DDESB APPROVAL INSIDE COVER

Explosives Site Plan

Remedial Investigation/Feasibility Study

Strother Field Formerly Used Defense Site (FUDS)
Disposal Area Munitions Response Site
Cowley County, Kansas

FUDS Property Number: B07KS0277

October 2015

Prepared By

Bay West LLC
for

U.S. Army Corps of Engineers
Kansas City District

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

ATCL-ACE 11 Dec 2015

MEMORANDUM FOR Military Munitions Center of Expertise, (CEHNC-EMM/Mr. Zange/Mr. Barker), P.O. Box 1600, Huntsville, AL 35807-4301

SUBJECT: Army and DDESB Final Approval for Explosive Site Plan, Remedial Investigation/Feasible Study, Disposal Area, Strother Field Formerly Used Defense Site, Cowley County, KS. USATCES MEC File Number 1440.

1. References:

a. Memorandum, CEHNC-CX-EMM, dated: 23 November 2015, Subject: Explosives Site Plan (ESP), Remedial Investigation/Feasible Study (RI/FS), Strother Field Formerly USED Defense Site (FUDS) Disposal Area Munitions Response Site Cowley County, KS, November 2015.

b. DoD 6055.09-M, Ammunition and Explosives Safety Standards, date varies by Volume, Administratively Reissued 4 August 2010.

c. Department of the Army Pamphlet 385-64, Ammunition and Explosives Safety Standards, 10 October 2013, Rapid Action Revision.

d. Memorandum, DDESB-PE, dated: 11 Dec 2015, Subject: DDESB Approval of Explosives Site Plan, Remedial Investigation/Feasible Study, Disposal Area, Strother Field Formerly Used Defense Site, Cowley County, KS, (encl).

2. The subject Explosives Site Plan, transmitted by reference 1.a. has been reviewed in accordance with reference 1.b. and 1.c. This memorandum with the enclosed reference 1.d., provides US Army Technical Center for Explosives Safety (USATCES) and Department of Defense Explosives Safety Board (DDESB) final approval.

3. Any changes that increase risk or hazard will require additional approval; an Amendment to this Explosives Site Plan must be submitted to USATCES and DDESB for review and approval. This approval and all other stipulations and requirements will be made part of the administrative record for the site.

ATCL-ACE
SUBJECT: Army and DDESB Final Approval for Explosive Site Plan, Remedial Investigation/Feasible Study, Disposal Area, Strother Field Formerly Used Defense Site, Cowley County, KS. USATCES MEC File Number 1440.

4. Point of contact for this submission is the undersigned, email: usarmy.mcalester.usamc.list.dac-est-siteplan@mail.mil

PAUL A. CUMMINS
Chief, Risk Management Division,
US Army Technical Center for Explosives Safety

CF(w/Encl):
Office of the Director of Army Safety (DACS-SF/Mr. Patton), Building 1456, 9351 Hall Road, Fort Belvoir, VA. 22060-5860
Office of the Deputy Assistant Secretary of the Army for Environment, Safety, and Occupational Health, Special Assistant for Munitions, DASA-DESOH (Mr. King), 110 Army Pentagon, Washington, DC 20310-0110

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
4800 MARK CENTER DRIVE, SUITE 16E12
ALEXANDRIA VIRGINIA, 22350

DDESB-PE

DEC 11 2015

MEMORANDUM FOR DIRECTOR, U.S. ARMY DEFENSE AMMUNITION CENTER
ATTENTION: ATCL-ACE

SUBJECT: DDESB Approval of Explosives Site Plan, Remedial Investigation/Feasibility Study, Disposal Area, Strother Field Formerly Used Defense Site, Cowley County, KS

References: (a) DAC ATCL-ACE Memorandum of 2 December 2015, Subject: Request DDESB Approval of Explosive Site Plan (ESP), Remedial Investigation/Feasibility Study (RI/FS), Strother Field Formerly Used Defense Site (FUDS) Disposal Area Munitions Response Site Cowley County, KS. USATCES MEC File Number 1440.

(b) DoD 6055.09-M, DoD Ammunition and Explosives Safety Standards, date varies by volume

(c) DDESB TP-15, Approved Protective Construction, Revision 3, May 2010

(d) DDESB TP-16, Methodologies for Calculating Primary Fragment Characteristics, Revision 4, 2 August 2012

The Department of Defense Explosives Safety Board (DDESB) Staff has reviewed the subject explosives site plan (ESP) forwarded by reference (a) against the requirements of reference (b). Based on the information provided, approval is granted for removal and treatment of material potentially presenting an explosive hazard (MPPEH) and munitions and explosives of concern (MEC) at Strother Field Formerly Used Defense Site, Cowley County, KS. This approval is based on the following:

a. The efforts addressed in this ESP involve manual unintentional detonation operations (to include mechanized unintentional detonation operations employing anomaly avoidance), mechanized low input unintentional detonation operations, intentional detonations, and intentional burning supporting munitions response actions within Munitions Response Site (MRS) Disposal Area.

b. The results of this ESP will be used to prepare an explosives safety submission per reference (a).

c. The munition with the greatest fragmentation distance (MGFD) for the MRS Disposal Area is the 4-pound Incendiary AN-M50X-A1 Round; the minimum separation distance (MSD) for teams for manual unintentional detonation operations is 9 feet (ft) and 47 ft for low input mechanized unintentional detonation operations, based respectively on K40 and the

hazardous fragment distance (HFD) of the MGFD; the MSD for nonessential personnel from manual and low input mechanized unintentional detonation operations is 47 ft based on the HFD of the MGFD; and the MSD for all personnel from intentional detonations and intentional burnings is 439 ft based on the maximum fragment distance (MFD) of the MGFD.

d. Collection points and consolidated shots are authorized provided the Army ensures usage of reference (c), paragraph C6.2.7.5.

e. The use of sandbags, water mitigation systems and earth tamping is authorized as an engineering control for intentional detonations involving the MEC identified in reference (a) provided the Army ensures usage per reference (c), paragraph C6.2.7.5.

f. Operators of mechanized equipment will be shielded from hazardous fragments based on an unintentional detonation from mechanized operations involving the MEC identified in reference (a). The use of barricades/shields is authorized as an engineering control to prevent fragment penetration provided the Army ensures usage per reference (d). Additionally, operators will be provided blast overpressure protection of 5 ft based on K24 of the MGFD.

g. The use of hearing protection is authorized as an engineering control for unintentional detonation operations to provide equivalent K24 blast overpressure protection for essential personnel at 4 ft based on K18 of the MGFD. The Army shall ensure the use of double hearing protection which provides > 9 decibel (dB) attenuation.

h. The use of the Miniature Open Front Barricade is authorized as an engineering control for unintentional detonation operations involving the MEC identified in reference (a) provided the Army ensures usage per reference (c), paragraph C6.2.7.5.

i. One ATF Type II aboveground magazine (AGM) is or two ATF Type II AGMs sited as a single complex are approved to store non-primary fragment producing demolition materials up to 50 pounds net explosive weight of hazard division (HD) 1.1 and mission essential quantities of HD 1.4. The applicable inhabited building distance is 388 ft and the public traffic route distance is 233 ft.

j. Prior to initiation and through completion of on-site explosives operations, all nonessential personnel will be evacuated and prevented from entering any area/facility encumbered by the MSD required for the operation being conducted, or explosives operations will be suspended if nonessential personnel enter the MSD.

k. MPPEH will be inspected and classified as material documented as safe prior to release to the public.

If changes occur during or after completion of this effort that could increase explosive hazards to site workers or the public due to the presence of military munitions at the site, an amendment to this ESP must be submitted to DDESB for review and approval.

The point of contact for this action is Ms. Kristene Bigej, (571) 372-6705, DSN 372-6705, E-mail address: kristene.a.bigej.civ@mail.mil.

THIERRY L. CHIAPELLO
Executive Director

Table of Contents

Appendices

1.0 Site

a. Name

Strother Field Disposal Area Munitions Response Site (MRS) (Map 1).

b. State

Kansas

2.0 Anticipated Start Date

April 2016

3.0 Purpose

The objective of the Remedial Investigation (RI) and Feasibility Study (FS) at the Strother Field Disposal Area MRS is to determine the nature and extent of potential munitions and explosives of concern (MEC) and to evaluate the need for further munitions response actions.

Subsequent removal responses may be dictated by action memoranda or other decision documents. Based on the results of this RI/FS and subsequent decision document, an Explosives Safety Submission (ESS) will be submitted if needed; the ESS will be in accordance with (IAW) Department of Defense (DoD) 6055.09-M.

4.0 Site Background and Current Conditions

Strother Field was commissioned in 1942 and used primarily for basic Air Corps cadet training. In 1944, the installation became a fighter pilot training station. Ordnance facilities documented at Strother Field included a small arms storage building, a magazine, an igloo, a skeet range, and a pistol range.

The Disposal Area MRS is a 28.3-acre portion of a former skeet range located in the northeast extent of the FUDS. The land is owned by the cities of Winfield and Arkansas City, managed by the Strother Field Commission, and primarily leased for farming. A Site Inspection (SI) conducted in 2009 encountered one potential MEC item (partial AN-M50 incendiary bomb) and munitions debris (MD) from AN-M50 and AN-M54 incendiary bombs and M15 white phosphorous (WP) grenades.

5.0 Executing Agencies

- United States Army Corps of Engineers (USACE); and,
- Contractors.

6.0 Scope of Investigation Actions

a. Scope

Table 6-1 describes the scope of the investigation. Map 1 depicts the location of Strother Field, and Map 2 depicts the Strother Field Disposal Area MRS.

Only unexploded ordnance (UXO) personnel qualified IAW Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 18 will perform UXO operations.

Depending upon the situation, the investigation will be by manual and/or mechanized methods.

Manual - The UXO Team will use earth moving machinery (EMM) to assist in manual excavation of anomalies. A UXO Technician will guide excavation. Excavation with EMM will stop at least 12 inches from anomalies and continue with hand tools.

Mechanized - The UXO Team will use armored EMM to remove material from suspected munitions burial pits, spread and scan the material or process it through a mechanical screen plant, and inspect it for the presence of munitions.

Table 6-1: Scope of Investigation

MRS	Type of Investigation	Investigation Method	MRS Acreage	Buffer Zone Acreage	Combined Acreage
Disposal Area MRS	RI/FS	• Surface clearance to support digital geophysical mapping (DGM) • DGM • Analog investigation • Intrusive investigation of anomalies • Mechanized excavation of burial pits if found • Munitions Constituent (MC) Sampling	28.3	20.95	49.25

The combined acreage reflects a 200-foot buffer zone around the MRS to allow for step-out.

7.0 Safety Criteria

The munition with the greatest fragmentation distance (MGFD) is the 4-pound (lb.) Incendiary AN-M50X-A1.

The potential MEC item encountered on this MRS was identified as a partial AN-M50 incendiary bomb, which is non-fragmenting. Neither the AN-M50X-A1 nor the AN-M50X-A3 variations of the AN-M50 Series have been documented as present on the site. The AN-M50X-A1 was chosen as a conservative proxy for the AN-M50.

If MEC with a greater fragmentation distance is encountered, the Minimum Separation Distances (MSD) will be adjusted in accordance with DDESB TP 16, operations will continue, and an amendment to this Explosives Site Plan (ESP) will be submitted for approval (a copy of this document will be available on-site). Explosives Safety Quantity Distance (ESQD) arcs will be adjusted accordingly.

a. See Appendix B for Fragmentation Data Sheet.

b. See Table 7-1 for MSD.

c. Any occupied buildings or public roadways in the MSD areas (Map 2) during MEC-related operations will be evacuated and/or roadways blocked to prevent non-essential personnel from entering during the conduct of MEC operations.

d. Strother Field is an active airport. Contact the airport manager at 620-221-9280 prior to operations to coordinate vertical exclusion zones. The Hazardous Fragment Distance

(HFD) of 47 feet will be kept clear during MEC operations that could produce an unintentional detonation. The Maximum Fragment Distance – Vertical (MFD-V) of 354 feet will be kept clear during intentional detonations.

e. The miniature open front barricade (MOFB) will be used as an engineering control for unintentional detonations when exclusion zones cannot be evacuated. In accordance with the munitions fragmentation database, a minimum thickness of 0.36 inches of aluminum is required. A copy of the guidance document Miniature Open Front Barricade, HNC-ED-CS-S-98-8 Revision 2, April 2013 will be available on-site.

f. Mechanized MEC operations will involve intentional contact with MEC. Personnel operating mechanized equipment will maintain the K24 separation distance (K18 if using double hearing protection of 9 decibels or better) and be shielded as described in the Fragmentation Data Sheet in Appendix B. The K18 distance is achieved by using an excavator with an effective digging range of >4 feet. If used, the mechanical screen plant will be equipped with a remote kill switch located at or outside the K24/K18. This is a low input mechanized MEC operation IAW DoD 6055.09-M V7.E4.5.8.3.5.1 because there is no intent to deform the munitions. If a munition becomes stuck in the mechanical screen plant, the screen plant will be shut down and the munition will be removed remotely.

g. For intentional detonations of explosive munitions (i.e. non-incendiary), the UXO Team will use earth tamp as an engineering control (single or multiple rounds) IAW the DDESB Buried Explosion Module (BEM), Version 6.3.3 or later if released, and DDESB TP 16. The BEM and TP 16 will be available at the site.

h. Sandbag or water mitigation may be used as engineering controls for explosive (i.e., non-incendiary) items to reduce the intentional detonation MSD. Sandbag thicknesses for selected munitions are presented in the DDESB Fragmentation database. The sandbag controls will be used in accordance with:

- HNC-ED-CS-98-7, Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions, August 1998, Amendment 1, February 2011 and Amendment 2, Nov 2014;

- CEHNC-EMM Memorandum, Safety Advisory: Use of Jet Perforator During Intentional Detonation While Using Sandbag Mitigation for Engineering Controls, 7 November 2011; and

- DDESB-PD memorandum of 22 May 2014, Subject: Revision of DDESB Approval for Use of Sandbags for Mitigation of Fragmentation and Blast Effects Resulting From Intentional Detonation of Munitions.

i. The MFD-V will be visually cleared prior to initiating detonations.

Table 7-1: Minimum Separation Distances (feet) [1]

MGFD	Unintentional Detonation				Intentional Detonation	
	Hazardous Fragment Distance	K18 Overpressure Distance	K24 Overpressure Distance	K40 Overpressure Distance	MFD Horizontal	MFD Vertical
4-lb. Incendiary AN-M50X-A1.[2]	47[3]	4[4]	5	9[5]	439	354

[1]DDESB Munitions Fragmentation Database dated September 22, 2015.
[2]Sandbag mitigation is not permitted as an engineering control for intentional detonations of 4 lb. Incendiary AN-M50X-A1.
[3]Minimum separation distance to the front of the MOFB, and for nonessential personnel and unshielded essential personnel during mechanized operations.
[4]For shielded personnel using double hearing protection during mechanized operations.
[5]Team separation distance and minimum separation distance for nonessential personnel from the sides and rear of MOFB.

8.0 Methods of Disposal

a. Disposal

The UXO Team will dispose of MEC by detonation or open burning within the MRS. All explosives operations will follow the procedures outlined in Technical Manual (TM) 60A 1-1-31 and Engineer Manual (EM) 385-1-97, *Explosives Safety and Health Requirements Manual*. Demolition operations will be performed daily or items properly guarded until operations can be conducted.

The UXO Team will normally detonate munitions encountered in place. The exception is when technically qualified personnel who are performing the functions of the Senior Unexploded Ordnance Supervisor (SUXOS) and Unexploded Ordnance Safety Officer (UXOSO) determine the risk associated with movement is acceptable, and movement is necessary for the protection of people, property, or critical assets, or the efficiency of the activities being conducted. In such cases, the SUXOS and UXOSO responsible for the MEC activities may evaluate the munition and authorize its movement within the MRS.

Collection Points

Collection points are those areas used to temporarily accumulate MEC pending destruction at the end of the day using consolidated shots. MEC items at collection points must be laid out as shown IAW US Army Engineering and Support Center, Huntsville (USAESCH) publication "*Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites, August 1998 with Terminology update March 2000*." A copy of this report will be available at the site. The maximum net explosive weight (NEW) at a collection point will be limited such that the K40 overpressure distance for the total NEW does not exceed the HFD for the area. MEC will not be left unattended at collection points.

Consolidated Shots

The UXO Team will consolidate multiple MEC for disposal IAW USAESCH publication "*Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites, August 1998 with Terminology Update March 2000*." A copy of this report will be available at the site. The maximum NEW during a consolidated shot must be limited such

that the K328 overpressure distance for the total NEW (including donor charges) does not exceed the MSD for the intentional detonation.

Open Burning

In accordance with the decision sheet issued by the 338th DDESB Meeting dated 19 November 2014, DoD 6055.09-M V5.E3.1.6 has been revised to state that the MSD for nonessential personnel from the burning of non-fragmenting munitions is the greater of the K40 or 75 feet. As a safety conservative measure, essential personnel will also withdraw to the minimum distance of 75 feet. The NEW of an intentional burn must be limited to 6.5 lbs. so the 75-foot MSD is not exceeded.

b. Explosives

Donor explosives will be stored in a Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) Type 2 magazine with attached detonator box (or two ATF Type 2 magazines sited as a complex), which will be sited as depicted on Map 3. The magazine will be placed in a portable cargo container (Conex) for additional security. The magazine is located northwest of the MRS in the 200-foot buffer area. MEC operations that could produce an unintentional detonation will be kept a minimum of the K11 distance of 2 feet from the magazine or the magazine will be emptied of all explosives while MEC operations are being conducted within the K11 distance.

The magazine(s) will be grounded for lightning protection. No more than 50 pounds NEW of hazard division (HD) 1.1 will be stored. Mission essential quantities of HD 1.4 may be stored. The Inhabited Building Distance (IBD) for the NEW is 388 feet and Public Transportation Route Distance (PTRD) is 233 feet IAW 6055.09-M V3.E3.T2.

Table 8-1: Magazine Data[1]

Net Explosive Weight (pounds)	Inhabited Building Distance (feet)	Public Transportation Route Distance (feet)
50	388	233

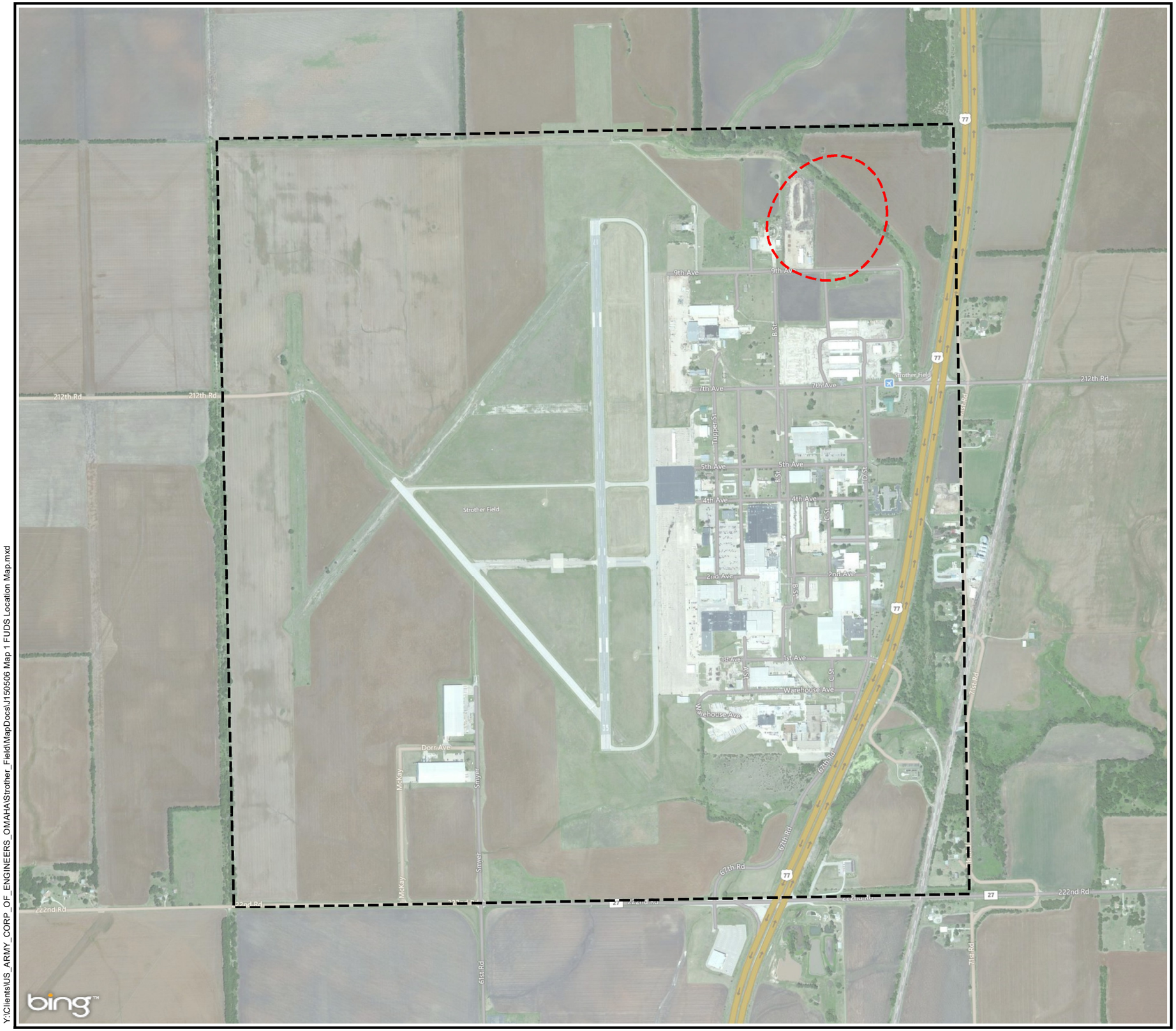
[1]DoD 6055.09-M Table V3.E3.T2, structure column

c. MPPEH

Material Potentially Presenting an Explosive Hazard (MPPEH) procedures will be IAW DoD Instruction 4140.62 and EM 35-1-97. MPPEH will be assessed and its explosives safety status determined and documented prior to transfer within the DoD or release from DoD control. Prior to release to the public, MPPEH will be documented by authorized and technically qualified personnel as Material Documented as Safe (MDAS) after a 100 percent (%) inspection and an independent 100% re-inspection to determine that it is safe from an explosives safety perspective.

Appendix A

Maps



Map 1

Strother Field Disposal Area MRS Location Map

Strother Field FUDS
Cowley County, Kansas
FUDS Property No. B07KS0277

Coordinate System: NAD 1983 UTM Zone 14N
Basemap: National Geographic Society, i-cubed

0 1,000 2,000 Feet
0 300 600 Meters

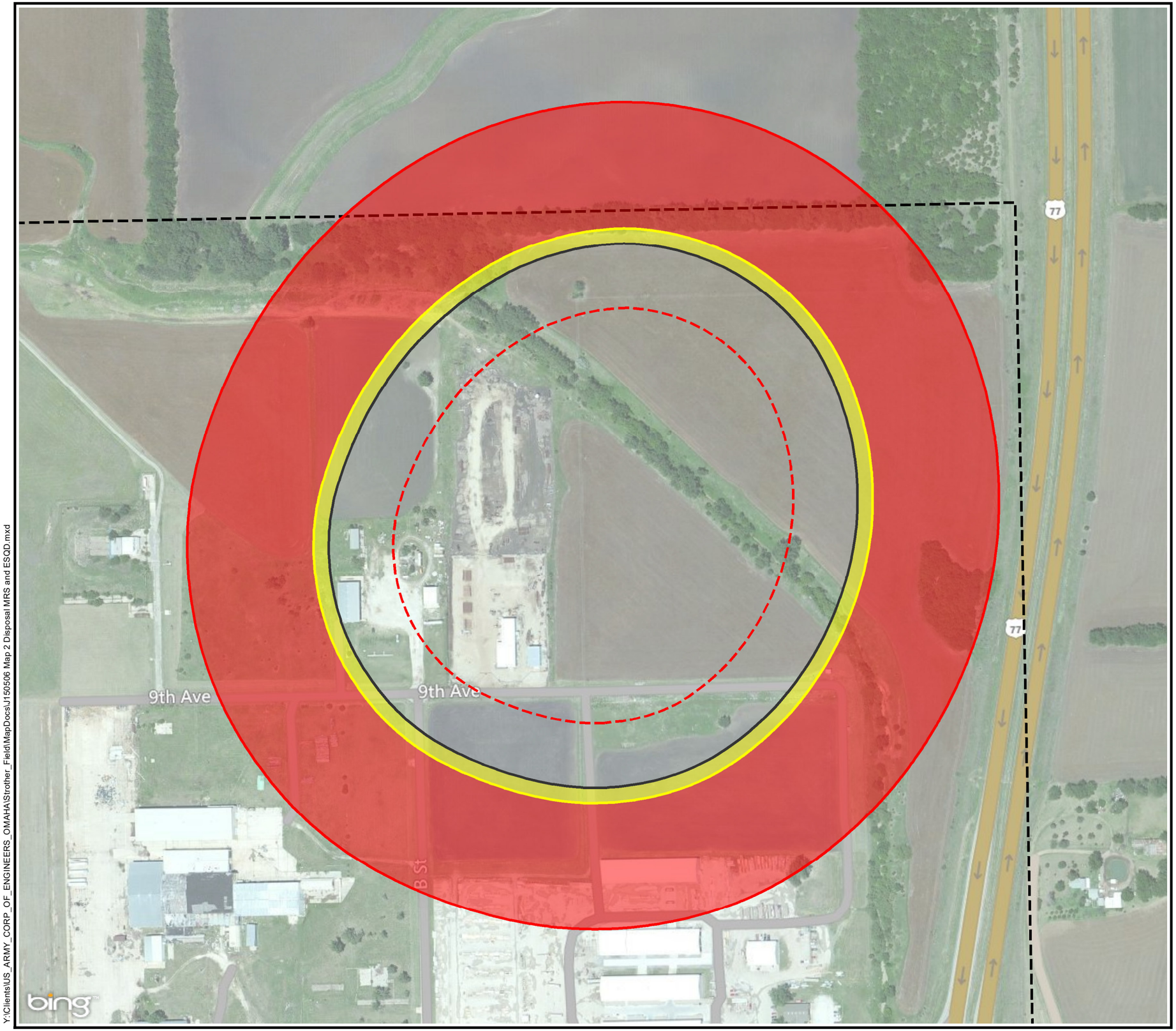
1 inch = 1,000 feet

Disposal Area MRS Boundary

Strother Field FUDS - Installation Boundary

Drawn By: ML Date Drawn/Revised: 12/23/2015 Project No. J150506

Y:\Clients\US_ARMY_CORP_OF_ENGINEERS_OMAHA\Strother_Field\MapDocs\J150506 Map 1 FUDS Location Map.mxd



Map 2

Disposal Area MRS and Explosive Safety Quantity Distances

Strother Field FUDS
Cowley County, Kansas
FUDS Property No. B07KS0277

Coordinate System: NAD 1983 UTM Zone 14N
Basemap: Bing Aerial Imagery WMS

0 300 600 Feet
0 100 200 Meters

1 inch = 300 feet

- Disposal Area MRS Boundary
- Strother Field FUDS - Installation Boundary
- 200' Buffer Area
- Hazardous Fragment Distance (HFD) 47'
- Maximum Fragment Distance, Horizontal (HFD-H) 439'

Note:
MGFD is the 4 lb. Incendiary AN-M50X-A1.
HFD and MFD-H extracted from Fragmentation Database September 22, 2015.

Drawn By: ML Date Drawn/Revised: 12/23/2015 Project No. J150506

Y:\Clients\US_ARMY_CORP_OF_ENGINEERS_OMAHA\Strother_Field\MapDocs\J150506 Map 2 Disposal MRS and ESQD.mxd

Map 3

Explosives Storage Magazine Location

Strother Field FUDS
Cowley County, Kansas
FUDS Property No. B07KS0277

Coordinate System: NAD 1983 UTM Zone 14N
Basemap: Bing Aerial Imagery WMS

0 250 500 Feet
0 75 150 Meters

1 inch = 250 feet

- ▲ Magazine Location
- Disposal Area MRS Boundary
- Strother Field FUDS - Installation Boundary
- 200' Buffer Area
- Public Transportation Route Distance 233'
- Inhabited Building Distance 388'

Drawn By: ML Date Drawn/Revised: 12/23/2015 Project No. J150506

Y:\Clients\US_ARMY_CORP_OF_ENGINEERS_OMAHA\Strother_Field\MapDocs\J150506 Map 3 Explosives Storage Magazine Location.mxd

Appendix B

Fragmentation Data Review Form

Fragmentation Data Review Form

Database Revision Date 9/22/2015

Category:	Chemical, WP, & Incendiary Rounds
Munition:	4 lb Incendiary AN-M50X-A1
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Incendiary
Munition Case Classification:	Robust

DODIC:	
Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	4/15/2013
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Black Powder
Explosive Weight (lb):	0.025
Diameter (in):	0.9600
Cylindrical Case Weight (lb):	0.04911
Maximum Fragment Weight (Intentional) (lb):	0.0011
Design Fragment Weight (95%) (Unintentional) (lb):	0.0002
Critical Fragment Velocity (fps):	5757

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	47
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	439
MFD-V [Maximum Fragment Distance, Vertical] (ft):	354

Overpressure Distances

TNT Equivalent (Pressure):	0.43
TNT Equivalent Weight - Pressure (lbs):	0.011
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	4
Public Traffic Route Distance (2.3 psi); K24 Distance:	5
Inhabited Building Distance (1.2 psi), K40 Distance:	9
Intentional MSD (0.0655 psi), K328 Distance:	72

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.43
TNT Equivalent Weight - Impulse (lbs):	0.011
Kinetic Energy 10^6 (lb-ft²/s²):	0.0184

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	Not Permitted
Water Containment System:	Not Permitted

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	1.57	0.79
Mild Steel:	0.30	0.16
Hard Steel:	0.25	0.13
Aluminum:	0.68	0.36
LEXAN:	2.70	1.40
Plexi-glass:	1.51	0.87
Bullet Resist Glass:	1.11	0.60

Item Notes

The TNT equivalency for black powder rounds has been updated from 0.4 to 0.43 to agree with Rev 4 of TP 16. This has resulted in minor changes in values.