DEPARTMENT OF THE ARMY
US ARMY DEFENSE AMMUNITION CENTER
1 C TREE ROAD
MCALESTER OK 74501-9053

REPLY TO
ATTENTION OF

SJMAC-ESM

8 1 OCT 20

MEMORANDUM FOR Mr. Hank Hubbard, U.S. Army Corps of Engineers (CEHNC-OE), P.O. Box 1600, Huntsville, Al 35807-4301

SUBJECT: Amendment 2, Explosives Safety Submission (ESS) Munitions and Explosives of Concern Removal Action, Choccoloco Area, Fort McClellan, AL

1. References:

a. Memorandum, Department of Defense Explosives Safety Board, DDESB-KO, 26 October 2005, SAB (Encl).

b. DOD 6055.9-STD, Ammunition and Explosives Safety Standards, 5 October 2005.

2. Reference 1a provides DDESB approval for subject amendment. This amendment expands the clearance depth for road segments 67, 68, 69, 70, 71, 72, and 72a along the Bains Gap Road, within the Choccolocco Area to depth of detection under the road.

3. Point of contact (POC) is Karl Raue, SJMAC-ESM, DSN 956-8122, (918) 420-8122, fax 8743, email karl.raue@dac.army.mil.

FOR THE DIRECTOR

Encl
as

CLIFFORD H. DOYLE
OE Team Leader
Explosives Safety Knowledge,
OE and Chemical Division

CF: (w/encl)
Office of the Director of Army Safety Office (DACS-SF), 2211 South Clark Street, Room 980, Arlington, VA 22202
Office of the Assistant Secretary of the Army for Installations & Environment), (Asst. for Munitions) (DESOH/Mr. King), 110 Army Pentagon, Washington, DC 20310-0110
U.S. Army Corps of Engineers (CESO/Ms Roberts), 441 G Street, NW, Washington, DC 20314-1000
BRAC Environmental Coordinator, (DAIM-BD-H-MC), Mr. Ronald M. Levy, U.S. Army Garrison, Fort McClellan, AL 36205-5000
Hampton BRAC Field Office, (DAIM-BO-H), 3a Benard St., Bldg 105 A, Fort Monroe, VA 23651-5000.
U.S. Army Engineering and Support Center Huntsville, (CEHNC-OE), 4820 University Square, P.O. Box 1600, Huntsville, AL 35816.

Printed on Recycled Paper

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

DDESB-KO

26 OCT 2005

MEMORANDUM FOR DIRECTOR, U.S. ARMY DEFENSE AMMUNITION CENTER
ATTENTION: SJMAC-ESM

SUBJECT: Amendment 2, Explosives Safety Submission (ESS) Munitions and Explosives of Concern Removal Action, Choccoloco Area, Fort McClellan, AL

References: (a) USADAC SJMAC-ESM Memorandum, 29 September 2005, Subject as above

(b) DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards, 5 October 2004

(c) DDESB-KO Memorandum, 28 August 2003, Subject: Explosives Safety Submission (ESS) for the Choccoloco Area U.S. Fish and Wildlife (FWS) Land Transfer at Fort McClellan, Alabama

(d) DDESB-KO Memorandum, 3 February 2004, Subject: Amendment 1 to the Conventional Explosives Safety Submission (ESS) for Ordnance and Explosives (OE) Removal Action for the Choccoloco Area of Fort McClellan, Alabama

The DoD Explosives Safety Board (DDESB) Secretariat has reviewed amendment 2 to the explosives safety submission (ESS) for the Choccoloco Area at Fort McClellan, AL provided via reference (a), against the requirements at reference (b) and the previous DDESB approvals at references (c) and (d). Amendment 2 revises the depth of removal of munitions and explosives of concern (MEC) along several road segments bordering Bains Gap Road. Based on the information provided at reference (a), we approve amendment 2 to the ESS for the Choccoloco Area of Fort McClellan, AL, to conduct a removal to depth of detection on road segments 67 through 72 and 72A along Bains Gap Road. This approval is based on the following:

a. The expanded munitions response for each of the road segments will be as described in Table 1-1 of reference (a).

b. The munition with the greatest fragmentation distance (MGFD) for road segments north and west of Bains Gap Road is the 60mm HE M49 mortar, which has a minimum separation distance (MSD) of 1,080 ft for intentional and unintentional detonations when no engineering controls are used.

(1) When the Miniature Open Front Barricade (MOFB) engineering control is used during intrusive activities not involving intentional detonations, the MSD may be reduced to 200 ft to the sides and rear of the MOFB, but remains at 1,080 ft to the front.

(2) When the DDESB-approved sandbag or water mitigation methods are used during intentional detonation activities, the MSD may be reduced to 200 ft.

c. The MGFD for road segments south of Bains Gap Road is the 81mm HE M43 mortar, which has an MSD of 1,395 ft for intentional and unintentional detonations when no engineering controls are used.

(1) When the MOFB is used during intrusive activities not involving intentional detonations, the MSD may be reduced to 200 ft to the sides and rear of the MOFB, but remains at 1,395 ft to the front.

(2) When the DDESB-approved sandbag or water mitigation methods are used during intentional detonation activities, the MSD may be reduced to 200 ft.

d. Detection equipment to be used must be capable of detecting the MGFD to at least the MGFD's expected depth of penetration in the type of soil within the segment.

e. Other stipulations established in reference (c), as modified via reference (d), remain in effect.

The point of contact for this action is Ms. Lydia E. Sanchez, (703) 325-1373, DSN 221-1373, E-mail address Lydia.Sanchez@ddesb.osd.mil.

T. CHIAPELLO FOR
WILLIAM E. WRIGHT
Captain, US Navy
Chairman

DEPARTMENT OF THE ARMY
US ARMY DEFENSE AMMUNITION CENTER
1 C TREE ROAD
MCALESTER OK 74501-9053

REPLY TO
ATTENTION OF

SJMAC-ESM

29 SEP 2005

MEMORANDUM FOR Department of Defense Explosives Safety Board, ATTN: DDESB-KO, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600

SUBJECT: Amendment 2, Explosives Safety Submission (ESS) Munitions and Explosives of Concern Removal Action, Choccolocco Area, Fort McClellan, AL

1. References:

a. Memorandum, Huntsville Center, Corps of Engineers, CEHNC-DE, 23 Aug 2005, subject: SAB.

b. Memorandum, Department of Defense Explosives Safety Board, DDESB-KO, 28 Aug 2003, subject: Explosives Safety Submission (ESS) for the Choccolocco Area U.S. Fish and Wildlife (FWS) Land Transfer at Fort McClellan, Alabama.

c. Memorandum, Department of Defense Explosives Safety Board, DDESB-KO, 03 Feb 2004, subject: Amendment 1 to the Conventional Explosives Safety Submission for Ordnance and Explosives Removal (OE) Removal Action for the Choccolocco Area of Fort McClellan, Alabama

d. DOD 6055.9-STD, Ammunition and Explosives Safety Standards, 5 October 2004.

2. Reference 1.a enclosed Amendment 2 to the Explosives Safety Submission (ESS) to the original ESS, reference 1.b., is submitted for your review IAW reference 1.d. We have reviewed this amendment against Army and DOD explosives safety criteria and find it acceptable. Recommend approval.

3. This amendment increases the clearance depth for road segments 67, 68, 69, 70, 71, 72, and 72A along the Bains Gap Road within the Choccolocco area to depth of detection under the road.

4. An expedited review is requested. If the project is delayed it will delay the rebuilding of the road to Federal Standards and will delay the reopening of the highway to the public. A DDESB response by 17 October 2005 is necessary for this project to begin on time.

SJMAC-ESM
SUBJECT: Amendment 2, Explosives Safety Submission (ESS) Munitions and Explosives of Concern Removal Action, Choccolocco Area, Fort McClellan, AL

5. Point of contact (POC) is Karl Raue, SJMAC-ESM, DSN 956-8122, commercial (918) 420-8122, fax 8743, Karl.Raue@dac.army.mil.

FOR THE DIRECTOR

Clifford H. Doyle

Encl

CLIFFORD H. DOYLE
Team Leader, Explosives Safety Knowledge,
Ordnance and Explosive Division

CF (w/encl):
Office of the Director of Army Safety Office (DACS-SF), 2211 South Clark Street, Room 980, Arlington, VA 22202
Office of the Assistant Secretary of the Army for Installations & Environment), (Asst. for Munitions) (DESOH/Mr. King), 110 Army Pentagon, Washington, DC 20310-0110
U.S. Army Corps of Engineers (CESO/Ms Roberts), 441 G Street, NW, Washington, DC 20314-1000
BRAC Environmental Coordinator, ATTN: DAIM-BD-H-MC, Mr. Ronald M. Levy, U.S. Army Garrison, Fort McClellan, AL 36205-5000
Hampton BRAC Field Office, ATTN: DAIM-BO-H, 3a Benard St., Bldg 105 A, Fort Monroe, VA 23651-5000.
U.S. Army Engineering and Support Center Huntsville, ATTN: CEHNC-OE, 4820 University Square, P.O. Box 1600, Huntsville, AL 35816.

DEPARTMENT OF THE ARMY
HUNTSVILLE CENTER, CORPS OF ENGINEERS
P.O. BOX 1600
HUNTSVILLE, ALABAMA 35807-4301

REPLY TO
ATTENTION OF

CEHNC-DE

23 AUG 2005

MEMORANDUM FOR US Army Technical Center for Explosives Safety, Explosives Safety Knowledge, OE and Chemical Division, (SJMAC-ESM/Mr. Cliff Doyle), Building 35, 1C Tree Road, McAlester, OK 74501-9053

SUBJECT: Amendment 2, Explosives Safety Submission (ESS), Munitions and Explosives of Concern Removal Action, Choccolocco Area, Fort McClellan, AL

1. Reference:

a. DDESB-KO memorandum, 28 August 2003, subject: Explosives Safety Submission (ESS) for the Choccolocco Areas U.S. Fish and Wildlife (FWS) Land Transfer at Fort McClellan, AL.

b. DDESB-KO memorandum, 3 February 2004, subject: Amendment 1 to the Conventional Explosives Safety Submission for Ordnance and Explosives (OE) Removal Action for the Choccolocco Area of Fort McClellan, AL.

2. This amendment is submitted to expand the clearance depth for road segments 67, 68, 69, 70, 71, 72, and 72A along the Bains Gap Road, within the Choccolocco Area, to the depth of detection under the road. Table 1-1 of the amendment also addresses the land mass areas in and around those segments that are to be cleared to depth of detection.

3. The effective date for this amendment to be implemented is 17 October 2005. All other portions of the ESS remain unchanged.

4. This office has reviewed the amendment and this memorandum constitutes MACOM approval.

5. If you have any questions, please call Mr. Hank Hubbard, at (256) 895-1586.

Encl

JOHN D. RIVENBURGH
Colonel, Corps of Engineers
Commanding

CEHNC-DE
SUBJECT: Amendment 2, Explosives Safety Submission (ESS), Munitions and Explosives of Concern Removal Action, Choccolocco Area, Fort McClellan, AL

CF: (wo/encl)
Commander, US Army Corps of Engineers, (CESO-SWD/Ms. Blanca Roberts) 441 G Street NW, Washington, DC 20314-1000

Explosives Safety Submission
Amendment 2

MUNITIONS AND EXPLOSIVES OF CONCERN
REMOVAL ACTION

CHOCCOLOCCO AREA
U.S. FISH AND WILDLIFE TRANSFER
Of
Fort McClellan, Alabama

August 2005

Prepared by
US ARMY CORPS OF ENGINEERS
Engineering and Support Center, Huntsville

TABLE OF CONTENTS

Section Page

1.0 INTRODUCTION 1
2.0 REASON FOR MUNITIONS AND EXPLOSIVES OF CONCERN (MEC) 1
3.0 AMOUNT AND TYPE OF MEC 1
3.1 ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) REPORTS 2
3.2 MUNITION WITH THE GREATEST FRAGMENTATION DISTANCE (MGFD) 2
4.0 START DATE 2
5.0 FROSTLINE 2
6.0 CLEARANCE TECHNIQUES 2
6.1 DETECTION METHODS 2
6.2 RECOVERY AND DISPOSAL 4
6.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PLAN 4
6.4 MUNITIONS DEBRIS EXPLOSIVE HAZARDS 4
7.0 ALTERNATE TECHNIQUES 4
8.0 OFFSITE DESTRUCTION 4
9.0 TECHNICAL SUPPORT 4
10.0 LAND USE RESTRICTIONS 5
11.0 PUBLIC INVOLVEMENT 5
12.0 MAPS 5
13.0 QUANTITY-DISTANCE 5

LIST OF TABLES

Table 1-1 Munitions Response Actions 1
Table 3-1 Minimum Separation Distances 2
Table 6-1 MEC Recovery and Detection Depths 3

APPENDIX A MAP
APPENDIX B CALCULATION SHEETS

1.0 INTRODUCTION

The original Explosive Safety Submission (ESS) for Choccolocco Area, U.S. Fish and Wildlife Transfer of Fort McClellan, AL was prepared for Fish and Wildlife Service (FWS) Roads, Fire Breaks, and High Use Areas. Amendment 1 resectorized FWS-1H into three areas. This amendment covers the area bordering Bains Gap Road (see Figure Amend 2-1) within the FWS land. This road is a paved road. Therefore, in accordance with the original ESS no clearance was done under the pavement of this road and the clearance extended 20 ft on either side of the centerline of the road. In order to facilitate planned road improvements, the clearance to depth of detection along road segments 67, 68, 69, 70, 71, 72, and 72A will be expanded. Table 1-1 lists the expanded munitions response for each of these road segments.

Table 1-1 Munitions Response Actions

Road Segment	Munitions Response Action
67	Clearance to depth of detection under pavement and 100 ft north of centerline of St. Clair Road (Area south of St. Clair Road is in the Bravo Area and is covered under another ESS)
68	Clearance to depth of detection under pavement and 100 ft north and south of centerline of Bains Gap Road
69	Clearance to depth of detection under pavement and 100 ft north and south of centerline of Bains Gap Road
70	Clearance to depth of detection under pavement and 100 ft north and south of centerline of Bains Gap Road
71	Clearance to depth of detection under pavement and 100 ft north and south of centerline of Bains Gap Road, In the Range 21 area only the portions under the paved areas 100 ft south of the centerline of Bains Gap road will be cleared to depth of detection (the unpaved area in Range 21 has already been cleared)
72	Clearance to depth of detection under pavement and 100 ft south of centerline of Bains Gap Road (Area north of Bains Gap Road is within the No Futher Action (NFA) Area discussed in the original amendment)
72A	Clearance to depth of detection under pavement and 100 ft south of centerline of Bains Gap Road (Area north of Bains Gap Road is within the No Futher Action (NFA) Area discussed in the original amendment)

2.0 REASON FOR MUNITIONS AND EXPLOSIVES OF CONCERN (MEC)

No change from original ESS.

3.0 AMOUNT AND TYPE OF MEC

No change from original ESS.

3.1 ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) REPORTS

No change from original ESS.

3.2 MUNITION WITH THE GREATEST FRAGMENTATION DISTANCE (MGFD)

No change from original ESS.

Table 3-1 Minimum Separation Distances

SECTOR	MGFD	MSD (ft)				
		For Unintentional Detonations		For Intentional Detonations		
		Max. Fragment Distance	To Sides & Rear Using MOFB	Without Engineering Controls	Using Sandbag Mitigation	Using Water Mitigation
FWS-2H	81mm HE M43	1395	200	1395	200	200
FWS-4H	60mm HE M49	1080	200	1080	200	200

Note: 1. See Appendix A for calculation sheets.
2. Text in original ESS discusses these engineering controls.

4.0 START DATE

The projected start date for this project is 17 October 2005

5.0 FROSTLINE

No change from original ESS.

6.0 CLEARANCE TECHNIQUES

6.1 DETECTION METHODS

The following information replaces Section 6.1 of the original ESS.

Table 6-1 MEC Recovery and Detection Depths

Sector	MEC Item	Depth of Recovery (in. below ground surface)	Maximum Detection Depth (in. below ground surface
FWS – 2H	75mm Shrapnel	7	32
	60mm M49A2	0 – 10	26
	81mm M43	0 – 12	35
	4.2" WP mortar	3	46.2
	3" Stokes Practice Mortar	0	33
FWS – 4H No MEC found[A]	75mm Shrapnel scrap	NA	32
	60mm mortar fragments	NA	26
	Hand grenade fragments	NA	28
	37mm projectile fragments	NA	16

[A]Note: No MEC was found during the EE/CA in Sector FWS-4H. The maximum detection depths shown above for FWS-4H are based on the MEC item not the scrap.

6.1.1 Analog Mag and Flag using Flux-Gate Magnetic Gradiometers

Approved detectors for this project include Schondstedt 52-CX, Forester Mk26, and MagnaTrak 102. All of these instruments have similar detection characteristics and can be expected to consistently detect the MEC items expected to the depths shown in Table 6-1. These detection depths are significantly deeper than the depths at which any MEC items were recovered during the EE/CA (see Table 6-1). The USAESCH MM-CX may approve other similar geophysical instruments.

6.1.2 Digital Geophysical Mapping Using Optically-Pumped (cesium vapor, potassium vapor, etc.) Magnetometry

Approved detectors for this project include the Geometrics 822, Geometrics 823, Geometrics 858, Scintrex, and GTL TM-4. All of these instruments have similar detection characteristics and can be expected to consistently detect the MEC items expected to the depths shown in Table 6-1. These detection depths are significantly deeper than the depths at which any MEC items were recovered during the EE/CA (see Table 6-1). The USAESCH MM-CX may approve other similar geophysical instruments.

6.1.3 Digital Geophysical Mapping Using Time-Domain Electromagnetic Induction

Approved detectors for this project include the Geonics EM-61, EM-61Mk2, GTL TM-5emu, and Zonge Nanotem. All of these instruments have similar detection characteristics and can be

expected to consistently detect the MEC items expected to the depths shown in Table 6-1. These detection depths are significantly deeper than the depths at which any MEC items were recovered during the EE/CA (see Table 6-1). The USAESCH MM-CX may approve other similar geophysical instruments.

6.2 RECOVERY AND DISPOSAL

No change from original ESS.

6.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PLAN

No change from original ESS.

6.4 MUNITIONS DEBRIS EXPLOSIVE HAZARDS

No change from original ESS.

7.0 ALTERNATE TECHNIQUES

Upon conclusion of the removal activities in each grid within each area, the UXO Quality Control Specialist (UXOQCS) will conduct a surface and subsurface quality control (QC) inspection. Grids that pass the QC inspection will be submitted to the USAESCH for Quality Assurance (QA) inspection. Any non-conformance to contractual requirements will be documented and reported in writing to the SUXOS, Quality Control Manager (QCM), and Project Manager (PM). The SUXOS will be responsible for the field remediation of the non-conformance.

8.0 OFFSITE DESTRUCTION

No change from original ESS.

9.0 TECHNICAL SUPPORT

The following information replaces section 9.0 in the original ESS.

9.1 MILITARY SUPPORT

No chemical warfare materiel (CWM) is suspected at this site. However, if suspected CWM is found, or if a MEC item cannot be positively identified, the USACE on-site OE Safety Specialist will request military support.

9.2 CONTRACTOR

The contractor for this project is TBD. All on-site UXO personnel will meet the training and minimum experience required by Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (TP 18), "Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel" and USAESCH MM-CX Interim Guidance Document 05-01, "Implementation of TP 18".

10.0 LAND USE RESTIRCTIONS

No change from original ESS.

11.0 PUBLIC INVOLVEMENT

No change from original ESS.

12.0 MAPS

Figure Amend 2-1 shows the area covered by this amendment and the associated Quantity-Distance (Q-D) arcs that will be used during the munitions response action. The Q-D arcs shown are based on the maximum fragment distances for the most probable munitions as shown in Table 3-1. These may be reduced as shown in Table 3-1 if the appropriate engineering controls are used.

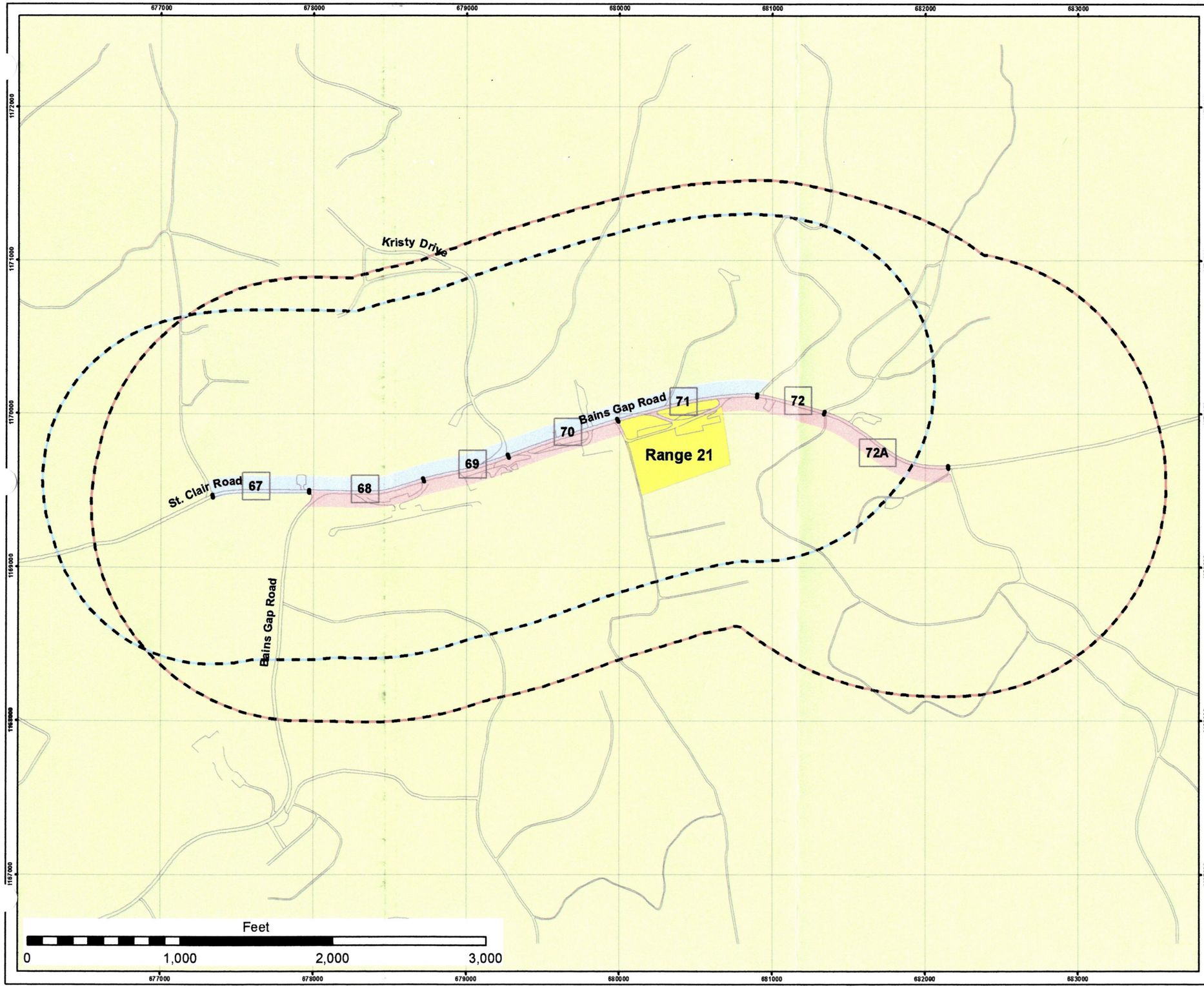
13.0 QUANTITY-DISTANCE

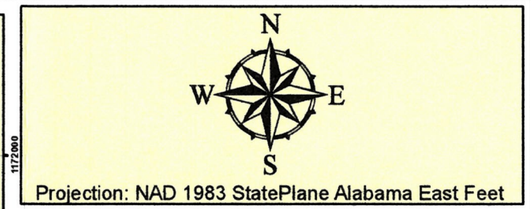
No change from original ESS.

APPENDIX A

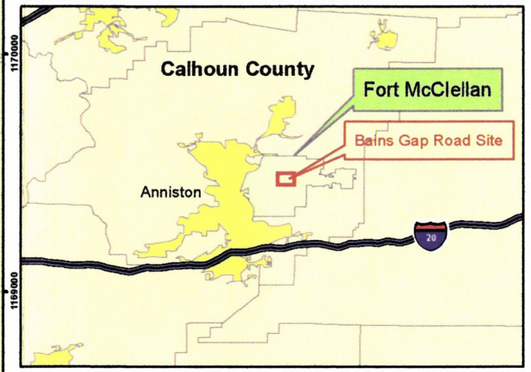
MAP

The embedded object files contain the map for this ESS. It is best printed in color on 11" x 17" paper.





Projection: NAD 1983 StatePlane Alabama East Feet



Area FWS_4H (Clearance Area)

60mm HE M49 = 1080'

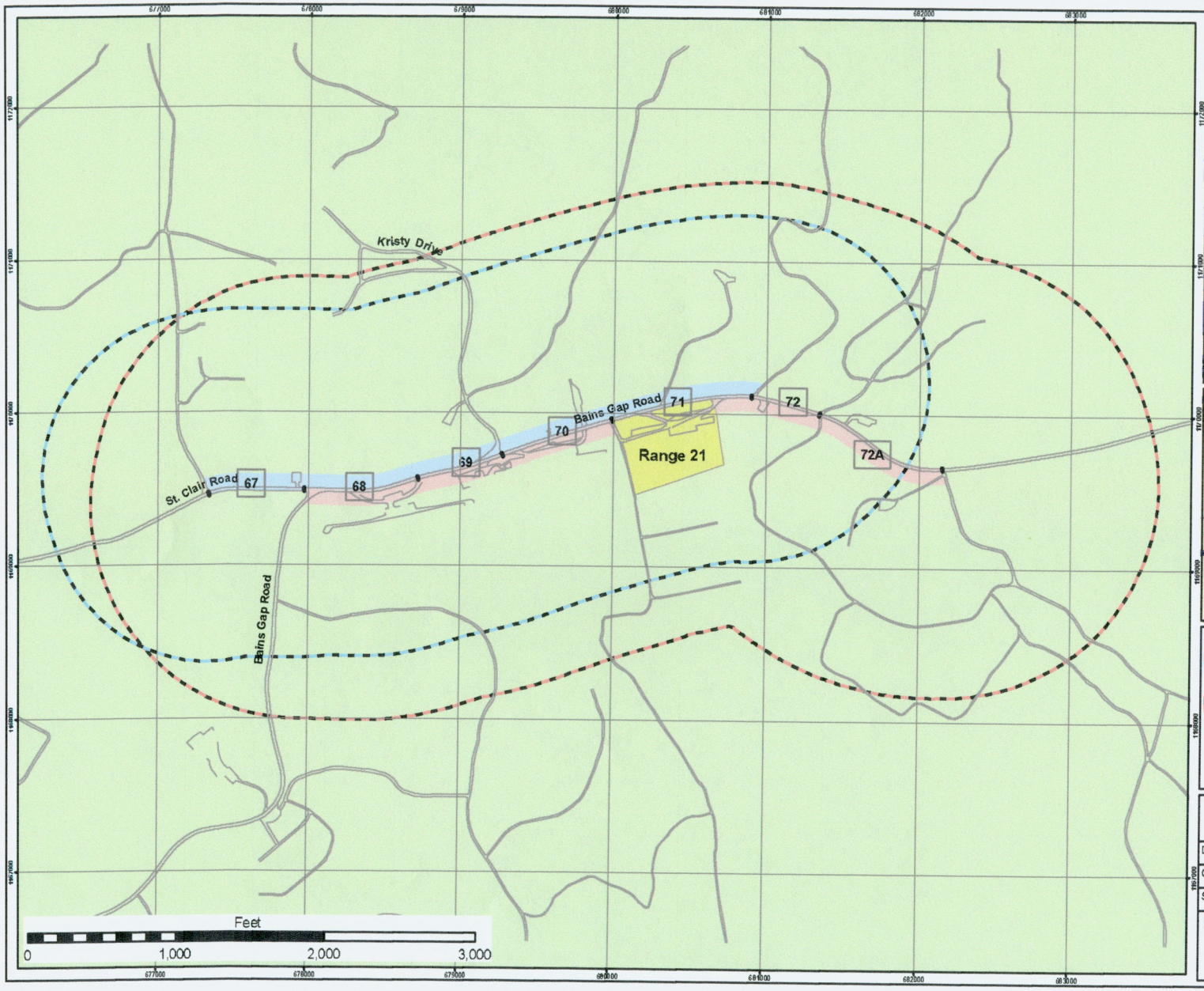
Area FWS_2H (Clearance Area)

81mm HE M43 = 1395'

Range 21

67 Road w/Segment No.

Fort McClellan Bains Gap QD Arcs	U.S. Army Engineering And Support Center Huntsville, AL
Drawn By: GDW	Scale: As Shown / Rev: 5
Checked By: MC	Date Drawn: 08/18/2005
Submitted By: MC	Plot Date: 08/18/2005
Figure Amend 2-1	Path: \\Hnc-fs-gis\edgis\PROJECTS\States\AL\McClellan\Bains_Gap\Bains_gap_road_msd.mxd



Area FWS_4H (Clearance Area)
60mm HE M49 = 1080'
Area FWS_2H (Clearance Area)
81mm HE M43 = 1395'
Range 21
67 Road w/Segment No.

Fort McClellan Bains Gap QD Arcs		U.S. Army Engineering And Support Center Huntsville, AL	
Drawn By:	GDW	Scale: As Shown	Rev: 5
Checked By:	MC	Date Drawn:	08/18/2005
Submitted By:	MC	Plot Date:	08/18/2005
Figure Amend 2-1	Path: \\Hnc-fs-gis\edgis\PROJECTS\States\AL\McClellan\Bains_Gap\Bains_gap_road_msd.mxd		

APPENDIX B
CALCULATION SHEETS

The embedded object file contains the calculation sheets. A calculation sheet is provided for each MEC item listed in Table 6-1 to ensure that a sheet is readily available in this amendment for each item it is reasonable to expect may be found in the area covered by this amendment. These should be printed in black and white on 8 ½" x 11" paper.

FRAGMENTATION DATA REVIEW FORM

Category:	HE Rounds	DODIC:	B632
Munition:	60 mm M49A3	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	mortar	Individual Last Updated Record:	Crull
Secondary Database Category:	60 mm	Date Record Retired:	
Tertiary Database Category:	Comp B		

Munition Information and Fragmentation Characteristics

Explosive Type:	Comp B
Explosive Weight (lb):	0.42000
Diameter (in):	2.3622
Max Fragment Weight (lb):	0.023675
Critical Fragment Velocity (fps):	5114

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	200
Vertical Range of Maximum Weight Fragment (ft):	856
Horizontal Range of Maximum Weight Fragment (ft):	1080

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	34
Inhabited Building Distance (09 psi), K50 Distance:	42
Intentional MSD (0065 psi), K328 Distance:	277

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	2.81
Mild Steel:	0.53
Hard Steel:	0.43
Aluminum:	1.14
LEXAN:	3.85
Plexi-glass:	2.43
Bullet Resist Glass:	1.89

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.023675
Critical Fragment Velocity (fps)SB:	5114
Kinetic Energy 106 (lb-ft2/s2)SB:	0.3096
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:	0.023675
Critical Fragment Velocity (fps)W:	5114
Kinetic Energy 106 (lb-ft2/s2)W:	0.3096
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft)W:	200/200

Print This Form Close Form

FRAGMENTATION DATA REVIEW FORM

Category:	Black Powder Roun	DODIC:	
Munition:	75 mm Mk1 (Shrapnel)	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/18/2005
Primary Database Category:	projectile	Individual Last Updated Record:	Crull
Secondary Database Category:	75 mm	Date Record Retired:	
Tertiary Database Category:	black powder		

Munition Information and Fragmentation Characteristics

Explosive Type:	Black Powder
Explosive Weight (lb):	0.19000
Diameter (in):	2.9528
Max Fragment Weight (lb):	0.026600
Critical Fragment Velocity (fps):	1200

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	200
Vertical Range of Maximum Weight Fragment (ft):	523
Horizontal Range of Maximum Weight Fragment (ft):	743

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	18
Inhabited Building Distance (09 psi), K50 Distance:	23
Intentional MSD (0065 psi), K328 Distance:	148

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall)	2.14
Mild Steel:	0.14
Hard Steel:	0.11
Aluminum:	0.28
LEXAN:	1.76
Plexi-glass:	0.96
Bullet Resist Glass:	0.76

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.026600
Critical Fragment Velocity (fps)SB:	1200
Kinetic Energy 106 (lb-ft2/s2)SB:	0.0192
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:	0.026600
Critical Fragment Velocity (fps)W:	1200
Kinetic Energy 106 (lb-ft2/s2)W:	0.0192
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft)W:	200/200

Print This Form | Close Form

FRAGMENTATION DATA REVIEW FORM

Category:	HE Rounds	DODIC:	C225
Munition:	81 mm M43	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	mortar	Individual Last Updated Record:	Crull
Secondary Database Category:	81 mm	Date Record Retired:	
Tertiary Database Category:	Comp B		

Munition Information and Fragmentation Characteristics

Explosive Type:	Comp B
Explosive Weight (lb):	1.29000
Diameter (in):	3.1890
Max Fragment Weight (lb):	0.057300
Critical Fragment Velocity (fps):	4933

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	230
Vertical Range of Maximum Weight Fragment (ft):	1097
Horizontal Range of Maximum Weight Fragment (ft):	1395

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	49
Inhabited Building Distance (09 psi), K50 Distance:	61
Intentional MSD (0065 psi), K328 Distance:	403

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	3.62
Mild Steel:	0.68
Hard Steel:	0.56
Aluminum:	1.43
LEXAN:	4.51
Plexi-glass:	3.00
Bullet Resist Glass:	2.40

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.057300
Critical Fragment Velocity (fps)SB:	4933
Kinetic Energy 106 (lb-ft2/s2)SB:	0.6972
Required Wall Roof Sandbag Thickness (in)SB:	24
Expected Maximum Sandbag Throw Distance (ft)SB:	125
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.057300
Critical Fragment Velocity (fps)W:	4933
Kinetic Energy 106 (lb-ft2/s2)W:	0.6972
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft)W:	200

Print This Form | Close Form

FRAGMENTATION DATA REVIEW FORM

Category:	Black Powder Roun
Munition:	3" Stokes (Black Powder)
Primary Database Category:	mortar
Secondary Database Category:	3 in
Tertiary Database Category:	black powder
DODIC:	
Date Record Created:	7/30/2004
Last Date Record Updated:	7/30/2004
Individual Last Updated Record:	Crull
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Black Powder
Explosive Weight (lb):	2.10000
Diameter (in):	3.0000
Max Fragment Weight (lb):	0.006829
Critical Fragment Velocity (fps):	4322

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	200
Vertical Range of Maximum Weight Fragment (ft):	977
Horizontal Range of Maximum Weight Fragment (ft):	1249

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	40
Inhabited Building Distance (09 psi), K50 Distance:	50
Intentional MSD (0065 psi), K328 Distance:	329

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	2.41
Mild Steel:	0.46
Hard Steel:	0.37
Aluminum:	0.98
LEXAN:	3.59
Plexi-glass:	2.21
Bullet Resist Glass:	1.72

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.006829
Critical Fragment Velocity (fps)SB:	4322
Kinetic Energy 106 (lb-ft2/s2)SB:	0.0638
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:	0.006829
Critical Fragment Velocity (fps)W:	4322
Kinetic Energy 106 (lb-ft2/s2)W:	0.0638
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft)W:	200/200

Print This Form | Close Form

FRAGMENTATION OF THE 4.2" WP MORTAR IS ESSENTIALLY THE SAME AS THE 4.2" M2/M2A1 (CHEMICAL).

MCrull 8/18/05

FRAGMENTATION DATA REVIEW FORM

Category:	Chemical, WP, & I	DODIC:	C703
Munition:	4.2" M2/M2A1 (Chemical)	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	mortar	Individual Last Updated Record:	Crull
Secondary Database Category:	4.2 in	Date Record Retired:	
Tertiary Database Category:	chemical		

Munition Information and Fragmentation Characteristics

Explosive Type:	Tetryl
Explosive Weight (lb):	0.14300
Diameter (in):	4.2000
Max Fragment Weight (lb):	0.064300
Critical Fragment Velocity (fps):	951

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	200
Vertical Range of Maximum Weight Fragment (ft):	691
Horizontal Range of Maximum Weight Fragment (ft):	952

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	23
Inhabited Building Distance (09 psi), K50 Distance:	28
Intentional MSD (0065 psi), K328 Distance:	186

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	1.20
Mild Steel:	0.10
Hard Steel:	0.08
Aluminum:	0.21
LEXAN:	1.71
Plexi-glass:	0.83
Bullet Resist Glass:	0.62

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.064300
Critical Fragment Velocity (fps)SB:	951
Kinetic Energy 106 (lb-ft2/s2)SB:	0.0291
Required Wall Roof Sandbag Thickness (in)SB:	NA
Expected Maximum Sandbag Throw Distance (ft)SB:	NA
Minimum Separation Distance (ft)SB:	NA

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.064300
Critical Fragment Velocity (fps)W:	951
Kinetic Energy 106 (lb-ft2/s2)W:	0.0291
Water Containment System:	NA
Minimum Separation Distance (ft)W:	NA

Print This Form | Close Form

FRAGMENTATION DATA REVIEW FORM

Category:	Grenades & Mines	DODIC:	G890
Munition:	Mk II Grenade	Date Record Created:	7/30/2004
		Last Date Record Updated:	4/28/2005
Primary Database Category:	grenade	Individual Last Updated Record:	Crull
Secondary Database Category:	hand	Date Record Retired:	
Tertiary Database Category:	TNT		

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	0.12500
Diameter (in):	2.2600
Max Fragment Weight (lb):	0.014217
Critical Fragment Velocity (fps):	3425

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	200
Vertical Range of Maximum Weight Fragment (ft):	390
Horizontal Range of Maximum Weight Fragment (ft):	390

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	21
Inhabited Building Distance (09 psi), K50 Distance:	27
Intentional MSD (0065 psi), K328 Distance:	174

Minimum Thickness To Prevent Perforation

4000 psi Concrete (Prevent Spall):	2.54
Mild Steel:	0.47
Hard Steel:	0.39
Aluminum:	1.00
LEXAN:	3.78
Plexi-glass:	2.37
Bullet Resist Glass:	1.88

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.014217
Critical Fragment Velocity (fps)SB:	3425
Kinetic Energy 106 (lb-ft2/s2)SB:	0.0834
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:	0.014217
Critical Fragment Velocity (fps)W:	3425
Kinetic Energy 106 (lb-ft2/s2)W:	0.0834
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft)W:	200/200

Print This Form | Close Form

FRAGMENTATION DATA REVIEW FORM

Category:	HE Rounds	DODIC:	
Munition:	37 mm MK II (0.053lb)	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	projectile	Individual Last Updated Record:	Crull
Secondary Database Category:	37 mm	Date Record Retired:	
Tertiary Database Category:	TNT		

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	0.05300
Diameter (in):	1.4567
Max Fragment Weight (lb):	0.024500
Critical Fragment Velocity (fps):	3302

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	200
Vertical Range of Maximum Weight Fragment (ft):	754
Horizontal Range of Maximum Weight Fragment (ft):	980

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	16
Inhabited Building Distance (09 psi), K50 Distance:	20
Intentional MSD (0065 psi), K328 Distance:	131

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	2.00
Mild Steel:	0.37
Hard Steel:	0.30
Aluminum:	0.79
LEXAN:	3.25
Plexi-glass:	1.94
Bullet Resist Glass:	1.51

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.024500
Critical Fragment Velocity (fps)SB:	3302
Kinetic Energy 106 (lb-ft2/s2)SB:	0.1336
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:	0.024500
Critical Fragment Velocity (fps)W:	3302
Kinetic Energy 106 (lb-ft2/s2)W:	0.1336
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft)W:	200/200

Print This Form | Close Form