ inflatable pool	200
M39 Submunition	0.00011	2338	0.0003006	5 gal carboys/ inflatable pool	200
2.36 " Rocket (Case Only)	0.001035	8888	0.0408807	5 gal carboys/ inflatable pool	200
60 mm M49A3	0.02367	5114	0.3095835	5 gal carboys/ inflatable pool	200
60 mm M49A5	0.01660	6290	0.328382	5 gal carboys/ inflatable pool	200
M15 WP Grenade	0.00340	2685	0.0122557	5 gal carboys/ inflatable pool	200
BLU-59, BLU-26, BLU-36 Submunition	0.00152	6278	0.0299541	5 gal carboys/ inflatable pool	200

Not Applicable

TABLE 8 (cont) - Water Containment System and Minimum Separation Distance

Munition	Max Fragment Weight (lb)	Critical Fragment Velocity (fps)	Equivalent Weight Kinetic Energy 10^6 (lb-ft^2/s^2)	Water Containment System	Minimum Separation Distance (ft)
Fragmentation Grenade, M67 (approx)	0.0011828	7006	0.0290283	5 gal carboys/ inflatable pool	200
2.75" M229 Rocket	0.005217	5569	0.0808994	5 gal carboys/ inflatable pool	200
6 lb Incendiary Bomb	0.0021	9431	0.0933909	5 gal carboys/ inflatable pool	200
FMU 54A/B Fuze	0.0064491	9031	0.2629909	5 gal carboys/ inflatable pool	200
75 mm M48	0.15303	3471	0.921814	1100 gal tank	200
3"/50 AP Mk 29	0.42992	1058	0.240619	5 gal carboys/ inflatable pool	200
3 in Stokes Mortar	0.04360	6189	0.835023	1100 gal tank	200
M1A1 Anti-Tank Mine	0.0138139	9891	0.6757199	5 gal carboys	264
				inflatable pool	200
4 lb Frag Bomb M83	0.076176	3266	0.4062754	5 gal carboys	264
				inflatable pool	200
81 mm M374	0.03083	6721	0.6963488	5 gal carboys	264
				inflatable pool	200
81 mm M56	0.03270	5724	0.5356943	5 gal carboys	264
				inflatable pool	200
3.5" M28A2 Rocket Case	0.05242	6126	0.9836056	1100 gal tank	200
90 mm M71	0.3426	2335	0.9339661	1100 gal tank	200
90 mm HEAT M371	0.124	3075	0.5862488	5 gal carboys	264
				inflatable pool	200
20 lb Frag Bomb M41	0.33321	3303	1.8176287	1100 gal tank	275
4 in Stokes Mortar	0.07820	6336	1.5696915	1100 gal tank	200
105 mm M1	0.20573	4055	1.6914479	1100 gal tank	200
105 mm HEAT M456	0.07010	6326	1.4026406	1100 gal tank	200
106 mm M344 (Case)	0.0630543	6238	1.2268048	1100 gal tank	200
4.2 in M3A1	0.07869	6391	1.6069785	1100 gal tank	200
British Naval 4.5"	0.408519	2461	1.237102	1100 gal tank	200
4.5 inch rocket M8	0.1485	5352	2.1268099	1100 gal tank	275
4.7 in Mark I	0.59147	3566	3.7606709	1100 gal tank	275
120mm M356	0.32909	3493	2.0076278	1100 gal tank	275
5 in 38 Caliber Mk 35	0.36485	3563	2.3158861	1100 gal tank	275
6" Trench Mortar	0.11418	3939	0.8857615	1100 gal tank	200
155 mm M107	0.64821	3426	3.8041893	1100 gal tank	275

[A]These rounds contain a shaped charge. Care must be taken that the destruction method does not allow formation of a jet and fragment slug.

Not Applicable

F-2 PROJECT FORMS

APPENDIX F-2

LIST OF PROJECT FORMS

Corrective Action Request
Daily Briefing Sign-In Sheet
Daily Instrument/ITS Report Form
Daily Operations Report MEC Operations
Daily Quality Control Report
Deficiency Notice
Equipment Maintenance Repair Form
Equipment Utilization Log
Field Activity Weekly Log
Field Change Request Form
Follow-Up Inspection/Surveillance Report
Initial Phase Inspection Report
Lessons Learned Report Form
MEC Accountability Log
MEC Data and Accountability Form
MEC Field Activity Daily Log
MEC Tracking Log
MPPEH Container Inventory Card
Non-Conformance Report
Preparatory Phase Inspection Report
Quality Control Surveillance Report
Record of Change Form
Safety Meeting Training Record
Surveillance Checklist
Tailgate Safety Briefing
Visitors Log

CORRECTIVE ACTION REQUEST

	CAR No.:
Project/Location	CAR Issue Date

Responsible Organization	Discussed With
Response Assigned to	Response Due Date

Requirement Violated/Finding

Recommended Corrective Action

Initiated by	Date	Approved By	Date

Remedial Action to Correct Condition *(Include Cause)*:

Scheduled Completion Date:

Corrective Action to Prevent Recurrence

Response Submitted By:		Date:

Evaluation Comments:	☐ Accept	☐ Reject

Verification Comments:	☐ Accept	☐ Reject

Evaluated By	Date	Verified By	Date

DAILY BRIEFING SIGN-IN SHEET

Project Information

Project Name/Location: _____ Date: _____

Person Presenting Brief: _____

Shift/Department: _____

Briefing Content

Awareness (Special AHA concerns, recent incidents, etc.): _____

_____

_____

_____

Other Issues (Plan changes, attendee comments, etc. _____

_____

_____

_____

Attendees (Please Print Name) - Return to SUXOS following the Briefing

1.		16.	
2.		17.	
3.		18.	
4.		19.	
5.		20.	
6.		21.	
7.		22.	
8.		23.	
9.		24.	
10.		25.	
11.		26.	
12.		27.	
13.		28.	
14.		29.	
15.		30.	

TETRA TECH NUS, INC.

DAILY INSTRUMENT	ITS REPORT

Project Name:	Project No:	Location:	Date:

☐ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐

I. Test Plot Information

Location:

Item Number	Inert Item/Surrogate Description	Depth (inches)	Azimuth/ Inclination Angle(Degrees)	Comments
1				
2				
3				
4				
5				

II. Instrument Information

Instrument Type/Manufacture	Instrument Serial Number	Test Plot Items Instrument Tested on (List Item Numbers)	Setting On Instrument Tested (As Per WP)	Test Results, ☒ indicates good for operation	Personnel Testing Equipment	Comments
				☐		
				☐		
				☐		
				☐		
				☐		
				☐		
				☐		
				☐		
				☐		
				☐		

III. Problems Encountered / Corrective Actions Taken.

explain in space below:

IV. Supervisor

Name and Signature:	Title/Company:	Date:

DAILY OPERATIONS REPORT – MEC OPERATIONS (Attach additional sheets if necessary)

Project Number: _____ REPORT NUMBER: _____

Title & Location: _____ Date & Time: _____

Contractor: _____ Weather: _____

SUXOS: _____ _____

WORK PREFORMED TODAY

Description	Employer	No.	Trade	Hours

JOB SAFETY

Was a Job Safety meeting held this date? Yes _____ No _____ Total Work Hours on Site This Date _____

(If yes attach copy of minutes)

Were there any lost time accidents this date? Yes _____ No _____ Previous Cumulative Work Hours _____

(If yes attach copy of OSHA report) (See Previous Report)

Total Cumulative Work Hours to Date _____

List of Actions taken today / Inspections conducted.

Equipment / material received today to be incorporated in job.

Equipment on job site today, including number of hours used today.

Remarks:

SUXOS: Date:

DAILY QUALITY CONTROL REPORT

Project Name: _____ Report No: _____

Project No: _____ Location: _____ Date: _____

☐ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

Weather/Precipitation:	High Temperature: Low Temperature:	Wind:	Humidity

I. Personnel Present (Reference/attach SUXOS's daily report if applicable)

Name	Position	Company

II. Work Performed

III. Quality Control Activities (Reference/attach inspection/surveillance reports):

IV. Problems Encountered / Corrective Actions Taken

V. Directions Given / Received:

VI. Special Notes / Lessons Learned

VII. Visitors

VIII. Approval

Name and Signature:	Title/Company:	Date:

Revised April 2005

TETRA TECH NUS, INC.

DAILY QUALITY CONTROL REPORT		
Contract Number:	Project:	
Report Number:	Location:	Date:

Phase	List Definable Features of Work, Locations, and List Personnel Present	
Preparatory		
Initial		Inspection Performed
Follow up		Inspection Performed

Rework Items Identified Today (Not Corrected by Close of Business)	Rework Items Corrected Today

Remarks

On behalf of the contractor, I certify that this report is complete and correct and the equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report.	_____ Project Quality Control Officer	_____ Date

Client Quality Assurance

Quality Assurance Representative Remarks and/or Exceptions to the Report

_____ Client QA Representative _____ Date

DEFICIENCY NOTICE

	Deficiency Notice No.
Client:	Project Number:
Project:	Specific Process:
Description of Process	

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

Name and Signature of Person Reporting Deficiency	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

DEFICIENCY NOTICE

	☐ Change
	☐ Other job factors

Enter brief explanation of each *basic cause* below:

Name and Signature of Person Conducting RCA	Title/Company	Date

III. Corrective Action

Name and Signature of Person Recommending CA	Title/Company	Date

Re-Inspection Results

IV. Re-Inspection
☐ Accepted
☐ Rejected

Reissued Under:
Deficiency Notice Number:
Non-Conformance Report Number:

Name and Signature of Person Re-Inspection	Title/Company	Date

V. ☐ Responsible Organization	☐ QA/QC	☐ SUXOS	☐ Project Manager
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

TETRA TECH NUS, INC.

EQUIPMENT MAINTENANCE/REPAIR

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	

TETRA TECH NUS, INC.

EQUIPMENT UTILIZATION LOG

EQUIPMENT I.D._____

DESCRIPTION_____

DATE OUT	TIME OUT	COND. CODE & COMMENTS OUT	CHECKED OUT BY	DATE IN	TIME IN	CHECKED IN BY	COND. CODE & COMMENTS IN

TETRA TECH NUS, INC.

DATE	
NO.	
SHEET 1 OF 1	

FIELD ACTIVITY WEEKLY LOG

PROJECT NAME:	PROJECT NO:
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF WEEKLY ACTIVITIES AND EVENTS:	
VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
PERSONNEL ON SITE:	
SIGNATURE:	DATE:

FIELD CHANGE REQUEST (FCR)

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

RE:

Drawing # _____ Title: _____

Specific Sections: _____ Title: _____

Other: _____

1. DESCRIPTION (items involved, submit sketch, if applicable):

2. REASON FOR CHANGE

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

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

4. DISPOSITION: (Approval Required by Client Representative)

_____ Not Approved (give reason).

_____ Considered minor change – APPROVED per recommended disposition – Documents will not be formally revised. Field office to maintain as –built records.

_____ 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:**
Navy Point of Contact / Client Representative (Signature)	**Date:**

FOLLOW-UP INSPECTION/SURVEILLANCE REPORT

Project Name: _____ Report No: _____

Project No: _____ Location: _____ Date: _____

I. Definable Feature of Work

- ☐ Project Management
- ☐ Excavation Observation/Operations
- ☐ MPPEH Processing/ Certification
- ☐ Safety Meetings
- ☐ Documentation Control
- ☐ Field Data Entry
- ☐ UXO Escort/ Avoidance Operations
- ☐ MEC Transfer to EOD
- ☐ Mobilization/Demobilization
- ☐ Document Review
- ☐ Data Management
- ☐ MEC Visual Survey/Certification Operation
- ☐ Equipment Management/ Checks
- ☐ Acceptance Sampling
- ☐ Other:

II. Type of Inspection

☐ Follow-up ☐ Surveillance

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

Revised May 2006

INITIAL PHASE INSPECTION REPORT

Project Name: _____ Report No: _____

Project No: _____ Location: _____ Date: _____

I. Definable Feature of Work

- ☐ Project Management
- ☐ Excavation Observation/Operations
- ☐ MPPEH Processing/ Certification
- ☐ Safety Meetings
- ☐ Documentation Control
- ☐ Field Data Entry
- ☐ UXO Escort/ Avoidance Operations
- ☐ MEC Transfer to EOD
- ☐ Mobilization/Demobilization
- ☐ Document Review
- ☐ Data Management
- ☐ MEC Visual Survey/Certification Operation
- ☐ Equipment Management/ Checks
- ☐ Acceptance Sampling
- ☐ Other:

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

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

Name	Position	Company

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

Is preliminary work complete and correct? ☐ Yes ☐ No

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

V. Task Execution

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

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

Is workmanship acceptable? ☐ Yes ☐ No

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

INITIAL PHASE INSPECTION REPORT

Project Name: _____ Report No: _____

Project No: _____ Location: _____ Date: _____

V. Resolve Differences

Comments:

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

Comments:

VII. Results of Inspection

☐ Acceptable ☐ Unacceptable NCR #:

Name:	Signature:	Date:

QC Manager Comments

QC Manager Review

☐ Concur	☐ Non-Concur	Signature:	Date

VIII. Distribution

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

Revised May 2006

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:

MEC ACCOUNTABILITY LOG

MEC Data

Report No.	Item	Category (UXO, Practice, etc.)	Found (Date)	Location	Disposition	Photo Ref	Disposition Date

Log Verification

SUXOS Signature:	Date:

Revised April 2006

MEC DATA AND ACCOUNTABILITY FORM

FOR UXO TEAM USE

Site Name: | 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) | Date:
☐ Transferred ☐ Transported ☐ Left In Place ☐ Destroyed ☐ BIP ☐ Other : _____

Client Notifications By: | Signature: | Date

Transferred To: | Signature: | Date:

Destroyed By: | Signature | Date:

Remarks: _____

SUXOS Signature: | Date:

Revised April 2006

TETRA TECH NUS, INC.

MEC FIELD ACTIVITY DAILY LOG

DATE	
SHEET	OF

FACILITY NAME: **SITE(s)**:	**PROJECT NO**: **TASK CODES**:

FIELD ACTIVITY SUBJECT:

SUMMARY OF DAILY PROGRESS:
LIST TRANSECTS AND/ORGRIDS and INSTRUMENTS USED

Instrument Test Strip Setup:

Vegetation Management:

Detector Aided Surveys:

QA/QC Check:

Geophysics Escort:

DOCUMENTATION OF MEC/MPPEH ENCOUNTERED:
LIST TRANSECT AND/OR GRID, PHOTO ID, AND DESCRIPTION

DATE	
SHEET	OF

TETRA TECH NUS, INC.

DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:

IMPORTANT PHONE CALLS/DECISIONS:

FIELD TASK MODIFICATIONS:

WEATHER CONDITIONS:

VISITORS ON SITE:

PERSONNEL ON SITE:

SIGNATURE:

DATE:

MEC TRACKING LOG
Naval Air Station Brunswick, Brunswick, Maine

SITE:_____

ID #	ITEM IDENTIFICATION	UXO TECH NAME	ITEM COORDINATES	DATE/TIME FOUND	DIGITAL PHOTGRAPH NUMBER	ARMED / UNARMED	PHYSICAL CONDITION / APPEARANCE	DATE DESTROYED

MPPEH CONTAINER INVENTORY CARD

PROJECT NAME. & LOCATION:	STOCK NUMBER:	LOT NUMBER:

DESCRIPTION:

Date	Document No.	Transaction	Gain	Loss	Balance	Printed Name/Signature

Page ___

Revised March 2006

NON-CONFORMANCE REPORT

	Report No.
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

Enter brief explanation of each *basic cause* below:

NON-CONFORMANCE REPORT

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	

PREPARATORY PHASE INSPECTION REPORT

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

UXO Team: _____ Location: _____ Date: _____

I. Definable Feature of Work

- ☐ Project Management
- ☐ Excavation Observation/Operations
- ☐ MPPEH Processing/ Certification
- ☐ Safety Meetings
- ☐ Documentation Control
- ☐ Field Data Entry
- ☐ UXO Escort/ Avoidance Operations
- ☐ MEC Transfer to EOD
- ☐ Mobilization/Demobilization
- ☐ Document Review
- ☐ Data Management
- ☐ MEC Visual Survey/Certification Operation
- ☐ Equipment Management/ Checks
- ☐ Acceptance Sampling
- ☐ 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.)

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?

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.)

PREPARATORY PHASE INSPECTION REPORT

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

UXO Team: _____ Location: _____ Date: _____

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

Revised 4/27/2005

TETRA TECH NUS, INC.

QUALITY CONTROL SURVEILLANCE REPORT	Report Number:
Project Name:	Contract No:
Client:	Project Manager:

1 - Activity

☐ Project Readiness UFP-SAP Review	☐ Pre-Operational Team Training Review	☐ Mobilization/Site Preparation	☐ Brush Cutting and Vegetation Clearance
☐ Pre-Survey ITS Review	☐ Daily Function Test	☐ UXO Detector-Aided Surface Survey/Quality Control Check	☐ UXO Detector-Aided Surface Survey Field Data Collection &Transcription
☐ Geophysical Survey	☐ Geophysical Survey Field Data Collection and Transcription	☐ GPS Data	☐ Demobilization
☐ Other:	☐ Other:	☐ Other:	☐ Other:

2 - Phase

☐ Preparatory	☐ Initial	☐ Follow up

3 - References

4 – Observed Condition/Activities and Comments

5 – Results of Surveillance

☐ Acceptable	☐ Unacceptable	Deficiency #: NCR #:
Conducted By:	Signature:	Date:

6 – Project Manager Review

☐ Concur ☐ Non-Concur	Signature:	Date:

7 - Distribution

☐ PM ☐ FOL ☐ SUXOS ☐ UXO Manager ☐ Safety ☐ Other:

RECORD-OF-CHANGE FORM

PROJECT NAME:	PROJECT NO.	
TO:	LOCATION:	DATE:

RE:
Worksheet #/SOP # _____ Title: _____
Specific Sections: _____

1. DESCRIPTION (items involved[1]:

2. REASON FOR CHANGE[1]:

3. RECOMMENDED ACTION[1]
_____ Minor Change _____ Major Change (Impacts Cost, Schedule)

4. DISPOSITION: (Approval Required by Client Representative)
_____ Not Approved (give reason).

_____ Considered minor change – APPROVED per recommended disposition – Documents will not be formally revised. Field office to maintain as –built records.

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

Prepared by (Signature)	Date:
TtNUS Project Manager (Signature)	Date:
Point of Contact / Client Representative (Signature)	Date:

(1) Attach continuation sheets, sketches, etc., as applicable.

TETRA TECH NUS, INC.

SAFETY MEETING/TRAINING RECORD

DATE: _____/_____/_____ **TIME: _____ AM PM**

1. Reason for Meeting/Training: (Check all that apply)	
	Daily Safety Meeting/Training
	Initial Site Safety Meeting/Training
	New Task Briefing
	Periodic Safety Meeting/Training
	New Site Procedures
	New Site Information
	Periodic Review of Site Information
	Other (Explain):

2. Personnel Attending Meeting/Training:

Name	Signature	Company

TETRA TECH NUS, INC.

LOCATION/SITE: _____

Safety Meeting/Training Record Con't:

3. Topics Covered (Check all that apply)

	Site Safety Personnel		**Decontamination Procedures**
	Site/Work Area Description		**Emergency Response Plan**
	Site Characterization		**Hazard Communication**
	Biological Hazard(s)		**On-Site Emergency**
	Chemical Hazard(s)		**On-Site Injuries/Illnesses**
	Physical Hazard(s)		**Evacuation Procedures**
	Heat Stress		**Rally Point(s)**
	Cold Stress		**Emergency Communication**
	Site Control		**Directions to Medical Facility**
	Work and Support Zones		**Drug and Alcohol Policies**
	PPE		**Medical Monitoring Program**
	Air Monitoring		**Specific Task Training**
	Safe Work Practices		**Confined Spaces**
	Engineering Controls and Equipment		**Heavy Equipment**
	Spill Containment Procedures		**Other: (Specify)**

4. Remarks:

SURVEILLANCE CHECKLIST

Activity	Frequency of Surveillance	Forms to be Used	Process Mapped	QC Procedure	Corrective Action / Failure Criteria
Project Management Planning	Periodic Inspection	QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist (Pittsburgh)will · Verify the following documentation is in the project file: a. Task Initiation Procedure (TIP)/Risk Management Plan (RMP) b. Fully executed contract. c. Project charge numbers d. Contract Notice Checklist e. Project Readiness Review Meeting f. Client Kickoff Meeting g. Peer-reviewed work plan	· Document not approved for use by appropriate personnel · Any one of the listed documents not in the project file · Where appropriate, a Deficiency Notice will be issued and a causal analysis/corrective action will be developed.
Document Review	Periodic Inspection	QC Surveillance Document Review Form	☐ Yes ☐ No ☐ N/A	QC Specialist (Pittsburgh) will · Verify a Document Review has been conducted on all project Documents. Project documents include, but are not limited to, the, work plans and procedures, QA/QC plans, health and safety plans, accident prevention plan · Verify the document review is documented on the document review form	· Document Review not Conducted · Document Review not Documented · Where appropriate, a Deficiency Notice will be issued and a causal analysis/corrective action will be developed.
Mobilization/ Site Preparation	3 Phase Inspection, Periodic Inspection	QC Project Checklist QC Preparatory Inspection QC Initial Inspection QC Surveillance	☐ Yes ☐ No ☐ N/A	UXOSO/QC Specialist will · Document that the kickoff meeting has been conducted · Utilize the Project Checklist during Site Preparation	· Any element of the Project Checklist not complete that involves safety · A kickoff meeting not conducted and documented · Where appropriate, a Deficiency Notice will be issued and a causal analysis/corrective action will be developed.
Documentation Control	Periodic Inspection	QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist (UXO Program Manager)Verify · Files will be administered and set up with file numbering or topical index system appropriate for the size of the project. · That documents and records submitted to Project Files are legible, complete · The documentation control plan is communicated at the Project Readiness Review Meeting. · Documents and records listed on the Records Retention Matrix are maintained.	·A Document Control Plan not implemented on the project ·Any element not conforming to the specification of the Document Control Plan · Where appropriate, a Deficiency Notice will be issued and a causal analysis/corrective action will be developed.
Data Management	3 Phase Inspection, Periodic Inspection	QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist will · verify project data is managed in a access database (or equivalent) · Verify all data is backed up on a daily basis · Compare electronic data with written reported results and verify consistency/ accuracy of the data.	· Any element not conforming to the specifications · Where appropriate, a Nonconformance report will be issued and a causal analysis/corrective action will be developed.
Excavation Observation/ Operations	3 Phase Inspection, Periodic Inspection	QC Preparatory Inspection QC Initial Inspection	☐ Yes ☐ No	QC Specialist will observe all excavation operations in search of MEC · Verify UXO Tech observes 100% of excavation operations. Fail criteria will be any excavation operations conducted without UXO technicians on site.	· Any element not conforming to the specifications · Any excavation operations conducted without UXO technicians on site. · Where appropriate, a Nonconformance report will be

	SURVEILLANCE CHECKLIST				
Activity	Frequency of Surveillance	Forms to be Used	Process Mapped	QC Procedure	Corrective Action / Failure Criteria
		QC Surveillance	☐ N/A		issued and a causal analysis/corrective action will be developed.
UXO Escort/ Avoidance Operations	3 Phase Inspection, Periodic Inspection	QC Preparatory Inspection QC Initial Inspection QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist will verify that UXO Technician is conducting avoidance activities while conducting UXO Escort Duties. · Verify no MEC are moved or disturbed during this phase of the project. Fail criteria will be any MEC moved or disturbed.	· Any element not conforming to the specifications · Any MEC moved or disturbed during Escort/ Avoidance Operations. · Where appropriate, a Nonconformance report will be issued and a causal analysis/corrective action will be developed.
MEC Visual Survey Operation and certification in accordance with ESS	3 Phase Inspection, Periodic Inspection	QC Preparatory Inspection QC Initial Inspection QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist will verify the UXO Tech completed a 100% visual survey for MEC on excavated material. ·Ensure MEC have been located, identified, and removed from the excavated material.	· Any element not conforming to the specifications ·. · Where appropriate, a Nonconformance report will be issued and a causal analysis/corrective action will be developed.
Field Data Entry	3 Phase Inspection, Periodic Inspection	QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist will verify · That the data entry is complete, accurate, and consistent and meets project objectives · Data is being recorded in real time not after the fact	· Any element not conforming to the specifications · Where appropriate, a Nonconformance report will be issued and a causal analysis/corrective action will be developed.
Logbook Entries	3 Phase Inspection, Periodic Inspection	QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist will verify · That the data entry is complete, accurate, and consistent and meets project objectives · Data is being recorded in real time not after the fact	· Any element not conforming to the specifications · Where appropriate, a Deficiency Notice will be issued and a causal analysis/corrective action will be developed.
MPPEH Processing/ Certification	3 Phase Inspection, Periodic Inspection	QC Preparatory Inspection QC Initial Inspection QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist will · Observe the MPPEH Processing procedure · Re-Inspect a % of the Scrap · Ensure no energetic material remains in the Certified MPPEH.	· Any MPPEH found in the Processing Area · Any energetic material discovered in the certified MPPEH · Any element not conforming to the specifications · Where appropriate, a Nonconformance report will be issued and a causal analysis/corrective action will be developed.
MEC Transfer to EOD	3 Phase Inspection, Periodic Inspection	QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist will · Observe the transfer of MEC to EOD control for transportation and treatment and ensure MEC transfer is conducted in a safe and effective manner.	· Any unsafe transfer procedures observed · Where appropriate, a Deficiency Notice will be issued and a causal analysis/corrective action will be developed.
Safety Meeting including Tailgate Safety Brief	3 Phase Inspection, Periodic Inspection	QC Surveillance	☐ Yes ☐ No	QC Specialist will · Observe the morning safety meeting · Observe the tailgate safety meetings	· Safety Meetings not taking place · Where appropriate, a Deficiency Notice will be issued and a causal analysis/corrective action will be developed.

SURVEILLANCE CHECKLIST

Activity	Frequency of Surveillance	Forms to be Used	Process Mapped	QC Procedure	Corrective Action / Failure Criteria
			☐ N/A		
Equipment Management	3 Phase Inspection, Periodic Inspection	QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist will Verify · A Inventory with serial numbers of all equipment to be utilized is completed · Components are marked with unique identifiers such as color coded electrical tape for individual assignment. · Equipment Damaged on the Project will have an Incident Report completed on the incident.	· Any element not conforming to the specifications · Where appropriate, a Deficiency Notice will be issued and a causal analysis/corrective action will be developed.
Equipment Checks	3 Phase Inspection, Periodic Inspection	QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist will Verify · All required Equipment Checks are completed Daily · Equipment checks are documented	· Any element not conforming to the specifications · Where appropriate, a Nonconformance report will be issued and a causal analysis/corrective action will be developed.
Acceptance Quality Control	3 Phase Inspection, Periodic Inspection	QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist will · Ensure that all production work is completed on the work to be sampled. · Ensure all Nonconforming situations are corrected prior to starting Acceptance Sampling. · Initially recheck 25% of excavated material determined to be MEC-free prior to certification in accordance with ESS and movement off site. · After 4 rechecks, if no MEC have been found, the rechecks may change to 10%. · If MEC is found in any recheck, that portion of the excavated material will be rejected and the UXO Tech will complete a resurvey of that material. · QC specialist will recheck that material. At this point the rechecks will be increased to 25% until 4 rechecks have been free of MEC. · Document the Acceptance Sampling on the appropriate Acceptance Sampling Log.	· Any element not conforming to the specifications · The excavated material will be returned to the UXO Tech for cure and will require causal analysis/corrective action if a MEC item is located in the excavated material during QC Acceptance Sampling · A Nonconformance report will be issued and a causal analysis/corrective action will be developed if the item fails Acceptance Sampling.
Other	3 Phase Inspection, Periodic Inspection	QC Preparatory Inspection QC Initial Inspection QC Surveillance	☐ Yes ☐ No ☐ N/A	QC Specialist will perform random surveillance and evaluation of the following activities: · As required by the project or client objectives.	· Any element not conforming to the specifications · Where appropriate, a Nonconformance report or Deficiency Notice will be issued and a causal analysis/corrective action will be developed.

TETRA TECH NUS, INC.

Project: NAS BRUNSWICK, BRUNSWICK MAINE			
Tailgate Safety Briefing			
Date: _____		**Location: _____**	
Time: _____		**Team #: _____**	
1. Reason for Briefing:			
	Daily Safety Briefing		**New Site Procedure**
	Initial Safety Briefing		**New Site Information**
	New Task Briefing		**Review of Site Information**
	Periodic Safety Meeting		**Other: (Specify)**

2. Personnel Attending

Name	Signature	Position

Briefing Given By:

Name	Signature	Position

TETRA TECH NUS, INC.

3. Topics: (Check All That Apply)			
	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:
4. Remarks:			

TETRA TECH NUS, INC.

Name	Signature	Position

TETRA TECH NUS, INC.

VISITERS LOG

NAS BRUNSWICK, BRUNSWICK, MAINE

Name	Signature	Position

TETRA TECH NUS, INC.

VISITERS LOG

NAS BRUNSWICK, BRUNSWICK, MAINE

DATE	PRINT NAME	SIGNATURE	ORGANIZATION	PHONE #

APPENDIX G

MSD CALCULATION FORMS FROM EXPLOSIVE SAFETY SUBMISSION

FRAGMENTATION DATA REVIEW FORM

Database Revision Date 12/31/07

Category:	Fuzes	DODIC:	
Munition:	Hand Grenade M204	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	fuze	Individual Last Updated Record:	Crull
Secondary Database Category:	M204	Date Record Retired:	
Munition Case Classification:	N/A		

Munition Information and Fragmentation Characteristics

Explosive Type:	RDX
Explosive Weight (lb):	0.00264
Diameter (in):	0.2430
Max Fragment Weight (lb):	0.000025
Critical Fragment Velocity (fps):	10638

Theoretical Calculated Fragment Range

HFD [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	NA
MFR-V [Vertical Range of Max Weight Fragment] (ft):	66
MFR-H [Horizontal Range of Maximum Weight Fragment] (ft):	78

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	6
Inhabited Building Distance (09 psi), K50 Distance:	8
Intentional MSD (0065 psi), K328 Distance:	50

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	0.34
Mild Steel:	0.03
Hard Steel:	0.02
Aluminum:	0.07
LEXAN:	0.32
Plexi-glass:	0.15
Bullet Resist Glass:	0.10

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.000025
Critical Fragment Velocity (fps)SB:	10638
Kinetic Energy 106 (lb-ft2/s2)SB:	0.0014
Required Wall Roof Sandbag Thickness (in)SB:	12
Expected Maximum Sandbag Throw Distance (ft)SB:	25
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.000025
Critical Fragment Velocity (fps)W:	10638
Kinetic Energy 106 (lb-ft2/s2)W:	0.0014
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft)W:	200/200

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Close Form

FRAGMENTATION DATA REVIEW FORM

Database Revision Date 12/31/07

Category:	HE Rounds	DODIC:	B562
Munition:	40 mm MK2	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/9/2007
Primary Database Category:	projectile	Individual Last Updated Record:	Crull
Secondary Database Category:	40 mm	Date Record Retired:	
Munition Case Classification:	Robust		

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	0.18700
Diameter (in):	1.5748
Max Fragment Weight (lb):	0.033061
Critical Fragment Velocity (fps):	3605

Theoretical Calculated Fragment Range

HFD [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	131
MFR-V [Vertical Range of Max Weight Fragment] (ft):	847
MFR-H [Horizontal Range of Maximum Weight Fragment] (ft):	1095

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	24
Inhabited Building Distance (09 psi), K50 Distance:	30
Intentional MSD (0065 psi), K328 Distance:	199

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	2.17
Mild Steel:	0.40
Hard Steel:	0.33
Aluminum:	0.86
LEXAN:	3.41
Plexi-glass:	2.08
Bullet Resist Glass:	1.63

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.033061
Critical Fragment Velocity (fps)SB:	3605
Kinetic Energy 106 (lb-ft2/s2)SB:	0.2148
Required Wall Roof Sandbag Thickness (in)SB:	12
Expected Maximum Sandbag Throw Distance (ft)SB:	25
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.033061
Critical Fragment Velocity (fps)W:	3605
Kinetic Energy 106 (lb-ft2/s2)W:	0.2148
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft)W:	200/200

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APPENDIX H

RESUMES OF FIELD PERSONNEL

APPENDIX H
RESUMES OF FIELD PERSONNEL

Resumes will be added to Final Work Plan upon identification of field personnel.

APPENDIX I

KEY TABLES FROM THE EXPLOSIVE SAFETY SUBMISSION

APPENDIX I

LIST OF TABLES

Site 12 EOD Area MGFD Materials and Thicknesses
EZs for the FMBW Area
EZs for the Site 12 EOD Area
Controlling EZs for Site 12 EOD Area and FMBW Area

Table 6-1 Site 12 EOD Area MGFD Materials and Thicknesses

MGFD	Lexan® Thickness (in)	Plexiglas® Thickness (in)	Mild Steel (in)	Hard Steel (in)
40-mm Mk 2 projectile	3.41[a]	2.08[a]	0.40[a]	0.33[a]

a From Fragmentation Data Review Form, Updated 31 December 07.

Table 6-2 EZs for the FMBW Area

MGFDs		EZs (ft)				
		Fragmentation Effects		Blast Overpressure Effects		
Description	NEW (lbs)	HFD	MFD	K328	K40	K24
M204 Grenade Fuze	0.00264[a]	NA[a]	78[a]	50[a]	6[a]	3[b]

a From Fragmentation Data Review Form, Updated 31 December 07.
b Calculated using $D=KW^{(1/3)}$, with W equaling the NEW of a single MGFD without the donor charge.

Table 6-3 EZs for the Site 12 EOD Area

MGFDs		EZs (ft)				
		Fragmentation Effects		Blast Overpressure Effects		
Description	NEW (lbs)	HFD	MFD	K328	K40	K24
40-mm Mk 2 projectile	0.187[a]	131[a]	1095[a]	199[a]	24[a]	14[b]

a From Fragmentation Data Review Form, Updated 31 December 07.
b Calculated using $D=KW^{(1/3)}$, with W equaling the NEW of a single MGFD without the donor charge.

Table 6-4 Controlling EZs for Site 12 EOD Area and FMBW Area

Operation	Sited As	ES	Basis[4] [5]	ESQD (ft)
Manual Operations FMBW Area[1]	Unintentional detonation	UXO Teams	K40 of the MGFD	6[8]
Manual Operations FMBW Area[1]	Unintentional detonation	Public and non-essential personnel	MFD of the MGFD[7]	78[8]
MEC treatment up to 0.013 lbs NEW FMBW Area[3]	Intentional detonation	Public and all personnel	HFD of the MGFD	6[8] [9] [10]
Manual Operations Site 12 EOD Area[1]	Unintentional detonation	UXO Teams	K40 of the MGFD	24[8]
Manual Operations Site 12 EOD Area[1]	Unintentional detonation	Public and non-essential personnel	HFD of the MGFD	131[8]
Mechanized Operations Site 12 EOD Area[2]	Unintentional detonation	Essential personnel	K24of the MGFD[6]	14[8]
Mechanized Operations Site 12 EOD Area[2]	Unintentional detonation	Public and non-essential personnel	HFD of the MGFD	131[8]
MEC treatment up to 37.2 lbs NEW Site 12 EOD Area[3]	Intentional detonation	Public and all personnel	MFD of the MGFD	1,095[8] [9]

1 Manual operations involve excavating anomalies with hand tools.
2 Mechanized operations involve excavating anomalies with an excavator and mechanically screening the soil.
3 The maximum NEW for which blast overpressure (K328) does not exceed the MFD of the MGFD.
4 MGFD is the M204 grenade fuze with 0.00264 lbs NEW of RDX.
5 MGFD is the 40 mm Mk 2 Projectile with 0.187 lbs NEW of trinitrotoluene.
6 Requires shields or barricades designed to defeat hazardous fragments from the MGFD. The K18 distance of 11 feet may be used if essential personnel wear hearing protection that provides ≥9 decibel attenuation.
7 MFD used in place of HFD. HFD of the M204 fuze listed as NA (Table 6-2).
8 Calculated using $D=KW^{1/3}$, with W equaling the NEW of a single MGFD without donor charge.
9 This distance can be reduced by employing engineering controls authorized by DDESB TP-16.
10 Disposal activities will be coordinated with NASB to occur when aircraft are not operating in the area, which will eliminate the need to calculate the MFD-V distance. Whenever possible, disposal activities will occur at the Site 12 EOD Area.

APPENDIX J

OTHER ADDITIONAL INFORMATION

J-1 QC INFORMATION

Project Documents and Records Table

Document/Record	Producer	Related Work Aspect	Frequency of Completion	Where Maintained
Field Checklists	Field UXO Personnel	All Field Activities	Field collection days	AAR/PF
MEC Accountability Log	SUXOS	All Field Activities	As needed	AAR/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 Surface Surveys	Field collection days	AAR/PF
Detector-Aided Surface Survey Data	UXO Personnel	Detector-Aided Surface Survey data collection	Field collection days	AAR/PF/NIRIS
Field notes (detailing equipment and procedure)	Field UXO Personnel	All Field Activities	Field collection days	AAR/PF
Assessment findings and corrective actions	Various (see below)	All	As needed	AAR/PF
Quality Control Surveillance Report	UXOQC	All Field Activities	minimum of once per phase for each definable feature of work	AAR/PF
Daily Quality Control Report	UXOQC	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

Document/Record	Producer	Related Work Aspect	Frequency of Completion	Where Maintained
After Action Report	Tetra Tech Personnel	All Project Work	One time	AAR/PF

AAR – After Action Report
PF – Project File
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	UXOQC	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
UXO Escort/Avoidance Operations	As needed to support operations	Internal	Tetra Tech	UXOSO	SUXOS	SUXOS	UXO Manager
Detector-Aided Surface Survey	25% of first four transects / grids or after any failure; 10% thereafter	Internal	Tetra Tech	UXOQC	SUXOS	SUXOS	UXO Manager 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)
Surface/Subsurface UXO Clearance	Daily (inspection); Weekly (formal surveillance)	Internal	Tetra Tech	UXOQC	SUXOS	SUXOS	UXO Manager PM
Blind Seed Items	Daily (inspection); Weekly (formal surveillance)	Internal	Tetra Tech	UXOQC	SUXOS	SUXOS	UXO Manager
Trenching Operations	Daily (inspection), Weekly (formal survelliance)	Internal	Tetra Tech	UXOSO	SUXOS	SUXOS	UXO Manager
Surveying and Mapping Operations	Initial, then Weekly	Internal	Tetra Tech	UXOQC	SUXOS	SUXOS	UXO Manager
UXO/MEC Accountability	As needed	Internal	Tetra Tech	UXOQC	SUXOS	SUXOS	UXO Manager PM
MEC Disposal	As needed, formal observation	Internal	Tetra Tech	UXOQC	SUXOS	SUXOS	UXO Manager PM
MPPEH Certification	As needed, formal survelliance	Internal	Tetra Tech	UXOQC	SUXOS	SUXOS	UXO Manager PM
Visitor Briefing	Initial then as needed to support operations	Internal	Tetra Tech	Project Safety Officer	SSO	SSO	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)
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
Hazard Assessment – Risk Analysis	At start of each definable feature of work, then as needed to support operations	Internal	Tetra Tech	Project Safety Officer UXOSO	UXOSO SUXOS	UXOSO SUXOS	HSM
Field Work Systems Audit	1 per contract year	Internal	Tetra Tech	QAM	UXO Manager PM	QAM UXO Manager	QAM 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	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
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
Blind Seed Items	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
Trenching Operations	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
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
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

Assessment Type	**Nature of Deficiencies Documentation**	**Individual(s) Notified of Findings** (name, title, organization)	**Time Frame of Notification**	**Nature of Corrective Action Response Documentation**	**Individual(s) Receiving Corrective Action Response** (name, title, organization)	**Time Frame for Response**
Hazard Assessment – Risk Analysis	e-mail	Linda Klink – 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 Tom Johnston – QAM, Tetra Tech	Within 5 business days of assessment	Letter Report	Linda Klink – PM, Tetra Tech Tom Johnston – QAM, Tetra Tech	Within 10 business days of receipt

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 Surface Survey)	Daily (e-mail)	TBD	UXOQC 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	UXOQC 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 and grid 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 will be conducted in accordance with SOP-06.	Internal	Preparatory: Ralph Brooks – UXO Manager, Tetra Tech Initial Inspection: UXOQC
UXO Detector-Aided Surface Surveys/Quality Control Check	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 – UXOQC

Definable Feature of Work	Description	Internal/ External	Responsible for Verification (name, organization)
UXO Detector-Aided Surface Survey Field Data Collection and Transcription	Review of SOP-01 (UXO Detector-Aided Surface Surveys) and SOP-02 (MEC Management and Accountability) which include procedures for data collection and transcription. The SUXOS will verify that the data collected during the first lot of field work 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 of SOP-02 (MEC Management and Accountability) and SOP-05 (UXO Demolition/Disposal Operations) which documents procedures to be utilized during surface/subsurface UXO clearance.	Internal	Ralph Brooks - UXO Manager, Tetra Tech TBD - SUXOS TBD - UXOQC
Blind Seed Items	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 - UXOQC
Trenching Operations	Review of the Work Plan (Section 2.0) which documents the procedures for trenching operations.	Internal	Ralph Brooks - UXO Manager, Tetra Tech TBD - SUXOS TBD - UXOQC
MEC Disposal	Review of SOP-05 (UXO Demolition/Disposal Operations) which documents procedures to be utilized during MEC disposal.	Internal	Ralph Brooks - UXO Manager, Tetra Tech TBD - SUXOS TBD - UXOQC

Definable Feature of Work	Description	Internal/ External	Responsible for Verification (name, organization)
MPPEH Certification	Review of the Work Plan (Section 2.13) which documents the procedures for MPPEH disposition, verification, and certification.	Internal	Ralph Brooks - UXO Manager, Tetra Tech TBD - SUXOS TBD - UXOQC
GPS Data	Review of SOP-05 (GPS) which documents procedures to be utilized in the collection of GPS positional data. 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
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

(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.	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	Once per week activity is conducted	Checklists and Field Forms which document equipment utilized and progression of brush cutting and vegetation clearing activities.	Ralph Brooks - UXO Manager, Tetra Tech
UXO Detector-Aided Surface Survey/Quality Control Check	Minimum of once per day surveys are conducted or more frequently as necessary	Checklists and Field Forms which document equipment utilized, grids/transcripts swept and grids/transcripts checked for quality control purposes.	Ralph Brooks - UXO Manager, Tetra Tech TBD – SUXOS TBD – UXOQC
UXO Detector-Aided Surface Survey Field Data Collection and Transcription	As needed, prior to data entry	Prior to entering data (field forms and electronic data) from the detector-aided surface surveys into the permanent project database, the UXO Manager or designated representative will review the filed 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.	Ralph Brooks - UXO Manager, Tetra Tech TBD - SUXOS

Definable Feature of Work	Frequency of Inspection	Supporting QC Document(s)	Responsible for Validation (name, organization)
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.	Ralph Brooks - UXO Manager, Tetra Tech TBD – SUXOS TBD – UXOQC
Blind Seed Items	Each Blind Seed Item	Verify all blind seed items have been located during collection and surveying activities.	Ralph Brooks - UXO Manager, Tetra Tech TBD – SUXOS TBD – UXOQC
Trenching Operations	Minimum of once per day trenching operations are conducted or more frequently as necessary	Checklists and Field Forms which document trenching operations checked for quality control purposes.	Ralph Brooks - UXO Manager, Tetra Tech TBD – SUXOS TBD – UXOQC
MEC Disposal	Each MEC item disposed	Ensure that SOP-05 (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 – UXOQC
MPPEH Certification	Each MPPEH item certified	Ensure that the Work Plan (Section 2.13) has been followed and verify that all MPPEH certification activities and documentation have been completed.	Ralph Brooks - UXO Manager, Tetra Tech TBD – SUXOS TBD – UXOQC
GPS Data	Each day of GPS use	Verify GPS positional accuracy, background levels, and static response (SOP-05, GPS).	TBD - SUXOS

Definable Feature of Work	**Frequency of Inspection**	**Supporting QC Document(s)**	**Responsible for Validation** (name, organization)
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

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 Surface Survey	a) Satisfactory rechecks of 25% of first four grids/transects by the UXOQC, or SUXOS if no UXOQC. b) Satisfactory rechecks of 10% of the grids/ transects by the UXOQC or SUXOS if no UXOQC after achievement of satisfactory rechecks on four grids/transects in a row.	TBD SUXOS Tetra Tech TBD UXOQC Tetra Tech
IIa	Surface and Subsurface Soil	MEC Clearance and Trenching Operations	Verification that all clearance activities and trenching operations have been completed per the Work Plan.	TBD SUXOS Tetra Tech TBD UXOQC 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

J-2 MSDS FOR DONOR EXPLOSIVES

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		

DYNO NOBEL INC. Disclaimer
The information contained herein is provided for reference purposes only and is intended only for persons having relevant technical skills. Because conditions and manner of use are outside of our control, the user is responsible for determining the conditions of safe use of the product. While the information is believed to be correct, DYNO NOBEL INC. shall in no event be responsible for any damages whatsoever, directly or indirectly, resulting from the publication or use of or reliance upon the information contained herein. **(No warranty, either expressed or implied, of merchantability or fitness for a particular purpose, or of any nature with respect to the product, or to the information, is made herein.)**

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

The information contained in this *Material Safety Data Sheet* is provided to all individuals who are or will be exposed to this product through use, handling, storage or transport. Remington believes, yet makes no warranty, that all information contained in this document is current as of the date of publication.

HELIX Liquid

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: *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

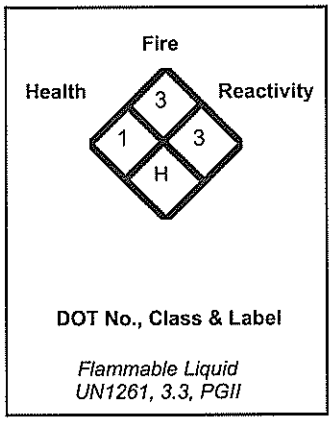
Chemical Family: Aliphalic Hydrocarbons

CAS No. 75-25-5

Chemical Formula: CH3 NO2

Percent Present: 99.9

DOT Hazard Class: Flammable Liquid



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

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.*

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Memphis, TN

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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.

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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.

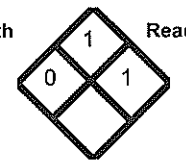
Aluminum 95-100%, OSHA 5mg/m3 respirable 15mg/m3 dust, ACGIH, 5mg/m3 fume 10mg/m3

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.*

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Memphis, TN

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HELIX Activator

Material Safety Data Sheet

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

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.*

Effects of Exposure

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.

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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.

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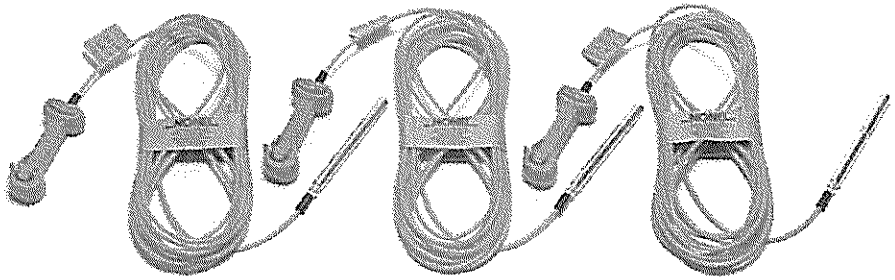
NONEL® EZ DET® 1.1B

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

See Product Disclaimer on page 2.

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

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Groundbreaking Performance

J-3 SI ANOMALY COORDINATES

APPENDIX J-3

LIST OF TABLES

Table 5.6-1 Suspect MEC and MD Items Discovered During Detector-Aided Surface Sweeps Inside and Outside of Existing/Historical Berm Area, Site 12 EOD Area

Table 5.7-1 Geophysical Anomalies at Site 12 EOD Area

Table 6.7-1 Geophysical Anomalies at Former Munitions Bunker West Area

TABLE 5.6-1

SUSPECT MEC AND MD ITEMS DISCOVERED DURING DETECTOR-AIDED SURFACE SWEEPS INSIDE AND OUTSIDE OF EXISTING/HISTORICAL BERM AREA SITE 12 EOD AREA NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE

MEC Item	Date Discovered	Location	GPS Location International Survey Feet	
			Northing	Easting
M18 Red Smoke Grenade	July 14, 2008	Inside Existing Berm	378283.24	3017265.5
M18 Red Smoke Grenade	July 14, 2008	Inside Existing Berm	378282.95	3017262.06
3-inch Cartridge Case	July 14, 2008	In Area of Former Berm	378217.39	3017391.82
Unknown Ordnance-Related Item	July 22, 2008	Just Outside of Existing Berm	378280.12	3017314.11
2.25-inch Rocket Motor (Munitions Debris)	August 7, 2008	Along North/South Transects East of Berm Area	378267.22	3017569.51
Frag (Munitions Debris)	August 7, 2008	Along North/South Transects South of Berm Area	378015.81	3017224.23
Gator Mine	August 11, 2008	Along East/West Transects Northwest of Berm Area	378494.37	3016946.82

TABLE 5.7-1

GEOPHYSICAL ANOMALIES AT SITE 12 EOD AREA
NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

Anomaly	Easting	Northing	Anomaly	Easting	Northing
1	3017263	378124	36	3017376	378184
2	3017323	378129	37	3017323	378185
3	3017346	378129	38	3017345	378187
4	3017251	378130	39	3017255	378188
5	3017300	378130	40	3017269	378188
6	3017336	378135	41	3017395	378189
7	3017371	378139	42	3017354	378193
8	3017304	378140	43	3017325	378197
9	3017234	378143	44	3017275	378198
10	3017323	378143	45	3017343	378198
11	3017329	378143	46	3017245	378199
12	3017269	378144	47	3017255	378199
13	3017310	378144	48	3017315	378199
14	3017300	378150	49	3017395	378199
15	3017255	378152	50	3017389	378203
16	3017333	378153	51	3017335	378205
17	3017343	378153	52	3017290	378207
18	3017308	378154	53	3017301	378207
19	3017385	378154	54	3017309	378208
20	3017324	378155	55	3017318	378208
21	3017326	378159	56	3017273	378209
22	3017353	378162	57	3017343	378210
23	3017274	378163	58	3017379	378210
24	3017314	378165	59	3017253	378213
25	3017330	378167	60	3017278	378213
26	3017268	378168	61	3017361	378217
27	3017300	378168	62	3017309	378218
28	3017323	378170	63	3017243	378219
29	3017335	378173	64	3017291	378219
30	3017348	378173	65	3017346	378219
31	3017399	378179	66	3017313	378222
32	3017315	378180	67	3017341	378222
33	3017356	378182	68	3017270	378223
34	3017288	378183	69	3017321	378224
35	3017251	378184	70	3017363	378224

TABLE 5.7-1

GEOPHYSICAL ANOMALIES AT SITE 12 EOD AREA
NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

Anomaly	Easting	Northing	Anomaly	Easting	Northing
71	3017388	378224	106	3017285	378270
72	3017264	378225	107	3017209	378275
73	3017353	378225	108	3017240	378275
74	3017338	378227	109	3017251	378277
75	3017248	378228	110	3017315	378278
76	3017280	378228	111	3017233	378280
77	3017273	378229	112	3017279	378280
78	3017295	378229	113	3017318	378280
79	3017390	378232	114	3017304	378282
80	3017224	378234	115	3017268	378283
81	3017265	378237	116	3017258	378284
82	3017280	378237	117	3017183	378288
83	3017294	378237	118	3017279	378289
84	3017251	378239	119	3017206	378290
85	3017240	378243	120	3017309	378290
86	3017298	378243	121	3017223	378294
87	3017214	378247	122	3017274	378295
88	3017233	378252	123	3017258	378297
89	3017295	378252	124	3017295	378298
90	3017246	378253	125	3017276	378300
91	3017271	378253	126	3017244	378303
92	3017285	378255	127	3017224	378307
93	3017293	378255	128	3017269	378309
94	3017226	378257	129	3017238	378312
95	3017310	378259	130	3017289	378312
96	3017298	378260	131	3017279	378313
97	3017250	378262	132	3017258	378314
98	3017238	378264	133	3017245	378318
99	3017260	378264	134	3017225	378323
100	3017205	378265	135	3017234	378323
101	3017223	378265	136	3017246	378324
102	3017304	378268	137	3017203	378330
103	3017269	378269	138	3017249	378330
104	3017194	378270	139	3017281	378330
105	3017264	378270	140	3017236	378335

TABLE 5.7-1

GEOPHYSICAL ANOMALIES AT SITE 12 EOD AREA
NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

Anomaly	Easting	Northing	Anomaly	Easting	Northing
141	3017241	378338	152	3017212	378251
142	3017260	378339	153	3017383	378244
143	3017213	378344	154	3017348	378122
144	3017224	378344	155	3017310	378121
145	3017251	378344	156	3017279	378120
146	3017271	378346	157	3017229	378180
147	3017304	378263	158	3017302	378125
148	3017255	378217	159	3017328	378157
149	3017219	378265	160	3017337	378139
150	3017296	378247	161	3017340	378133
151	3017300	378248			

Coordinates in NAD83 Maine State Plane West US survey feet.

TABLE 6.7-1

GEOPHYSICAL ANOMALIES AT FORMER MUNITIONS BUNKER WEST AREA
NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

Anomaly	Easting	Northing	Anomaly	Easting	Northing
1	3011766	384296	36	3011252	384674
2	3012242	384298	37	3011878	384674
3	3012260	384304	38	3012260	384682
4	3012290	384316	39	3011912	384696
5	3011768	384318	40	3011990	384706
6	3012268	384330	41	3011264	384718
7	3011992	384332	42	3012276	384728
8	3011754	384342	43	3012256	384742
9	3012274	384360	44	3012220	384750
10	3012302	384370	45	3011216	384754
11	3011650	384374	46	3012244	384760
12	3012262	384378	47	3012214	384766
13	3011642	384382	48	3011932	384770
14	3011798	384382	49	3012246	384774
15	3011616	384388	50	3012142	384776
16	3011630	384390	51	3011280	384786
17	3012270	384390	52	3012256	384786
18	3011694	384398	53	3012266	384786
19	3011710	384418	54	3011250	384796
20	3011732	384422	55	3012248	384796
21	3012280	384430	56	3011876	384802
22	3012268	384436	57	3011268	384828
23	3012274	384444	58	3011850	384932
24	3012252	384454	59	3012210	385112
25	3011778	384460	60	3011540	385122
26	3012264	384472	61	3012206	385124
27	3012286	384492	62	3011832	385128
28	3011836	384522	63	3011532	385136
29	3012216	384536	64	3011524	385142
30	3012234	384576	65	3011574	385142
31	3011212	384624	66	3012218	385156
32	3012286	384626	67	3011538	385158
33	3011446	384632	68	3012152	385160
34	3011822	384634	69	3011676	385164
35	3012280	384668	70	3011496	385178
71	3011472	385180	91	3011856	385662

TABLE 6.7-1

GEOPHYSICAL ANOMALIES AT FORMER MUNITIONS BUNKER WEST AREA
NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

Anomaly	Easting	Northing	Anomaly	Easting	Northing
72	3011524	385186	92	3011840	385704
73	3012002	385214	93	3011858	385704
74	3011648	385216	94	3011842	385738
75	3011530	385222	95	3011904	385588
76	3011530	385234	96	3012308	384389
77	3011790	385248	97	3012298	384433
78	3011512	385250	98	3012302	384428
79	3011642	385250	99	3011718	384420
80	3011514	385268	100	3011755	384497
81	3011520	385276	101	3011748	384374
82	3011624	385280	102	3011702	384421
83	3012028	385286	103	3011560	385108
84	3011602	385298	104	3011459	385150
85	3011828	385408	105	3011550	385161
86	3011890	385448	106	3011717	384442
87	3011920	385482	107	3011571	384394
88	3011928	385486	108	3011725	384416
89	3011706	385564	110	3011298	384752
90	3011838	385572	111	3011698	385357

Coordinates in NAD83 Maine State Plane West US survey feet.

J-4 MILITARY EOD INFORMATION

DEPARTMENT OF THE NAVY
EXPLOSIVE ORDNANCE DISPOSAL MOBILE UNIT TWO
DETACHMENT NEWPORT
1176 HOWELL STREET, BLDG 119
NEWPORT, RI 02841-1708

1134
Ser 08/023
05 Jan 09

From: Officer in Charge, Explosive Ordnance Disposal Mobile Unit TWO, Detachment Newport, RI
To: Distribution

Subj: EXPLOSIVE ORDNANCE DISPOSAL MOBILE UNIT TWO DETACHMENT NEWPORT WATCHBILL AND RECALL LIST

Encl: (1) EOD Watchbill for 01 Jan – 31 Mar 2009

1. Explosive Ordnance Disposal Mobile Unit TWO Detachment NEWPORT is responsible for providing Explosive Ordnance Disposal (EOD) services to all Navy installations/commands within the New England area and to respond to any military ordnance incident located in the ocean, contiguous waters, rivers, canals or enclosed bodies of water. The U.S. Army is responsible for providing EOD services on Army installations and to all military ordnance incidents on land mass areas except where specifically assigned to another service.

2. Joint instruction OPNAV 8027.1G/AR 75-14/MCO 8027.1D/AFR 136-8 states that in the interest of public safety the closest capable EOD unit should respond. In the New England area EODMU TWO Detachment NEWPORT, Rhode Island, is the closest fully manned military EOD asset.

3. EODMU TWO Detachment NEWPORT can assist and respond to other federal agencies or civilian authority requests for assistance concerning hazardous explosive items and emergent diving services. EODMU TWO Detachment NEWPORT is under the operational control of Commander, Navy Region Mid-Atlantic. Unless time does not permit, approval to respond to any incident will come from the Director of Public Safety for Commander, Navy Region Mid-Atlantic.

4. Enclosure (1) lists the EODMU TWO Detachment NEWPORT duty personnel and their recall phone numbers as well as alternate EOD activities.

//s//
B. A. Cummings

EODMU TWO Detachment NEWPORT Watchbill

Listed below is the contact information for all detachment EOD Techs. All techs are qualified to initiate emergency responses, make initial recommendations as well as provide guidance when required. If assistance is required during normal working hours contact EODMU TWO Detachment NEWPORT directly. If assistance is required after normal working hours please contact myself or EODCS Sheckley directly as we have our cell phones on us at all times.

EODMU TWO Detachment NEWPORT:
Voice: (401) 832-3301
FAX: (401) 832-6157
STU-III: (401) 832-4468

NAME		HOME	CELL PHONE	EMAIL
LT	Cummings	401-619-1907	401-862-6864	brian.a.cummings@navy.mil
EODCS	Sheckley	401-293-0591	401-862-6865	todd.sheckley@navy.mil
EODC	Carlson	-	619-395-5260	stephen.carlson@navy.mil
EODC	McCalicher	-	401-832-4483	ronald.mccalicher@navy.mil
EODC	Virgilio	-	401-862-6870	kenneth.virgilio@navy.mil

In the event that EODMU TWO Detachment NEWPORT is unavailable (TAD out of area), and an immediate response is required, please contact the EOD activities listed below in order for assistance:

IED (Improvised Explosive Device)

Connecticut

State Police Bomb Squad	(860) 537-7570
Hartford PD Bomb Squad	(860) 527-7300 Ext 5395
New Haven/Yale Police Bomb Squad	(203) 946-6330
Stamford PD Bomb Squad	(203) 977-4459
FBI SABT (New Haven)	(203) 777-6311

Maine

State Police Bomb Squad	(207) 624-7076
Bangor PD Bomb Squad	(207) 947-7384
Portland PD Bomb Squad	(207) 874-8479

Massachusetts

State Police Bomb Squad	(617) 567-2233
Boston PD Bomb Squad	(617) 343-4245
Cambridge PD Bomb Squad	(617) 349-3230
FBI Office	(617) 742-5533

New Hampshire

State Police	(603) 271-3636
Nashau PD Bomb Squad	(603) 589-1638

Rhode Island

State Fire Marshall Bomb Squad	(401) 294-0861

Vermont

State Police Bomb Squad	(802) 244-8727

Military Ordnance

EODMU TWO DET EARLE, NJ:---------- (732) 866-2258; DSN 449-2258

Encl (1)

NOTE: For privacy and security reasons, phone numbers will only be disclosed to authorized personnel and only on a need-to-know basis.

APPENDIX K

RECORD OF CHANGE

FIELD CHANGE REQUEST (FCR)

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

RE:

Drawing # _____ Title: _____

Specific Sections: _____ Title: _____

Other: _____

1. DESCRIPTION (items involved, submit sketch, if applicable):

2. REASON FOR CHANGE

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

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

4. DISPOSITION: (Approval Required by Client Representative)

_____ Not Approved (give reason).

_____ Considered minor change – APPROVED per recommended disposition – Documents will not be formally revised. Field office to maintain as –built records.

_____ 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:**
Navy Point of Contact / Client Representative (Signature)	**Date:**

APPENDIX L

RESPONSES TO STAKEHOLDERS COMMENTS

RESPONSE TO USEPA COMMENTS DATED JULY 29, 2009
DRAFT TIME CRITICAL MUNITIONS AND EXPLOSIVES OF CONCERN REMOVAL ACTION WORK PLAN FOR SITE 12 EOD AREA AND FORMER MUNITIONS BUNKER WEST AREA DATED JULY 2009 (Rev. 0)
NAVAL AIR STATION BRUNSWICK, MAINE

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

1. **Comment:** Page 1-1, Section 1.0 – Introduction: The Navy, exercising its authority under Executive Order 12580, has made a determination that a time-critical removal action under CERCLA is necessary at the Site 12 EOD and FMBW areas. The Navy's justification for this determination is based on the planned construction of a Marine Corps Armed Force Reserve Center (USMC AFRC) just north of the Site12 EOD area in Spring 2010 that will require prior MEC surface clearance to ensure the safety of workers associated with this construction project. While not impacted by the planned USMC AFRC construction project, the FMBW area is also to be transferred as part of the NAS Brunswick closure process. The final NAS Brunswick Reuse Plan identifies the western portion of the base that encompasses the FMBW area for future educational and natural area uses. For CERCLA actions where, based on the site evaluation, the lead agency determines that a removal is appropriate, and that less than six months exists before on-site removal activities must begin, the lead agency shall:

- Publish a notice of availability of the administrative record file in a major local newspaper of general circulation within 60 days of initiation of on-site removal activity;
- Provide a public comment period, as appropriate, of not less than 30 days from the time the administrative record file is made available for public inspection;
- Prepare a written response to significant comments;
- Prepare an Action Memo to select a removal action and to document the need for a removal action based upon criteria in the National Contingency Plan.

The Navy will need to conduct and complete these tasks as part of their lead agency obligations when conducting this removal action. EPA respectfully requests that the Navy provide EPA all future deliverables associated with this removal action.

Response: The Navy will complete the above bulleted tasks and will provide EPA and appropriate environmental stakeholders copies of all future deliverables associated with the removal action at Site 12 EOD Area and Former Munitions Bunker West (FMBW) Area. The Action Memo will only address the time-critical removal action at Site 12 EOD Area. The removal action at FMBW Area will be conducted in conjunction with the Site 12 EOD Area removal action for efficiency purposes. The FMBW Area removal action is being conducted to confirm the absence of MEC. MEC is not expected to be present at FMBW Area and, therefore, an Action Memo will not be prepared for this site; however, the FMBW tie-in to Site 12 field work will be mentioned in the Site 12 Action Memo.

2. **Comment:** Page 2-4 1st Bullet Point & Figure 5: The proposed 11 test pits cover practically all the strong subsurface EM-61 responses from the MEC SI investigation with the exception of one location in the vicinity of anomaly #137. EPA requests that one additional test pit be conducted in a NE-SW orientation to evaluate this most northern lobe of the MEC SI geophysical survey.

Response: An additional trench (for a total of 12) will be added at anomaly #137 at Site 12 EOD Area. The trench will be orientated NW-SE across anomaly #137 in order to evaluate the northwestern edge/boundary of the MEC SI geophysical survey area. Figure 5 will be revised to show the location of the additional trench. Page 2-4, 1st bullet, as presented below, along with text throughout the work plan will be revised to state that a total of 12 trenches are planned for Site 12 EOD Area.

"Trenching (~~11~~ *12* total) will be needed to gain a clear understanding of the type of subsurface *MPPEH [*MDAS (Material Documented as Safe*) and MDEH (Material Documented as an Explosive Hazard)]*, MEC, and non-MEC materials, soil characteristics, depth of burial, and general depths to bedrock and/or groundwater at Site 12 EOD Area. Figure 5 of Appendix B presents the proposed locations of the ~~11~~ *12* trenches."

3. **Comment:** Page 2-16 ¶2 and Section 11.0 Environmental Protection Plan: EPA supports the approach for screening/clearing test pit soils. EPA suggests that the excavated soils to be cleared of MEC/MPPEH/scrap metal as well as those soils deemed "cleared" after the screening process, be placed on poly sheeting to minimize the introduction of any small (<20 mm) metallic items into the already cleared surface soils. Unintentional surface spreading of potentially MC-contaminated subsurface soils can also be minimized.

Response: Page 2-16, paragraph 2 (and Section 11.0): A sentence will be added as the 10th sentence of this paragraph:

"Once MEC/MPPEH/scrap metal is removed, the remaining soil will then be placed in the cleared soil pile. *A piece of poly sheeting will be placed on the ground prior to the establishment of cleared soil pile(s) in order to minimize the introduction of small metallic items and small arms (<20mm), and the unintentional surface spreading of potentially MC contaminated subsurface soil into already cleared surface soil.* Trenching excavation operations will continue in batches as described above until the end of the work shift or until the trench has been characterized."

4. **Comment:** Section 2.12, Reporting and Disposition of MEC, Section 4.0 – Explosives Siting Plan & Appendix F – UXO Demolition/Disposal Operations: MEC/MPPEH items that are safe to move will be consolidated for later onsite explosive treatment while unsafe items will be blown in place (BIP). For those items that can be moved and consolidated, EPA recommends that this operation be conducted in a mobile detonation chamber to prevent the spreading of MEC/MPPEH debris and related MC residues across the site that the Navy is attempting to clear of surface geophysical anomalies. If the collected MEC/MPPEH items can be safely moved off-base by ground transportation, the Navy could treat/demilitarize the items at a permitted facility as another option to prevent unintended spreading of MEC/MPPEH debris across the site.

For those MEC items that will be required to be blown in place, the locations of where the BIPs are conducted should be located and recorded by GPS and/or tape measure procedures so that any future MC sampling of these areas can take place as part RI field investigations.

Response: MEC/MPPEH items that can be moved and consolidated will be treated in a demolition area. The demolition area will be designed using engineering controls to prevent the spreading of MEC/MPPEH debris and related MC residues when conducting BIP operations. A sentence describing the engineering controls will be inserted as the 8th sentence of the first paragraph in Section 2.12 on page 2-19 and in SOP-05, Section 5.1:

Section 2.12

"The ESQD arc created by the NEW for each temporary holding area will not extend beyond that established for the site. *In order to prevent the spreading of MEC/MPPEH debris and related MC residues, items will be destroyed in "demolition areas" using engineering controls consisting of 2 feet of sandbags placed on all four sides of each MEC/MPPEH item, with a plywood cover and 2 feet of sandbags on top of the plywood.* Demolition operations will be performed on the day the MEC item is discovered, if possible."

Appendix F, SOP-05, Section 5.1, 5th bullet

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~~ *demolition* area *using engineering controls consisting of 2 feet of sandbags placed on all four sides of each MEC/MPPEH item, with a plywood cover and 2 feet of sandbags on top of the plywood."* (Note: strikethrough will be crossed out in the SOP and the italicized information will be added into the SOP)

All locations where BIP operations take place will be recorded using a GPS and/or tape measure. The following paragraph will be added to Section 4.2 (also see the Navy's response to MEDEP Comment 27 for other additions to Section 4.2) :

Section 4.2

"In all areas used for demolition operations, both BIP and items safe to move for consolidated explosive treatment, the location(s) will be recorded using a GPS and/or tape measure from a known point so that future MC sampling of these areas can take place as part of RI field investigations. Post demolition procedures will include a check of the demolition location with a magnetometer and removal of large fragmentation to ensure that there are no remaining MEC/MPPEH debris or related residues. Any MEC items, failing to be properly disposed of, which are discovered during the post demolition procedures, will be destroyed prior to the end of the day."

5. **Comment:** Section 7.3 – MEC Documentation: The procedure outlined in this section should provide adequate location and type/condition information for discovered MEC/MPPEH items that would require any follow-up MC sampling as part of the Site 12 EOD Area RI.

Response: Additional information concerning MEC documentation will be added to Section 7.3, page 7-1 (also includes responses to MEDEP comment #31), and Appendix F, Sections 5.1 and 10.0 of SOP-05:

Section 7.3

"Tetra Tech will establish a system to record MEC/*MPPEH* findings in the areas of concern (per SOP-02, MEC Management and Accountability). The SUXOS (Senior UXO Supervisor) will direct the establishment of this 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 the item. The anomalies identified on the dig sheet will be located using GPS or tape measure procedures, if required."

Appendix F, SOP-05, Section 5.1, 14th bullet

- "Prior to and after each shot, the Demolition Shot Record is to be filled out, *to include location of shot,* by the DS with all applicable information."

Appendix F, SOP-05, Section 10.0, 3rd bullet

- "The DS shall enter the appropriate data on the Demolition Shot Record, to reflect the MEC destroyed, *grid location(s) of items destroyed*, and shall complete the appropriate information on the Magazine Data Card, which indicates the demolition materials used."
  (Note: the italicized text will be added, in italicized font, to the SOP)

RESPONSE TO MEDEP COMMENTS DATED AUGUST 3, 2009
DRAFT TIME CRITICAL MUNITIONS AND EXPLOSIVES OF CONCERN REMOVAL ACTION WORK PLAN FOR SITE 12 EOD AREA AND FORMER MUNITIONS BUNKER WEST AREA DATED JULY 2009 (Rev. 0)
NAVAL AIR STATION BRUNSWICK, MAINE

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

General Comments:

1. **Comment:** Please provide a schedule in accordance with Section 11.e. of the Federal Facility Agreement.

   Response: The schedule below depends on timely regulatory approval of the work plan and NOSSA approval of the ESS. The Navy's goal is to conduct the work this field season.

   Conference call with Stakeholders by August 26
   Resolve comments and followup with regulators by August 31
   Issue Final TCRA and ESS by September 9
   Develop Draft TCRA Action Memo(AM) for Navy review by September 15
   Issue TCRA AM to Regulators by September 22
   Resolve Regulator issues on TCRA AM by 9 October
   ESS approved by 9 October
   Issue TCRA AM for Public notice by 12 October
   Begin TCRA Fieldwork by 13 October

2. **Comment**: At various places in the document it states that the work will performed in accordance with federal, state and local regulations, but these regulations are not listed. Please include the list of the Applicable or Relevant and Appropriate Requirements (ARARs) as part of the workplan.

   Response: The Work Plan references specific ARARs where appropriate. Additional text will be added concerning transport and notifications, as per the Navy's response to MEDEP Comments 6, 11, 20, 22, and 24.

3. **Comment**: If possible, please provide MEDEP two weeks notice prior to implementing the workplan so that MEDEP staff can visit the site, if schedules allow.

   Response: Agree. Once established, MEDEP will be provided with a schedule which will include the start date for the project.

4. **Comment:** The Navy or their consultant need to provide regular updates on the removal action regarding the number and type of items found and any demolition to take place on the Base. MEDEP and EPA contact information should be added to the contact list in Appendix F-1 SOP 2.

Response: MEDEP and EPA contact information will be added to page 5 of SOP-02 and updates will be provided. At a minimum updates will be provided by e-mail on a weekly basis and if any unexpected events occur such as encountering MEC at FMBW. This requirement will be added to SOP-2.

The following table lists contacts information:

Position	Name	Organization	Direct Dial Phone	Cell Phone
NASB Environmental Director	*Lisa Joy*	*NAS Brunswick*	*207.921.1720*	
Project Manager	Linda Klink	Tetra Tech	412.921.8650	
UXO Manager	Ralph Brooks	Tetra Tech	770.413.0965 x231	404.661.4916
NASB POC	Mike Fagan	NAS Brunswick	207.921.1717	206.780.1034
Navy Remedial Project Manager	Todd Bober	BRAC PMO NE	215.897.4911	
Remedial Project Manager	*Claudia Sait*	*MEDEP*	*207.287.7713*	
Remedial Project Manager	*Michael Daly*	*USEPA Region 1*	*617.918.1386*	

5. **Comment:** The plan must include notification of the town and local authorities of the demolition of any Munitions and Explosives of Concern (MEC)/Material Possibly Presenting an Explosive Hazard (MPPEH). A notice in the local paper should also be considered so that abutters and nearby residents will be aware of the activity.

   Response: NAS Brunswick Environmental Staff and Public Affairs Office will provide notifications as needed to the local community should demolition of MEC/MPPEH be required. This may include the local town manager, the local fire department, and local police department, as necessary.

6. **Comment:** The workplan needs to provide more specific information on the method of disposal, explosives to be used, location of the demolition, containment, and how MEC/MPPEH materials, if found, in the FMBW will be transported to Site 12. Similar information is also needed for the MEC to be blown in place.

   Response: The disposal method will be disposal by denotation using Helix binary high explosives, blasting caps, and Nonel non-explosive shock tube. The demolition area will be within the berm area at Site 12 EOD Area. A note will be added to Figure 4 indicating that demolition will take place within the existing berm area of Site 12 EOD Area. Containment will be provided by the construction of surface demolition engineering controls consisting of 2 feet of sandbags placed on all four sides and on top of each MEC/MPPEH prior to disposal. Section 2.12 will be updated to reflect this containment procedure. MEC/MPPEH

materials transported from FMBW Area to Site 12 EOD Area will be secured in place in either a container or sandbagged to prevent movement during transportation. Items will be transported to disposal locations in accordance with facility procedures and ATF licensing requirements. The transportation vehicle will have a wooden bed liner and will be equipped to secure the containers in the vehicle. Additionally, the vehicle will be equipped with fire extinguishers and any other applicable safety equipment. Transportation of explosives or MEC will be coordinated with the installation to ensure that the installation's existing explosive laden routes are followed. Section 3.2.4 will address transportation concerns.

Section 2.12

"The ESQD arc created by the NEW for each temporary holding area will not extend beyond that established for the site. *In order to prevent the spreading of MEC/MPPEH debris and related MC residues, items will be destroyed using engineering controls in "demolition areas" consisting of 2 feet of sandbags placed on all four sides of each MEC/MPPEH item, with a plywood cover and 2 feet of sandbags on top of the plywood.* Demolition operations will be performed on the day the MEC item is discovered, if possible."

Section 3.2.4

"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. Explosives *and MEC/MPPEH* will be transported from *either the* storage facility *or FMBW Area* to disposal locations at the project sites in accordance with facility procedures *(to include the use of designated explosive laden routes), US DOT, CFR 49* and ATF licensing requirements. *All MEC/MPPEH will be placed in containers or sandbagged to prevent movement during transportation. Incompatible explosive items will be separated by sandbags to prevent sympathetic denotation.* The transportation vehicle will have a wooden bed liner and will be equipped to secure the containers in the vehicle. Additionally, the vehicle will be equipped with fire extinguishers and any other applicable safety equipment.

Transportation of explosives or MEC will be coordinated with the installation to ensure that the installation's existing explosive laden routes are followed. Delivery of explosives will be coordinated with the installation to ensure that explosive laden routes are followed and that an escort meets and guides the delivery truck along the correct route. Existing routes run from the FMBW to the Site 12 EOD area from the south of the runway into the site. Delivery trucks will report to the back gate and be escorted by weapons storage personnel along the appropriate route to the ammunition magazine."

7. **Comment:** Please explain how this work will be sequenced (e.g., Will the sites be done consecutively or simultaneously)?

Response: The majority of the work associated with this project will be conducted at Site 12 EOD Area. Work will begin at this site. Work at FMBW Area will be conducted when there are breaks in the work at Site 12 EOD Area, e.g., on weekends.

8. **Comment:** The Health and Safety Plan (HASP) must be referenced and a copy must be on site during the investigation and removal actions.

   Response: A copy of the HASP will be on-site during all investigation and removal activities.

9. **Comment:** In Appendix F, there is an Army Corps of Engineers document entitled "Use of Water for Mitigation of Fragmentation and Blast Effects due to Intentional Detonation of Munitions". Nothing in the text indicated that any of the demolition would be performed in water. How does this document factor into this TCRA?

   Response: The above referenced document is Attachment 3 to SOP-05, UXO Demolition/Disposal Operations, and is a standard attachment to this SOP. The information in this attachment is not applicable to the work being conducted at either Site 12 EOD Area of FMBW Area and will; therefore, be crossed out in SOP-05.

Specific Comments:

10. **Comment:** Section 1.0, Page 1-1, Introduction, paragraph 3: This section notes the future construction of the Marine Corps Armed Force Reserve Center north of Site 12 and the need to ensure the safety of the workers, however it does not appear that the area of the proposed Reserve Center is proposed for clearance. Please explain this discrepancy.

    Response: There is no MEC area/site within the footprint of the proposed Marine Corps Armed Force Reserve Center. However, as shown on Figure 8 of Appendix B, due to the close proximity of Site 12 EOD Area to the footprint of the proposed Marine Corps Armed Forces Reserve Center, it will be necessary to clear the surface from a munitions explosive hazard perspective at Site 12 EOD Area in order to ensure the safety of workers associated with the construction project. For example, construction vehicles and foot traffic are expected in and around the construction effort associated with the proposed Reserve Center and this area may overlap Site 12 EOD Area. In addition, the actual boundaries of Site 12 will be determined as a result of all current and future investigations.

    Clarification will be added to paragraph 3 of Section 1.0 on Page 1-1:

    "….At Site 12 EOD Area, as part of the Base Realignment and Closure (BRAC) property transfer process, construction of the Marine Corps Armed Forces Reserve Center, to be located north of the site (see Figure 8 of Appendix B), is scheduled to begin in Spring 2010, with various studies for the construction design to begin prior to that date. In order to ensure the safety of workers associated with the construction project, surface clearance will be performed to protect against potential exposure to MEC and other munitions-related items that may be on site *at Site 12 EOD Area*. *For example, construction vehicles and foot traffic are expected in and around the construction effort associated with the proposed Marine Corps Armed Forces Reserve Center, and this area may overlap Site 12 EOD Area.*"

11. **Comment:** Section 2.3.1, Page 2-2, Off-Site MEC Disposal: Based on the heading, please clarify if the MEC will be taken to Rhode Island for demolition; please clarify.

Response: It is not anticipated that the UXO Technicians will require routine EOD support for MEC findings during this investigation and removal action. If any MEC items are located that cannot be identified, Tetra Tech personnel will notify the POC at NASB and the Navy RPM who will notify the nearest military EOD personnel. The nearest military EOD personnel are located in Rhode Island, the military EOD personnel will determine how to handle and dispose of the MEC item(s). It is unlikely that MEC items will be taken to Rhode Island for disposal; however, military EOD personnel will make this determination.

Clarification will be added to Section 2.3.1, Page 2-2:

"In the unlikely event that MEC is discovered on site that is beyond the capabilities of the UXO personnel, Tetra Tech personnel will notify the ~~Navy~~ POC at NASB and the Navy RPM who 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~~ *NASB* POC or military EOD*. Military EOD will make a determination of how to handle and dispose of these MEC items… Although transportation is not anticipated, if it is necessary MEC/MPPEH will be transported by EOD in accordance with facility procedures (to include the use of designated explosive laden routes), US DOT, CFR 49 and ATF licensing requirements.*"

12. Comment: Section 2.4, Pages 2-2 & 2-3, Technical Scope: Bullet 3: Please include the proposed depth of the detection and MEC removal for Site 12.

Response: A surface MEC removal will be conducted at Site 12 EOD Area.

The third bullet of Section 2.4 will be revised:

- Surface investigation and *surface* MEC removal at the Site 12 EOD Area within the perimeter road and extension beyond the *perimeter* road, as necessary.

13. Comment: Section 2.4, Page 2-3, Site 12 EOD Area, bullet 1: "This area used the perimeter road of the site…

Instead of "area", do you mean "this investigation"? Please check and correct as necessary.

Response: The fifth sentence of bullet 1 will be revised:

"This *SI investigation* area used the perimeter road of the site as the boundary which will be the preliminary boundary for this *surface* MEC removal action, and should provide adequate coverage for the removal action."

14. Comment: Section 2.4, Page 2-3, Site 12 EOD Area, bullet 2: "Moreover, no geophysical surveys were conducted in the outer areas as part of the SI."

a.) Please define the phrase “outer areas” (i.e., “outside the perimeter road”).
b.) “Moreover, no geophysical surveys were conducted in the outer areas as part of the SI. The SI identified a few MEC items at ground surface and some areas of subsurface ferrous anomalies in the outer areas.”

These two sentences seem to contradict one another. Please rectify.

Response: During the SI, subsurface geophysical surveys were conducted within, on, and 10 feet beyond the existing berm area of Site 12 EOD Area. A 100 percent coverage UXO detector-aided surface sweep was conducted during the SI within, on, and 10 feet beyond the existing berm and UXO detector-aided surface sweeps were conducted along widely spaced transects in the area outside of the existing berm area and within the perimeter road SI investigation area boundary. No UXO or geophysical surveys were conducted beyond the perimeter road. Clarification will be added throughout the text concerning which areas received surface and subsurface surveys during the SI and which areas did not.

The sentence referenced in comment 14b will be revised:

“…Moreover, no geophysical surveys were conducted in ~~the outer~~ areas *beyond 10 feet outside of the existing berm* as part of the SI. *During detector-aided surface sweeps, t*~~T~~he SI identified a few MEC items at the ground surface and some areas of *shallow* subsurface ferrous anomalies in the ~~outer~~ area~~s~~ *between the existing berm and perimeter road*….”

15. Comment: Section 2.4, Page 2-4, Site 12 EOD Area, Bullet 1:

a.) The recent elevated rainfall may result in shallower depths to groundwater than is typical for the site. Based on data from 1971 to 2000, the precipitation normals for Brunswick range from 3.15 inches (in.) in August to 4.87 in. in November. Recent data for June and July 2009 indicate precipitation 1-1.5 in. above normal for those months. This may result in higher than expected water tables. (No response required.)

Response a): The comment is noted.

b.) Eleven trenches are proposed. Please briefly explain what criteria were used to select the 11 locations and the direction of the trench.
c.) Due to Anomaly 137’s position at the northern extent of the geophysical survey, and proximity to the berm access point, MEDEP strongly suggests trenching this area also.

Response b) and c): Figure 5 of Appendix B presents the locations of the SI geophysical interpreted anomalies at Site 12 EOD Area. The data collected during the SI geophysical survey show many interpreted anomalies, the interpreted individual anomalies are labeled on Figure 5 with a “+” symbol and number (unique identifier) that could represent MEC items, munitions fragments, or other buried metal. Individual anomalies with values greater than or equal to 10 mV were automatically picked by the processing software and are included in the interpretation. Areas of buried metal, where the potential for multiple metallic items exists, were also interpreted and outlined on Figure 5. Computer-generated individual anomalies (+ symbols) may not have been picked in the outlined areas of buried metal where the absence of discrete anomaly peaks prohibited placement (positioning) of picks (including the areas along the edge of the grid or survey area). The pink-shaded (color contoured) areas represent anomalies with the highest amplitude and represent

larger and/or shallower amounts of buried metal; anomaly size is also an indicator of the amount of metal present. Trench locations were chosen to cover "pink" areas that represent areas where concentrations of metallic items (which could be MEC and other munitions-related items) are most likely to be located. The trenches are oriented in a fashion to allow adequate coverage of the anomaly area and in some cases are oriented to determine what may be present at the boundary of the geophysical survey area (e.g. anomaly #137 as described below). Trenching is being conducted to gain a clear understanding of the type of subsurface *MPPEH*, MEC, and non-MEC materials, soil characteristics, depth of burial, and general depths to bedrock and/or groundwater at Site 12 EOD Area to aid in planning the RI.

Also, per Comment 15.c (and as per EPA Comment #2): An additional trench (for a total of 12) will be added at anomaly #137 at Site 12 EOD Area. The trench will be orientated NW-SE across anomaly #137 in order to evaluate the northwestern edge/boundary of MEC SI geophysical survey area. Figure 5 will be revised to show the location of the additional trench. Page 2-4, 1st bullet, as presented below, along with text throughout the work plan will be revised to state that a total of 12 trenches are planned for Site 12 EOD Area.

"Trenching (~~11~~ *12* total) will be needed to gain a clear understanding of the type of subsurface *MPPEH (MDAS and MDEH)*, MEC, and non-MEC materials, soil characteristics, depth of burial, and general depths to bedrock and/or groundwater at Site 12 EOD Area. Figure 5 of Appendix B presents the proposed locations of the ~~11~~ *12* trenches."

16. Comment: Section 2.4, Page 2-4, Site 12 EOD Area Bullet 3 and Page 2-5, FMBW Area, Bullet #2: If the non MEC materials to be "marshaled" and staged for off-site disposal are to be left in the staging area until the RI implementation, the Work Plan needs to include measures to prevent leaching of any contaminants to groundwater or soils.

Response: Non-MEC debris that may be located in these areas would include cultural debris items, e.g., tire rims, shovel head, and other metallic and non-metallic items (non-MC contaminated items). Only the non-MEC/cultural debris item, and not MC contaminated items or soil, will be "marshaled" and staged for off-site disposal; therefore, leaching of contaminants to groundwater or soil is not a concern.

Bullet 3 on page 2-4 and bullet 2 on page 2-5 will be revised:

- "Non-MEC debris, *for example, tire rims and shovel heads (non-MC contaminated items)*, located during the detector-aided surface surveys will be moved to a nearby location; marshalling and off-site disposal of non-MEC debris will be deferred to the RI or addressed by NASB."

- "Non-MEC debris, *for example, tire rims and shovel heads (non-MC contaminated items)*, will be moved to a nearby location prior to detector-aided survey operations and anomaly investigation/clearance operations occurring; marshalling and off-site disposal of non-MEC debris is deferred to the RI or addressed by NASB."

17. Comment: Section 2.4.1, Page 2-5, Detection Equipment, Methods, and Standards, para 1: "During the Site 12 EOD area…and the White's will be used as a backup instrument in areas suspect to contain nonferrous metals."

Please explain the criteria for determining suspect areas for nonferrous metals.

Response: During the detector-aided surface survey at Site 12 EOD Area, both the Schonstedt ferrous metal detector and White's all metals detector will be used. The use of both instruments during surveys will help to rule out anomalies as false positives. The text in the work plan will be revised to indicate that both instruments will be used.

Section 2.4.1 paragraph 1 will be revised, as follows:

"A Schonstedt GA-52Cx, ferrous metal detector, or equivalent, will be used during the detector-aided surface surveys. The detector-aided surface survey at the Site 12 EOD Area will cover 100 percent of the accessible area within the perimeter road (see Figure 4 in Appendix B). The wooded areas of the FMBW Area not previously investigated during the SI will also be investigated during a detector-aided surface survey along meandering paths of approximate 100 foot spacing through accessible areas of the site. In addition to the Schonstedt, a White's Spectrum XLT all-metals detector, or equivalent, will be used during the surface survey~~s~~ at the Site 12 EOD Area and FMBW Area to assist in the location of metal targets with little or no ferrous metal content. Each target on the dig sheet at FMBW *Area* will be reacquired with the Schonstedt and/or White's and then checked with both instruments before it is considered cleared of MEC hazards. ~~During the Site 12 EOD Area detector-aided surface survey, the Schonstedt will be the primary instrument and the White's will be used as a backup instrument in areas suspect to contain nonferrous metals."~~

18. Comment: Section 2.10.2, High Density Area, Pages 2-16 & 2-17:

a.) "Soil and debris contents of the excavator bucket will be spread on the ground near the excavation…"

The area/areas where the soil is to be examined and stockpiled should be shown on a figure or a general description of the area and precautions to prevent cross contamination outlined.

Response a): A note will be added to Figure 4 of Appendix B to indicate that excavated soil is expected to be examined and stockpiled immediately adjacent to the given trench excavation.

Per response to EPA Comment #3: Page 2-16, paragraph 2 (and Section 11.0): A sentence will be added as the 10th sentence of this paragraph:

"Once MEC/MPPEH/scrap metal is removed, the remaining soil will then be placed in the cleared soil pile *immediately adjacent to the given trench location. A piece of poly sheeting will be place on the ground prior to the establishment of cleared soil pile(s) in order to minimize the introduction of small metallic items and small arms (<20mm), and the unintentional surface spreading of potentially MC contaminated subsurface soil into already cleared surface soil.* Trenching excavation operations will continue in batches as described above until the end of the work shift or until the trench has been characterized."

b.) "Upon completion of the excavation, the cleared soil will then be backfilled and compacted with…"

To aid in future investigation(s) of Site 12 the coordinates of the trenches must be surveyed or located by a GPS unit.

Response b): The location(s) of the trenches to include the trench corners (if possible) at Site 12 EOD Area will be recorded using a GPS and/or tape measure from a known point. This statement will be added throughout the work plan text in the appropriate locations.

c.) Please discuss how and where the MPPEH will be stored: also include the storage locations on a figure.

Response c): MPPEH will be segregated into material documented as safe (MDAS) and material documented as having an explosive hazard (MDEH). MDAS will be secured on site (Site 12 EOD Area) in a locked/sealed container, with the SUXOS controlling the access to the lock/seal. MDEH will be treated as MEC and treated with donor charge.

d.) Page 2-17, para 4: This paragraph seems to contradict sections 2.12 and 2.13. If at all possible, the number and type of item and the depth it was found must be recorded and GPS'ed. MEDEP suggests that small arms cartridges be counted and caliber or size noted and totaled per grid/trench per day. Anything other than small arms should have more extensive information including identification (if possible), where it was found and how deep. This will assist in determining sampling and analysis during the Remedial Investigation.

Response d): As stated in Sections 2.10.2, 2.12, and 2.13, the UXO Team will attempt to identify all MEC and MPPEH 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. Information regarding MEC finds will be recorded on the MEC tracking log and all MEC items will be photographed. The UXO Team Leader will maintain a daily log recording, at a minimum, the length, width and depth of the excavated trench, the location(s) excavated, and a description of the MEC/MPPEH removed along with the weight and estimated number of other metallic debris removed.

Small arms cartridges are not explosive and are not MEC or MDEH, small arms are considered MDAS and; therefore, as indicated on Page 2-17, paragraph 4, the UXO Team Leader will note all observations of "other metallic debris" and small arms (MDAS) on his/her daily log to document findings. This log will include information on general quantities of small arms ammunition found during the trenching operations. Paragraph 4 will be changed to read:

"The UXO Team Leader will maintain a daily log recording, at a minimum, the length, width and depth of the excavated trench *(and trench corners if possible)*, the location(s) excavated, and a description of the MEC/MPPEH removed along with the *estimated* weight and estimated number of other metallic debris. *Estimated weight and number of expended cartridges and bullets (small arms MDAS) removed will also be documented (e.g., several hundred bullets were found in the eastern end of trench T3 from approximately 2 to 3 feet*

below ground surface). 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."

e.) If possible the trench corners or "ends" should be located with a GPS for inclusion in the spatial dataset for the project, and for use in planning the SI/RI.

Response e): See MEDEP response 18b.

19. Comment: Section 2.1.3, Reporting and Deposition of MPPEH, page 2-20, para 1**:** "If any items are suspected…procedures described in Section 2.2 will be followed."

Section 2.2 is referenced but there is no Section 2.2 in the main body of the text. Please check and correct or clarify, as necessary.

Response: Section 2.13 is entitled Reporting and Disposition of MPPEH. Section 2.13 references Section 2.2, Discovery of CWM or HTRW, which discusses procedures to be followed if any items, including MPPEH, discovered at either Site 12 EOD Area or FMBW Area are suspected to or found to contain HTRW.

20. Comment: Section 2.13, Reporting and Deposition of MPPEH, page 2-21, para 4: This certified contractor will be responsible for transportation of the material to an off-site facility for disposal or demilitarization."

Please explain in the text how it will be decided to demolish (explode) the MPPEH at Site 12 or to send it off to be demilitarized if it has an explosive hazard. If it is to be sent off the Base for disposal please discuss what safe guards will be used to transport it.

Response: Demilitarization is removing both the explosive hazards and physical characteristics of an ordnance item to ensure that the item is safe and that it no longer functions or can be made to function as originally intended. Demolition is a form of demilitarization where an explosive donor charge is used to destroy and dispose of a suspect UXO (unexploded ordnance) item. So, in demolition, explosives are used to blow up the item. Inert devices, training devices, or other pieces of ordnance debris that do not contain an explosive hazard must also be demilitarized so that it no longer functions or has the appearance of ordnance based on its originally intended use.

Section 2.13 explains the process for determining whether MPPEH is MDAS (material documented as safe) or MDEH (material documented as an explosive hazard), the SUXOS is responsible for ensuring that this process is followed. The existing text implies that MDEH may be transported offsite as necessary by Tetra Tech (or Tetra Tech subcontractor), which is not the case. If the MPPEH is determined to be explosive (MDEH), it will be disposed of similar to MEC and will be treated on-site with a donor charge. In the unexpected event that MDEH cannot be treated on site, assistance from the nearest military EOD component in Rhode Island will be requested. If MPPEH is determined not to be explosive (i.e., MDAS), it will be certified and verified by the SUXOS, and transported off-site by an approved certified contractor (in accordance with DoD 4160-21-M-1 [DoD, 1995]). The certified contractor will be responsible for transportation of the material to an off-site facility for disposal or demilitarization. The certified contractor will only transport

material documented as safe (MDAS) and therefore he will not need an ATF license or training in accordance with CFR 49, Section 170-179.

As presented in Section 3.2.5, for explosives purchased by Tetra Tech to use as donor charges, these 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. Explosives will be transported from the storage facility to disposal locations at the project sites in accordance with facility procedures and ATF licensing requirements. The transportation vehicle will have a wooden bed liner and will be equipped to secure the containers in the vehicle. Additionally, the vehicle will be equipped with fire extinguishers and any other applicable safety equipment.

The last paragraph of Page 2-21 will be revised as follows

"*If MPPEH is determined to be MDEH, it will be disposed of similar to MEC and* ~~MDEH~~ will be consolidated and treated with donor charges. *In the unlikely event that an MDEH item cannot be treated with a donor charge (e.g., item encountered with net explosives weight greater than 25 pounds) assistance from the nearest military EOD component in Rhode Island will be requested. If MPPEH 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 (DoD, 1995)]. This certified contractor will be responsible for transportation of *MDAS* material to an off-site facility for disposal or demilitarization."

21. <u>Comment</u>: <u>Section 3.0, Explosive Management Plan, page 3-1</u>: Please provide more specifics on the type and quantity of explosives materials (i.e., jet perforators, blasting caps, detonating cord, etc) needed for this removal action.

<u>Response</u>: The minimum amount of donor charge explosives that can be purchased for this project will be purchased; additional explosives will be purchased during the project if necessary. Tetra Tech will purchase 16 blasting caps, 1 roll of Nonel, and 24 sticks of Helix binary explosives. Nonel is a non-explosive shock tube used to ignite blasting caps and the Helix binary explosive is not explosive during storage; it becomes an explosive only after it is mixed when it is ready for use. The first paragraph of Section 3.2.1 will be revised:

"The quantity of explosives to be used will be kept to a minimum determined by the storage capabilities of the NASB-supplied bunker and the anticipated needs of the UXO Team. *Initially, sixteen blasting caps, one roll of Nonel, and 24 sticks of Helix binary explosives are planned for purchase for this project. Nonel a is non-explosive shock tube and the binary explosive is not explosive during storage, it becomes an explosive only after it is mixed when it is ready to for use; therefore, the blasting caps are the only net explosive weight that will be added to the bunker.* No more than 100 pounds NEW of demolition explosives will be stored at any one time during MEC removal operations. This is an upper limit and the actual NEW will depend on the exact type of demolition explosives procured.

The following sentence will be added as the first sentence of Section 3.2.4 Transportation:

Transportation of explosives by a local vendor will comply with the use of designated explosive laden routes and US DOT, CFR 49 and ATF licensing requirements."

22. <u>Comment</u>: <u>Section 3.2.1, Acquisition, page 3-1, bullet 2</u>: The Navy is correct that no permit is necessary however the substantive requirements of the law must be followed and should be noted.

<u>Response</u>: The substantive requirements of the law will be followed during this project and will be noted in bullet 2; also see the response to MEDEP Comment 21:

- "All explosives will be used and stored at NASB. Based on discussion with the Maine State Fire Marshal's Office, a State Explosives Permit/License is not required for explosives work on federal property. T*he substantive requirements of the law established in ATF Publication 5400.7, ATF Federal Explosives Law and Regulations, will be followed during this project.*"

23. <u>Comment</u>: <u>Section 3.2.3; Storage, page 3-2</u>: Please provide more specifics on the explosives storage facilities. (MEDEP assumes that one or more of the unused bunkers in the weapons area will be used but this needs to be stated.)

<u>Response</u>: A magazine has been assigned for temporary storage of explosives within the Weapons Compound [126-C or -D] and this will be cited in Section 3.2.3.

24. <u>Comment</u>: <u>Section 3.2.6, Page 3-3, Inventory, #2:</u> Please specify who is initially notified in this situation.

<u>Response</u>: The notification procedures in item #2 of Section 3.2.6 will be updated per the requirements of the ATF permit:

"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, NASB POC, and Navy Remedial Project Manager (RPM) by telephone and follow up with a written report within 24 hours.
2. ~~Notify proper authorities will be notified in writing within 24 hours of the event~~. *Report within 24 hours of discovery, by telephone, 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 or Loss – Explosives Materials" will be submitted to the nearest ATF Division Office (Portland ME, phone (207) 780-3324) in accordance with the instructions on the form*.
3. *The NAS Brunswick authorities will coordinate with local authorities and the State Fire Marshall as required.*

25. <u>Comment</u>: <u>Section 3.2.6, Inventory, page 3-3, para 4</u>: "All remaining explosives remaining in storage at the end of the project will be issued and used during a final cleanup shot."

MEDEP has reservations about detonating up to 100 pounds net explosive weight (NET) rather than returning it to the vendor or using it for the next clearance job. Depending on

the type of explosive, which must be identified, it has the potential for contributing to the contamination at the site. Please explain why this is necessary and the maximum limit of NEW per shot.

Response: Tetra Tech will be ordering the minimum amount of explosives that can be purchased (see response to MEDEP Comment #21 for types and quantities expected to be purchased for this project) and will purchase additional explosives only if necessary during the project and are, therefore, not expecting much if any to remain upon completion of the project. As stated in Section 3.2.1, no more than 100 pounds NEW of demolition explosives will be stored at any one time during MEC removal operations, however, it is not expected that this quantity of explosives will be necessary. Site 12 EOD Area had a 25-pound explosive limit when EOD operations ceased, and it is assumed that this is the explosive limit that will be used at this site; therefore, the maximum limit of NEW per shot will be 25 pounds.

The last paragraph of Section 3.2.6 will be revised:

"All explosives remaining in storage at the end of the project will be issued and used during a final cleanup shot. *The final cleanup shot will not exceed the 25-pound explosive limit for Site 12 EOD Area*. There will be no excess explosive inventory to warehouse or ship. Documents will be completed showing final disposition of all explosives."

26. Comment: Section 4.1, Ordnance and Explosives Areas, page 4-1, para 1: The paragraph states that the unintentional detonation exclusion zone boundary is an arc of 131 feet as shown on figure 4. On figure 4 the note indicates that the unintentional detonation boundary is a minimum of 131 from the edge of the investigation. But, the Intentional Detonation Boundary is stated to be 1,095 feet from the area of investigation but is inside the unintentional detonation exclusion zone. It appears the exclusion zones as shown in the legend have been switched. Please recheck the figure and the legend and correct, as necessary.

Response: Figure 4 will be corrected; the exclusion zones are switched and should be: the Unintentional Detonation Boundary is 131 feet from the edge of the investigation area and the Intentional Detonation Boundary is 1,095 feet from the edge of the investigation area.

27. Comment: Section 4.2, Planned or Established Demolition Areas, page 4-1: Please provide more specifics and add to Figure 4 regarding the area(s) on Site 12 that will be used for demolition of the MEC.

Response: A note will be added to Figure 4 to indicate that the planned detonation area is within the existing berm area at Site 12 EOD Area and Section 4.2 will be revised:

"The Site 12 EOD Area is the planned demolition area. MEC items from the FMBW Area that are acceptable to be handled will be transported and disposed of within *the existing berm area of* Site 12 EOD Area. *The existing berm area was selected because contamination is already expected to exist at this location and future MC sampling will be conducted in any case at this location; note, however, that the donor explosives are expected to be completely consumed during detonation and not result in additional soil*

contamination. MEC items that are unacceptable to handle will be treated using BIP procedures. *Future MC sampling will likely be conducted at BIP locations both to investigate a release at the location and to investigate whether the BIP detonation resulted in soil contamination*."

28. **Comment:** Section 4.3.2, Collection Points, page 4-2: "No demolition explosives or recovered MEC/MPPEH will be stored on site."

It is unclear what is meant by "site"; please be more specific.

Response: Recovered MEC/MPPEH will be addressed on a daily basis, Section 4.3.2 will be revised:

"No demolition explosives or recovered MEC/MPPEH will be stored on site*, but will be addressed on a daily basis*."

29. **Comment:** Section 5.1, Objective, Page 5-1, para 1 & Appendix F-1, SOP-01, Section 4, Page 3, para 3: The text indicates that the instrument test strip (ITS) will be used once per instrument and operator, whereas the SOP indicates the ITS is a daily check for subsurface clearance operations. Please clarify if the ITS will be used as a daily check for clearance of the FMBW.

Response: An ITS will be conducted prior to detector-aided surface surveying by each operator using his/her given equipment as stated in Section 5.1. Section 5.3.2.1 Equipment Function Test describes the sensitivity test to be conducted on a daily basis.

The following changes will be made:

Section 5.1 Objective, 3rd sentence, will be revised to read: "The ITS will only need to be conducted prior to detector-aided surveying by each operator using his/her given equipment*; in addition, the ITS will be used daily for FMBW surface/subsurface investigation in wooded area conducted via detector-aided survey."*

Section 5.3.2 Equipment Standardization table regarding ITS frequency: "Once at beginning of project and after change in equipment or operators *and daily for FMBW surface/subsurface investigation in wooded area conducted via detector-aided survey."*

The sentence in Section 4, page 3, paragraph 3 of SOP-01 will be revised (in italics) to read: "The normal daily check for subsurface detector-aided survey operations will be the instrument test strip (ITS) *for surface/subsurface investigation in FMBW wooded area."*

30. **Comment:** Section 7.1.General, & Section 7.3, MEC Documentation, page 7-1: Please include an electronic version of the spatial data for the trenches, cleared areas and MEC/MPPEH findings as a geo-referenced file or with the point data as a spreadsheet for incorporation to MEDEP's database.

Response: Electronic versions of spatial data, either as a geo-referenced file or with the point data as a spreadsheet, will be provided to MEDEP, Section 7.1 and 7.3 will be revised:

Section 7.1
"The recorded GPS information *will be provided to MEDEP and* will be incorporated into the existing Environmental GIS (EGIS) established for NASB, and geo-referenced maps showing all coordinates and MEC*/MPPEH* findings will be included in the After Action Report."

Section 7.3, 2nd paragraph
"The After Action Report will present 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 NASB *and will also be provided to MEDEP* to record and manage areas of concern, and detail the location of each MEC*/MPPEH* item found/removed. 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 NASB *and MEDEP* mapping.

31. Comment: Section 7.3, MEC Documentation, page 7-1: From the information in this section only the MEC will be recorded with the GPS. MPPEH must also be GPS'ed

Response: As stated in Sections 2.10.2, 2.12, and 2.13, the UXO Team will attempt to identify all MEC and MPPEH 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. Text within Section 7.1 and 7.3 will be revised to indicate that locations of MEC and MPPEH will be recorded by GPS or other means. Section 7.1 and 7.3 revisions below also include responses to EPA comment #5 and MEDEP comment #30.

Section 7.1
"The recorded GPS information *will be provided to MEDEP and* will be incorporated into the existing Environmental GIS (EGIS) established for NASB, and geo-referenced maps showing all coordinates and MEC*/MPPEH* findings will be included in the After Action Report."

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). The SUXOS will direct the establishment of this 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 the 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. The After Action Report will present 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 NASB *and will also be provided to MEDEP* to record and manage areas of concern, and detail the location of each MEC*/MPPEH* item found/removed.

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 NASB *and MEDEP* mapping. The After Action Report will also provide observations made by the UXO Team and recommendations for future maintenance activities, if appropriate."

32. Comment: Section 11.0, Soil Erosion and Sediment Control, Page 11-1: To be effective, silt fence must be dug into the soil and staked; hay bales must also be staked in. This seems unnecessarily risky. MEDEP has an expert on staff that could provide suggestions to minimize risk but accomplish the same goal.

Response: It is not anticipated that trenches will remain open, each trench will be backfilled before beginning excavation at another trench; therefore, it is not anticipated that silt fences or hay bales will be necessary during trenching activities. However, if determined to be necessary in the field based on site conditions (e.g., MEC/MPPEH is visible in excavated trench at the end of a work day), silt fences and hay bales will be staked by UXO technician practicing anomaly avoidance procedures. The section on Soil and Erosion Control (first paragraph of Section 11.0) will be revised:

"*Erosion controls are not anticipated to be necessary based on short duration of excavation for a given trench (each trench will be backfilled before beginning excavation at another trench location) and the flat topography. Moreover, operations will not be conducted during a rain event. However, if warranted based on site conditions, a silt fence may* ~~will~~ be placed around the Site 12 trenching areas prior to commencing excavation activities *or during excavation activities (i.e., unlikely event that MEC/MPPEH item finding delays trench backfilling at the end of the day)*. As the excavation progresses, temporary berms may *also* be constructed with existing soil around the perimeters of the excavations to control water flows. In addition, *if necessary,* in areas of high water flows, hay bales *may*~~will~~ be utilized to collect sediment as necessary. *Each trench will be backfilled before beginning excavation at another trench location.* At FMBW Area, the excavations are small and will not remain open for long. Therefore, erosion and sediment control is not warranted."

33. Comment: Section 11.0, Stockpiled Soil, page 11-1: Please explain why covering the stockpiled soil will not be necessary.

Response: Soils from trenching activities will only be stockpiled and staged on-site at Site 12 EOD Area during clearing and screening activities associated with each individual trench. Each trench will be backfilled before beginning excavation on another trench, and; therefore, it is not expected that covering of soil stockpiles will be necessary due to the short duration of time that soil will be stockpiled and staged on site during this project. The section on Stockpiled Soil (2nd paragraph of Section 11.0) will be revised; also see the Navy's response to USEPA Comment 3 for additional changes to this section concerning poly sheeting:

"Stockpiled soil will be staged as close 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 but may* ~~will~~ be employed, as necessary (i.e., Site 12 EOD Area trenching) to control storm water runoff. *Each trench will be backfilled before beginning excavation at another trench location."*

34. Comment: Section 11.0, Chemicals on Site, page 11-1, para 2: "Should a spill occur, it will be reported to the NASB-POC…"

MEDEP, Response Services must also be also be notified.

Response: Should any spills occur, notifications shall first go out to NAS Brunswick Security Department and personnel from the Environmental Department. The Environmental Department shall contact both the MEDEP and Paul Burgio/Todd Bober of the Navy.

The text, Chemicals on Site, 2nd to last paragraph, will be revised as follows:

"Should *any* spill occur, *notifications shall first go out to the NASB Security Department and personnel from the Environmental Department. The Environmental Department shall contact both the MEDEP [Public Safety (all hours) 800-482-0777 and Southern Maine Regional Office (normal working hours) 207 287-7800] and the Navy BRAC PMO project personnel."*

35. Comment: Appendix B, Figures:

a.) Figure 1: The colors used to depict the highways and for the MEC area are very similar in the legend please correct if possible.

Response a): The designation for highways on Figure 1 will be changed to brown; the designation for MEC areas will remain pink.

b.) Figures 2 & 3: The highway designation in the legend needs to be changed to "MEC Area".

Response b): The designation for highways will be deleted from the legends on Figures 2 and 3 and the designation for MEC Area will be added to the legend on Figure 2.

c.) Figure 4: This figure needs to include where the demolition of MEC/MPPEH will take place, the area/areas where the soil is to be examined and stockpiled, and the proposed demolition area. Also as noted in comment 26 above the Unintentional and Intentional Boundary appear to be switched and need to be corrected in the legend.

Response c): A note will be added to Figure 4 indicating that examination of soil and soil stockpiling will occur immediately adjacent to each trench excavation, and demolition will take place within the existing berm area of Site 12 EOD Area. See response to MEDEP comment #26, the boundaries indicating the unintentional and intentional detonation boundaries will be corrected on Figure 4.

d.) Figure 8: The relevance of Figure 8 to the workplan is unclear.

Response d): Figure 8, Proposed NAS Brunswick Property Transfer Timeline Fiscal Year 2010, is included for reference. This figure shows the location of the proposed Armed Forces Reserve Center in relation to Site 12 EOD Area.

36. Comment: Appendix C-3: The project organization chart will need to be complete in the final document.

Response: The names of the individuals on the UXO team, including the SUXOS and the UXO Team Leader, along with the MDAS/MPPEH subcontractor, will be identified approximately two weeks before the project begins. Notifications and completion of the organization chart will take place at this time.

37. Comment: Appendix F-1, Standard Operating Procedure (SOP) 1, Meandering Path UXO Detector-Aided Surface Survey, para 1: "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."

This appears to contradict Section 2.4, bullet 2 which states: Detector-aided surface surveys of the Site 12 EOD Area within the perimeter road, 100 percent coverage, and meandering path detector-aided surface surveys within the FMBW wooded area …" This supports the recommendation in the SI report was that a walk, detector-aided, through was needed in several wooded areas to confirm the absence of MEC. (Executive Summary ES-6) Please revise the SOP.

Response: The detector-aided surface survey area at Site 12 EOD Area within the perimeter road is an open area with little to no heavy brush and; therefore, little brush cutting will be necessary for 100 percent coverage of this area. Meandering path detector-aided surface surveys will be conducted at FMBW Area in the wooded area. Some brush cutting of the understory may be necessary in these areas; however, large mature trees (larger than 2" in diameter) which are present in these wooded areas will not be cut and UXO technicians will "meander" around these types of obstacles. As a result, this SOP should not require revision.

38. Comment: Appendix F-1 - SOP 05, Section 4.0, Page 6, Bullet #1:
Although it is unlikely to be a concern, Navy should verify that the radar/antenna located 860 feet north of the site will not be an issue.

Response: Demolition shots will be trapped and confined using engineering controls consisting of 2 feet of sand bags on the sides and top of the shot, thus fragmentation damaging the antenna is not a concern. Demolition procedures will be conducted at least 860 feet away for the antenna; therefore, EMR emissions from the radar antenna are not a concern.

39. Comment: Appendix F-1, SOP -5, Section 4, General Operational and Safety Procedures, bullet 4: "The quantity of MEC to be destroyed will be determine by the agreed to limit, with the net explosive weight (NEW) of the demolition explosives factored into the total NEW.

MEDEP couldn't find the NEW in the main text. If it not already included in the text, it must be, along with the rationale for the NEW proposed.

Response: Site 12 EOD Area had a 25-pound explosives limit when it was closed and this will be the NEW limit for detonations. This amount will be added to the main text in the appropriate sections.

40. Comment: Appendix F-1 - SOP 05, Section 5.0, Page 8, Bullet #6: If at all possible the pits should not remain open for durations of two weeks, given the heavy rains which have been frequent this summer and the increased potential for mobilizing munitions constituents.

Response: Demolition pits will not be "dug" during this project; therefore, this bullet is not applicable to this project. Instead, "demolition areas" will be created on the ground surface and will consist of 2 feet of sandbags placed on all four sides of each MEC/MPPEH item, with a plywood cover and 2 feet of sandbags on top of the plywood. This bullet will be crossed out in SOP 05.

41. Comment: Appendix F-1 SOP 5, Section 5.1, General Requirements, bullet 29: "When operated in accordance with the conditions of the procedure the demolition should not present a noise problem.

a.) Please provide the rationale for this statement.

Response a): Demolitions will take place within the range limits, and; therefore, noise should not be a problem in areas outside of this limit. Also, no demolition activities will be conducted if there is less than a 2,000-foot ceiling (Section 4 bullet 28). The purpose of this limiting factor is to reduce refraction of the blast wave off a low cloud ceiling and to minimize the noise associated with the explosion. Finally, "demolition areas" will be created on the ground surface and will consist of 2 feet of sandbags placed on all four sides of each MEC/MPPEH item, with a plywood cover and 2 feet of sandbags on top of the plywood. These types of demolition area engineering controls will also muffle the sound of the explosion and have been used with success at other UXO sites.

b.) This bullet states if there is a noise complaint it should be recorded and reported to the SUXOS, then to the UXO PM and Facility POC. Isn't more likely the complaint will come into the Base and the Facility POC will pass it along to the UXO PM? Please correct as necessary.

Response b): Agree. If a complaint is received, it will addressed by the NAS Brunswick Environmental Staff and Public Affairs Office.

c.) The bullet is silent on what, if any measures will be taken if there are complaints of the noise from the demolition.

Response c): If complaints are received they will have to be assessed considering the circumstances surrounding the incident on an individual basis by the NAS Brunswick Environmental Staff and Public Affairs Office. The Tetra Tech UXO specialists will be available to the NASB POC to provide technical advice as needed.

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

JOHN ELIAS BALDACCI
GOVERNOR

DAVID P. LITTELL
COMMISSIONER

September 10, 2009

Mr. Todd Bober
Department of Navy
Base Realignment and Closure
Program Management Office-Northeast
4911 South Broad Street
Philadelphia, PA 19112-1303

Re: Site 12 & Former Munitions Bunker West Area (FMBWA)
Time Critical Removal Action Workplan- Response to Comments (RTCs)
Naval Air Station, Brunswick, Maine

Dear Mr. Bober:

Pursuant to Section VI of the Naval Air Station, Brunswick, Maine Federal Facility Agreement (Oct 1990), as amended, the Maine Department of Environmental Protection (MEDEP) has reviewed the Navy's revised responses emailed on September 3, 2009 from Linda Klink, to MEDEP's comments, dated August 3, 2009, for draft "Time Critical Munitions and Explosives of Concern, Removal Action Workplan for Site 12 Explosives Ordnance Disposal Area and Former Munitions Bunker West Area", dated July 2009, prepared by Tetra Tech NUS.

Based on that review, MEDEP has no further comments provided that the response to comments, as revised, are finalized and included in the final workplan along with this letter.

Please contact me at (207) 287-7713 or claudia.b.sait@maine.gov, if you have any questions or comments.

Respectfully,

Claudia Sait
Project Manager-Federal Facilities
Bureau of Remediation & Waste Management

Cf: Hard Copy:
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From: Daly.Mike@epamail.epa.gov [mailto:Daly.Mike@epamail.epa.gov]
Sent: Thursday, September 03, 2009 3:38 PM
To: Klink, Linda
Cc: Sait, Claudia B; Orient, Jeff; Joy, Lisa M CIV NAS Brunswick, N45; 'Fagan, Michael CIV NAS Brunswick, Environmental'; Burgio, Paul CIV OASN (I&E) BRAC PMO NE; Bober, Todd A CIV NAVFAC MIDLANT
Subject: Re: Navy's revised response to MEDEP and EPA comments, TCRA work plan Site 12 & FMBW as per conference call, NASB CTO 69/WE09

Hi Linda,

This was very easy to review!...., the responses to EPA comments are acceptable.

I hope the work outlined in the work plan can commence this fall so the site can move into the MC investigation phase in short order.

Have a great long weekend!

Mike

"Klink, Linda" <Linda.Klink@tetratech.com>

09/03/2009 03:28 PM

To
"Sait, Claudia B" <Claudia.B.Sait@maine.gov>, Mike Daly/R1/USEPA/US@EPA

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Subject
Navy's revised response to MEDEP and EPA comments, TCRA work plan Site 12 & FMBW as per conference call, NASB CTO 69/WE09

Mike and Claudia,

Thank you for your input during our conference call of 08/27/09 concerning resolution of EPA/MEDEP comments on the TCRA work plan for Site 12 EOD Area and Former Munitions Bunker West Area. Attached please find the revised comment response letter in revisions mode reflecting the associated changes.

Please e-mail your concurrence that your comments have been adequately addressed. Then, I will formalize the comment response letter (i.e., "accept" the changes), and finalize the work plan (including the comment response letter as an appendix).

Thank you.
[attachment "TCRA WP_RTC revmod EPA&MEDEPinput_090309.doc" deleted by Mike Daly/R1/USEPA/US]