T Range
Best Management Practices:
Operations, Maintenance, and Monitoring Plan

Camp Edwards, Massachusetts

prepared for:
Massachusetts National Guard
Environment & Readiness Center
Bldg. 1204 West Inner Road
Camp Edwards, MA 02542

8 June 2007

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URS Corporation
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ACRONYMS

AO	Administrative Order
ASP	Ammunition Supply Point
BMP	Best Management Practice
CSM	Conceptual Site Model
DoD	Department of Defense
DODIC	Department of Defense Identification Code
DPT	Director of Plans and Training
EMC	Environmental Management Commission
EPA	US Environmental Protection Agency
E&RC	Environmental and Readiness Center
FCC	Facility Category Code
FE	Facilities Engineering
HEPA	High-Efficiency Particulate Air
HMWMP	Hazardous Material and Waste Management Plan
IAGWSP	Impact Area Groundwater Study Program
MA DOT	Massachusetts Department of Transportation
MANG	Massachusetts National Guard
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MMR	Massachusetts Military Reservation
NATO	North Atlantic Treaty Organisation
OMM	Operations, Maintenance and Monitoring
P2	Pollution Prevention
PVC	Polyvinyl chloride
RFMSS	Range Facility Management Support System
RSO	Range Safety Officer
SACON	Shock Absorbing Concrete
SAR	Small Arms Range
SDWA	Safe Drinking Water Act of 1974
USAEC	US Army Environmental Command

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1.0 INTRODUCTION

Camp Edwards is an important training center for National Guard, Reserve Components, US Coast Guard, and law enforcement agencies throughout the northeastern United States. Located on Cape Cod, an environmentally sensitive region, Camp Edwards contains threatened and endangered wildlife species, prime wildlife habitat, archeological sites, and culturally sensitive areas (Massachusetts National Guard [MANG] 1997). Moreover, the Camp sits on top of the Sagamore lens, a sole source drinking water aquifer for Cape Cod. The northern 15,000 acres of Camp Edwards, the Reserve/Training Area, are located within the recharge area of the aquifer. Camp Edwards is committed to excellence in environmental protection, training, readiness and management of training sites. Training facilities available at Camp Edwards include small arms ranges (SARs), training areas, battle positions, observation posts, and maneuver roads and trails. These facilities support a variety of training activities to include small arms marksmanship. In particular, the SARs support training and qualification in basic infantry skills with small arms weapons systems, including pistols, rifles, machine guns, and shotguns. MANG will seek to constantly improve upon training practices that protect the future of the surrounding eco-system and the aquifer, and maintain a viable ready force.

1.1 Purpose

The purpose of this Range Best Management Practice (BMP): Operations, Maintenance, and Monitoring (OMM) Plan is to identify the operations and management practices that MANG will implement to return “Tango” (“T”) Range to service in support of small arms weapons marksmanship training. This plan identifies BMPs that allow the employment of small arms at T Range in a manner that:

- Meets current and future training requirements and
- Employs maximum feasible use of pollution prevention (P2) to protect the Upper Cape Water Supply Reserve, managed as a Massachusetts Department of Environmental Protection (MassDEP) Zone II for public water supplies.

This plan, along with other range-specific plans, is in support of the Camp Edwards *Pollution Prevention Overview (Small Arms Range Supplement)* (SAR P2 Overview) (MANG 2007). Per the phased approach outlined in the SAR P2 Overview, MANG is developing BMP OMM plans for each SAR that will support marksmanship training (see Figure 1-1). Prior to the employment of lead-bullet ammunition on any SAR, Camp Edwards will present the corresponding range-specific BMP OMM plan to the Environmental Management Commission (EMC) and US Environmental Protection Agency (EPA) for review and approval. The range-specific BMP OMM plan will also be sent to MassDEP for review and coordination as part of the SAR working group; however, state approval would be through the EMC. MANG will program for funding requirements to implement the BMPs on an annual basis. Lead-bullet ammunition will only be fired at Camp Edwards on ranges with approved BMP OMM plans and as BMPs are funded and implemented.

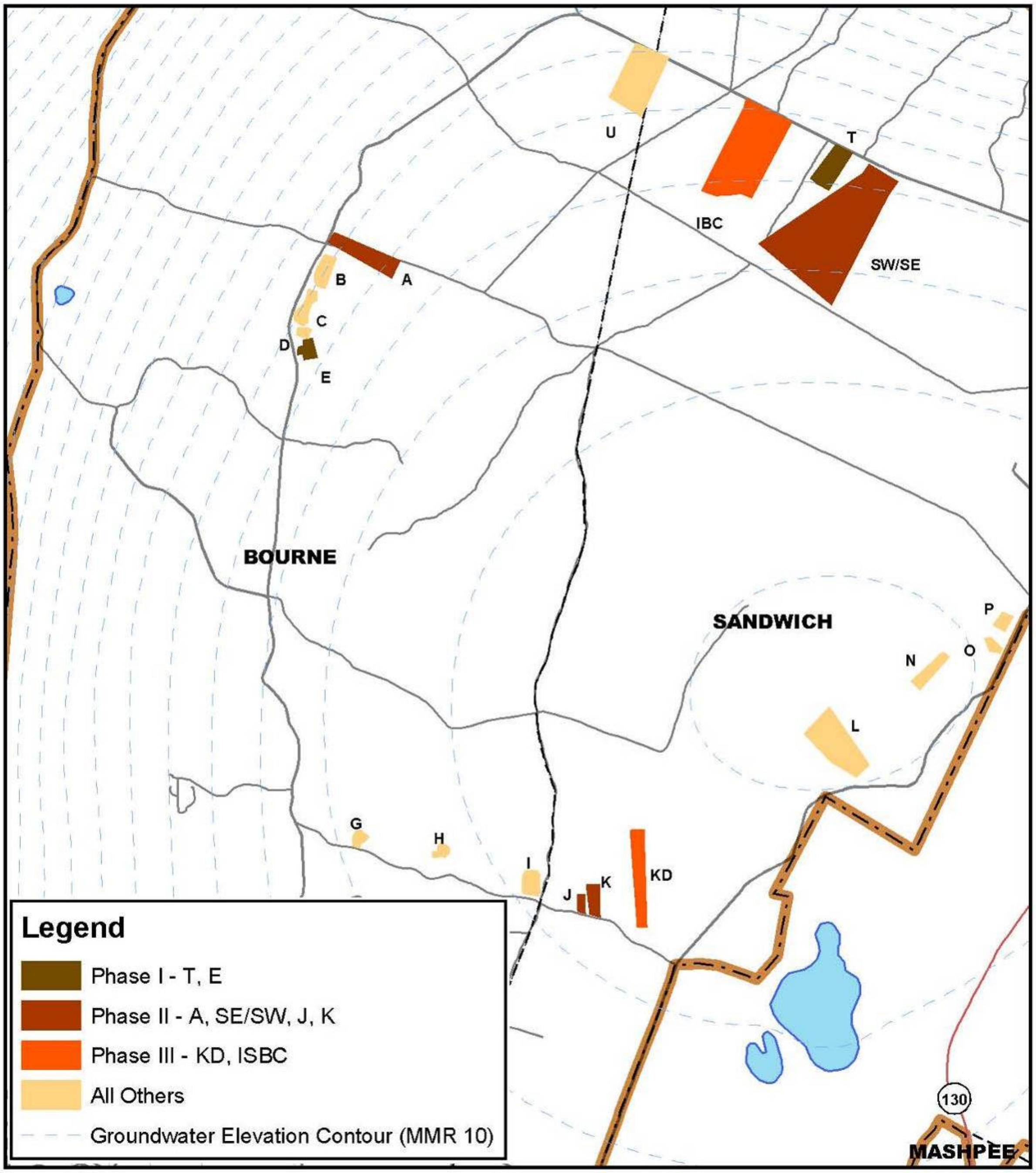

Figure 1-1. Small Arms Ranges and Phases for Return to Live Fire

1.2 Scope

This BMP OMM plan is limited to the operation and use of T Range. It supports the use of T Range as a fully operational 25-m Rifle/Machine Gun Zero Range [Facility Category Code (FCC) 17801] to meet current and anticipated requirements for small arms training exercises at Camp Edwards. Although this plan identifies specific BMPs for the management of metals to sustain operations at T Range, the scope of the BMPs addressed is not limited to typical environmental management options. It also includes BMPs for safe and efficient administration, use, management, and maintenance. The analysis of alternative approaches for sustainable operation of T Range and the BMPs recommended in this plan are based on range-specific conditions and are not intended to apply to other SARs at Camp Edwards or on other Army or Department of Defense (DoD) installations or ranges.

1.3 Background

T Range represents the highest priority and is first in the sequence of SARs that Camp Edwards seeks to bring on-line to support small arms marksmanship training. Although it has historically supported many training requirements, in the future it will be used as a standard 25-m Rifle/Machine Gun Zero Range primarily in support of training with M16 and M4 rifle and M249, M240, and M60 machine guns.[1]

1.3.1 Historical Use

T Range has historically supported multiple training requirements. In the late 1980s, T Range was an assault course where primarily blank ammunition was used. In 1990 or 1991, MANG began using T Range to familiarize soldiers with firing the .50 caliber M2 machine gun using plastic bullets. In the early 1990s MANG also began using T Range to support pistol marksmanship training. 9mm lead-bullet ammunition was fired until banned in 1997. Subsequently, military and civilian law enforcement personnel fired frangible (copper and/or tungsten powder composite) bullets in .38 caliber, 9mm, and .40 caliber on T Range. A small amount of 12 gauge shotgun ammunition was also fired on T Range.

T Range has two distinct firing lines. The first firing line is 76.2 meters (m) long and consists of 6 large (approximately 6.7 × 12.2 × 2.4 m) mounds, on top of which are 2 foxholes each, totaling 12 elevated machine gun firing positions. In the middle of the six mounds, next to the range tower, is a hardened maintenance trail that allows for mounted machine gun firing from a parked tactical vehicle. The second firing line is 43.9 m long with 15 firing positions and sits 15.2 m in front of the machine gun firing positions.

[1] FCC 17801, 25-m Rifle/Machine Gun Zero Range, can also be used to support pistol marksmanship and as an alternate qualification course for M16.

1.3.2 Environmental Drivers

For MANG to resume effective small arms training, two significant legal drivers define the path forward; they are EPA Region 1 Administrative Order 2 (AO2) issued to MANG in 1997 and Massachusetts Chapter 47 of the Acts of 2002.[2]

Appendix A, Section II.E of AO2 states the following conditions and requirements for the resumption of prohibited training activities. "If…EPA approves resumption of Respondents' activities at the Training Range and Impact Area, Respondents shall ensure maximum feasible use at such time of pollution prevention technologies in any training activities. Specific measures to be evaluated by Respondents include the following:

- Use of non-toxic lead-free combat ammunition;
- Use of bullet traps at all small arms ranges;
- Use of munitions-capturing material, such as 'Sacon';
- Use of non-exploding artillery and mortar rounds; and
- Development of guidances for the operation and maintenance of the ranges consistent with the pollution prevention strategies."

With regard to the resumption of small arms marksmanship training, Chapter 47 of the Acts of 2002, Section 10(d), states the following: "After consultation with the science advisory council and the community advisory council, the commission may adjust environmental performance standards based upon sound and accepted scientific analysis, monitoring data and other relevant information. The proponent of any adjustment shall bear the burden of justifying the proposed adjustment and demonstrating that the proposed adjustment is protective of the drinking water supply and wildlife habitat."

MANG, in its endeavor to meet the requirements of these two legal drivers, is following the tenants of the Army's Strategy for the Environment—Mission, Environment, and Community. MANG development of a SAR P2 Overview to provide the management strategy for Camp Edwards SARs and identify range-specific BMPs to prevent the migration of pollution to the water supply and sensitive natural resources fulfills the requirements of both of the drivers.

As such, this plan identifies potential pathways for migration of, and potential exposure to, contaminants from T Range. Environmental management and P2 BMPs are analyzed and selected based on their ability to disrupt the pathways to potential receptors. The selected BMPs for T Range are described in this plan. Prior to beginning marksmanship training on T Range,

[2] AO2 was issued in April 1997 following AO1, issued in February of that year. AO1 required the NGB to investigate sources of contamination potentially from the training ranges and Central Impact Area. AO2 required that Camp Edwards cease certain training activities (e.g., firing lead small arms ammunition, artillery fire, and mortar fire) pending environmental investigations. These activities are still prohibited.
Chapter 47 of the Acts of 2002 codified a Memorandum of Agreement, ensuring permanent protection of the drinking water supply and wildlife habitats in the Reserve/Training Area, while allowing compatible military training. It created the EMC, to oversee compliance with and enforcement of Environmental Performance Standards and environmental laws and regulations within the Reserve/Training Area.

Camp Edwards will present this BMP OMM plan to EMC and EPA for review and approval. The BMP OMM plan will also be sent to MassDEP for review and coordination as part of the SAR working group; however, state approval would be through the EMC.

1.4 Roles and Responsibilities

To implement this BMP OMM plan, Camp Edwards will involve a team of experts to manage training operations, facility maintenance, and environmental protection functions.

1.4.1 Training Site Commander

The Training Site Commander is responsible for the overall operation of Camp Edwards to include the immediate supervision, control, coordination, and safety of all Camp Edwards' facilities and promotion of mission compatible and environmentally sustainable uses of Camp Edwards resources.

1.4.2 Director of Plans and Training

The Director of Plans and Training (DPT) is the primary advisor to the Training Site Commander on all matters concerning the safe, efficient utilization of Camp Edwards' training facilities. Within the overall responsibility for Range Control operations, the DPT will:

- Provide review, comments, and approval of the SAR P2 Overview and individual range BMP OMM plans;
- Identify and program for range modernization, operations, and maintenance requirements based on training load and doctrine; and
- Include requirements within the SAR P2 Overview and individual range BMP OMM plans for planning and budgeting actions as appropriate for sustainable OMM of ranges.

1.4.3 Range Control Officer

The Range Control Officer is the primary representative of the Training Site Commander at Range Control and, as such, will:

- Coordinate the generation of range modernization requirements and oversee range modernization projects;
- Control access to ranges;
- Schedule and issue ranges to using units and clear/close out units upon completion of range use;
- Coordinate operation of ranges and oversees using units while training on Camp Edwards ranges;
- Enforce applicable guidance and regulations, range standard operating procedures, and safety requirements;
- Conduct periodic inspections of range conditions and identify requirements for repair and maintenance;
- Coordinate the repair of damage to range facilities (e.g., bullet containment systems);

- Collect Range utilization reports from using units; and,
- Maintain range utilization, inspection, repair, and maintenance records.

1.4.4 Director of Facilities Engineering

The Director of Facilities Engineering (FE) is the primary representative of the Training Site Command for accomplishment of facility sustainment, restoration, and modernization and, as such, will:

- Coordinate necessary maintenance on SARs to include:
  - Periodic lead removal from SAR berms and other bullet containment systems that are integral to the range facility;
  - Repairing damaged range facilities (e.g., bullet containment systems); and,
  - Repairing erosion damage to firing points, target areas, berms, and other range areas;
- Coordinate necessary maintenance on all training support facilities on ranges (e.g., bleachers, parking areas, buildings).

1.4.5 Environmental and Readiness Center

The Environmental and Readiness Center (E&RC) is the primary representative for the Training Site Commander for accomplishment of sustainable environmental management requirements. To support the return and sustainment of small arms training at Camp Edwards in accordance with environmental agreements, orders, and regulatory and legal requirements, the E&RC will:

- Make adequate professional personnel resources available to the DPT and Range Control Officer to oversee or review implementation of P2 or pollution control BMPs;
- Coordinate with the Range Control Officer and FE to support the recovery, management, recycling, or disposal of metals from ranges in accordance with DoD guidance and federal and state solid waste regulations, as applicable;
- Conduct periodic reviews of range BMP OMM plans;
- Coordinate with MANG Environmental personnel, both full-time and part-time, to conduct periodic inspections of T Range to ensure compliance with the BMPs;
- Coordinate required environmental sampling and monitoring on ranges; and
- Responsible for day-to-day coordination with the EMC, EPA, MassDEP, and other appropriate federal, state, and local environmental resource protection agencies to monitor concerns with SAR operations.

2.0 TRAINING DESCRIPTION

Small arms training conducted at Camp Edwards may vary per using unit depending on the unit's mission and the types and amounts of training required to maintain proficiency in mission essential tasks. This section describes training types and amounts anticipated on T Range. It also describes range use procedures and restrictions that support safety and protection of human health and the environment.

2.1 Training Capabilities

Camp Edwards' current training requirements include the need for small arms familiarization, zeroing sights, marksmanship practice, weapons qualification, and small unit tactics. Table 2-1 provides basic descriptions of various types of small arms weapons training. The Army specifies certain range types to conduct these tasks for different weapons systems. The Army also specifies the number of repetitions needed to become proficient in each task. Camp Edwards must have a sufficient number of ranges to accommodate the throughput requirements for all soldiers, weapons systems, and training types.

Table 2-1. Small Arms Weapons Training Terms

Term	Description
Weapons Familiarization	Weapons familiarization is instruction in the components, operation, proper use, and safe handling of firearms.
Zero	Zeroing aligns the sights with the barrel so that the point of aim equals the point of impact for a given ammunition load.
Practice/Marksmanship	Marksmanship training by which soldiers learn to accurately fire a given weapons system. It allows soldiers to attain and maintain proficiency in engaging targets with the weapon.
Transition	Transition firing provides the gunner the experience necessary to progress from short range firing at fixed targets to field firing at various target types and longer ranges. The gunner experiences and learns the characteristics of fire, field zeroing, range determination, and engaging targets in a timed scenario. Transition firing is conducted on specific types of ranges and is scored to provide the gunner with feedback.
Record Fire/Qualification	Record fire requires a gunner to complete several phases of firing tasks to qualify to operate a particular weapon. Record fire is scored to provide the gunner with feedback and to record the gunner's qualification.

As a 25-m Rifle/Machine Gun Zero Range with 15 firing lanes, T Range is designed for training shot-grouping and zeroing exercises with pistols, rifles, and machine guns. Training tasks will include weapons familiarization, zeroing, practice marksmanship, and alternate qualification (see Section 2.1.1). Soldiers will develop the skills necessary to align the sights and practice basic marksmanship techniques against stationary targets (Headquarters Department of the Army 2006).

Adjacent to the parking area, there is a row of elevated former firing positions approximately 76 m long. There are 6 large mounds, approximately 7 × 12 × 3 m in size, with 2 foxholes on the top of each mound. This firing line will no longer be used. The elevated mounds will be left in place, and the foxholes will be filled in. The Range Control Officer or authorized designee will monitor training to ensure these elevated positions will not be used. The elevated mounds will direct access and egress to the firing range and will allow observation of weapons training. Signage will be place on top of the mounds that indicate "Firing from the Mounds is Prohibited." These mounds will be vegetated and managed for erosion control.

The firing line at T Range is 44 m long with 15 firing positions and is situated 15 m in front of the elevated mounds. There are 15 wooden framed target holders placed 25 m downrange from the firing line. Soldiers will expend all ammunition from the designated firing positions along the firing lines downrange to the targets. No weapons will be discharged forward of the firing lines, across firing lanes, or at an angle of fire inconsistent with bullet trajectory through the target holder and into bullet containment systems (MANG 2006). In addition to the requirements of this plan, all firing on T Range will be conducted in accordance with Camp Edwards Regulation 385-63, which is summarized below in Section 2.1.3. Figure 2-1 depicts the bullet path from the firing line on T Range.

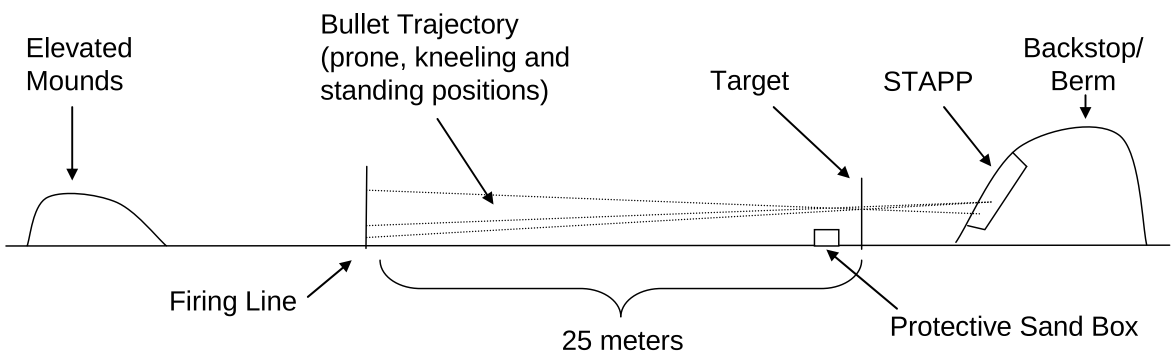

Figure 2-1. Basic Lateral View of T Range

The ground level firing line allows users to zero rifles and machine guns and conduct marksmanship training with these weapons systems. Users may also zero and practice pistol marksmanship at the firing line.

T Range can also be used as an alternate range for M16 and M4 qualification using scaled targets; although, the use of this range for qualification is suboptimal. Scaled targets simulate firing at longer ranges by using reduced image size and perspective (see Figure 2-2).

Figure 2-2. Scaled Target

2.1.1 Training Types/Exercises

The primary use for T Range, as a 25-m Rifle/Machine Gun Zero Range is training shot-grouping and zeroing exercises with 5.56mm and 7.62mm rifles and machine guns. 25-m Rifle/Machine Gun Zero Ranges are used to train soldiers on the skills necessary to align the sights and practice basic marksmanship techniques against stationary targets (Headquarters Department of the Army 2006). This type of range can also be used as an “alternate course” to qualify on the M16 and M4 with scaled targetry. Finally, it can also support basic pistol familiarization, zeroing, and marksmanship training.

During a training exercise, a unit occupies the range for 1–5 days. The length of the unit’s occupation depends on the training goals for that exercise. After checking out the range from Range Control, the designated Range Safety Officer (RSO) delivers any requisite safety and/or environmental announcements (see Section 6.1.2). The unit erects a small covered space with a folding table that acts as a desk for the records (e.g., ammunition log). The safety officer distributes ammunition to each soldier, notating rations in the records log.[3] No training is permitted forward of the firing line.

Familiarization exercises include a review of the weapon’s basic components, applicable ammunition, and any firing attachments. Soldiers learn safe operating procedures for clearing ammunition from the chambers, function check, and inspection. Maintenance lessons include cleaning, lubrication, and preventive procedures to keep the weapon in combat-ready operation. Soldiers learn how to load and unload ammunition, adhering to safety procedures. Familiarization can be conducted at the firing line or in the assembly area.

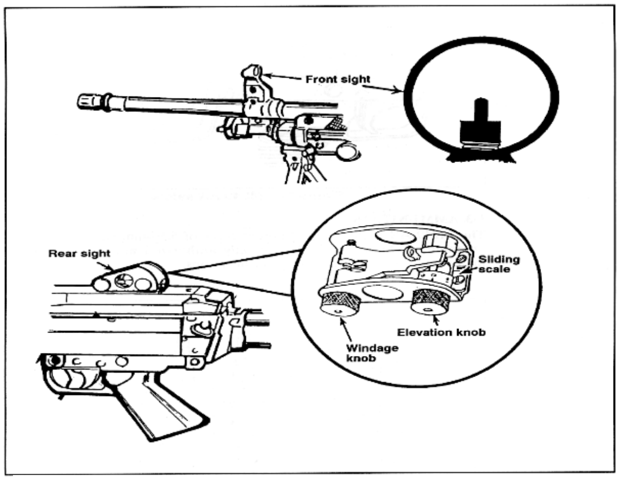

Figure 2-3. Front and Rear Sights

Zeroing is one of the most basic and universal training tasks for small arms marksmanship. During zeroing, one soldier occupies each of the 15 positions along the second firing line. To set the sights, soldiers learn the turns required of the windage knob or peep sight for accuracy. Having mastered those basics, soldiers move onto the adjustments required to engage targets at various ranges (elevation) (i.e., 25 m, 100 m, etc.). Rotation of the elevation knob toward the muzzle (front of the weapon) increases the range, whereas rotation toward the buttstock (back of the weapon) decreases the range (see Figure 2-3). Fine adjustments for zeroing are made by adjusting the peep sight. T Range is a 25-m range, so units utilize scaled targets to depict targets beyond 25 m (see Figure 2-2). These scaled targets have smaller silhouettes to represent targets that are farther away.

[3] At the end of the exercise, soldiers return unused ammunition. The safety officer subtracts the number of rounds returned from the amount distributed to record the munitions expenditure. The unit turns in this record to range control upon check out proceedings.

Marksmanship training is divided into three phases: preliminary, basic, and advanced. Skills trained in the preliminary phase include the practice of steady position, aim, breath control, and trigger control. For example, breath control is practiced when the user inhales, places his/her finger on the trigger while holding the breath, and then releases that breath when shooting. This basic skill controls the shooter's firing rate and promotes accuracy. The basic phase applies these fundamentals in day and night cover conditions. The advanced phase trains the soldier in combat techniques of fire and techniques of employment.

The objectives of marksmanship training are:

- Accurate initial burst. Obtaining initial burst of fire on the target is essential to good marksmanship. This requires the rifleman to estimate range to the target, set the sights, and apply the fundamentals of marksmanship while engaging targets.
- Adjustment of fire. The rifleman must observe the strike of the rounds when the initial burst is fired. If not on target, the soldier must manipulate the weapon for accuracy.
- Speed. Speed is essential and is an acquired skill gained through extensive training. Speed should not be stressed to the detriment of accuracy (Headquarters Department of the Army 1985).

2.1.2 Weapons Systems and Ammunition Types

T Range will be used primarily for zeroing the 5.56mm rifle (M16 and M4) and machine gun (M249) and 7.62mm machine gun (M240 and M60). T Range may also serve as an alternate range for training on all calibers (i.e., .22, .357, .38, .40, 9mm, .45, .44) of pistols. The most frequently fired pistol caliber on T Range, by both law enforcement and military, is the 9mm (M9). A more detailed discussion of ammunition types potentially used on T Range and an evaluation of potential usage of "non-toxic lead-free combat ammunition" is included in Section 4.1.

2.1.3 Use Procedures and Restrictions

Camp Edwards Regulation 385-63 outlines extensive rules and procedures for the ranges and training lands on Camp Edwards (MANG 1997). It notes that, "Users are to minimize environmental disturbance to protect the ecosystem as well as preserve the long-term value of our training site." Applicable subsections of this manual that apply to T Range are:

- Section 2-3, Safety and Environmental Briefing
- Section 2-5, Ammunition, Demolition, and Pyrotechnics Restrictions
- Chapter 3, Environmental Considerations
- General Training and Environmental Protection Approvals and Conditions

Range Control personnel are well-versed with this regulation and educate RSOs during the scheduling and issuance of ranges to using units. Camp Edwards' personnel oversee and assist the training conducted on T Range and evaluate whether training is conducted in accordance with operational, safety and environmental requirements, see Section 6 for additional OMM procedures relevant to environmental BMPs. Camp Edwards will update Regulation 385-63 to resolve any inconsistencies with the requirements of this BMP OMM plan. All such inconsistencies will be identified prior to range use.

Before occupying T Range, the unit must designate an RSO who will receive a safety briefing. The briefing informs units of the installation's restricted areas (impact area, forward of the firing line at any range), prohibitions of mortar and artillery munitions and pyrotechnics, misfire and malfunction procedures, communication procedures, and environmental considerations. Procedures directly related to environmental protection include:

- Units must conduct any vehicle maintenance on paved or concrete parking areas. No vehicle maintenance will be conducted on T Range.
- Weapons maintenance, cleaning, and lubrication will be conducted in a manner that minimizes the potential for release of solvents or lubricants to the environment.
- Units will dispose of empty containers or waste rags, patches, and cleaning materials per the Camp Edwards Hazardous Material and Waste Management Plan (HMWMP). Specifically, units will be issued a waste receptacle when checking into a range. All cleaning supplies and oily rags generated on the range will be collected in the receptacle, which will be returned to Range Control upon check out. Range control will establish a satellite accumulation point for these wastes. Upon accumulation of 55-gallons of such waste, it will be disposed of per the Camp Edwards HMWMP and in compliance with all State and Federal Solid and Hazardous waste requirements.
- Units will use portable latrines.
- Units will avoid wildlife and damage to wildlife habitat.
- Units should take precautions for ticks.
- Soldiers will expend all ammunition from the designated firing positions along the firing line downrange to the targets. No weapons will be discharged:
  - Forward of the firing line or across firing lanes; or,
  - At an angle of fire inconsistent with bullet trajectory through the target holder and into bullet containment systems.
- Units must get approval from Range Control prior to employment of tracer ammunition on T Range.
  - The delinking of tracer rounds is not authorized (MANG 1997). For details regarding the use of tracer rounds on T Range, see Section 4.1.1 under Standard Combat Lead-ball Bullet Ammunition.
  - All fire (particularly tracer fire) will be observed by Range Control Officer (or authorized designee) to evaluate whether bullet flight is through target holders and into bullet containment systems and whether training is conducted in accordance with these applicable procedures.

2.2 Training Capacity

For planning purposes, MANG has estimated the throughput capacity of T Range. The throughput capacity of a range is the maximum number of soldiers or units that it can accommodate in a given period of time. The calculations provided below represents the maximum number of soldiers that could be trained on T Range given the stated assumptions and default values. Calculation of throughput capacity is based on the type of training, the time required for a single individual or unit to complete a training event or series of events, and the period of time (day, week, month, year) that applies. Throughput calculations for some types of ranges may also include the number of soldiers or units that can train simultaneously.

The daily throughput capacity of T Range (25-m Rifle/Machine Gun Zero Range) with 15 lanes is estimated as follows[4]:

Number of lanes: 15

Time required for one soldier to complete firing: 30 minutes or 2 soldiers/hour

Time available for training: 8 hours/day

Number of soldiers per hour: 15 lanes x 2 soldiers/lane/hour = 30 soldiers/hour

Maximum throughput capacity = 30 soldiers/hour x 8 hours/day = 240 soldiers/day

To obtain the annual capacity, multiply the daily capacity by the number of days available for training:

Maximum daily throughput capacity = 240 soldiers/day

Days available for training: 280 (estimated)

Maximum annual throughput capacity = 240 soldiers/day x 280 days/year
= 67,200 soldiers/year

The calculation above represents a theoretical maximum of 67,200 soldiers per year using T Range. MANG does not foresee this level of training usage on T Range because MANG has approximately 6,000 soldiers, of which some are deployed or training elsewhere. The following sections examine a conservative number of soldiers and related munitions expenditures.

[4] The calculation of throughput capacity is an estimate for planning purposes only. It is not intended to establish a limit on the utilization of T Range. Adjusting any assumed value (e.g., hours of training/day, number of training days/year), will increase the throughput on T Range.

Assuming each of MANG's 6,000 soldiers would train and qualify with the standard issue M16 or M4 rifle, each soldier would require 98 rounds of 5.56mm ammunition per year. If all of these soldiers were to train and qualify on T Range, the training load could be estimated as follows:

Estimated number of soldiers = 6,000 soldiers/year

Ammunition issued = 98 rounds of 5.56mm ammunition per soldier allocation per year

Estimated ammunition load on T Range = 6,000 soldiers/year x 98 rounds of 5.56mm ammunition = 588,000 5.56mm rounds/year

This is a conservatively high estimate of munitions firing level because MANG estimates that at any given time 1,500 soldiers are deployed and not training and 1,000 soldiers are qualifying at other installations. Although this calculation does not account for variations in the types and calibers of weapons systems and ammunitions that could be fired on T Range, it does provide insight into the total firing load that T Range could experience.

Table 2-2 contains ammunition expenditures from 1994 to 2004 on all Camp Edwards SARs where 5.56mm (M16 and M4) rifle and (M249) machine gun, 7.62mm (M60 and M240) machine gun, and pistols were fired. The table includes expenditures (for relevant calibers) from B, C, D, E, G, H, I, J, K, N, O, P, and T Ranges.

Table 2-2. Historical Ammunition Usage

Training Year[5]	Training Days	5.56mm Tung	5.56mm Plastic	5.5mm6 Lead	7.62mm Lead	.45 Lead/ Frang[6]	.40 Lead/ Frang	.38 Lead/ Frang	9mm Lead/ Frang
2005	43	106,771	0	0	0	0	0	0	5,552
2004	58	125,990	11,242	0	0	2,700	4,750	2,150	22,320
2003	66	235,580	0	0	0	3,900	2,900	0	10,750
2002	49	147,053	20,752	0	0	3,880	3,000	0	6,000
2001	49	75,217	26,210	0	0	6,651	38,747	0	16,233
2000	42	69,473	46,250	0	0	6,630	8,650	0	5,550
1998	36	0	131,056	0	0	0	0	0	0
1997		0	44,757	215,461	34,894	0	24,172	21,031	202,660
1996		0	0	365,836	64,207	11,165	79,557	62,279	388,956
1995		0	0	531,665	64,541	7,860	66,850	85,003	488,920
1994		0	0	532,900	99,118	68,224	5,915	65,983	454,220
TOTAL	**347**	**760,084**	**280,267**	**1,645,862**	**262,760**	**111,010**	**234,541**	**236,446**	**1,601,161**

Note: 1997 was the last training year that training with lead-bullet ammunition was permitted on Camp Edwards

MANG will track and report the actual amount of ammunition fired on T Range annually. The following information will be collected each time T Range is in use: total number of personnel trained, the weapon systems used, the type of ammunition, and the number of rounds expended will be collected each time (See Appendix A, Training Facility Utilization Report).

[5] Training year is a fiscal year, October to September.
[6] Pistol fire prior to 1998 used lead-core ammunition. After 1998 pistol fire was conducted primarily using frangible bullets.

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3.0 CONCEPTUAL SITE MODEL

The Conceptual Site Model (CSM) is a description of a site and its environment based on existing knowledge. It is used to develop site-specific hypotheses regarding the location and movement of environmental pollutants and any potential interaction (exposures) with humans and other environmental resources. The basic components of a CSM are the source, pathway, and receptor.

This CSM evaluates exposure pathways for which BMPs must be selected and implemented to protect human health and the environment. The CSM supports the feasibility evaluation of BMPs (i.e., alternative ammunition and bullet containment systems) in Section 4.2 and the development of OMM procedures in Section 6. Although a STAPP^{TM} bullet containment system is currently installed on T Range, this CSM evaluates theoretical sources, pathways, and receptors of contaminants assuming no such BMPs are in place.

Figure 3-1 provides a pictorial representation of the general CSM for theoretical metals migration from T Range with no BMPs in place. The pictorial CSM also depicts theoretical exposure via multiple media and mechanisms. It is used to identify the potential migration and exposure pathways for which BMPs must be developed and implemented. Descriptions of potential sources, pathways, and receptors are provided in the following sections.

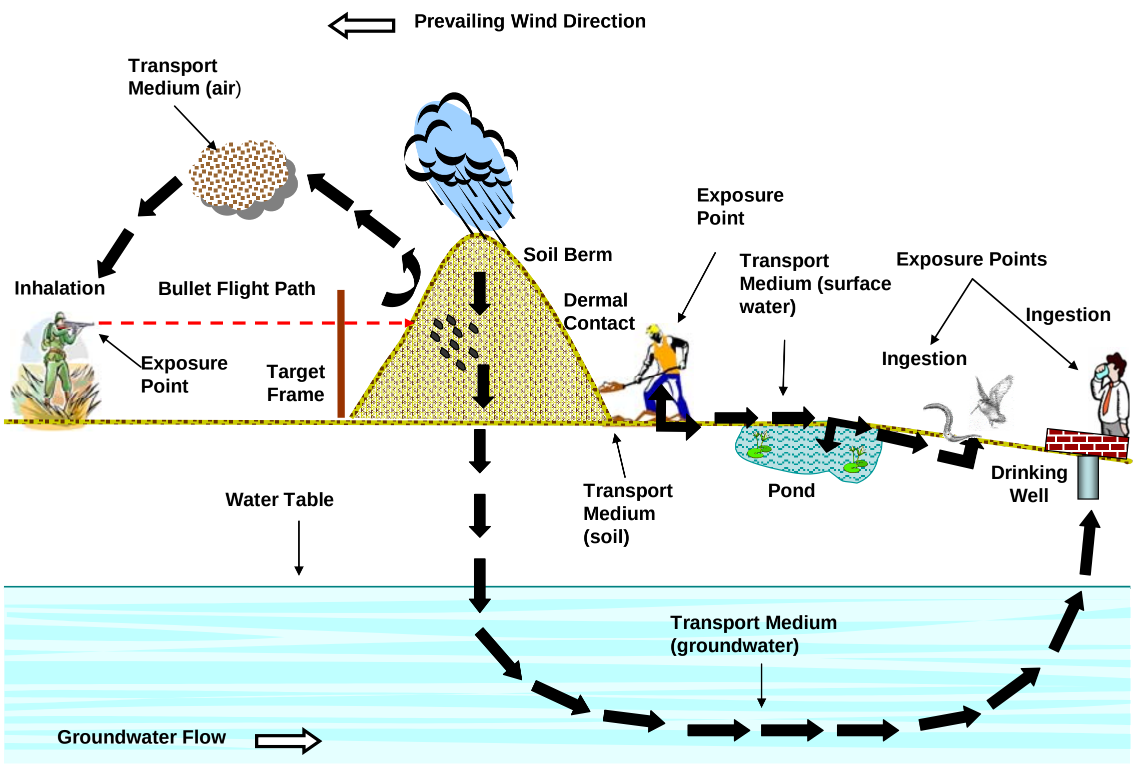

Figure 3-1. Pictorial Presentation of SAR CSM

3.1 Sources

On T Range, metals (typically lead) originate from small arms weapons fire. Metals are deposited into the environment through muzzle blast or bullet deposition on the range floor or into the berm on T Range. Bullets fired into the range berm or deposited on the range floor may remain somewhat intact or may fragment if they strike rocks or other hard materials. Bullets may also strike other bullets previously deposited on the range, causing pulverization. Small particles are more susceptible to transport mechanisms than intact bullets because of their lower mass and higher relative surface area exposed to weathering. Metals released from the muzzle blast may be entrained in the air and trace amounts may fall out to surface soils, becoming available to transport mechanisms other than air. While observing weapons firing, particularly night fire with tracer ammunition, range control personnel can see trajectories, points of impact, and ricochets[7]. The amount of rounds impacting in front of the bullet containment system or ricocheting away from the bullet containment system is indicative of the system's effectiveness at containing rounds fired.

The muzzle blast associated with small arms fire may also release residual energetic materials, primarily nitroglycerin/nitrocellulose[8], from propellants. Trace amounts of unconsumed propellant can be entrained in the air and fall out to surface soils. Deposition of propellants occurs primarily at the firing line. See Appendix B for a detailed listing of compounds within each type of ammunition.

Table 3-1 summarizes the total metals loading rates assuming the training load described in Section 2.2 (i.e., 588,000 rounds of 5.56mm ammunition) and the standard issue military service ammunition. If alternative training ammunition is employed by military units or civil law enforcement, these amounts may vary.

Table 3-1. Annual Metals Loading (Source Term) for CSM on T Range[9]

Munitions Constituent (kg)	Mass (lbs)
Lead	1,452.58
Copper	600.10
Antimony	14.67

[7] Tracers use special bullets that are modified to accept a small pyrotechnic charge in their base. When they are ignited upon firing, the composition in the tracer burns brightly to make the projectile visible to the naked eye. This allows the shooter to follow the bullet trajectory relative to the target in order to make corrections to their aim. See Section 4.1.1 for more information regarding use of tracer ammunition on T Range.

[8] As of 2007, nitrocellulose is not regulated at the state or federal level. There are no health advisories for nitrocellulose. Camp Edwards is self-imposing the monitoring of nitrocellulose based on discussions with the Small Arms Working Group.

[9] Assumes specifications for 5.56mm (M193), 7.62mm (M80), .45 cal (M1911), .38 cal (M41), and .40 cal and 9mm (M882) (MIDAS 2002).

3.2 Potential Pathways

3.2.1 Surface and Subsurface Soil

Bullets deposited into the range berm may become fragmented when striking rocks upon impact or from impacts of other subsequent bullets. Trace amounts of metals and propellants from muzzle blasts may be deposited on the range floor. These particles may adsorb to surface soil. "Once introduced into the environment, metallic lead oxidizes (rusts) resulting in the formation of lead salts on the metallic lead surface (Scheetz 2004). Rainfall encountering the lead salts dissolves a small portion, which can travel with the infiltrating water into the soil. The solubility of the salts is low, which limits mobility. Any remaining dissolved lead reacts with the soil matrix resulting in the precipitation of various less-soluble lead species and sorption of lead onto soil particle surfaces. The capacity of soil for lead sorption is not infinite, but in some cases, the mass of lead introduced into the environment and subsequently dissolved is negligible compared to the sorptive capacity of the soil" (Clausen, et al 2007).

"Camp Edwards surface soils are coarse-grained and typically classified as sandy loams and loamy sands. These soils permit rapid recharge of percolating water and facilitate air exchange with the atmosphere" (Clausen, et al 2007). The permeability of the sandy soil on-site seems to indicate that dissolved metals may move vertically (downward) from surface to subsurface soils rapidly, as surface water would. However, soil conditions on Camp Edwards are not sufficiently acidic to readily dissolve metallic lead. The soils have very little organic matter and pH values ranging from 6.2 to 7.4 with a median pH value of 6.5. The soil and groundwater conditions are aerobic at Camp Edwards (Clausen, et al 2007). Actual pH values recently measured on T Range are between 5.9 and 7.4, with a pH median value of 6.4[10] (Impact Area Groundwater Study Program [IAGWSP] 2007). Other geochemical conditions present at Camp Edwards within the surface soils (e.g., chloride, resistivity, permeability, and oxygen) are not conducive for significant corrosion, dissolution, and transport of lead either. "There are two principal reasons corrosion processes are inhibited at Camp Edwards: lack of chloride and coarse soil texture. Chloride is the most important naturally occurring anion with regard to metal-corrosion and its content in Camp Edwards' soils and water is low" (Clausen, et al 2007).

The typical activities of range users, such as soldiers walking on the range and crews conducting maintenance and repairs, may disturb the soil. These users and range workers have the potential to move metals-tainted soil on and off the range. The sandy soil on T Range is highly erodible. Sandy soils on the berm or range floor at T Range, to which metal particles may have adsorbed, are more likely than loamy or clay soils to erode during severe precipitation, which is often experienced at Camp Edwards. However, the low gradient (relatively flat topography) of the area should limit the distance that eroded soil travels. Minor erosion of storm water control swales was noted during operational and environmental assessments of T Range (MANG 2007).

Nitroglycerin and nitrocellulose deposited in surface soils, primarily at the firing line, may be transported through erosion or by soil disturbing activities of range users and range maintenance workers. Nitroglycerin is slightly soluble in water; therefore, it could be transported vertically to subsurface soils.

[10] IAGWSP determined pH at T Range during a recent sampling event in April 2007.

Multiple soil profile samples collected prior to and after remediation from six different SARs on Camp Edwards indicated little vertical migration of lead in soils. The mobility and bioavailability of other metals that do corrode in these conditions will be limited by the adsorptive capacity of the sandy soil. Limited corrosion processes and the soil's ability to adsorb metals will limit the dissolution and migration of metals from surface soils to subsurface soils.

3.2.2 Surface Water

Bullets that have been pulverized into small metal particles theoretically could dissolve when exposed to precipitation and, in this form, would be available for transport via storm water runoff. Trace amounts of metals and propellants from muzzle blast that have fallen onto surface soils would also be available for transport via surface water runoff.

Storm events with intense downpour are common to Camp Edwards and produce significant amounts of rainfall that could potentially transport dissolved metals, metal particles, or trace energetic materials. Swales in the range floor on T Range allow surface water and suspended or dissolved metals to flow from the east side of the firing points downrange toward the west side of the targets. The nearest body of surface water is a pond located near SW Range, located approximately 1,100 m east of the range boundary. Therefore the potential for metals migration from T Range to a surface water body is highly unlikely because the distance between the firing line and the pond is so great. Additionally, the rate of surface water flow is low due to the relatively low gradient (flat topography) on T Range and the high permeability of the sandy soil on the site. The presence of low spots and limited storm water controls gives rain water the opportunity to pool on T Range, but this is largely offset by the highly permeable soils. Once again, "several mitigating factors such as the lack of chloride and coarse soil texture limit corrosion of metallic lead and subsequent dissolution of lead oxides at Camp Edwards" (Clausen, et al 2007). These factors will retard the transport of both dissolved chemicals and metal fragments via surface water.

3.2.3 Groundwater

The high permeability of sandy soil on T Range and the amount of rainfall common to Camp Edwards create the potential for dissolved metals in soil or surface water to percolate to groundwater. However, the highly permeable soils also limit the exposure of metals in surface soils to precipitation and limit corrosion and dissolution. The Camp Edwards Lead Assessment Study states "the principal conclusions are that corrosion and dissolution processes are sufficiently slow and mechanisms for attenuation, such as precipitation and adsorption, sufficiently robust, that lead has not migrated to groundwater" (Clausen, et al 2007). Furthermore, groundwater data collected from across Massachusetts Military Reservation (MMR) demonstrate that lead from firing on SARs has not contaminated groundwater despite significant and continuous releases of lead from weapons training and environmental exposures from one to several decades.

"A qualitative evaluation of lead migration suggests it could take centuries for lead to migrate to groundwater at Camp Edwards. A review of previously-performed modeling suggests the uncertainties in modeling lead migration are very large and the results overpredicted lead transport in one case. In the other case, modeling results suggested lead would not move appreciably from the SAR. Considering a key uncertainty is the concentration in unsaturated zone moisture, sampling with lysimeters is likely a very useful means of evaluating whether lead migration is occurring or whether the qualitative review indicating significant migration will not occur is sufficient" (Clausen, et al 2007).

Groundwater below T Range flows northwest at a rate of 1–2 ft/day. MANG understands the importance of not only protecting groundwater from lead contamination, but to also protect the vadose zone soils above the water table and the soil-pore water contained in this zone from lead contamination. All feasible pollution prevention measures and BMPs will be implemented to prevent contamination of the vadose zone soils at T Range. MANG will monitor the first 5 feet of soil-pore water for munitions constituents in the range areas most likely to be impacted: at the firing line and at the toe of the berm.

The mobility and bioavailability of metals that do corrode in this environment will be limited by the adsorption capacity of the soil. The factors discussed above indicate a low potential for metal deposited on the range floor to dissolve and percolate the 30 m below ground surface to reach groundwater.

3.2.4 Air

Metal and propellant particles released from muzzle blast and entrained in the air may potentially be transported via the air pathway. Deposition of these particles occurs primarily at the firing line. High wind speeds and gusts are common to T Range with the prevailing wind being westerly. Air transport of lead at firing ranges may account for the movement of more lead quantities than is generally perceived. However, dusts containing metal particles typically do not travel far from the immediate range area before being deposited back on the soil surface (Fabian 2005). Additionally, vegetation on the range and trees surrounding T Range make it less likely for wind to carry metal particles much beyond the range boundary.

3.3 Potential Receptors

3.3.1 Surface and Subsurface Soil

The low mobility of soil combined with relatively controlled range and site access restrict the potential human receptors via the soil pathway to range users, range maintenance workers, and occasional trespassers. Human on-site users, through normal range use, may potentially be exposed to metals in surface soil while conducting range activities. Ecological receptors, such as microscopic organisms, invertebrates, and flora, can potentially absorb metals into their systems through ingestion or absorption of metals from surface soils on T Range.

3.3.2 Surface Water

The high permeability of the sandy soil and limited corrosion processes on T Range make off-sight movement of metals via surface water very unlikely. Site access is relatively well controlled, and the potential for human exposure to on-range surface water, in the form of run-off or short lived pooling of precipitation, is restricted to range users and range maintenance workers. Human on-site users, through normal range use, may potentially be exposed to metals in surface water pooled on the range while conducting range activities. Potential ecological receptors may include soil microorganisms, invertebrates, or flora consuming or absorbing metal contaminated surface water that exists on or off range. The possibility exists for bioaccumulation as a result of these smaller organisms being eaten by higher order fauna.

3.3.3 Groundwater

Although it is highly unlikely, metals that potentially dissolve and leach to groundwater on T Range could move to the sole source aquifer beneath the site through advection and dispersion processes. The nearest drinking water supply wells, WS-2 and WS-3 for the Upper Cape Water Cooperative, are approximately 686 m northeast of the T Range boundary. T Range is hydraulically upgradient of these public water supply wells. Camp Edwards, and T Range specifically, sit above the Sagamore lens of the Upper Cape Water supply, which is 30–76 m thick and supplies water to off-site as well as on-site populations. These potential receptors include the populations of the Upper Cape towns of Bourne, Falmouth, Mashpee, and Sandwich, as well as to the towns of Barnstable and Yarmouth, the Barnstable County Correctional Facility, and the Massachusetts Military Reservation (MMR). The 102nd Fighter Wing water supply system provides water to base residents and to employees working in the general cantonment area of MMR (MMR 2005). Furthermore, MANG understands the importance of not only protecting groundwater from lead contamination, but to also protect the vadose zone soils above the water table and the soil-pore water contained in this zone from lead contamination. All feasible pollution prevention measures and BMPs will be implemented to prevent metals contamination of the vadose zone soils at T Range.

3.3.4 Air

Human and ecological receptors could potentially be exposed to metals in air (e.g., through entrainment of fugitive dust) on T Range. This transport and exposure mechanism is thought to only be viable to on-site receptors, such as range users, range operators, and maintenance personnel. Part of basic small arms training is breath control, whereby the user inhales, places his/her finger on the trigger, and releases that breath when shooting. This basic skill controls the shooter's firing rate and promotes accuracy. Releasing one's breath after firing the weapon may limit the ability for the soldier to inhale fugitive dust, even though the range user is a potential receptor (see Section 2.1.1).

Vegetation on range and trees surrounding T Range make it unlikely for wind to carry metal particles beyond the range boundary, likely preventing human off-site and ecological exposure. In 2006, the US Army Environmental Command (USAEC) evaluated the potential for human health effects to offsite residents breathing air emissions following the functioning (firing of one or more items) of the M855 (5.56mm), M80 (7.62mm), and M882 (9mm) ball cartridges. The risk assessments for each caliber concludes that receptors are safe as close as 300 meters for M855, 200 meters for M80, and 100 meters for M822 (Environmental Health Risk Assessment Program 2006). T Range is over 1,000 m from the installation boundary and the nearest off site receptor, making the potential air pathway to offsite residents highly unlikely.

3.4 Potential Source-Receptor Interaction

Figure 3-2 follows deposited metals through potential transport pathways from T Range. A complete exposure pathway includes all the following elements:

- A source and mechanism of release,
- A transport mechanism and exposure medium (e.g., water or soil), and
- An exposure (intake) route (e.g., ingestion or inhalation) to a receptor.

The absence of any of these elements results in an incomplete exposure pathway. A solid circle on the far right side of the figure represents a potentially complete pathway and exposure to humans on-site (range users, operators), humans off-site (community members), and/or ecological resources (flora/fauna).

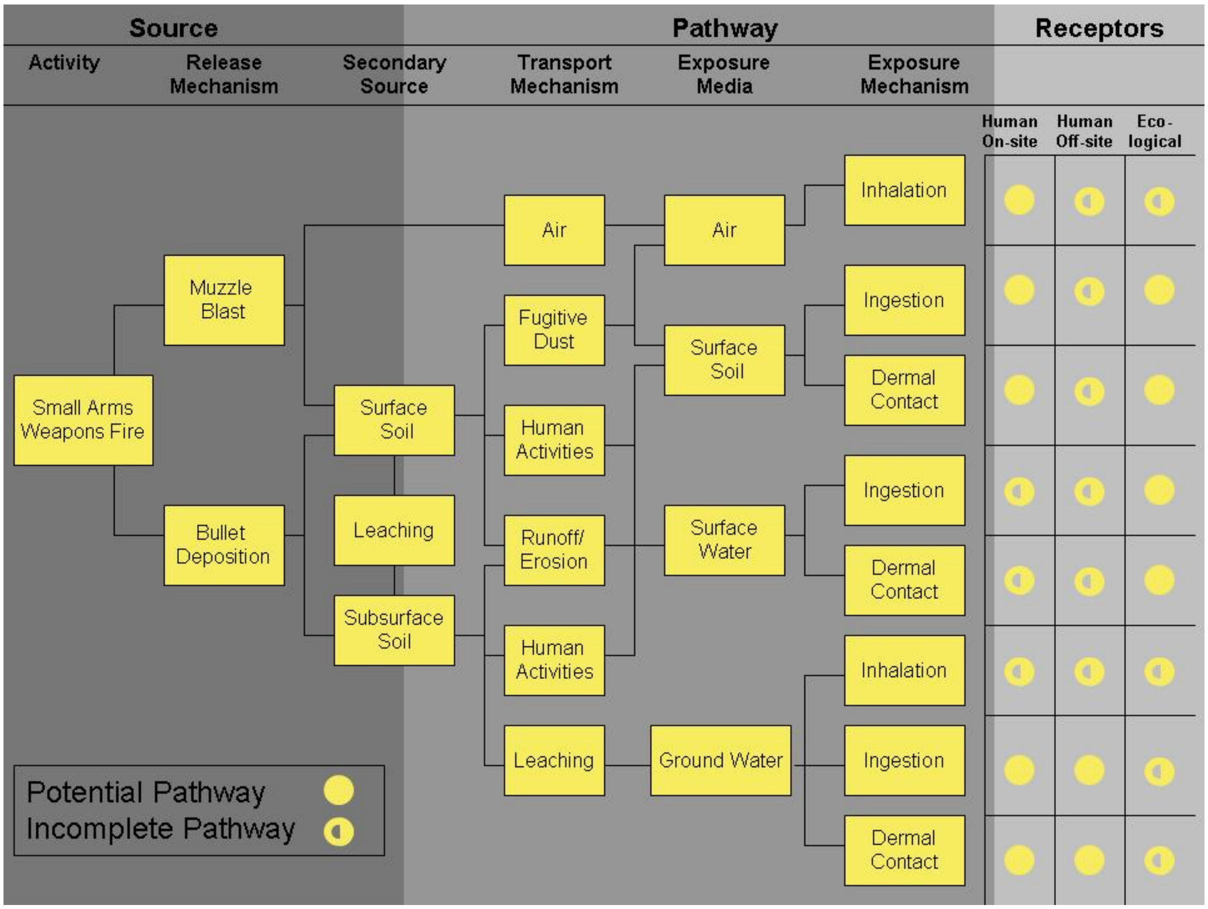

Figure 3-2. Graphic Presentation of T Range CSM

Based on the CSM for T Range, MANG has implemented a system of range upgrades and BMPs that will either sever potential pathways or monitor environmental conditions to confirm that pathways remain incomplete. MANG will manage metals on T Range at their source, through containment and periodic removal and recycling. The feasibility of such containment measures are evaluated in Section 4. MANG will monitor potential migration pathways, such as surface soil and groundwater, to evaluate whether metals are transported to receptors. The monitoring approach is described in Section 6.2.2. MANG will also implement a number of other monitoring and maintenance BMPs to sustain the conditions on T Range that limit metals mobility. These BMPs include maintaining healthy vegetation on range areas to prevent soil erosion, maintaining wind breaks to limit windborne metals transport, and maintaining soil pH to minimize corrosion/dissolution of metals into groundwater. These BMPs are described in Section 6.3.

3.4.1 Surface and Subsurface Soil

Normal activities of both range users and ecological receptors may potentially expose them to metals-contaminated soil through dermal contact and possibly ingestion. Any construction or maintenance work conducted on the range shall be completed in accordance with the site-specific health and safety plan that limits inadvertent exposure to contaminated soil (IAGWSP 2007). Erosion of large amounts of soil from T Range is unlikely because of the low gradient and vegetative cover on the range floor, downgradient area, and swales. Additionally, the nearest installation boundary is 2,225 m, making it highly unlikely for off-site human exposure via erosion of surface or subsurface soil.

Illegal trespassing, sometimes involving all-terrain vehicles with child drivers/passengers, has been observed on MMR. This activity is strictly prohibited, and if caught, violators are prosecuted. In this scenario, exposures of individuals to contaminated soils on T Range are assumed to be brief and acute. Soil contaminant concentrations that are acutely toxic could have a negative effect on the receptor.

3.4.2 Surface Water

The likelihood of metals transport via surface water from T Range is improbable. The nearest body of surface water is approximately 1,100 m from the range boundary, and range floor gradients do not promote high velocity drainage to off-range areas. Standing surface water on the range is also unlikely due to the high permeability of the sandy soil. The majority of storm water and precipitation on the range will percolate through the soil. Storm water that pools on the range or is transported off-range will contain very low quantities of dissolved metals because of the soil properties on site, as discussed in previous sections. These range conditions eliminate the potential for exposure for both human and ecological receptors via surface water.

3.4.3 Groundwater

It is very unlikely that residents of MMR and surrounding towns consuming or using water from the Upper Cape Water Supply Reserve beneath T Range will be exposed to metals. It is unlikely that metals from T Range will dissolve and percolate through soil to the aquifer because of soil properties previously discussed. The status of the Upper Cape Water Supply Reserve as the sole source of drinking water for a large population demands protection through a very conservative management approach. As such, MANG will manage the groundwater pathway as potentially complete for exposure of on-site and off-site users via ingestion. Potential exposure of ecological receptors to groundwater beneath T Range is limited to groundwater discharge to Shawme Lake, located 1,100 m hydraulically downgradient from T Range (MANG 2007).

3.4.4 Air

Because dusts containing metal particles typically do not travel far before being deposited on the range floor, the only possible air-receptor interaction is the inhalation of dusts by human on-site users conducting training activities or maintenance.

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4.0 FEASIBILITY OF POLLUTION PREVENTION BMPs

This section evaluates the feasibility of applicable P2 technologies to block the potential pathways cited in Section 3.4. Per the requirements of AO2, MANG must “ensure maximum feasible use…of pollution prevention technologies.” In particular, EPA requested that the following measures be evaluated:

- Use of non-toxic lead-free combat ammunition;
- Use of bullet traps at all SARs;
- Use of munitions-capturing material, such as shock absorbing concrete (SACON);
- Use of non-exploding artillery and mortar rounds; and
- Development of guidance for the OMM of the ranges consistent with the P2 strategies.

To satisfy these requirements, MANG will evaluate P2 options against a common set of screening criteria to analyze their feasibility. For a P2 measure to be “feasible” for use at T Range, it must be:

- Implementable
- Effective/protective of human health and the environment
- Cost effective

This section explicitly evaluates alternatives for using non-toxic lead-free ammunition and using bullet containment systems, which addresses the first three of the five categories of P2 measures recommended for evaluation by EPA in AO2. The fourth category of P2 measure (i.e., use of non-exploding artillery and mortar rounds) is beyond the scope of this plan. Although this plan does not explicitly evaluate alternatives for “development of guidance for the operation and maintenance of the ranges consistent with the pollution prevention strategies,” this plan does contain guidance for the OMM of the ranges.

Each OMM procedure contained in this plan (see Section 6) is generally accepted and uses measures to monitor and manage lead-bullet ammunition on SARs. As a result, MANG believes these procedures to be implementable, protective, and cost effective and are supportive of the overall P2 strategy for T Range.

4.1 Non-toxic Lead-free Combat Ammunition

T Range supports familiarization, zeroing, and marksmanship exercises with M16, M4, M249, M60, M240, and M9 weapons systems. Each phase of small arms training may involve the use of multiple types of training ammunition. This section evaluates the feasibility of using non-toxic, lead-free ammunition to enable soldiers to conduct the training required on T Range to Army standard in a manner that is protective of human health and the environment.

Although they allow soldiers to practice maneuver exercises and force-on-force training, blank ammunition, and simulated munitions (paint ball) are not appropriate for marksmanship training. Blanks do not fire a projectile to practice and demonstrate marksmanship. Simulated munitions (paint ball) projectiles do not have the ballistic properties associated with lead-bullet ammunition.

Plastic ammunition is also available to familiarize soldiers with employing weapons systems. Plastic ammunition does not have the ballistic properties (e.g. the muzzle velocity, projectile trajectory, and point of impact at distance) or realism associated with the lead-bullet ammunition used in combat situations. Marksmanship proficiency with lead-bullet (combat) ammunition cannot be attained, maintained, and demonstrated (through weapons qualification) using plastic ammunition. Weapons must be modified (i.e., the use of a different bolt in the firing mechanism) to train with plastic ammunition. Soldiers engaging targets with plastic ammunition do not experience conditions that are sufficiently representative of lead-bullet ammunition used in combat situations.

Because simulated munitions (paint ball), blanks, and plastic ammunition do not support marksmanship skill sets and are in current use at Camp Edwards, a detailed evaluation of their implementability, protectiveness, and cost effectiveness is not included in this section. Although these ammunition types will continue to be used for their intended purposes, they are not feasible alternative ammunition types for the marksmanship training required on T Range.

Tungsten-nylon composite bullet ammunition is available within the Army ammunition inventory, but they are not authorized for issue or use. Its use was suspended at Camp Edwards due to concerns of mobility in the environment. It will not be evaluated for use on T Range.

There is commercially-available ammunition for 5.56mm (M16 and M4) rifle and (M249) machine gun, 7.62mm (M240 and M60) machine gun, and 9mm (M9) pistol that use alternative bullet materials (e.g., copper). These ammunition types are lethal and may approximate ballistic properties of standard combat lead-bullet ammunition.

Frangible ammunition contains an alternate bullet composition that is designed to penetrate soft targets and break apart upon impact with hard targets. They are designed for close quarters combat.

Full copper bullet ammunition, steel bullet ammunition, and frangible bullet ammunition are evaluated along with standard combat lead-bullet ammunition against the feasibility criteria for use on T Range.

4.1.1 Implementability

Copper or Steel Bullet Ammunition

A number of commercial vendors manufacture 100% copper 5.56mm, 7.62mm, and 9mm bullets. These bullets are lethal and possess ballistic properties similar to those of lead bullet ammunition. Although available from commercial vendors, the Army ammunition inventory does not stock 5.56mm, 7.62mm, or 9mm ammunition that contain full copper bullets. No such ammunition has undergone the extensive Army ammunition acceptance testing and been approved for material release within the Army[11].

The Army ammunition inventory stocks .50 caliber armor piercing rounds, which include a projectile composed entirely of steel. 50 caliber weapons will not be used on T Range, so the steel bullet ammunition currently available within the Army inventory does not support marksmanship training at T Range. The Army ammunition inventory also contains rounds in both 5.56mm and 7.62mm that contain a steel penetrator with a lead slug. The steel penetrator portion makes the rounds armor piercing. At least one commercial vendor manufactures 100% steel 5.56mm and 7.62 rounds. The Army has not conducted performance or safety testing on these 100% steel bullets and these rounds have not been approved for material release; therefore, they are not included in the Army ammunition inventory. None of the currently available bullet containment systems are recommended for use with armor piercing ammunition; however, this limitation does not preclude their use in alternative training situations without bullet containment systems on other ranges at Camp Edwards. Although 100% steel bullets are not available in the Army inventory, it is still possible to procure them using alternative procurement methods. Where bullet containment is not an option on other ranges, 100% steel bullets may be a potentially viable ammunition option that is protective of human health and the environment.

The Army conducts a strict and exhaustive acceptance testing and type classification process for ammunition before it is procured and stocked in the Army inventory. The process requires development of a military specification, solicitation for procurement, acceptance testing for ballistic performance, safety of use, insensitivity to shock and dramatic changes in temperature, etc. The MANG can only authorize the purchase of ammunition that is available in the Army inventory. In February 2006, DoD issued a directive for “Nonstandard Ammunition and Explosives”:

> *“To ensure the safety of the US military and civilian personnel, contractor, and the general public, the Army centrally procures ammunition and explosives by implementing safety and procedural safeguards to assure that ammunition and explosives meet strict operational, safety, and quality criteria. Local procurement of nonstandard ammunition and explosives circumvents controls potentially exposing US military and civilian personnel, contractors, or members of the public to injury or death.”*

To conduct realistic and standardized training and qualification of marksmanship skills, soldiers must become proficient with the combination of weapons and ammunition that they will employ during combat. No copper or steel bullet ammunition have been formally tested by the US Army for acceptability of performance to be standard issue for the M16, M4, M249, M240, M60, or M9 weapons systems. Although these alternative bullet compositions may be commercially available for these weapons systems, MANG cannot be certain that this ammunition provides realistic and safe training for the soldiers that will conduct marksmanship training on T Range.

[11] The Army Training and Doctrine Command is responsible for establishing these requirements and standards and for testing alternative ammunition to ensure it meets these requirements. To meet these rigorous standards, the Army conducts a multi-year testing process for each new alternative. If met, the alternative ammunition would undergo a procurement process, as outlined in Army Regulation 710-2-2. As of Fiscal Year 2007, no other alternative bullet compositions have met or exceeded standards and been procured for the Army ammunition inventory.

Employing an untested ammunition type on the scale associated with military training may also result in safety mishaps. These alternative bullet compositions are not implementable in a manner that supports training to Army standard at T Range. However, the alternative bullet compositions may be applicable in other training situations on other ranges at Camp Edwards. For example, on ranges where soldiers engage "pop-up" targets at varying distances for qualification or field fire training (e.g., on a Modified Record Fire Range or Multi-purpose Machine Gun Range), use of bullet containment systems may prevent "line of sight" to targets. In these cases, use of alternative bullet materials may be the most feasible means to provide adequate environmental protectiveness while maintaining training realism/effectiveness.

The DoD is actively pursuing alternatives to lead-bullet ammunition. MANG will continue to work with DoD as alternative types of ammunition become available and approved by DoD for use in qualifying military personnel. Once alternative ammunition is approved by DoD, the MANG will work with the EMC and EPA to obtain approval under their applicable jurisdictional authority(s) to use alternative ammunition for both military and non-military training at Camp Edwards. MANG will also provide alternative ammunition information to MassDEP for review and coordination as part of the SAR working group; however, state approval would be through the EMC.

Law enforcement agencies have historically used copper jacketed lead bullets for both training and service use. Law enforcement agencies are not subject to Army training doctrine and Army ammunition procurement policies. Recently, law enforcement agencies training at Camp Edwards have also used copper bullets in sizes 5.56mm and 9mm and have been satisfied that these bullets meet their training requirements. However, recent input from local law enforcement has expressed a preference for being able to fire lead-bullet ammunition, their standard-issue duty ammunition, on a range designed to manage such projectiles in an environmentally protective manner (Cummings 2007).

Frangible Bullet Ammunition

DoD (e.g., US Air Force) has historically procured a 5.56mm (AA40) and a 9mm (AA16) jacketed frangible round that is intended for use against personnel and to avoid/minimize collateral damage. These rounds are intended to penetrate soft targets with the projectile breaking up on impact with hard targets. The jacketed frangible bullet contains a core comprised of copper-tungsten powder and a nylon binder. The core is coated with a copper alloy jacket. Frangible ammunition has a shorter effective range than lead-core (service) ammunition and is designed for close quarters combat such as military operations in urban environments.

No frangible ammunition has been safety tested, type classified, and material released for Army use. It is not acceptable training ammunition for general employment of T Range-supported weapons systems and will not be used on T Range; however, frangible bullet compositions that do not contain tungsten may be approved for use by other military services or other range users to fulfill training requirements elsewhere on Camp Edwards. The MANG will work with the EMC and EPA to obtain approval under their applicable jurisdictional authority(s) to use alternative ammunition. No bullets containing tungsten will be used anywhere on Camp Edwards by MANG or any other agency.

Standard Combat Lead-bullet Ammunition

Lead-bullet ammunition is the ammunition on which Army marksmanship training doctrine is based. Because lead-bullet ammunition is the standard issue combat ammunition for the 5.56mm (M16 and M4) rifle and (M249) machine gun, 7.62mm (M240 and M60) machine gun, and 9mm (M9) pistol, it is ideal for training the perishable marksmanship skills on these weapons.

Training in darkness (night fire) and machine gun fire requires the use of tracer ammunition. Tracer versions of standard lead-bullet ammunition are readily available in 5.56mm and 7.62mm. Tracers use special bullets that are modified to accept a small pyrotechnic charge in their base. When they are ignited upon firing, the composition in the tracer burns brightly to make the projectile visible to the naked eye. This allows the shooter to follow the bullet trajectory relative to the target in order to make corrections to their aim. Tracer ammunition supports training as outlined in *Field Manual 3-22.68, Crew Served Machine Guns, 5.56mm and 7.62mm* (Department of Army 2003). Unit-specific mission essential training tasks may include tracer fire, although there is no Army-wide doctrinal requirement to fire tracer ammunition on a standard 25m zero range. Due to the fact that T Range will be the only available range on Camp Edwards for some time interval, a small amount (estimated at less than 1,000 rounds/year) of tracer fire may occur.

Tracer projectiles are constructed with a hollow base filled with a pyrotechnic flare material. In both US and North Atlantic Treaty Organisation (NATO) standard ammunition, which is available through the Army ammunition inventory, tracer ammunition consists of a copper alloy cartridge case and a copper alloy clad lead bullet. It also contains an igniter composition and a tracer composition, usually a mixture of strontium salts, metal fuel such as magnesium, and a small amount of polyvinyl chloride (MIDAS 2002). A full list of all compounds contained in each approved ammunition type proposed for use on T Range can be found in Appendix B.

4.1.2 Effectiveness/Protectiveness

Copper or Steel Bullet Ammunition

Copper bullet ammunition has relatively low human toxicity, is corrosion resistant, and requires no bullet jackets for 5.56mm and 9mm small arms. If MANG were to procure and use copper bullets to support all small arms training at T Range, it would contribute significant amounts of copper loading to the range. Copper is regulated by several federal statutes and regulatory systems to include the Occupational Safety and Health Act; Comprehensive Environmental Response, Compensation, and Liability Act; Safe Drinking Water Act (SDWA) of 1974; Emergency Planning and Community Right-to-Know Act Toxics Release Inventory; Clean Water Act; and Federal Insecticide, Fungicide and Rodenticide Act of 1972. The regulatory levels set for copper tend to be much higher than those set for lead. The maximum contaminant level (MCL) for lead in drinking water is 0.015 mg/L and the MCL for copper is 1.3 mg/L (USEPA 2007).

The higher MCL associated with copper relative to lead is reflective of the lower levels of human toxicity demonstrated by copper. Copper is known to have some toxic effects on humans (e.g., mental illness and liver damage) and aquatic organisms (e.g., damage to gills, liver, kidneys). The extent to which these effects would impact natural resources at Camp Edwards is unknown.

The CSM outlined in Section 3 would apply to the use of both copper-bullet ammunition and lead-bullet ammunition. In keeping with the requirement for maximum feasible use of P2 technologies for training on Camp Edwards, MANG would presumably implement similar bullet containment, metals monitoring, and periodic metals removal BMPs for T Range whether lead bullets or copper bullets were fired.

The 100% steel projectiles used in steel-bullet ammunition are widely recognized as environmentally benign.

Frangible Bullet Ammunition

Currently available frangible ammunition bullets contain a core comprised of copper-tungsten powder and a nylon binder. The Governor of Massachusetts and the MANG decided to suspend the use of the tungsten-nylon composite "lead free" M855 5.56mm rounds (fired on Camp Edwards from 1999 to 2006) when a study detected tungsten migrating in the environment. It is presumable that the same rationale that led to this suspension would apply to the tungsten in frangible bullets. This would make the currently available frangible ammunition an unacceptable option for full-scale training at T Range. No bullets containing tungsten will be used anywhere on Camp Edwards by MANG or any other outside agency. However, frangible ammunition compositions that do not contain tungsten may be commercially available and potentially useful to fulfill training requirements elsewhere on Camp Edwards.

Standard Combat Lead-bullet Ammunition

Although lead is a highly regulated hazardous substance due to its toxic properties, it has been in use at Camp Edwards for several decades and at small arms ranges around the world for several hundred years. In order to use and manage lead-bullet ammunition in a manner that is protective to human health and the environment, MANG has implemented best management practices to contain and monitor lead deposited on the range. MANG has observed very low lead mobility at Camp Edwards due to soil properties that inhibit corrosion and sufficiently high soil sorption capacity. The coarse permeable soils will limit the length of time bullets in the environment remain in contact with water, and thus will limit the corrosion of lead fragments deposited into soil (Packer, et al 2002) (see Section 3.2.1).

Geochemical conditions on site are critical when assessing the fate-and-transport of lead and the potential corrosion of spent projectiles. Surface soils at Camp Edwards are course-grained sandy loams and loamy sands, which facilitate air exchange with the atmosphere and rapid recharge of percolating water. The soils have very little organic matter and a pH ranging from 6.2 to 7.4. The soil and groundwater conditions are aerobic at Camp Edwards (Clausen, et al 2007). Actual pH values measured on T Range are between 5.9 and 7.4, with a pH median value of 6.4 (IAGWSP 2007).

"Once introduced into the environment, metallic lead oxidizes (rusts) resulting in the formation of lead salts on the metallic lead surface (Scheetz 2004). Rainfall encountering the lead salts dissolves a small portion, which can travel with the infiltrating water into the soil. The solubility of the salts is low, which limits mobility. Any remaining dissolved lead reacts with the soil matrix resulting in the precipitation of various less-soluble lead species and sorption of lead onto soil particle surfaces. The capacity of soil for lead sorption is not infinite, but in some cases, the mass of lead introduced into the environment and subsequently dissolved is negligible compared to the sorptive capacity of the soil" (Clausen, et al 2007).

Over 9,000 soil samples have been analyzed for lead across Camp Edwards; when mapped by location the elevated lead concentrations coincide with the SARs. The overall lead concentrations in soil ranges from non-detect to 11,600 mg/kg, with a median value of 13 mg/kg. For the most part, reported lead levels in surface soils (0 to 0.3m) are within the range of measured background levels, although some isolated areas of elevated lead are present. Out of 37 soil samples collected on T Range, the highest lead concentration found was 5,800 mg/kg in the first 1 foot of soil at the firing line. A recent SAR study conducted at 4 different SARs on Camp Edwards found lead concentrations in soil between 41 and 460 mg/kg on T Range. The frequency of lead detections and the concentration of lead decreases with increasing soil depth (Clausen, et al 2007). The data indicate that elevated lead concentrations were found mostly in the surface soils at the firing line and near the target areas. "Little or no migration to the subsurface is apparent, i.e. the frequency of lead detections and the concentration of lead decreases with increasing soil depth. Bricka et al (1998) studied G, H, and K Ranges [at Camp Edwards] and found lead was generally attenuated within the top 100 cm of soil with a few higher detections at depth" (Clausen, et al 2007). Lead-bullet ammunition would be a viable ammunition type because it has little potential to migrate, and any potential migration can be monitored and managed through BMPs.

Lead has been reported in 24 of more than 500 groundwater samples taken at Camp Edwards, and only one of these detections has come from sampling at a SAR. Many of the lead detections are related to sources other than lead ammunition, such as leaded fuel spills. Thirteen groundwater monitoring wells were installed in Fall 2006 downgradient and near the berm face for several SARs. These wells have been sampled twice since installation and to date have had no consistent reportable lead detections. There is only one groundwater monitoring well (MW-72S) associated with the SARs with a single low detection in the ppb range. For comparison purposes, the EPA drinking water MCL for lead is 0.015 mg/L. These results indicate lead has not migrated to groundwater at the maintained ranges that have been monitored, including two at which training with lead-bullet ammunition began in 1935 (Clausen, et al 2007).

"Unsaturated zone modeling using two different software codes predicted the vertical migration of lead would take centuries to reach groundwater. Groundwater data collected to date from across Camp Edwards demonstrated little to no lead contamination as a result of accumulation from small arms training, despite lead being continuously released to soil for more than 60 years. Lead introduced into the groundwater near Camp Edwards in a sewage treatment effluent was rapidly and completely attenuated. The lack of lead in groundwater derived from the small arms firing ranges is supported by independent unsaturated zone modeling efforts" (Clausen, et al 2007). Lead-bullet ammunition would be a viable ammunition type because it has little potential to migrate, and potential migration can be managed through BMPs.

The amount of tracer ammunition required to be fired on T Range is estimated to be very small, less than 1,000 rounds/year. The tracer composition in these rounds is primarily strontium salts (strontium peroxide, strontium nitrate), magnesium, and a small amount of polyvinyl chloride. There is very little evidence of strontium salts and magnesium exhibiting toxic effects to human and ecological receptors in anything but very high-dose exposures. The amounts of strontium salts (approximately 0.2 grams) and magnesium (approximately 0.06 grams) per round are also very small. Over time and under certain conditions polyvinyl chloride may break down into dioxins, a known carcinogen. A study conducted by USAEC using EPA-approved protocol, showed the dioxin emissions were negligible at the gun barrel when firing tracer rounds (Environmental Health Risk Assessment Program 2006).

MANG will conduct validation testing with tracer rounds on the STAPP™ system. This validation will supplement findings from demonstrations at Fort AP Hill, Fort Drum, and Yuma Proving Ground. At Yuma Proving Ground and Fort Drum, NDCEE performed controlled condition testing of the STAPP™ to determine if it can perform effectively and support vendor claims in both cold and hot climates under extreme rates of fire. At Yuma Proving Ground, NDCEE fired more than 30,000 5.56mm rounds (M855), including 1,401 5.56 tracer rounds (M856) in a 2' by 4' impact area over a two day period where documented air temperatures reached 110 degree Fahrenheit. The ignition temperature of tracer rounds is much higher than the flash point of the granular rubber (380 degrees F), yet the trap did not catch fire (Spinos 2007). At Fort Drum, NY, NDCEE fired 4,800 5.56mm rounds into a 2' by 4' impact area within 1 hr. and 10 min. Temperatures were as low as 18.5 degrees F during firing. They observed no smoldering, no smoke or fire, and no excessive damage (Spinos 2007).

Given that a large portion of this material is consumed when the round is fired and that these rounds will be managed using the same bullet containment system as the standard lead-bullet ammunition, MANG believes that tracer ammunition can be managed in a manner that is protective of human health and the environment through the BMPs in place on T Range.

4.1.3 Cost Effectiveness

Based on FY 2006 DoD ammunition procurement data, unit costs associated with standard issue lead-bullet ammunition is approximately equivalent to that of frangible ammunition. Comparisons to prices for commercially available 100% copper bullets indicate costs of nearly two times that of lead-bullet ammunition for 5.56mm, 32% greater for 7.76mm, and over 7 times greater for 9mm (see Table 4-1).

Table 4-1. Ammunition Prices per Round*

	Lead	Full Copper**	Frangible
5.56mm	$0.25	$0.48	$0.28
7.62mm	$0.56	$0.74	$0.38[12]
9mm	$0.11	$0.81	$0.18

* Unless otherwise noted, unit cost taken from Department of Air Force Ammunition Procurement Budget Submission, submitted to Congress Feb 2005.

** Estimated based on commercially advertised prices for bullets (single component only) of similar (non-military) ammunition calibers (http://www.barnesbullets.com/prodtsx_new2006.php). Unit cost of complete round manufactured to Military Specification may be significantly higher, although the cost could drop significantly if purchased in bulk.

Compared to lead-core service ammunition, the cost difference associated with using full copper ammunition is approximately $60,000 per training year. Copper ammunition should be considered for use at T Range if it satisfies training requirements and its additional expense is justified by a greater degree of protectiveness of human health and the environment. Costs associated with frangible ammunition and lead-bullet ammunition are approximately equal. Both of these ammunition types should be considered if they satisfy training requirements and if it they are sufficiently protective of human health and the environment.

4.1.4 Results of Feasibility Evaluation

Simulated munitions (paint ball), blanks, and plastic are already used for some small arms training on Camp Edwards but they do not support marksmanship skill sets; therefore, they are not recommended as feasible non-toxic, lead-free ammunition for T Range.

Copper ammunition could be managed in a manner that is protective of human health and the environment, through implementation of the bullet containment system, metals monitoring, and periodic metals removal BMPs proposed in this plan. However, the Army has not conducted acceptance testing and type classification for solid copper ammunition and it is not stocked in the Army inventory. MANG cannot be certain that commercially available solid copper ammunition provides realistic and safe training for the soldiers that will conduct marksmanship training on T Range. Copper ammunition, although unavailable and insufficient to support all military training requirements, satisfies a number of training requirements specific to civil law enforcement users.

The only steel bullet stocked in the Army ammunition inventory is a .50 caliber steel bullet, which is an armor piercing round that has different ballistics and a much greater effective range than lead-bullet ammunition. T Range does not support this weapons system. The Army has not tested commercially available steel ammunition for its training capabilities or safety. It is not recommended as feasible non-toxic, lead-free ammunition.

[12] Commercial (non-military) unit cost (Precision Ammunition Inc. Frangible Price List, June 2006, http://www.precisioncartridge.com). Unit cost of round manufactured to Military Specification may be significantly higher, although the cost could drop significantly if purchased in bulk.

No frangible ammunition has been safety tested, type classified, and material released for Army use. Frangible ammunition currently available in other military inventories contains tungsten, which is currently banned at Camp Edwards. No bullets containing tungsten will be used anywhere on Camp Edwards by MANG or any other outside agency. Frangible ammunition is not recommended as a feasible non-toxic, lead-free ammunition.

Although some ammunition discussed above is not available for use in the current Army inventory, it is possible to procure using alternative procurement methods. On other ranges at Camp Edwards where bullet containment is not an option due to training requirements, copper or steel bullets may be the only ammunition that is protective of the environment. However, alternative ammunition compositions (e.g., copper, steel) that do not contain tungsten may be commercially available and potentially useful to fulfill training requirements elsewhere on Camp Edwards.

Table 4-2 summarizes the ammunition feasibility evaluation for T Range based on the criteria presented in Section 4.0. Based on the information presented, the table ranks the feasibility as high, medium, or low. A high ranking denotes that the proposed technology entirely meets and supports the criteria. A medium ranking denotes that the proposed technology partially meets the criteria. And a low ranking denotes that the proposed technology does not meet the criteria.

Table 4-2. Ammunition Feasibility Evaluation for T Range on Camp Edwards

	Simulated munitions, Blank, and Plastic	Copper	Steel	Frangible	Lead
Implementable	L	M/L	M/L	M/L	H
Protective of human health and the environment	H	H/M	H	L	M
Cost effective	H	M	M	H	H

4.1.5 Recommended Feasible Ammunition

To support required small arms training at T Range, MANG and agencies will use standard issue lead-bullet ammunition. Lead-core ammunition is used in military combat and in law enforcement. Marksmanship training with the same ammunition used in combat provides the most realistic training for the soldier. The skills of sight alignment, sight picture, trigger control, and follow-through are perishable skills that must be routinely practiced using the combination of ammunition and weapon that most closely represents combat conditions. Use of lead-core ammunition supports training to standard on T Range.

Lead mobility at Camp Edwards is relatively well understood and can be managed and monitored through BMPs to prevent contamination of groundwater and surface waters. During a recent study of lead mobility, the US Army Corps of Engineers concluded that corrosion and dissolution processes are sufficiently slow and mechanisms for attenuation, such as precipitation and adsorption, sufficiently robust, that metallic lead has not migrated to groundwater (Clausen, et al 2007). Soils conditions at Camp Edwards inhibit the corrosion of metals despite the relatively acidic pH. Furthermore, soil conditions on Camp Edwards SARs allows for lead sorption which limits the mobility of lead. It is recommended that Camp Edwards use the standard US Army issue lead-bullet ammunition on T Range.

Table 4-3 details the ammunition for each of the respective weapons systems permitted for use on T Range. Detailed drawings and chemical compositions of these ammunition types are located in Appendix B. Range Control approval is required for the use of tracer and a fire extinguisher shall be located in the range tower to address fire risk. Armor piercing rounds, incendiary rounds, frangible rounds, plastic rounds, tungsten-based rounds, and ammunition for weapons systems not listed are prohibited for use on T Range. These rounds will not be used on T Range until STAPP™ is validated for use with these rounds and the decision to use them is coordinated with and approved by EMC, EPA, and Mass DEP.

Table 4-3. Permitted T Range Ammunition

Weapons System	Permitted Ammunition
5.56mm rifle (M16 and M4) and machine gun (M249)	M16 and M4 rifle: M193 ball and M196 tracer* M249 machine gun: M855 ball and M856 tracer*,
7.62mm machine gun (M240 and M60)	M80 ball and M62 tracer*
9mm pistol (M9)	M882 ball

* Only after expressly approved by Range Control.

Other governmental agencies such as law enforcement, Federal Bureau of Investigation, and Drug Enforcement Administration may be able to acquire and use solid copper ammunition to satisfy training requirements. This alternative ammunition will be contained, managed, and monitored in the same manner as the standard issue service ammunition.

4.2 Bullet Containment Systems

Figure 4-1. Aerial View of T Range before berm/STAPP construction

Bullet containment systems include typical soil backstop berms, backstops constructed of alternate material (e.g., SACON), and a number of commercially available design bullet traps. Bullet traps are particularly effective when located behind fixed targets, as are found on 25-m ranges (see Figure 4-1). They may be effective as backstops on other range types where a well-defined shot pattern exists.

Camp Edwards decided in 2005 to install STAPP™ to demonstrate/validate its ability to manage tungsten ammunition. With agency concurrence, T Range was selected as the site for the demonstration. To evaluate the maximum feasible use of bullet containment systems on SARs, Camp Edwards considered four bullet containment systems: a soil berm, STAPP™ granular rubber trap, a steel deceleration trap, and SACON. The bullet containment systems were evaluated against the following feasibility screening criteria:

- Implementable
- Effective/Protective of Human Health and the Environment
- Cost Effective

4.2.1 Implementability

Soil Berm

Figure 4-2. Soil Backstop

The soil berm is the oldest and most basic way to stop and contain bullets. In its simplest form, this type of backstop is a properly sized and positioned soil mound placed behind the targets (see Figure 4-2). Bullets pass through the target, strike the soil backstop, and remain embedded in the soil until removed. Ideal backstop slopes vary based on soil types but most are optimized at approximately 26 degrees to minimize erosion and bullet ricochet.

Vegetation, mostly grasses, is grown on the backstops and berms to reduce erosion. T Range has a soil backstop that is 5 m high by 67 m long by 16 m wide. Both slopes are vegetated, and the face is 30 degrees and the backslope is 35 degrees. MANG installed this soil berm to support the STAPP™ system installed in 2005 (see Section 4.2). Soil berms support authorized lead-bullet and tracer ammunition used on T Range. Soils used in SAR berms should be screened of rocks, and ideally the berm face is composed of sand that will limit ricochet and bullet damage on impact. Routine OMM of a soil backstop includes erosion repair and resurfacing, vegetation mowing, fertilizing, and clearing to ensure adequate target visibility and minimization of soil erosion. The T Range footprint and anticipated training can accommodate this design.

STAPP™

A STAPP ™ system is a granular rubber bullet containment system. It includes a 45 cm granular rubber berm face, a self-closing rubber membrane cover, a synthetic lumber frame, an impermeable liner, and an internal water collection reservoir. Granular rubber can stop the projectiles proposed for use on T Range. The STAPP™ system is capable of accepting tracer rounds as long as its self-closing rubber membrane is maintained. The granular rubber and cover extinguish the tracer by ultimately depriving it of oxygen. There is little to no dust created from the impact of the bullet with the rubber material. Cleaning should occur after approximately 40,000–60,000 rounds per lane. This equates to a total capacity of between 600,000 and 900,000 rounds for a 15 lane system. Given the estimated ammunition expenditure rates for T Range, projectile removal would be required after approximately three training years. The process of separating the lead from the rubber uses specialized equipment and will require range “down time.” However, this downtime will not impact the ability of T Range to satisfy throughput requirements.

Deceleration Trap

This bullet trap is a system in which fired bullets are deflected off of a lower and/or upper steel plate and into a circular deceleration chamber. The chamber resembles the shell of a snail and bullets revolve in it until they lose energy and drop into the collection chamber below (see Figure 4-3). An auger conveyer system is placed beneath the deceleration chamber to collect and transport the bullets to a bucket at the end of the system. Deceleration traps can support oblique fire and ammunition up to and including .50 caliber (i.e., calibers projected for use on T Range). “Wet system” deceleration traps use a specially formulated biodegradable liquid lubricant that circulates through the trap, coating bullets and virtually eliminating airborne metals dust. “Wet systems” are not recommended for outdoor ranges in regions that have freezing temperatures. These wet systems can accept tracer fire. Use of tracer rounds requires that the collection bucket be lined with sand to mitigate potential fire hazards. The use of tracer ammunition may scorch the system and degrade the auger, requiring premature replacement (Drucker 2007).

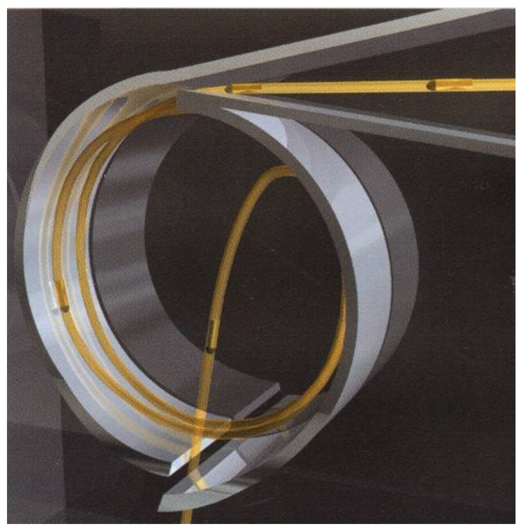

Figure 4-3. Cross-Section of Deceleration Chamber

Typical OMM requires 2-8 hours/month, depending on the number of rounds fired and whether automated bullet collection systems are included. These systems typically require 8–12 m front to back to accommodate the trap. T Range can accommodate such a system.

SACON

SACON is a low-density, fiber-reinforced, foamed concrete. When properly designed, SACON provides a means of effectively capturing and containing lead in a variety of SAR uses. SACON can be locally manufactured and can be camouflaged with range terrain. SACON can withstand small caliber ammunition up to .50 caliber, and it can accept tracer ammunition. SACON does not burn. SACON will not photo-degrade and contains no potentially toxic organic compounds.

SACON should be a minimum of 2.4 m thick to allow a stable debris-filled bullet pocket to develop on a 25-m range. In tests, a .50 caliber bullet penetrated 56 cm into the SACON. 7.62mm rounds penetrated 10 cm into the SACON and remained there. SACON can accept up to 7,100 rounds before requiring rotation, and it can be patched in place. A damaged area can be cut out and replaced with cores.

4.2.2 Effectiveness/Protectiveness

Soil Berm

Bullets pass through the target, strike the soil backstop, and remain embedded in the soil until removed. As bullets strike the same spot behind the target, a bullet pocket is formed. An unintended consequence of creating this bullet pocket is that bullets will impact each other and cause pulverization. Pulverized lead is more mobile, both by wind and water. Bullet on bullet impacts may also cause projectiles to ricochet. These effects can be minimized through proper vegetation, erosion management, and berm maintenance.

There is also the potential for metals contained in soil berms to migrate vertically through soil to groundwater. During a recent study of lead mobility, the US Army Corps of Engineers concluded that corrosion and dissolution processes at Camp Edwards are sufficiently slow and mechanisms for attenuation, such as precipitation and adsorption, sufficiently robust, that metallic lead has not migrated to groundwater above a specific method reporting limit. (Clausen, et al 2007). Soils conditions at Camp Edwards inhibit the corrosion of metals despite the relatively acidic pH. Furthermore, soil conditions on Camp Edwards SARs allows for lead sorption which limits the mobility of lead. “Little or no [lead] migration to the subsurface is apparent, i.e. the frequency of lead detections and the concentration of lead decreases with increasing soil depth. Bricka et al (1998) found lead was generally attenuated within the top 100 cm of soil” (Clausen, et al 2007). The soil conditions present at Camp Edwards will decrease the potential of the metal deposited into a soil berm from migrating to groundwater. Soil berms rely on erosion control and soil conditions/chemistry to limit the degree of bullet corrosion and migration. They lack some of the redundant features found in bullet traps to contain munitions constituents. To provide the redundant features that limit exposure and migration of munitions constituents that are found in some other bullet containment systems (e.g., granular rubber traps), soil berms must be augmented with other features (e.g., impermeable layers such as clay, constructed rain guards, and geo-textile covers).

STAPP™

The STAPP™ system has a number of redundant features that limit the exposure of trapped projectiles to weathering and prevent migration of munitions constituents. STAPP™ has a self-closing cover that repels surface water thus reducing the availability of water for dissolution of metal projectiles Bullets entering the system through the self-closing membrane and into the granular rubber are captured safely and are left virtually intact, with minimum deformation and almost no fragmentation. The STAPP™ system has an impermeable liner which contains all metal projectiles, preventing contact with the soil beneath the system and possible leaching of metals to groundwater over time. Rounds can be shot from any distance with no ricochet or back splatter. STAPP™ can support tracer ammunition if there are no openings in the protective top cover/membrane or the bottom liner. The absence of holes provides a reduced oxygen environment that extinguishes tracer ammunition (see Section 4.1.2). Munitions debris and munitions-related compounds are contained within an impermeable membrane. The small amount of precipitation that enters the system through perforations in the cover is collected in a reservoir at the toe of the system. This water can be periodically drained, tested, and disposed of accordingly. The STAPP™ system allows the rubber granular material to be filtered to collect projectiles and recycle or dispose of appropriately.

Deceleration Trap

Some designs include roofs that keep water and snow from entering the trap and possibly transporting lead into the environment. Some designs also include automated bullet collection systems under the deceleration chamber that simplify the collection and recycling or disposal of the fired projectiles. Some systems are "dry," meaning that no fluids are used to assist the operation of the trap. Army demonstration/validation testing of one such system resulted in a loss (failure to capture) of approximately 20% of total lead mass fired into the system, with the majority of the material lost as dust. Some of these systems are "wet." This means that fluid flows over the surface of the lower steel plate. The purpose of the fluid is to capture any dust or debris generated by the impact of the bullet with the steel plate. In recent demonstration/validation testing of "wet" deceleration traps, the US Army noted numerous leaks resulting from cracks at weld seams on the system. These leaks resulted in a release of the water/oil solution, which could contain metals and require secondary management.

SACON

The low permeability of SACON reduces the amount of lead (from bullet debris) that is exposed to weathering on the range. The high alkalinity of SACON can reduce the rate of lead corrosion and decrease the solubility of the lead corrosion products, thus lowering the amount of lead available for migration. In validation testing, USAEC found that the exposure of the bullet debris to the SACON material resulted in the formation of insoluble lead corrosion products. As a result, all SACON debris removed from these ranges was classified as non-hazardous and disposed of as a solid waste (Fabian 1999).

Also during this validation testing, USAEC found that SACON material that has been shot with the M855 5.56-mm round cannot be economically recycled. Further testing will be required to establish valid recycling performance criteria. The cost of recovering the aggregate from the used SACON blocks is approximately 100 times the cost of purchasing new aggregate material. Disposal of the used SACON as a solid waste coupled with the purchase of new aggregate material would be approximately 75 percent cheaper than recovering the aggregate material; therefore, recycling was not proven to be economically feasible (Fabian 1999).

SACON should be inspected quarterly for excessive wear and damage. Repairs should be implemented immediately to support the safe and sustained use of the trap. When performing maintenance, there is a potential for personnel exposure to lead dust.

Improper manufacturing has the potential to create safety problems. SACON with densities or aggregates greater than required may create a ricochet hazard. Also, the configuration or shape of the SACON products has a significant effect on its durability.

4.2.3 Cost Effectiveness

Soil Berm

Initial construction costs associated with installing a basic soil berm include grading and earth moving, the addition of soil amendments, and seeding. Periodic maintenance activities include lead recovery. During lead recovery activities, heavy equipment is used to “mine” the projectiles from the berm face for purposes of recycling or disposal. The mining efforts are typically concentrated in the areas of the bullet pockets since the pockets contain the highest density of projectiles. A certain amount of the berm soil will be contaminated and must be disposed of and replenished. This large-scale maintenance activity is time consuming, costly, and can result in significant downtime for the range. A recent upgrade to a Fort Jackson SAR included the following costs: Soil Amendment Plan: $9,000; Construction Costs: $31,000; Annual Operations Costs: $2,000; Fertilizer and Lime Costs: $1,500; Soil Testing: $50.

STAPP™

Initial installation costs for the STAPP™ system include materials/equipment costs of $55–$85/ft, delivered. This cost does not include labor associated with installation as this is site specific, dependent on site preparation required (e.g., build the supporting berm). For the first 3 years, maintenance costs are generally under $1,000. The STAPP™ Company trains on-site personnel on procedures for patching, sampling, and maintaining the system. Some system components may be under warranty, which varies per model and is site specific. Costs for periodic bullet removal are approximately $1,200 per lane. If lead disposal is required, transportation and disposal costs are typically about $2,000 per event. The total cost for bullet removal of the entire T Range system would be approximately $20,000 to $25,000 (Ciskowski 2007a).

Deceleration Trap

Capital costs associated with equipping T Range with this type of system range from $300,000 to $400,000 depending on the specific brand and model selected. Maintenance costs associated with these systems were not evaluated in available demonstration/validation tests. Required maintenance was conducted under an extended 5-year warranty, which can be purchased at a cost of approximately $14,767.

SACON

To support 25 m firing from the 15 firing lanes on T Range, the backstop should be at least 30.5 m long, 2.4 m tall, and 2.4 m deep. From the manufacturers, the backstop blocks are 2 ft long, 1 ft wide, and 6 in. deep. Each block is $26.35 (with large orders receiving discounted pricing). SACON blocks are laid out within a concrete slab, with 71 to 76 cm tall footers making up the perimeter of the trap. This trap can be placed on sand, but concrete is recommended. Creating a feasible backstop for T Range would require 6,400 SACON blocks, totaling $168,640 (not including shipping, labor, sand, or concrete slab).

For 30,000 5.56mm rounds per lane throughput, the US Army estimates an annual recurring maintenance cost of $3,800 per lane; T Range's 15 lanes would cost $57,000 annually (Fabian 1999). Used SACON can be disposed of as a solid waste. Coupled with the purchase of new aggregate materials, this would be approximately 75% cheaper than recovering the aggregate material (USAEC 1999). All of the costs outlined above are summarized in Table 4-4 below.

Table 4-4. Estimated Total Cost of Bullet Containment Systems (in dollars)

Bullet Containment System	Capital Costs	Annual OMM Costs*	Total investment with OMM over 5 years
Soil Berm	40,000	3,550	57,750
STAPP™	200,000	1,000	205,000
Deceleration Trap	350,000 (avg)	15,000	425,000
SACON	168,640	57,000	453,640

* Does not include lead removal or disposal costs

4.2.4 Results of Feasibility Evaluation

Table 4-5 presents the results of the bullet containment system feasibility evaluation based on the criteria presented in Section 4.0. Based on the information presented, the table ranks the feasibility as high, medium, or low. A high ranking denotes that the proposed technology entirely meets and supports the criteria. A medium ranking denotes that the proposed technology partially meets the criteria. And a low ranking denotes that the proposed technology does not meet the criteria.

Table 4-5. Bullet Containment System Feasibility Evaluation for T-Range on Camp Edwards[1]

	Soil Berm	STAPP™	Deceleration Trap	SACON
Implementability	H	H	M	M
Protective of human health and the environment	M	H	M/H	M
Cost effective	H	H	M	M

1. This feasibility assessment is applicable to the unique conditions and uses of T Range on Camp Edwards, MA and does not imply applicability to other Army installations or ranges.

4.2.5 Recommended Feasible Bullet Containment System

Camp Edwards recently installed a STAPP™ bullet containment system on T Range. This system satisfies the criteria of implementability, and effectiveness/protectiveness. STAPP™ technology is in use at Fort AP Hill, Virginia, and Fort Jackson, South Carolina. This system has proven that it can support 5.56mm, 7.62mm, and 9mm ammunition sufficiently, safely, and cost effectively. Its protective rubber membrane traps the bullet, minimizes airborne lead, and reduces potential lead residue runoff. It blocks potential pathways to on-site and off-site receptors and supports sufficient throughput of required military and agency training on T Range (see Section 5).

The system is 30.5 × 9 m and provides bullet containment for 15 firing lanes. The system includes a 46 cm granular rubber berm face, a self-closing rubber membrane cover, a synthetic lumber frame, an impermeable liner, and an internal water collection reservoir. The STAPP™ system is capable of accepting tracer rounds as long as its self-closing rubber membrane is maintained. Section 5.1 provides more detail on the system and its implementation on T Range. Based on the evaluation conducted above, MANG believes that use of the STAPP™ constitutes the maximum feasible use of P2 technologies for bullet containment at T Range.

5.0 RANGE LAYOUT

The purpose of this section is to provide visual/pictorial representations of the physical design modifications to T Range to support the P2 BMPs described in Section 4 and Section 6.

5.1 Range Plan

T Range has generally flat topography, with the exception of two sloped areas: the vegetated backstop/berm supporting the installed STAPP™ system and the elevated mounds behind the firing line. Distinct features of T Range include an access road, a parking lot, a range tower, a target shed, a firing line, the range floor, protective sand boxes, a bullet containment system, 15 target frames, and future support facilities.

T Range is surrounded by trees, which buffer noise and act as a windbreak. The entrance leads to a gravel parking area approximately 50 m x 250 m in size. Adjacent to the parking area, there is a row of 6 elevated mounds approximately 76 m long. These mounds are covered with grass and are about 7 × 12 × 3 m in size. They were once machine gun firing positions but now serve only to direct access and egress to the firing range and to allow elevated observation of weapons training from several positions. The firing line at T Range is 44 m long with 15 firing positions and is situated about 15 m in front of the elevated mounds. The firing line is slightly elevated (approximately 0.5 m) from the range floor to allow proper trajectory of fired rounds through targets and into the STAPP™ system from standing, kneeling, and prone positions. There are 15 wooden framed target holders placed 25 m downrange from the firing line. The range floor between the firing positions and target frames is relatively flat and covered with grass. Protective timber "sand boxes" are arranged in two, overlapping lines in a staggered pattern in front of the target frames to protect the base of STAPP™ system from undershot. Figure 2-1 shows a number of these features, repeated in this section for convenience. The STAPP™ bullet containment system and the berm are approximately 30 m from the firing line. The STAPP™ system is described in detail below in Section 5.2. Proposed T Range future construction includes support facilities, such as bleachers and a pavilion that will be used for meals, ammunition issue, and weapon breakdown and cleaning. The pavilion will be located adjacent to the current parking areas of T Range. The bleachers will provide seating for training announcements and will be situated behind the firing line in order to safely observe firing.

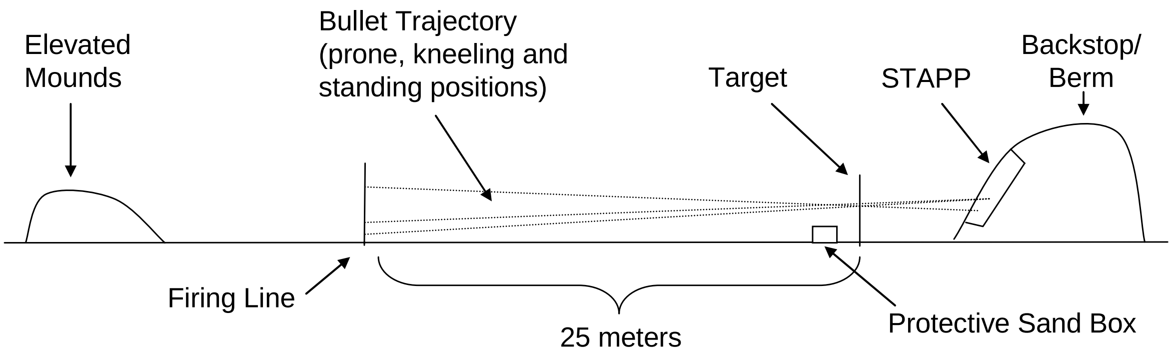

Figure 2-1. Basic Lateral View of T Range

The T Range plan incorporates several elements selected to disrupt migration pathways identified in the CSM. See Figure 5-1 for the locations of these elements. The primary P2 design feature on T Range is the STAPP™ bullet containment system, which has been installed on the soil berm. The STAPP™ system limits the interaction of precipitation with bullets, retards the vertical movement of metals into soil, and the transport of dissolved and particulate metals toward the toe of the berm. Vegetation on the sides and back slope of the berm will prevent erosion of berm soil caused by surface water flow. The entire range is buffered by trees to prevent wind erosion and the migration of lead particles off-range through wind entrainment. Three lysimeters will be installed at a depth of 1.2 m across the toe of the berm. Three more lysimeters will be installed across the firing line at the same depth of 1.2 m below ground surface. These lysimeters will be used to monitor soil-pore water and vapor for dissolved metals as an early indication of contaminant migration from the ground surface towards the water table. Because groundwater flows from south to north across the range, the existing groundwater monitoring well is located appropriately to monitor for the presence of munitions constituents in groundwater.

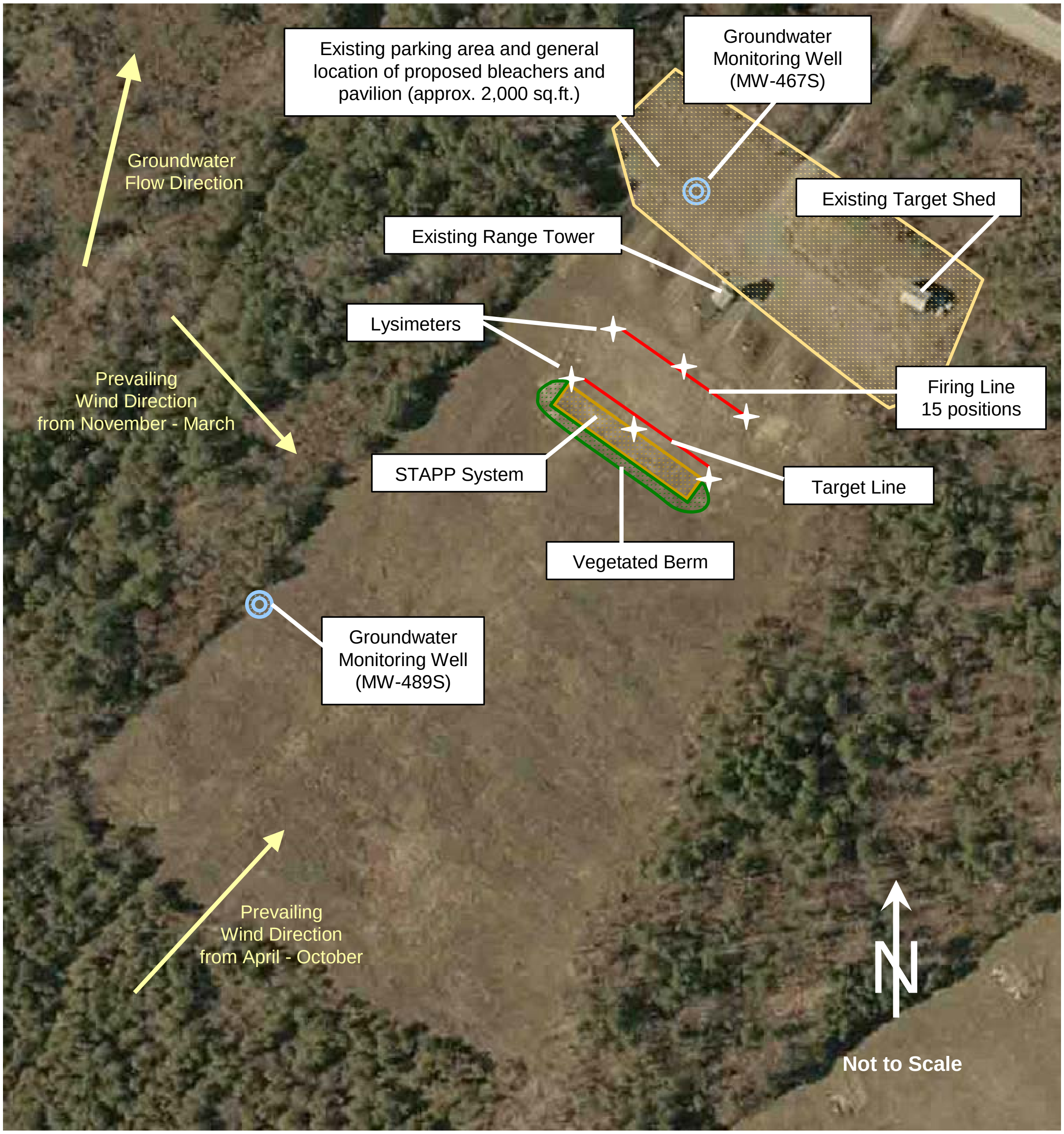

Figure 5-1. Aerial View of T Range Plan

5.2 Details and Specifications of Bullet Containment System

The STAPP™ system on T Range employs several features that collectively sever pathways of metals migration noted in the CSM. The vegetated back slope prevents soil erosion, as does the vegetated range floor. The self-closing rubber membrane cover on the front of the berm is waterproof but will allow bullets to pass through its surface and into the granular rubber matrix below. The apex of the berm is covered with a heavy duty reinforced vinyl geotextile; the material is Thoroshield 4050 FR Black. It was installed to control erosion of the soil berm above the bullet containment system. The tarp is secured to the top of the STAPP™ system such that rain water will flow off of the tarp and onto the top membrane of the STAPP™ system. On the backside of the berm the tarp is secured to wood timbers flush with the slope of the berm (MacPherson 2007).

Figure 5-2. Protective Sand Boxes and Target Frames on T Range

The non-permeable liner prevents bullets in the granular rubber from interacting with berm soil. Additionally, the liner will collect water that has passed through perforations in the membrane cover and will direct it toward the water collection piping instead of allowing it to percolate through soil and possibly into groundwater.

The base of the STAPP™ system and the target frames are protected from being damaged by undershot by a series of sand-filled timber frames, see Figure 5-2. The 8' long sand boxes were constructed with 6" x 6" pressure treated timbers, 2" x 4"s and plywood, all pressure treated wood. They are fastened using nails, spikes and wood dowels. The use of nails and spikes were minimized to help prevent bullet ricochet hazards. The wood dowels provide most of the fastening strength. Prior to installation, Camp Edwards leveled the ground surface and placed the 17 sand boxes in two lines in a staggered pattern to protect the bottom of the STAPP™ system. The boxes were filled with clean/washed sand from an off-site source. After they are filled with sand, a plywood top was secured with nails. A heavy duty vinyl geotextile fabric (Thoroshield 4050) is then secured to the box to make it shed rain water. Proper placement of the boxes in a staggered pattern across the firing lanes will minimize gaps and still allow walking access to targets and the STAPP™ system (MacPherson 2007). These features can be seen in place on T Range in Figures 5-2 and 5-3 and are depicted in Figure 5-4 on the following page.

Figure 5-3. STAPP System and Geotextile Tarp on T Range

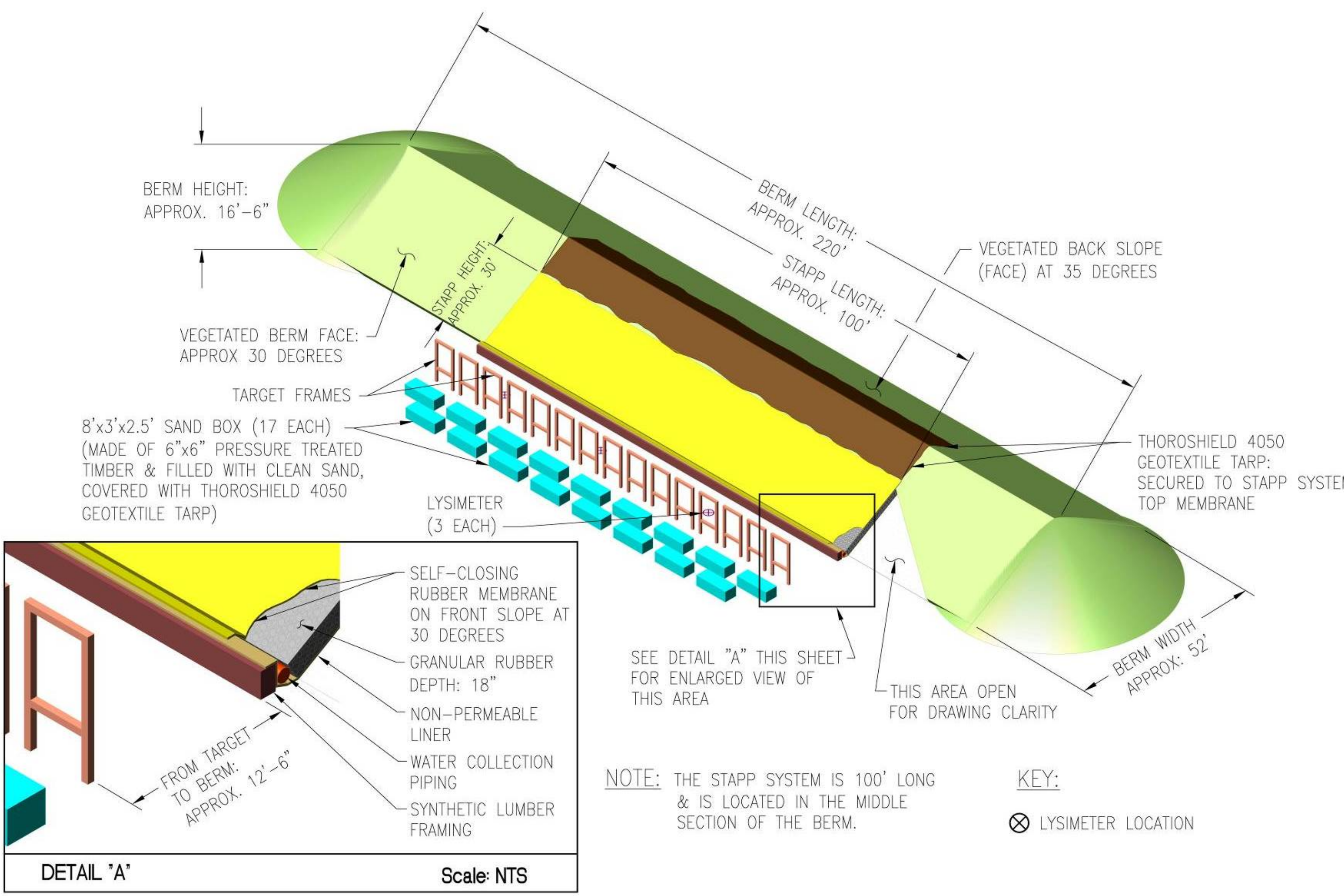

Figure 5-4. Drawing of STAPP™ Bullet Containment System

5.3 Details of Monitoring Features

A groundwater monitoring well is located on the north side of T Range. Its location is appropriate to monitor impacts from firing on T Range because groundwater flows to the north. An upgradient groundwater monitoring well in the northwest corner of the range will allow MANG to monitor for metals in groundwater that may have been contributed from other activities, not related to T Range. Depth to groundwater at T Range is approximately 30.5 m, and the installed wells will sample groundwater to a depth of 42 m below ground surface. Specifications of the groundwater monitoring well installed on T Range are shown below on Figure 5-5.

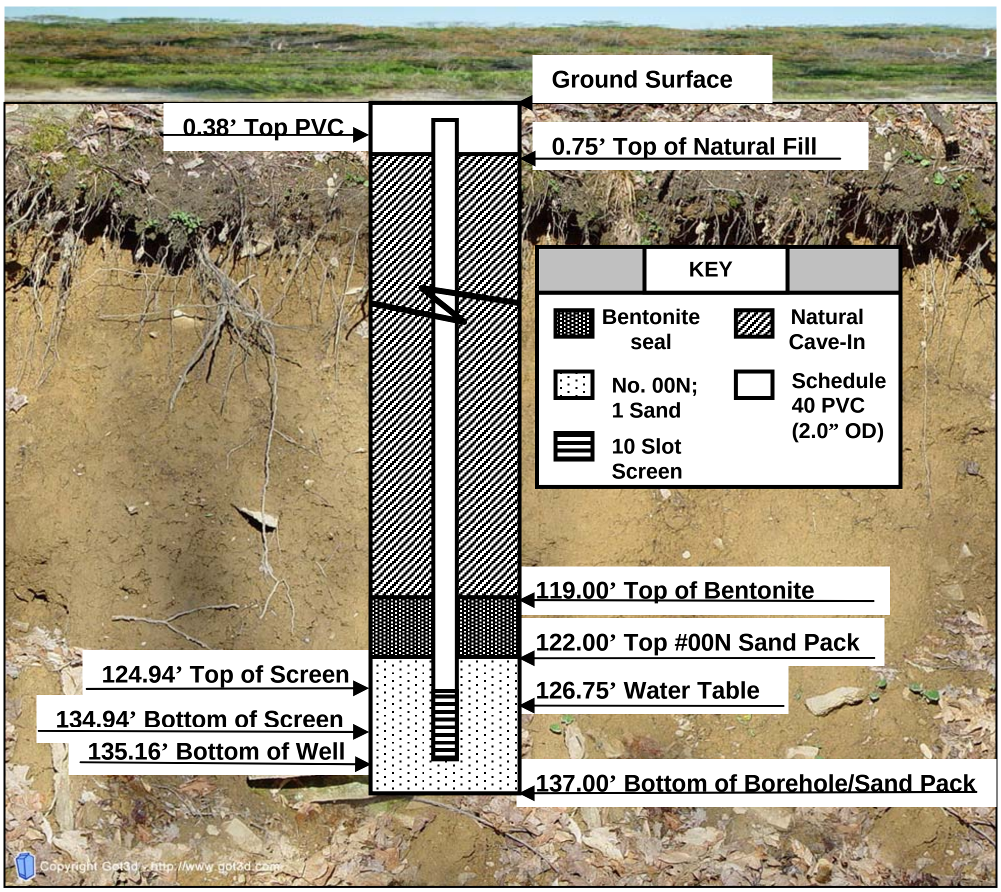

Figure 5-5. SAR Groundwater Monitoring Well Construction Details

Lysimeters will also allow MANG to monitor for dissolved munitions constituents in soil-pore water on T Range. The lysimeters will function as early warning signs of lead migration because of their position within the first 1.5 m of surface soil at the toe of the berm and at the firing line. The lysimeters at the toe of the berm will detect whether metals from fired ammunition are contained by the STAPP™ system. The lysimeters at the firing line will detect the migration of any metals or propellants from the muzzle blast of fired weapons. Lysimeter sampling will characterize contaminate migration through the soil-pore water toward the aquifer. Lysimeter specifications can be seen in Figure 5-6.

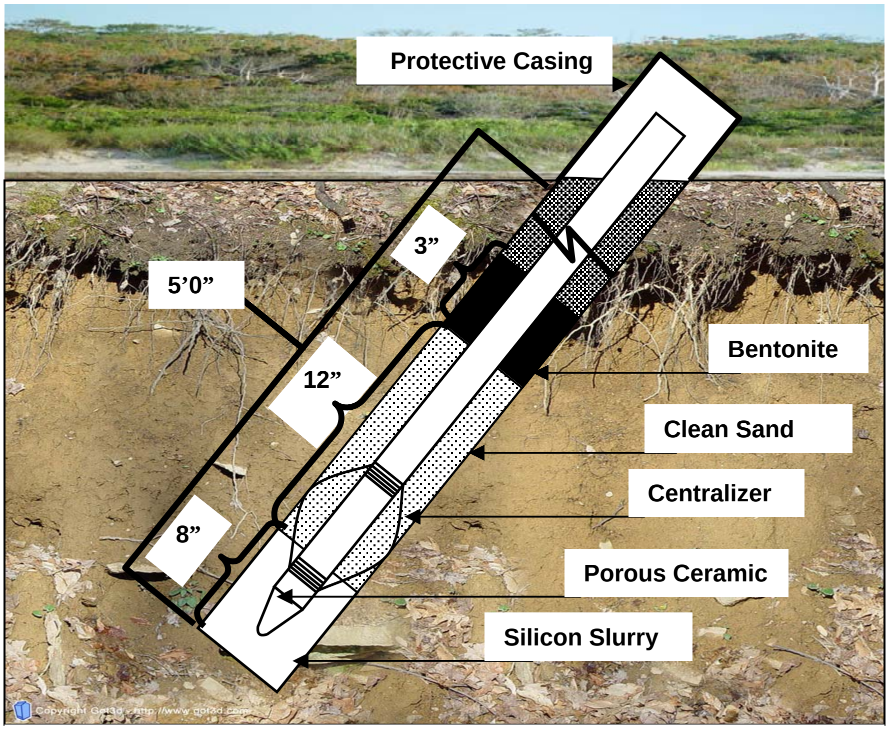

Figure 5-6. SAR Lysimeter Construction Details

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6.0 RANGE OPERATIONS AND MAINTENANCE

This section provides guidance for the OMM of T Range that is consistent with the P2 strategies evaluated and selected in Section 4. The following guidance satisfies the criteria identified by MANG to describe the "maximum feasible use of P2." As such, the following guidance was developed to be implementable, protective of human health and the environment, and cost effective.

6.1 General Range Operations

6.1.1 Range Scheduling and Access Controls

T Range may be used for weekend, inactive duty training, or during the two week-long annual training periods. Annual training units have the first priority for scheduling training areas and ranges. Per Camp Edwards Regulation 385-63, Range Control schedules T Range usage based upon written input received from using units. Units forward a written request to "Commander Camp Edwards, ATTN: Range Control" or utilize the Range Facility Management Support System (RFMSS) Program stating the dates and facility desired. The written request must include the anticipated number of soldiers occupying and using the range, the types of weapons to be used, the types of ammunition to be used (by DODIC), and estimated amounts of ammunition to be expended. A master schedule is available for viewing electronically via the RFMSS Program. To avoid conflicts, co-use of a previously scheduled area will be confirmed only after Camp Edwards Operations and Range Control receive a written consent from the originally scheduled unit.

6.1.2 Issuing and Clearing the Range

A unit representative must sign out T Range from Range Control prior to occupation or use. Units must confirm the information provided at the time the range was scheduled (e.g., numbers of soldiers, weapons, and ammunition). Each unit will receive a T Range usage packet, which will include a Weekly Range Bulletin. This bulletin indicates training facilities scheduled, airspace requirements, local restrictions, and other information pertinent to units training at Camp Edwards. Commanders are responsible for distribution to subordinate units and appropriate personnel. Prior to occupation, or immediately thereafter, unit personnel will inspect the range and report any deficiencies immediately to Range Control (see Section 6.2.1). Camp Edwards' personnel will conduct safety and environmental awareness briefings to designated Officers in Charge and RSOs prior to issuing the range. The briefing will cover the requirements of this document as well as requirements of Camp Edwards Regulation 385-63, *Range Safety and Trainers Guide*, and safety requirements from applicable weapons manuals, Field Manuals, and Technical Manuals.

Upon completion of training, units shall police their brass and ammunition containers and packaging. Using units remove expended cartridge casings from the range, visually inspect them to remove any live rounds, and turn over the expended casings to the temporary Ammunition

Supply Point (ASP)[13]. The turnover is documented using DoD Form 1348. Other range residue such as weapons cleaning materials and trash generated on the range will be collected on-site in a waste receptacle issued by Range Control upon check-in. The waste receptacle will be returned to Range Control upon check out. Range control will establish a satellite accumulation point for wastes generated from weapons cleaning. Upon accumulation of 55-gallons of such waste, it will be disposed of per the Camp Edwards HMWMP and in compliance with state and federal solid and hazardous waste management regulations.

All units/organizations using T Range will complete a Training Facility Utilization Report (see Appendix A[14]). This report summarizes the training activities conducted on the range and includes: the weapons systems used, the type and amount of ammunition used, the firing lanes that were used, and the types of vehicles present on the range. After policing their brass and related range residue, the unit/organization will inspect the range using the T Range Inspection Form (see Appendix C). This form includes a review of the general order and condition of the facility, a visual check of erosion and vegetation on the range, and a visual inspection of the STAPP™ system. Blank copies of both of these reports will be included in the check-in packet distributed at Range Control. Upon clearing T Range, each unit/organization will submit the completed reports to Range Control. The Range Control Officer or authorized designee will be available to answer any questions that arise during the visual inspection, but it is the unit/organization's responsibility to complete the range inspection. Once T Range is inspected and cleared by Range Control personnel (via signature on the inspection forms), the unit or organization representative will report to Range Control returning any T Range packets or equipment issued and to close out the hand receipt prior to clearing the installation.

6.1.3 Oversight of Training Operations

Per Section 1.4, the Range Control Officer is responsible for oversight of T Range operations. The Range Control Officer issues and clears T Range. He/She is the main point of contact for using units for range communications, usage requirements, and conflict resolution. Also, the Range Control Officer will monitor units on T Range to support compliance with this plan and Camp Edwards Regulation 385-63. The Range Control Officer will schedule all required monitoring described in Section 6.2 and all maintenance described in Section 6.3 with the appropriate Camp Edwards staff.

E&RC in coordination with Range Control will have the MANG Environmental personnel, both full-time and part-time personnel, conduct site inspections of the range. Inspections can be conducted in conjunction with range control personnel or separately. Also, the various environmental agencies will also inspect the range and/or units for compliance with the established T Range OMM plans. If the range is operational, the environmental agency representative will identify themselves to the Officer or Non-Commissioned Officer In Charge, who is responsible for the overall conduct of the range that day.

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[13] A temporary ASP is typically established by each using unit for the duration of each training event on the range. The location may be a tent or the back of a vehicle and provides a single location for ammunition drawn from the installation ASP to be issued to and turned-in by the using soldiers.

[14] The range inspection report in the Appendix is being continually improved for use on T Range.

6.2 Range Monitoring

In addition to routine compliance monitoring, Range Control coordinates the general and environmental inspections and requisite rehabilitation on T Range. Small arms training with lead-bullet ammunition will leave metals within the bullet containment system and possibly munitions constituents elsewhere on T Range. To understand the nature and extent of munitions constituents on T Range, Camp Edwards will institute a monitoring program for soil, soil-pore water, and groundwater. MANG will also implement a number of other inspection and monitoring BMPs to ensure the conditions on T Range that limit metals mobility are maintained. These BMPs include monitoring the condition of the bullet containment system, vegetation cover, and soil pH to minimize corrosion/dissolution of metals into subsurface soil or groundwater.

6.2.1 Range Inspections

Range inspections will be conducted by using units/organizations each time the range is used. Range Control will inspect the range on a regularly scheduled bi-weekly (every two weeks) basis, as the weather permits. Furthermore, Range Control will conduct detailed inspections 3 times during the peak training period and internal inspections of the STAPP™ system periodically. There are three levels of inspections at T Range: visual inspections, detailed inspections, and internal inspections. The requirements of each type of inspection is presented on the T Range Inspection Form (see Appendix C). Each type of inspection is described in detail below.

Unit Inspections

A visual inspection will be conducted by using units/organizations each time the range is used. Appendix C[15] contains the T Range Inspection Form which outlines a visual inspection of the general order and condition of the range, a visual check of erosion and vegetation on the range, and a visual inspection of the STAPP™ system. In cooperation with Range Control, units will complete Sections A-D of the T Range Inspection Form and submit this form along with the Training Facility Utilization Report (provided in Appendix A) as it clears T Range. Both the Range Control Officer and unit representatives sign off on these completed forms before turning them into Range Control. The form allows range users to identify deficiencies in the design, operation, and maintenance of the range itself and its BMPs. The using units may also be a line of defense against rapid erosion events from storms or deterioration of bullet containment systems that may not be identified during other regularly scheduled inspection or evaluation programs. Range Control collects the T Range Inspection Forms and schedules any required maintenance with either Facilities Engineering (FE) or the Environmental Office accordingly. Range Control files the inspection forms for administrative recordkeeping.

Range Control Inspections

Most MANG training occurs between April and October. During this peak training period, the Range Control Officer will conduct a bi-weekly visual inspection of T Range using the T Range Inspection Form in Appendix C and compare his/her observations with the recently completed

[15] Units only complete sections A through D of the T Range Inspection Form. Completion of section E is only completed by Range Control Officer during their 3X annual detailed inspections.

inspection forms of using units. The Range Control Officer will also conduct a visual inspection within one week after major storm events[16].

Range Control will also conduct a detailed inspection of T Range at the start, midpoint, and the completion of the peak training period. The detailed inspections will be conducted 3 times per training year: in the fourth week of March before training begins, in the fourth week of July during training season, and in the fourth week of October at the end of the peak training period. This detailed inspection will include features described in the T Range Inspection Form Sections A-E (see Appendix C) as well as photo documentation of range conditions.

During the initial detailed inspection of T Range conducted each year in March, Range Control will take baseline condition photos of the firing line, range floor, soil berm, and bullet containment system. These baseline photos will help field crews evaluate future observed conditions against the baseline and help document the rehabilitation of any reported range deterioration. Range Control will create a photo log using the baseline condition photos and any inspection and rehabilitation photos. The photo log will include the date, time, direction, and any pertinent site notes associated with each picture. The following sections contain guidance for conducting range inspections.

MANG will conduct an internal inspection of the components of the STAPP™ system each time MANG removes the cover and sifts the granular rubber material to remove and recover captured projectiles. The internal inspection will be performed once after the first year of training operations. Subsequent to the initial internal inspection, regularly scheduled internal inspections will occur after 500,000 rounds have been fired on T Range or every 3 years, whichever occurs first. The internal inspection will include features described in the T Range Inspection Form Section F (see Appendix C).

6.2.1.1 General Conditions and Order of Facility

Distinct features of T Range include an access road, a parking lot, a range tower, a target shed, a firing line, a range floor, protective sand boxes, a bullet containment system, 15 target frames, and future support facilities. Proposed T Range future construction includes support facilities, such as bleachers and a pavilion that will be used for meals, ammunition issue, and weapon breakdown and cleaning. The pavilion will be located adjacent to the current parking areas of T Range. The bleachers will provide seating for training announcements and will be situated behind the firing lanes in order to safely observe firing. The parking areas will be inspected for general condition and any POL stains from vehicles. The range tower, target frames/holders, and firing positions, and shed must be in adequate condition to support unit training use. The protective timber “sand boxes” in front of the target frames will be evaluated to identify deterioration, damage or excessive amounts of undershot. Units will note the condition of each of these features and any specific deficiencies in need of repair.

[16] A major storm event is defined as an accumulation of more than 5 cm in a 24-hour period.

6.2.1.2 Erosion

Erosion is the displacement of soil by wind or water or by downward or downslope movement in response to gravity or human activity. T Range is generally flat, with the exception of two sloped areas: the vegetated backstop/berm supporting the installed STAPP™ system and the elevated mounds behind the firing line. The potential causes of erosion on T Range are lack of vegetation or human activity/disturbance, such as staff climbing the berm to inspect the top of the berm and the STAPP system. If units did not engage the target accurately, bullets may impact the vegetated berm surrounding the STAPP™ bullet containment system[17]. Disturbed or deteriorated vegetation on both sloped areas could allow erosion to occur via wind or water.

Four to five months after the STAPP™ was installed, it was observed that rainwater runoff was seeping under the STAPP™ system and causing erosion. The first evidence of the erosion was additional sandy soil observed in a 5 to 6 foot swale beyond the base of the STAPP™ system. Further observation revealed a portion of the berm near the top of the STAPP™ had washed away in a rain event. The surface of the STAPP™ system was no longer a uniform level surface, but had a depression leading from the eroded berm section above the STAPP™ to the swale at the base of the STAPP™. The self-closing cover was opened and the granular rubber was removed to inspect the condition of the impermeable liner. The liner was intact. Soil was added to the berm below the STAPP™ system to fill the depression. To prevent future erosion from the top, a geotextile tarp was installed over the top of the berm and attached to top of the STAPP™ to allow water to runoff the backside of the berm and over the face of the self-closing cover, mitigating the potential for erosion at the top and around the sides of the STAPP™ system.

If the geotextile tarp above the STAPP™ system deteriorates, is severely torn or becomes unsecured, run-off from the soil berm may erode the soil surrounding the frame supporting the STAPP™. After precipitation, erosion is identified by the presence of rills or gullies on the downward slope. Using the T Range Inspection Form (see Appendix C), using units and the Range Control Officer shall identify evidence of erosion on key features of T Range. The inspection form provides a blank comment area to describe conditions and a simple range drawing/map where erosion hotspot locations can be identified.

6.2.1.3 Vegetation

Camp Edwards will plant and maintain Massachusetts Highway (MassHighway) seed mix to provide a vegetative cover on the soil berm areas around the bullet containment system, the range floor, and the elevated mounds behind the firing line to reduce erosion (Ciaranca 2006). Inspectors will visually estimate the percentage of vegetative coverage on these three areas. A space is provided on the inspection form to note the degree of vegetation cover and any need for revegetation.

[17] Although it is highly unlikely that units will fire enough bullets into the berm to create a hotspot (see Section 3.2.2.2), it should be noted that this cumulative impact may further deteriorate the slope, causing erosion.

6.2.1.4 Bullet Containment System

The condition of the bullet containment system will be closely monitored and necessary maintenance and repairs will be conducted in accordance with the metrics outlined below. A number of features of the STAPP™ bullet containment system will be monitored to contain metals deposition and sever potential migration pathways. These features include:

- the self-closing rubber membrane cover (faces and seams),
- the rubber filler material,
- the impermeable liner,
- the internal water reservoir, and,
- the synthetic lumber support structure.

In March 2007, the internal water reservoir was inspected and pumped out. Although MANG anticipated less than 50 gallons would be pumped out, 580 gallons were removed. Again in April 2007, the reservoir was inspected and an additional 530 gallons were removed. This demonstrated that the base of the STAPP™ system will contain water as designed; however, the amount of water collecting in the reservoir is not consistent with the design of an enclosed system to repel surface water. The initial volume of water recovered may be a result of the improper gluing of the seams upon installation of the STAPP system. The glue used to cement the outer membrane was not properly applied ensuring total contact of the two surfaces. This lack of total contact allowed wind to separate the membranes and permitted some rain to enter the system through the open seams. All seams were re-inspected and re-glued as needed. The second volume of water may be due to how the geotextile tarp was attached to self-closing cover, permitting rain water to infiltrate the system. The two upper corners where the geotextile tarp is attached to STAPP™ will be inspected as a possible source of rain water entering the system. All seams in the self-closing cover will be inspected as well.

Self-closing rubber membrane (faces and seams)

The self-closing cover is the top layer of the STAPP™ system. Although the rubber membrane that covers the granular rubber is “self-closing” it can become worn and perforated to the point where significant amounts of precipitation can accumulate within the system. The wear and perforation of the rubber membrane is heavily dependant upon range use. Both the frequency of operations at the range and the caliber of projectiles used in training will affect the useful life of the rubber membrane. STAPP™ has estimated a total replacement of rubber membrane after 10 years of use in its life cycle cost analysis (Ciskowski 2007b). Figure 6-1 depicts the progression of wear and perforation on a heavily used STAPP™ system over a number of years.

Figure 6-1. Examples of Wear and Deterioration of the Self-Closing Rubber Membrane on the STAPP™ System

Holes in the cover. MANG will visually inspect the rubber membrane in accordance with the range inspections outlined in Section 6.2.1. If granular rubber material is clearly visible through holes in the cover, the cover is not preventing exposure of bullets to air and water and will be repaired. No tracer fire will be conducted when such holes are present. When underlying rubber media is visible, repair should be scheduled to occur within 72 hours. This applies to holes created by firing as well as conditions created by weathering, stretching, wear and tear, accidents, etc.

METRIC: *For any tear or hole 5 centimeters (cm) or larger in length, MANG will initiate repair of the membrane within 5 working days of inspection, weather permitting, per the instructions outlined in Section 6.3.1. When underlying rubber media is visible, repairs will be scheduled to occur within 72 hours.*

Failed seams. Seam failure is most problematic in the bottom one foot of the STAPP™ system, near the base. A slight leveling of the self-closing cover can occur at the "toe" of the system above the internal water collection unit. In this area, the cover gradient is less steep than throughout the rest of the system and at times water may pond on the top of the self-closing cover. If the self-closing cover has a seam failure in the lower portion of the STAPP™, ponding water could penetrate the cover and accumulate in the water collection system. Larger seam failures can also be problematic in the upper portions of the STAPP™ system as they will also allow precipitation to leak into the system and will allow air-flow supporting continued combustion of tracer rounds.

METRIC: *Failed seams occurring above the bottom one foot of self-closing cover (where water is not likely to pond on the membrane) require repair if the seam failure exceeds 6 inches. Failed seams occurring at/near the toe (within the bottom one foot) require repair if greater than one inch in size. Repairs will be initiated within 5 working days of inspection, weather permitting.*

Ponding on the surface of the cover. A slight leveling of the self-closing cover may occur in the bottom one foot of the STAPP™ system, near the base, above the internal water collection unit. If this leveling becomes a depression, water ponds on the top of the self-closing cover in this area. Ponding water may seep into the STAPP™ system through failed seems or holes in the cover.

METRIC: *Each time the top membrane of STAPP™ is opened to check the water reservoir system (three times annually), the inspector will re-distribute the granular rubber media appropriately to prevent any ponding of water in the first foot of the STAPP™ on top of the self-closing cover.*

Rubber filler material

The rubber filler material is approximately 18 inches of loose, granular rubber fill situated below the self-closing cover. Irregularities in the surface of the STAPP™ system may be indicative of two different problems: (1) irregular distribution or settling of the granular rubber media, causing "thin-spots" and poor bullet stopping capacity; or (2) erosion or irregular settling of soil beneath the STAPP™ system causing stretching or other stresses that may damage the impermeable liner.

METRIC: *A bulge or depression that exceeds 4 inches in height/depth over a length of 4 feet will be considered "significant" and will be repaired. Irregular settling will be measured using a 4 foot long straight edge placed on the surface of the self-closing cover. Separation of 4 inches between the straight edge and the cover of the STAPP™ will indicate a need to "re-grade" or "rake" the rubber filler material to an even level distribution across the STAPP™. Repairs will be initiated within 5 working days of inspection, weather permitting. Furthermore, each time the top membrane of STAPP™ is opened to check the water reservoir system (three times annually), the inspector will re-distribute the granular rubber media to a minimum depth of 15 inches.*

Impermeable liner

The impermeable liner is situated below the rubber filler material in the STAPP™ system and lies directly on the surface of the soil berm. Figure 6-2 on the following page shows punctures in the impermeable liner beneath a STAPP™ system caused by repeatedly firing .50 caliber projectiles into a system that was not designed for such use (i.e., insufficient depth of granular rubber). MANG will inspect the impermeable liner for punctures and tears each time the granular material is sifted to remove and recover captured projectiles (i.e., after the first year of training operations and subsequently after 500,000 rounds have been fired on T Range or every 3 years, whichever occurs first).

METRIC: *Any perforations, holes, rips, or seam failures in the impermeable liner will be repaired. Repairs will be initiated within 5 working days of inspection, weather permitting.*

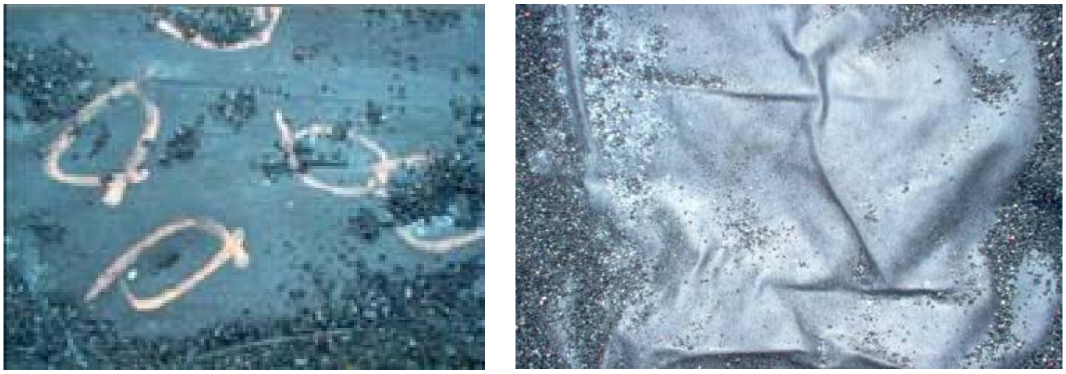

Figure 6-2. Examples of Perforated (left) and Intact (right) Liners

Internal water reservoir system

External Visual Inspection. Units and range control will conduct a visual inspection of the ground surrounding the STAPP™ water reservoir at the bottom of the berm to check for any leaking. STAPP™ is currently developing a device to monitor the water level within the reservoir, it will be available for implementation in August 2007 (Ciskowski 2007b).

METRIC: Any leaking will be further investigated and the source of leaking repaired. Repairs will be initiated within 5 working days of inspection, weather permitting. Camp Edwards will sample, collect, and properly dispose of the liquid that accumulates in the corrugated plastic reservoir within the STAPP™ system after 15 cm of rain (or 152 cm of snow) or after 5 or more cm of water accumulates in the reservoir.

Figure 6-3. Internal Water Reservoir System

Internal Visual Inspection. The internal water reservoir system is situated at the base of the STAPP™ system. It allows water which has penetrated the self closing cover to accumulate and be removed. Figure 6-3 at right shows the internal water reservoir system of the STAPP™. The water reservoir system will be checked for punctures from stray bullets or cracks from mishandling and freeze/thaw cycles. Proper inspection of the impermeable liner and the internal water reservoir requires removal of the self-closing cover and displacement of some of the granular rubber material. This process will also require redistribution of the granular rubber across the system and resealing the self-closing cover around the edges of the STAPP™ system. MANG will inspect the internal reservoir system for punctures and cracks each time the granular material is sifted to remove and recover captured projectiles (i.e., after the first year of training operations and subsequently after 500,000 rounds have been fired on T Range or every 3 years, whichever occurs first).

METRIC: *All cracks or punctures in the reservoir will be repaired. Repairs will be initiated within 5 working days of inspection, weather permitting.*

Synthetic lumber support structure

The synthetic lumber support structure makes up the frame surrounding the rubber granular material and holds the impermeable liner and self-closing cover in place. Figure 6-4 at right illustrates damage to the support frame for the installed bullet containment system.

Figure 6-4. Example of Damage to STAPP™ Support Frame

METRIC: *Conditions that effect the distribution of granular material or integrity of the cover or liner will be noted on the Range Inspection Form. Units and range control will also note the firing lanes in which they occur. Range Control will capture the initial damage with a photo and Camp Edwards will make repairs in accordance with the process and schedule outlined in Section 6.3.1. Repairs will be initiated within 5 working days of inspection, weather permitting.*

6.2.2 Environmental Sampling and Analysis

As part of the Monitoring/Sampling BMP, Camp Edwards will sample a number of environmental media on T Range, including the water collected in the reservoir of the bullet containment system, groundwater, soil-pore water, and surface soils. Camp Edwards will sample the existing groundwater monitoring well and the proposed groundwater monitoring well after it is installed, see Figure 5-1 (repeated in this section for convenience). Also, Camp Edwards will

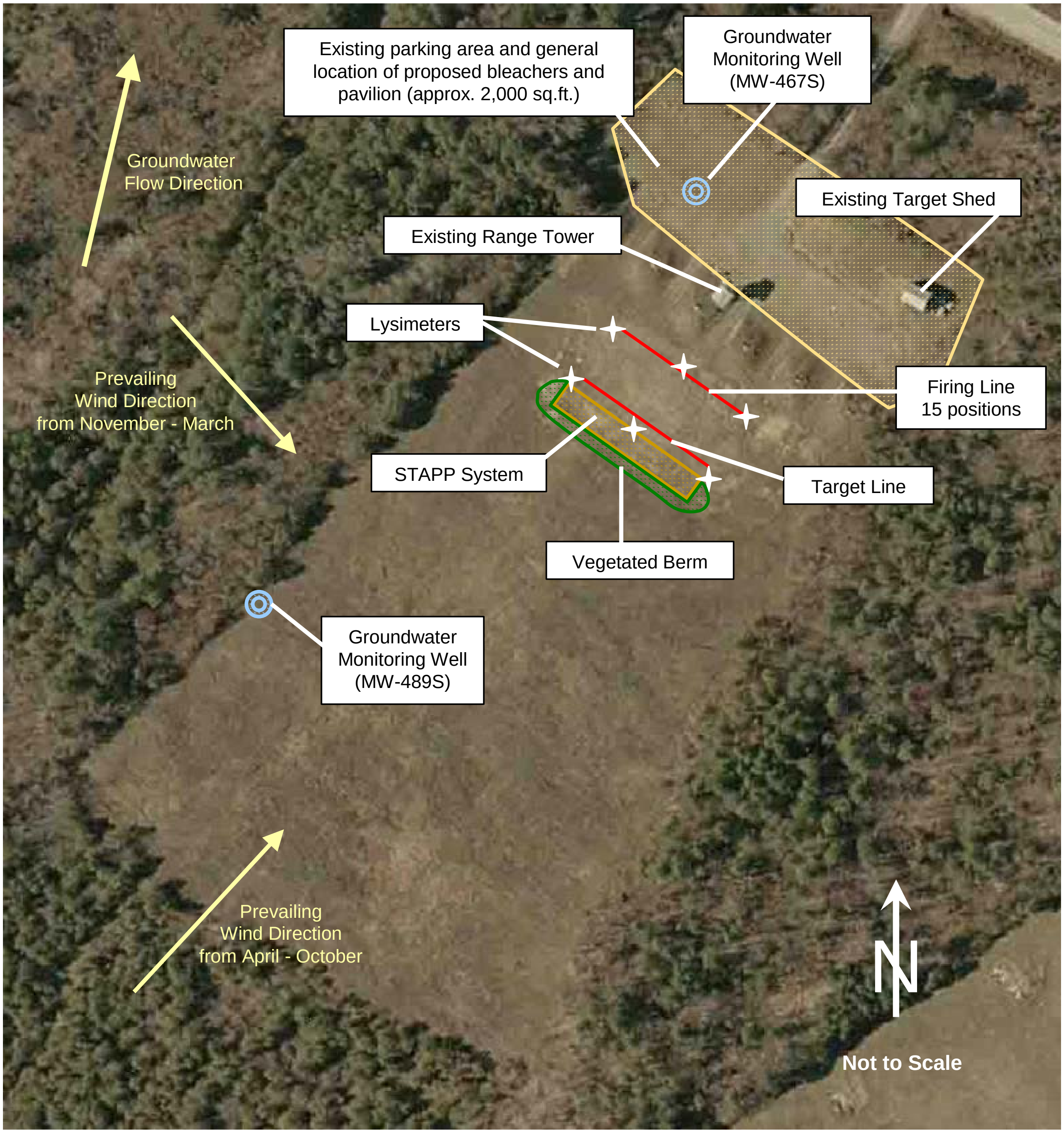

Figure 5-1. Aerial View of T Range Plan

install lysimeters in soil under the toe of the bullet containment system and at the firing line. If chemical constituents from the ammunition are not contained by the system and begin to percolate through the soil-pore water toward the aquifer, the lysimeters will provide an early warning. Sampling and analysis will be coordinated with EMC, EPA, and MassDEP. The goal of the monitoring is two-fold: to validate the conceptual site model and to initiate routine range maintenance activities as needed to promote range sustainability. The following sections provide guidance for sampling and analysis of environmental media on T Range.

6.2.2.1 Water from Bullet Containment System

The E&RC will sample, collect, and properly dispose of the liquid that accumulates in the corrugated plastic reservoir within the STAPP™ system after 15 cm of rain (or 152 cm of snow) or after 5 or more cm of water accumulates in the reservoir. Camp Edwards will identify and coordinate with the receiving treatment and disposal facility to determine the appropriate analytical methods for testing the water. Based on the results of this sampling, Camp Edwards will dispose of the water in accordance with all applicable state and federal laws and regulations. In no cases will water from the STAPP™ system reservoir be discharged onto the ground on T Range.

After a series of consistent sampling results, Camp Edwards may employ “process knowledge” rather than sampling and analysis as a means of characterizing the water. To collect the water, Camp Edwards personnel will remove the self-closing rubber membrane at the corner of the trap and move enough of the granular rubber material to access the reservoir system cap. The cap is removed and the water in the reservoir will be emptied.

6.2.2.2 Groundwater

Figure 5-2 indicates the location of the downgradient groundwater monitoring well (MW-467S) and the location of the upgradient groundwater monitoring well (MW-489S). MANG will sample these wells annually in October for propellants and metals. The groundwater samples will be analyzed for lead, copper, zinc, and antimony (using method SW6010B), tungsten (using method SW6020), and nitroglycerine (using method 8330b) (USEPA 2007).

6.2.2.3 Lysimeters

Camp Edwards will install three lysimeters at the firing line and three more at the toe of the STAPP™ system: at firing lane 4, between firing lanes 7 and 8, and at firing lane 10 (see Figure 5-2). Soil in front of the firing line is a potential hotspot for metals accumulation. Muzzle blast from small arms may deposit metals and energetic materials onto surface soils. Lysimeters will provide an early indication if dissolved metals are migrating through soil-pore water toward groundwater. Camp Edwards will sample the lysimeters three times during the first year of operations on T Range in April, August/September, and November/December based on a significant rain event. In subsequent years, the lysimeters will be sampled annually in October/November depending on rainfall. The soil-pore water samples will be analyzed for lead, copper, and antimony (using method SW6010B), tungsten (using method SW6020), and nitroglycerine (using method 8330b) (USEPA 2007).

6.2.2.4 Surface Soil

Camp Edwards will sample surface soil from two different areas on T Range: in front of the firing line and along the toe of the berm. Area 1 sampling area will be established just in front of the firing line to characterize the deposition of metals and propellants in surface soils generated from muzzle blast. Area 2 sampling area will be established along the toe of the berm to assess any potential deposition of metals in surface soils from the bullets striking the targets, bullet containment system, and soil berm. Each soil sampling area is 35 m long (the approximate length of both the firing line and target area) and 5 m wide. Figure 6-5 shows the locations of the proposed sampling areas on T Range.

Once a year, in October, MANG will sample the surface soil in the sampling areas as outlined below:

- **Area 1:** A 100-point composite sample will be collected from 0 to 7.6 cm below grade. A second 100-point composite sample will be collected in the same manner, then ground in a puck mill. Grinding of the sample will improve homogeneity for analysis and create finer metals particles. The ground sample will be analyzed for lead, copper, zinc, and antimony (using method SW6010B), tungsten (using method SW6020), and nitroglycerine (using method 8330b) (USEPA 2007). The unprocessed sample will be analyzed for lead, copper, zinc, and antimony (using method SW6010B) and tungsten (using method SW6020). Two 100-point composite replicate samples will also be collected in the same manner as described above, then ground in a puck mill. The replicate samples will be analyzed for lead, copper, zinc, and antimony (using method SW6010B), tungsten (using method SW6020), and nitroglycerine (using method 8330b) (USEPA 2007).

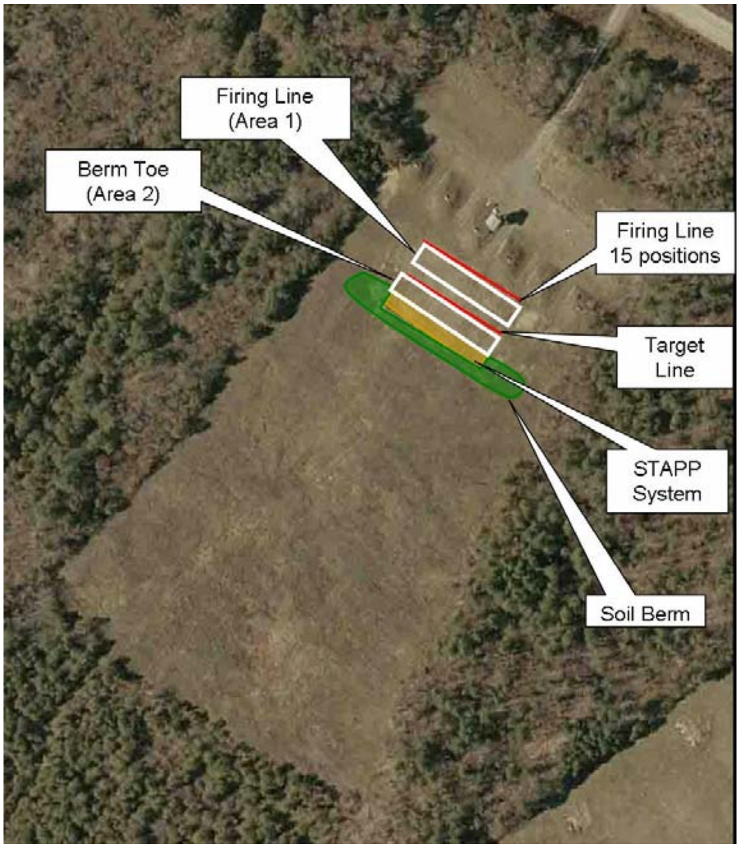

Figure 6-5. Surface Soil Sampling Areas

- **Area 2:** A 100-point composite sample will be collected from 0 to 7.6 cm below grade. A second 100-point composite sample will be collected in the same manner, then ground in a puck mill. Both the ground and the unprocessed sample will be analyzed for lead, copper, zinc, and antimony (using method SW6010B), and tungsten (using method SW6020).

These sampling, processing and analytical methods will be re-evaluated after the first year of monitoring and thereafter for validation and refinement. Camp Edwards' staff will use a plug extractor to systematically collect representative samples from each grid and will not concentrate samples in one portion of the sampling grid.

6.2.2.5 pH

A neutral pH in soil will help reduce metals migration on the range. Lead is least mobile between a pH of 6.5 and 8.5. Within this range, lead binds more easily to clay and organic matter in the soil. Therefore, it is important to keep the pH of the soil as close to neutral (pH of 7) as possible to stabilize the lead in the soil. A neutral pH will inhibit corrosion and allow the lead in the soil to bind to clay and organic particles (ATSC 1998).

Limestone (lime) addition to surface soils is standard practice for increasing pH and neutralizing soils. A pulverized variety of lime will be applied before peak training season to increase its effectiveness. If large granules of lime are applied, it may take six months or longer to raise the pH of the soil to the desired level. Once the optimum pH is reached, it should be checked once a year and lime applied as needed to promote vegetative growth and prevent vertical migration of lead (ATSC 1998).

A recent sampling event found pH values on T Range are between 5.9 and 7.4 in the first one foot of soil, with a median of 6.4 (IAGWSP 2007). Camp Edwards will test soil pH on a quarterly basis in January, April, July, and October at the firing line and the toe of the berm in the first year of fire operations then re-evaluate. To determine the average soil pH of each area, 6–12 soil samples will be collected at a depth of 15 cm along the firing line and along the toe of the berm. The soil samples will be mixed thoroughly to accurately represent soil from the sampling locations (Clemson 2007b). The soil samples will then be tested for pH. Camp Edwards will manage the soil pH through soil amendment with lime with the goal of maintaining neutral soil pH (see Section 6.3.6).

6.3 Range Maintenance

Camp Edwards will conduct periodic maintenance on T Range to ensure it remains in adequate condition to support training requirements and design features and BMPs function as intended. To the maximum extent possible, maintenance will be conducted during off-peak training periods (between October and April). This preventative maintenance will be conducted as soon as needed, regardless of other maintenance schedules. Maintenance and repairs at T Range will be documented in a maintenance log and summarized in an Annual Range Maintenance Report.

6.3.1 Bullet Containment System

The bullet containment system on T Range consists of a soil berm, the STAPP™ system, and a geotextile tarp covering the top of the berm to prevent erosion along the top and sides of the STAPP™ system. The tarp will be visually inspected for weathering, holes, or tears. Holes in the tarp greater than 10 cm in size will be repaired with like material. Repairs will be initiated within 5 working days of inspection, weather permitting.

Based on the unit observations reported on T Range Inspection Forms and Range Control's visual inspections, the following steps will be taken to repair holes or tears to the self-closing rubber membrane cover of the STAPP™ when granular rubber filler material is clearly visible through external inspection.

1. Sand the perimeter of the damaged area.
2. Wipe area clean using rubbing alcohol.
3. Cut a repair patch of the self-closing rubber membrane that is slightly larger than the damaged area to allow a 2.5–5 cm overlap. (The overlap provides a sound surface to which the repair patch adheres.)
4. Sand and wipe clean the underside of the repair patch.
5. Place a bead of the STAPP™-supplied glue on both the perimeter of the damaged area as well as the coordinating under side of the patch.
6. Lay the patch on top of the damaged area and apply hand-pressure.

The glue provided is made of cyanogeneacrylate; therefore, the manufacturer recommends breathing protection for large repairs (STAPP 2006). The same procedures will be conducted to repair any perforations in the impermeable liner material using appropriately matched materials and adhesives. Damage to the STAPP™ support frame will be made on an as needed basis. The time required to complete minor repairs is generally less than 10 minutes. Larger repairs may require up to 30 minutes for a properly equipped worker.

After either 15 cm of precipitation or an observation of 5 cm of liquid in the reservoir, Camp Edwards personnel will sample, remove (using a wet/dry shop vacuum), and dispose of the water in the internal reservoir system per the guidelines outlined in Section 6.2.2.1.

6.3.2 Periodic Metals Removal

Figure 6-6. STAPP™ Sifter

Camp Edwards will remove bullets from the STAPP™ system after completion of the initial year of training. In subsequent years, bullets will be removed after 500,000 rounds have been fired on T Range or every 3 years, whichever occurs first. Camp Edwards will use either the specially designed STAPP™ sifter, or a compatible system, for removing metals from the STAPP™ system. This unit has a very simple design consisting of a table positioned at a defined slope with a small vibrator positioned on the underside of the table. The granular rubber and bullet mixture is placed onto the table, and due to the vibration slowly moves down the slope of the table. A piece of piping at the end of the table is connected to a cyclone vacuum with a high-efficiency particulate air (HEPA) filter. The vacuum has enough suction to remove the granular rubber but not the bullets. The granular rubber is sucked up via the cyclone and the air is filtered with a HEPA filter (see Figure 6-6). Total mass of metals removed from the bullet containment system will be compared with the total computed mass loading of bullets fired on T Range from the Training Facility Utilization Reports (see Appendix A). This comparison is indicative of the efficiency with which the STAPP™ system eliminates the source of metals on T Range.

6.3.3 Interim Triggers for Focused Assessments and Maintenance Actions for the Initial Year of Fire Operations on T Range

Based on the results of soil, lysimeter and groundwater sampling described in Section 6.2.2, Camp Edwards will initiate range characterization and maintenance actions to prevent pollution of the environment, in coordination with the EMC, EPA, and MassDEP. The need for maintenance actions will be indicated by comparing monitoring results to a series of action levels. The type of action necessary will be dependent on the media being sampled/analyzed and the action level triggered (see action levels presented in Tables 6-1, 6-2, and 6-3). The action levels in the tables below are interim numbers for the time period of July 2007 to December 2008 of operations on T Range. As such, they are subject to change as more information is developed on the leaching potential of these compounds and the effectiveness of the P2 plan as a whole. These action levels will be periodically reviewed (per Section 7.3) in coordination with the EMC, MassDEP and EPA.

The surface soil action level numbers are based on modeled potential for leaching to groundwater calculated using proposed sampling areas and a sample depth of 3 inches. The action levels for surface soil are provided in Table 6-1.

Table 6-1. Interim Surface Soil Action Levels for the Initial Year of Fire Operations on T Range

Analyte	Level 1 Focused Reassessment[1]
Lead	9,070 mg/Kg
Antimony	3,500 mg/Kg
Nitroglycerine	10 mg/Kg

Notes:

1. The purpose of the Focused Reassessment will be to validate the initial sampling results, evaluate the cause, and assess the hazards. Results will be reviewed with stakeholders and may result in modification of the Conceptual Site Model. If reassessment verifies sampling results, MANG will coordinate with the EMC, EPA, and MassDEP to identify appropriate maintenance actions (e.g., soil removal). Actions may include temporary suspension of the use of the range.

Soil-pore water action level numbers are based on a relevant drinking water standard (or similar risk-based concentration) for the respective compound and will require a reassessment of the Conceptual Site Model and more focused investigation of the mechanism of contamination. Level 2 numbers are two times the Level 1 concentrations and will require a range maintenance action. Action levels for soil-pore water are provided in Table 6-2.

Table 6-2. Interim Soil-Pore Water Action Levels for the Initial Year of Fire Operations on T Range

Analyte	Level 1 Focused Reassessment[1]	Level 2 Range Maintenance[2]
Lead	15 ug/L	30 ug/L
Copper	1,300 ug/L	2,600 ug/L
Antimony	6.0 ug/L	12 ug/L
Nitroglycerine	4.8 ug/L	9.6 ug/L

Notes:
1. Focused Reassessment to include actions such as resampling, validation of results, an evaluation of the cause or need for action, and review of the results with stakeholders. Possible modification of the Conceptual Site Model and follow on action could result. MANG will coordinate with the EMC, EPA, and MassDEP to identify appropriate maintenance actions (e.g., dust control, pH control, soil removal).
2. Range Maintenance may include soil removal, resampling, or temporary suspension of firing on the range. The range will be reconstructed once favorable results from the post excavation sampling are received. Soil removal may not be required if a removal action has already been conducted based on soil monitoring results.

With proper BMP implementation, surface soil and soil-pore water monitoring, and appropriate maintenance actions, MANG does not anticipate significant detections of target analytes in groundwater samples. Therefore, detection at concentrations provided in Table 6-3 reflects a potentially serious condition that could require significant actions, such as a cease fire at the T-Range. Level 1 numbers are based on one-half the relevant drinking water standard (or equivalent risk number). Level 2 numbers are based on the relevant drinking water standard.

Table 6-3. Interim Groundwater Action Levels for the Initial Year of Fire Operations on T Range

Analyte	Level 1 Focused Reassessment[1]	Level 2 Cease Fire and Maintenance Action[2]
Lead	7.5 ug/L	15 ug/L
Copper	650 ug/L	1,300 ug/L
Antimony	3.0 ug/L	6.0 ug/L
Nitroglycerine	2.4 ug/L	4.8 ug/L

Notes:
1. Focused Reassessment to include actions such as resampling, validation of results and evaluation of the cause and review of the results with stakeholders. Possible modification of the Conceptual Site Model and follow on action could result.
2. Groundwater concentrations at or above Level 2 concentrations require significant actions including cease fire at the range, a complete reassessment of the pollution prevention program and follow on assessment and possible remediation.

Nitroglycerin has been detected in soil samples taken from the center of the firing line at T Range in concentrations up to 47 mg/kg. In response to these findings, Camp Edwards will initiate a range maintenance project at T Range to remove the nitroglycerin contaminated soil as agreed to during coordination with the EMC, EPA, and MassDEP about the results of soil sampling described in Section 6.2.2.4.

MANG anticipates the need to conduct periodic soil removal maintenance every three to five years, depending on the volume of training and the results of surface soil sampling outlined in Section 6.2.2.4. During this periodic soil removal, Camp Edwards anticipates removing 3 inches of surface soil from the firing line (the depth of past nitroglycerin detections) of T Range (approximately 43 m wide and 6 m downrange). MANG will use earthmoving equipment and hand tools to remove approximately 60 tons of soil. The removed soil will be placed in drums, characterized through a complete TCLP metals series, and disposed of at an approved and permitted facility, in accordance with state and federal solid and hazardous waste regulations. MANG will replace the removed soil with clean fill and revegetate the area. The costs associated with the labor, equipment, soil characterization, transportation and disposal, and clean soil is estimated at between $15,000 and $20,000.

6.3.4 Protective Timber "Sand Boxes"

The protective timber "sand boxes" in front of the target frames will be evaluated to identify deterioration, damage or excessive amounts of undershot. The top surface of the geotextile tarps covering the boxes will be inspected periodically for signs of wear and tear in order to prevent rain from infiltrating into the sand in the center of the wooden frame. Large holes in the tarps will be patched with like material. The density/amount of bullets lodged in the wooden face of sand boxes will be inspected bi-weekly and by each using unit to check for bullet ricochet hazard. Once the wooden face of a sand box is full of bullets, the box will be rotated 180º to reveal the clean backside towards the firing line. After one rotation, when the wooden face is full of bullets again the sand box will be refurbished or replaced with a new sand box.

6.3.5 Vegetative Cover and Wind Breaks

At the conclusion of the training year in October, the Camp Edwards Range Control will coordinate the spread of MassHighway Seed Mix, as required, on areas of the T Range floor, elevated mounds behind firing line, and backstop berm supporting the STAPP™ that have less that 50% vegetative cover. If during the course of the training year, the T Range Inspection Forms identify areas of low vegetative cover, Range Control shall coordinate and schedule range maintenance as soon as growing conditions allow. Maintenance activities will be timed and conducted as to not interfere with scheduled training and to avoid cumulative erosion.

Forested buffers, serving as natural windbreaks and noise abatement, will be maintained around T Range. Each year in March, before the peak training period begins, FE will trim tree limbs on the range boundary. Any diseased or dead trees may be removed, as advised by E&RC. FE will clear this range maintenance with Range Control to minimize interference with any scheduled training on the range.

6.3.6 Soil pH

When soil pH levels are neutral, lead remains relatively unavailable for migration in soils. Camp Edwards will amend soils with material to increase alkalinity, typically lime, with a goal of maintaining neutral soil pH.

Limestone products come in four types: pulverized, granular, pelletized, and hydrated. The finer the particle size of the limestone the faster it will change the soil pH value. When lime is added to the soil, maximum contact with the soil is essential.

Ground calcitic limestone (calcium carbonate) is faster acting than ground dolomitic limestone (calcium-magnesium carbonate) and is recommended for addition to the sandy soils on site. To raise the soil pH from 5.9 (the lowest measured pH on T Range) to 7.0, 5–8 lb of ground calcitic limestone will be added per 100 ft^2 of soil. Soil amendments should be spread evenly over the soil using a spreader and will affect the top 2.5–5 cm of soil. It will take approximately one to two years for the soil to fully reflect the pH change (University of Minnesota 2007; Clemson 2007a).

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7.0 CONCLUSIONS AND CONTINUAL IMPROVEMENT

7.1 Conclusions

MANG will conduct marksmanship training on T Range, using standard lead-bullet ammunition, including use of tracer ammunition. This training will include:

- Familiarization, zeroing, marksmanship practice and alternate qualification using the 5.56mm rifle (M16 and M4) and machine gun (M249) and the 7.62mm machine guns (M240 and M60); and
- Familiarization, zeroing, marksmanship practice and alternate qualification using all calibers (i.e., .22, .357, .38, .40, 9mm, .45, .44) of pistols.

Based on the CSM for T Range, evaluations of SAR P2 BMPs conducted in the SAR P2 Overview, and the feasibility assessment contained in Section 4.0 of this document, MANG will satisfy the requirement of AO2 to employ "maximum feasible use" of P2 technologies by:

- Implementing a system of range upgrades and BMPs that will either sever potential migration and exposure pathways or monitor environmental conditions to confirm that pathways remain incomplete.
- Implementing a "contain, maintain, and monitor" approach to SAR BMPs that will include redundant methods to prevent pollution (e.g., bullet containment, pH management, erosion control) and methods to assess the effectiveness (e.g., inspections, sampling) of each system in each environmental media (e.g., soil, groundwater). This approach will include:
  - Managing metals on T-Range at their source, through containment in the STAPP™ system and periodic removal and recycling.
  - Monitoring potential migration pathways, such as surface soil, soil-pore water, and groundwater, to evaluate whether contaminants metals are being transported in environmental media.
  - Implementing a number of other monitoring and maintenance BMPs to sustain the conditions on T Range that limit metals mobility (e.g., monitoring the condition of the bullet containment system, maintaining healthy vegetation on range areas to prevent soil erosion, maintaining wind breaks to limit windborne metals transport, and maintaining soil pH to minimize corrosion/dissolution of metals into groundwater.

MANG believes that implementing these SAR BMPs will support the adjustment of the environmental performance standards established in Chapter 47 of the Acts of 2002, Section 10(d). Through these BMPs, MANG will demonstrate that the resumption of small arms marksmanship training on T Range is protective of the drinking water supply and wildlife habitat on Camp Edwards.

The BMPs selected and described in this BMP OMM Plan will support the employment of small arms on T Range in a manner that meets training requirements while protecting human health and the environment. As training requirements change, MANG may seek to conduct additional training activities on T Range. As environmental conditions or the understanding of conditions change, it may become necessary to add or modify management actions to protect human health and the environment. All such modifications to training activities or management action will be fully coordinated with the EMC, EPA, and MassDEP.

7.2 Record keeping

To facilitate the periodic review and continual improvement of this plan and, in turn, the management of T Range; MANG will document operations, monitoring, and maintenance. Table 7-1 identifies the records that MANG will maintain for T Range. These records will be maintained indefinitely and will become part of the permanent real property records of the site.

Table 7-1. Recordkeeping Procedures

Record	Contents	Frequency	Responsible Office
Range Utilization Report	• Use days • Munitions expenditures by type, quantity, and using unit	Annually	Range Control
Range Condition Inspection Report	• General conditions • Erosion • Vegetation • Bullet containment system	Quarterly	Range Control
Environmental Sampling and Analysis Report	• Water from bullet containment systems • Groundwater • Lysimeter • Soil • pH	Annually	E&RC
Range Maintenance Report	• Bullet containment system • Periodic metals removal (mass, locations, and methods) • Vegetation • Soil pH	Annually	Range Control
Periodic Review Report	see Section 7.3	Annually	E&RC
Photologs	see Section 6.2.1	As Needed	Range Control

7.3 Reviewing and updating this plan/Periodic Review

MANG will conduct periodic reviews of this plan to evaluate whether training activities, environmental conditions, and BMPs on T Range remain protective of human health and the environment. The first review will take place in Fall 2007, assuming the range returns to live-fire in Summer 2007. Subsequent reviews will occur when MANG desires to significantly modify the training activities at T Range, when MANG becomes aware of information that indicates environmental conditions are not protective of human health or the environment, or at an interval not to exceed 5 years. The E&RC will provide a progress report for the operation of T Range in the annual State of the Reservation Report. If a problem with an implemented BMP or an unacceptable condition is identified on the range between scheduled reviews, a request for a periodic review may be submitted to EMC and EPA in coordination with MassDEP.

The purpose of periodic reviews is to answer three general questions:

- Are the BMPs on T Range functioning as intended?
- Are the assumptions used at the time of BMP selection still valid?
- Does new information indicate that the previously selected BMPs are no longer protective of human health and the environment?

Stakeholders and regulators will be involved in the periodic review process through coordination with EMC. MANG will notify EMC and the Small Arms Range Working Group at the time the periodic review is initiated to seek their involvement. Another notification, including notification of the availability of results, will be made when a review is completed.

The periodic review will consist of an evaluation of the records described in Section 6.2, as well as the identification and review of new information, a site visit, and preparation of a short Periodic Review Report. MANG will identify readily available information regarding T Range that has become available since implementation of this plan or the last periodic review. New information may also be gathered through interviews with persons knowledgeable about the site, including stakeholders such as adjacent property owners, local agencies, and regulators. MANG will gather information pertaining to the following areas:

- New training missions or training activities supported on T Range;
- Modifications to the layout of T Range;
- New development or changes in land use in the vicinity of T Range (on and off installation);
- Recreational or other new activities at T Range or in the vicinity of T Range;
- Changes in accessibility to T Range;
- Changes to statutes, regulations, or policies effecting the use and management of T Range; and,
- New technologies or techniques that can cost effectively improve training or environmental conditions at T Range.

MANG will prepare a short Periodic Review Report to document the information collected and evaluated, and present the findings of the evaluation to EMC and EPA in coordination with MassDEP and other stakeholders. The report will document whether training activities and BMPs continue to be protective of human health and the environment. The report will also recommend follow-up actions, as warranted. Based on the conclusions drawn in the report, MANG will update the T Range BMP OMM Plan to reflect recommended actions. A draft of the modified T Range BMP OMM Plan will be coordinated with EMC, EPA, MassDEP, and other stakeholders for review and comment. Final copies of the plan will be made available to these stakeholders.

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Appendix A
Training Facility Utilization Report

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T RANGE: TRAINING FACILITY UTILIZATION REPORT

This form will be completed by all units/organizations conducting training at Camp Edwards. Return form to Range Control upon completion of training.

UNIT:	UIC:	COMPONENT:

ADDRESS:	DATE OF TRAINING:

NAME/ RANK / LAST 4 RANGE OIC:	NAME/ RANK / LAST 4 RANGE RSO:

NUMBER OF PERSONNEL TRAINED:	RANGE HOT TIME:	RANGE COLD TIME:

FIRING LANES USED DURING TRAINING
(circle the firing lanes used): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

WEAPONS SYSTEMS:	TYPE OF AMMUNITION:	NUMBER EXPENDED:

VEHICLES BY TYPE PRESENT ON RANGE:	QTY:

TYPES OF EXERCISES CONDUCTED:

REMARKS:

SIGNATURE OF RANGE OIC/ RSO:
DATE:

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Appendix B
Army Ammunition Specifications

5.56mm, ball, M193

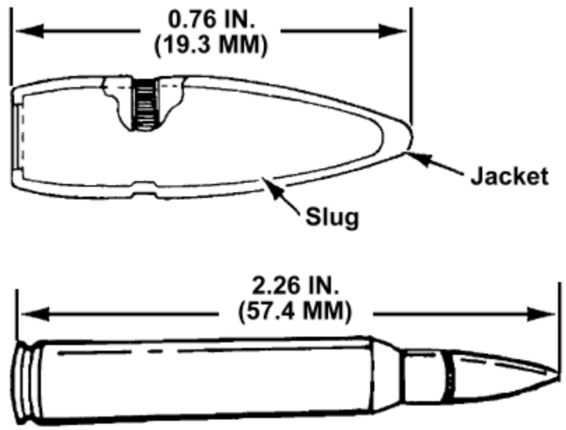

Figure B-1.
5.56mm, ball, M193

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M193
NSN : 1305009263970 **DODIC:** A066
Status: OFFICIAL

Reported Weight : 182.0000 **Unit :** GR
Reported Weight (lbs): 0.0260
Calculated Weight (lbs): 0.0262 100.60 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
10523632	STD	CTG 5.56MM BALL M193	M		182.0000	GR	1		MIL-C-9963	
10523632	STD	CTG 5.56MM BALL M193	C		182.0000	GR	1		MIL-C-9963	
10524200(BULK)	STD	CASE	P	I	95.0000	GR	1	0.013572	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B			1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B			1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	ALT	SEALING COMPOUND (ALT)	B	B			1		MIL-S-22473	
	STD	VEHICLE (N/A) (60%)	Cmpd	B						
	STD	SOLVENTS (N/A) (20%)	Cmpd	B						
	STD	PIGMENTS (N/A) (20%)	Cmpd	B						
11820451	ALT	CASE (ALT)	P	I	115.0000	GR	1		MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0109	GR	1		MIL-C-13783	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M193
NSN : 1305009263970 **DODIC:** A066
Status: OFFICIAL

Reported Weight : 182.0000 **Unit :** GR
Reported Weight (lbs): 0.0260
Calculated Weight (lbs): 0.0262 100.60 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B	0.0141	GR	1		MIL-L-10287	/1 OR 2////
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	ALT	CITRIC ACID (ALT)	B	B	0.0109	GR	1		MIL-C-11029	
	STD	CITRIC ACID (77-92-9) (99.9%)	Cmpd	B						
	STD	BROMOTHYMOL BLUE (76-59-5) (0%)	Cmpd	B						
	ALT	SEALING COMPOUND (ALT)	B	B	0.0141	GR	1		MIL-S-22473	
	STD	VEHICLE (N/A) (60%)	Cmpd	B						
	STD	SOLVENTS (N/A) (20%)	Cmpd	B						
	STD	PIGMENTS (N/A) (20%)	Cmpd	B						
	STD	PROP WC844	P	X	28.5000	GR	1	0.004072	10542743	
	STD	PROP WC844	Mtl	X					10542743	
	STD	NITROCELLULOSE (9004-70-0) (66.95%)	Cmpd	X					MIL-DTL-244	/ ////
	STD	NITROGEN (7727-37-9) (13.2%)	Cmpd	X						
	STD	NITROGLYCERIN (55-63-0) (11.2%)	Cmpd	X					MIL-N-246	
	STD	DIBUTYL PHTHALATE (84-74-2) (6%)	Cmpd	X					ASTM-D608	
	STD	DIPHENYLAMINE (122-39-4) (1.5%)	Cmpd	X					MIL-D-98	
	STD	ANHYDROUS SODIUM SUL (7757-82-6) (0.5%)	Cmpd	X					A-A-59279	
	STD	GRAPHITE (7782-42-5) (0.4%)	Cmpd	X					MIL-G-155	
	STD	CA CARBONATE (471-34-1) (0.25%)	Cmpd	X					MIL-C-293	
	ALT	PROP CMR 170 (ALT)	P	X	26.5000	GR	1		11735682	
	STD	PROP CMR 170	Mtl	X					11735682	
	STD	NC (N 13.15%) (9004-70-0) (88.95%)	Cmpd	X					MIL-N-244	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M193
NSN : 1305009263970 **DODIC:** A066
Status: OFFICIAL

Reported Weight : 182.0000 **Unit :** GR
Reported Weight (lbs): 0.0260
Calculated Weight (lbs): 0.0262 100.60 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	NITROGLYCERIN (55-63-0) (5.5%)	Cmpd	X					MIL-N-246	
	STD	METHYL CENTRALITE (611-92-7) (2.25%)	Cmpd	X					MIL-M-19719	
	STD	ETHYL CENTRALITE (85-98-3) (2.25%)	Cmpd	X					MIL-E-255	
	STD	K SULFATE (7778-80-5) (0.55%)	Cmpd	X					MIL-P-193	
	STD	GRAPHITE (7782-42-5) (0.5%)	Cmpd	X					MIL-G-155	
10534279	STD	PRIMER #41	C		4.0000	GR	1		MIL-P-46610	
10534281	STD	ANVIL	P	I	0.7000	GR	1	0.000100	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	SHELLAC	B	B	0.0194	GR	1		TT-S-300	/1/B//BODY 4/
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0194	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	ETHYL ACETATE	B	B	0.0194	GR	1		TT-E-751	
	STD	ETHYL ACETATE (141-78-6) (86.5%)	Cmpd	B						
	ALT	SHELLAC (ALT)	B	B	0.0194	GR	1		TT-S-300	/1/B//BODY 1/
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	SHELLAC (ALT)	B	B	0.0194	GR	1		JAN-S-732	/2////
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0194	GR	1		MIL-L-46075	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M193
NSN : 1305009263970 **DODIC:** A066
Status: OFFICIAL

Reported Weight : 182.0000 **Unit :** GR
Reported Weight (lbs): 0.0260
Calculated Weight (lbs): 0.0262 100.60 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
10534280	STD	CUP PRIMER	P	I	2.5000	GR	1	0.000357	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	ALT	ETHYL ACETATE (ALT)	B	B	0.0194	GR	1		TT-E-751	
	STD	ETHYL ACETATE (141-78-6) (86.5%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0201	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0201	GR	1		MIL-L-46075	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
	STD	SHELLAC	B	B	0.0197	GR	1		TT-S-300	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M193
NSN : 1305009263970 **DODIC:** A066
Status: OFFICIAL

Reported Weight : 182.0000 **Unit :** GR
Reported Weight (lbs): 0.0260
Calculated Weight (lbs): 0.0262 100.60 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
10534282	STD	DISC	P	I	0.0100	GR	1	0.000001	MIL-P-60169	/1////
	STD	PAPER SEALING	Mtl	I					MIL-P-60169	/1////
	STD	SHELLAC	B	B	0.0194	GR	1		TT-S-300	
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
10534283	STD	PELLET BOOSTER	P	X	0.3900	GR	1	0.000056	10522388	
	STD	PRIMER COMP FA-956	Mtl	X					10522388	
	STD	PB STYPHNATE (15245-44-0) (37%)	Cmpd	X					MIL-L-757	
	STD	BA NITRATE (10022-31-8) (32%)	Cmpd	X					MIL-B-162	///1//
	STD	SB SULFIDE (1345-04-6) (15%)	Cmpd	X					MIL-A-159	///1,2 OR 3//
	STD	AL PWDR (7429-90-5) (7%)	Cmpd	X					MIL-A-512	/3/F/6//
	STD	PETN (78-11-5) (5%)	Cmpd	X					MIL-P-387	///2//
	STD	TETRACENE (92-24-0) (4%)	Cmpd	X					MIL-T-46938	
10524197	STD	BULLET M193	C		56.0000	GR	1			
12903080	STD	JACKET POINTED	P	I	17.5000	GR	1	0.002500	MIL-C-21768	//220///
	STD	CU ALLOY	Mtl	I					MIL-C-21768	//220///
	STD	COPPER (7440-50-8) (90%)	Cmpd	I						
	STD	ZINC (7440-66-6) (9.9%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.05%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B			1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	ALT	SEALING COMPOUND (ALT)	B	B			1		MIL-S-22473	
	STD	VEHICLE (N/A) (60%)	Cmpd	B						
	STD	SOLVENTS (N/A) (20%)	Cmpd	B						
	STD	PIGMENTS (N/A) (20%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M193
NSN : 1305009263970 **DODIC:** A066
Status: OFFICIAL

Reported Weight : 182.0000 **Unit :** GR
Reported Weight (lbs): 0.0260
Calculated Weight (lbs): 0.0262 100.60 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
10542368	STD	SLUG	P	I	38.5000	GR	1	0.005500	MIL-L-13283	//1///
	STD	PB-SB ALLOY	Mtl	I					MIL-L-13283	//1///
	STD	LEAD (7439-92-1) (99%)	Cmpd	I						
	STD	ANTIMONY (7440-36-0) (1%)	Cmpd	I						
								0.026158		

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5.56mm, tracer, M196

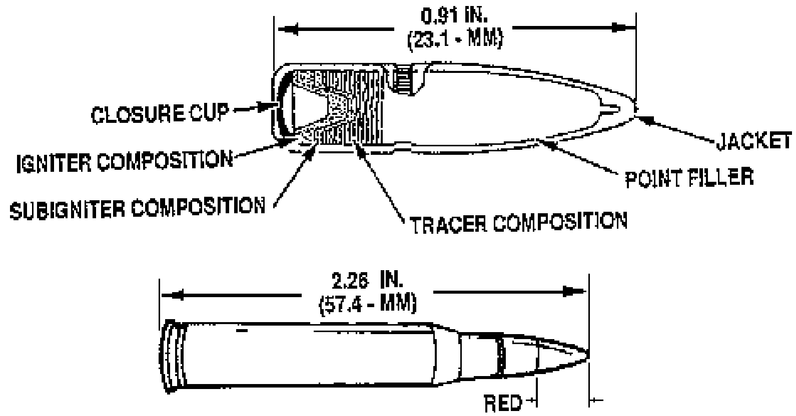

Figure B-2.
5.56mm, tracer, M196

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M196 **Reported Weight :** 177.0000 **Unit :** GR

NSN : 1305009144719 **DODIC:** A068 **Reported Weight (lbs):** 0.0253

Status: OFFICIAL **Calculated Weight (lbs):** 0.0254 100.56 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
10534193	STD	CTG 5.56MM TR M196	M		177.0000	GR	1		MIL-C-60111	
10534193	STD	CTG 5.56MM TR M196	C		177.0000	GR	1		MIL-C-60111	
10524200(BULK)	STD	CASE	P	I	95.0000	GR	1	0.013572	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B			1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B			1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	ALT	SEALING COMPOUND (ALT)	B	B			1		MIL-S-22473	
	STD	VEHICLE (N/A) (60%)	Cmpd	B						
	STD	SOLVENTS (N/A) (20%)	Cmpd	B						
	STD	PIGMENTS (N/A) (20%)	Cmpd	B						
11820451	ALT	CASE (ALT)	P	I	115.0000	GR	1		MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0109	GR	1		MIL-C-13783	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M196
NSN : 1305009144719 **DODIC:** A068
Status: OFFICIAL

Reported Weight : 177.0000 **Unit :** GR
Reported Weight (lbs): 0.0253
Calculated Weight (lbs): 0.0254 100.56 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B	0.0141	GR	1		MIL-L-10287	/1 OR 2////
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	ALT	CITRIC ACID (ALT)	B	B	0.0109	GR	1		MIL-C-11029	
	STD	CITRIC ACID (77-92-9) (99.9%)	Cmpd	B						
	STD	BROMOTHYMOL BLUE (76-59-5) (0%)	Cmpd	B						
	ALT	SEALING COMPOUND (ALT)	B	B	0.0141	GR	1		MIL-S-22473	
	STD	VEHICLE (N/A) (60%)	Cmpd	B						
	STD	SOLVENTS (N/A) (20%)	Cmpd	B						
	STD	PIGMENTS (N/A) (20%)	Cmpd	B						
	STD	PROP IMR 8208-M	P	X	25.3000	GR	1	0.003614	10535450	
	STD	PROP IMR 8208-M	Mtl	X					10535450	
	STD	NC (N 13.15%) (9004-70-0) (93.17%)	Cmpd	X					MIL-N-244	
	STD	ETHYLENE DIMETHACRYL (97-90-5) (5%)	Cmpd	X					MIL-E-14828	
	STD	DIPHENYLAMINE (122-39-4) (0.88%)	Cmpd	X					MIL-D-98	
	STD	K SULFATE (7778-80-5) (0.55%)	Cmpd	X					MIL-P-193	
	STD	GRAPHITE (7782-42-5) (0.4%)	Cmpd	X					MIL-G-155	
	ALT	PROP WC844 (ALT)	P	X	28.5000	GR	1		10542743	
	STD	PROP WC844	Mtl	X					10542743	
	STD	NITROCELLULOSE (9004-70-0) (66.95%)	Cmpd	X					MIL-DTL-244	/ ////
	STD	NITROGEN (7727-37-9) (13.2%)	Cmpd	X						
	STD	NITROGLYCERIN (55-63-0) (11.2%)	Cmpd	X					MIL-N-246	
	STD	DIBUTYL PHTHALATE (84-74-2) (6%)	Cmpd	X					ASTM-D608	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M196
NSN : 1305009144719 **DODIC:** A068
Status: OFFICIAL

Reported Weight : 177.0000 **Unit :** GR
Reported Weight (lbs): 0.0253
Calculated Weight (lbs): 0.0254 100.56 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	DIPHENYLAMINE (122-39-4) (1.5%)	Cmpd	X					MIL-D-98	
	STD	ANHYDROUS SODIUM SUL (7757-82-6) (0.5%)	Cmpd	X					A-A-59279	
	STD	GRAPHITE (7782-42-5) (0.4%)	Cmpd	X					MIL-G-155	
	STD	CA CARBONATE (471-34-1) (0.25%)	Cmpd	X					MIL-C-293	
	ALT	PROP CMR 170 (ALT)	P	X	25.8000	GR	1		11735682	
	STD	PROP CMR 170	Mtl	X					11735682	
	STD	NC (N 13.15%) (9004-70-0) (88.95%)	Cmpd	X					MIL-N-244	
	STD	NITROGLYCERIN (55-63-0) (5.5%)	Cmpd	X					MIL-N-246	
	STD	METHYL CENTRALITE (611-92-7) (2.25%)	Cmpd	X					MIL-M-19719	
	STD	ETHYL CENTRALITE (85-98-3) (2.25%)	Cmpd	X					MIL-E-255	
	STD	K SULFATE (7778-80-5) (0.55%)	Cmpd	X					MIL-P-193	
	STD	GRAPHITE (7782-42-5) (0.5%)	Cmpd	X					MIL-G-155	
10542726	STD	BULLET M196	C		54.0000	GR	1			
10542727	STD	JACKET	P	I	24.0000	GR	1	0.003429	MIL-S-13468	//220///
	STD	CU ALLOY CLAD STEEL	Mtl	I					MIL-S-13468	//220///
	STD	COPPER (7440-50-8) (99.27%)	Cmpd	I						
	STD	MANGANESE (7439-96-5) (0.42%)	Cmpd	I						
	STD	CARBON (7440-44-0) (0.13%)	Cmpd	I						
	STD	SILICON (7440-21-3) (0.07%)	Cmpd	I						
	STD	SULFUR (7704-34-9) (0.06%)	Cmpd	I						
	STD	PHOSPHORUS (7723-14-0) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B			1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B			1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	ALT	SEALING COMPOUND (ALT)	B	B			1		MIL-S-22473	
	STD	VEHICLE (N/A) (60%)	Cmpd	B						
	STD	SOLVENTS (N/A) (20%)	Cmpd	B						
	STD	PIGMENTS (N/A) (20%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M196
NSN : 1305009144719 **DODIC:** A068
Status: OFFICIAL

Reported Weight : 177.0000 **Unit :** GR
Reported Weight (lbs): 0.0253
Calculated Weight (lbs): 0.0254 100.56 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	ALT	PAINT WATERBASE ACRYLIC (ALT)	B	B			1		LCC324	
10542728	STD	FILLER POINT	P	I	26.5000	GR	1	0.003786	MIL-L-13283	//1///
	STD	PB-SB ALLOY	Mtl	I					MIL-L-13283	//1///
	STD	LEAD (7439-92-1) (99%)	Cmpd	I						
	STD	ANTIMONY (7440-36-0) (1%)	Cmpd	I						
	STD	TR COMP	P	X	1.2000	GR	1	0.000171	10522416	
	STD	TR COMP R-284	Mtl	X					10522416	
	STD	SR NITRATE (10042-76-9) (55%)	Cmpd	X					MIL-S-20322	//A OR B///
	STD	MG PWDR (7439-95-4) (28%)	Cmpd	X					MIL-M-382	/3////
	STD	POLYVINYL CHLORIDE (9002-86-2) (17%)	Cmpd	X					MIL-P-20307	
	STD	IGN COMP	P	X	1.2000	GR	1	0.000171	10542723	
	STD	IGN COMP I-560	Mtl	X					10542723	
	STD	SR PEROXIDE (1314-18-7) (30%)	Cmpd	X					MIL-S-612	//B///
	STD	SR NITRATE (10042-76-9) (27.5%)	Cmpd	X					MIL-S-20322	//A OR B///
	STD	MG PWDR (7439-95-4) (27.5%)	Cmpd	X					MIL-M-382	/3////
	STD	POLYVINYL CHLORIDE (9002-86-2) (15%)	Cmpd	X					MIL-P-20307	
	STD	IGN COMP	P	X	1.0000	GR	1	0.000143	10542722	
	STD	IGN COMP I-559	Mtl	X					10542722	
	STD	SR PEROXIDE (1314-18-7) (71.55%)	Cmpd	X					MIL-S-612	//B///
	STD	MG PWDR (7439-95-4) (14.5%)	Cmpd	X					MIL-M-382	/3////
	STD	CA RESINATE (9007-13-0) (7.95%)	Cmpd	X					MIL-C-20470	/1 OR 2////
	STD	PB DIOXIDE (1309-60-0) (6%)	Cmpd	X					MIL-L-376	/1 OR 2//1//
	ALT	IGN COMP (ALT)	P	X	1.0000	GR	1		9340703	
	STD	IGN COMP I-561	Mtl	X					9340703	
	STD	SR PEROXIDE (1314-18-7) (74.25%)	Cmpd	X					MIL-S-612	//B///
	STD	MG PWDR (7439-95-4) (17.5%)	Cmpd	X					MIL-M-382	/3////
	STD	CA RESINATE (9007-13-0) (8.25%)	Cmpd	X					MIL-C-20470	/1 OR 2////
11740678	STD	CUP CLOSURE	P	I	0.2000	GR	1	0.000029	ASTM-B36	//220///
	STD	BRASS	Mtl	I					ASTM-B36	//220///
	STD	COPPER (7440-50-8) (90%)	Cmpd	I						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M196
NSN : 1305009144719 **DODIC:** A068
Status: OFFICIAL

Reported Weight : 177.0000 **Unit :** GR
Reported Weight (lbs): 0.0253
Calculated Weight (lbs): 0.0254 100.56 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	ZINC (7440-66-6) (9.9%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.05%)	Cmpd	I						
10534279	STD	PRIMER #41	C		4.0000	GR	1		MIL-P-46610	
10534281	STD	ANVIL	P	I	0.7000	GR	1	0.000100	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	SHELLAC	B	B	0.0194	GR	1		TT-S-300	/1/B//BODY 4/
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0194	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	ETHYL ACETATE	B	B	0.0194	GR	1		TT-E-751	
	STD	ETHYL ACETATE (141-78-6) (86.5%)	Cmpd	B						
	ALT	SHELLAC (ALT)	B	B	0.0194	GR	1		TT-S-300	/1/B//BODY 1/
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	SHELLAC (ALT)	B	B	0.0194	GR	1		JAN-S-732	/2////
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0194	GR	1		MIL-L-46075	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M196
NSN : 1305009144719 **DODIC:** A068
Status: OFFICIAL

Reported Weight : 177.0000 **Unit :** GR
Reported Weight (lbs): 0.0253
Calculated Weight (lbs): 0.0254 100.56 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
10534280	STD	CUP PRIMER	P	I	2.5000	GR	1	0.000357	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	ALT	ETHYL ACETATE (ALT)	B	B	0.0194	GR	1		TT-E-751	
	STD	ETHYL ACETATE (141-78-6) (86.5%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0201	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0201	GR	1		MIL-L-46075	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
	STD	SHELLAC	B	B	0.0197	GR	1		TT-S-300	
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M196
NSN : 1305009144719 **DODIC:** A068
Status: OFFICIAL

Reported Weight : 177.0000 **Unit :** GR
Reported Weight (lbs): 0.0253
Calculated Weight (lbs): 0.0254 100.56 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
10534282	STD	DISC	P	I	0.0100	GR	1	0.000001	MIL-P-60169	/1////
	STD	PAPER SEALING	Mtl	I					MIL-P-60169	/1////
	STD	SHELLAC	B	B	0.0194	GR	1		TT-S-300	
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
10534283	STD	PELLET BOOSTER	P	X	0.3900	GR	1	0.000056	10522388	
	STD	PRIMER COMP FA-956	Mtl	X					10522388	
	STD	PB STYPHNATE (15245-44-0) (37%)	Cmpd	X					MIL-L-757	
	STD	BA NITRATE (10022-31-8) (32%)	Cmpd	X					MIL-B-162	///1//
	STD	SB SULFIDE (1345-04-6) (15%)	Cmpd	X					MIL-A-159	///1,2 OR 3//
	STD	AL PWDR (7429-90-5) (7%)	Cmpd	X					MIL-A-512	/3/F/6//
	STD	PETN (78-11-5) (5%)	Cmpd	X					MIL-P-387	///2//
	STD	TETRACENE (92-24-0) (4%)	Cmpd	X					MIL-T-46938	
								0.025429		

5.56mm, ball, M855

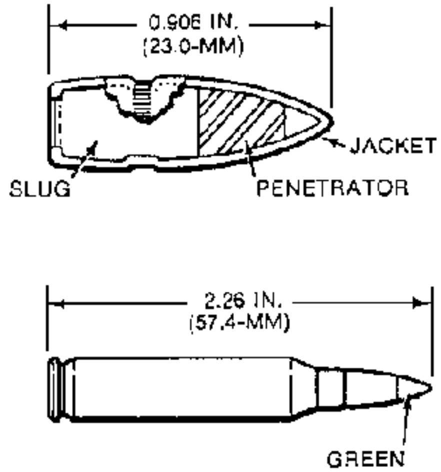

Figure B-3.
5.56mm, ball, M855

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M855
NSN : 1305011555455 **DODIC:** A058
Status: OFFICIAL

Reported Weight : 42.5600 **Unit :** LB
Reported Weight (lbs): 42.5600
Calculated Weight (lbs): 42.8351 100.65 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
9342868	STD	CTG 5.56MM BALL M855	M		42.5600	LB	1		MIL-C-63989	
9342868	STD	CTG 5.56MM BALL M855	C		190.0000	GR	1,600		MIL-C-63989	
9378276	STD	CASE	P	I	95.0000	GR	1	21.714720	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0109	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B	0.0141	GR	1		MIL-L-10287	/1 OR 2////
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	ALT	CITRIC ACID (ALT)	B	B	0.0109	GR	1		MIL-C-11029	
	STD	CITRIC ACID (77-92-9) (99.9%)	Cmpd	B						
	STD	BROMOTHYMOL BLUE (76-59-5) (0%)	Cmpd	B						
11820451	ALT	CASE (ALT)	P	I	115.0000	GR	1		MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0109	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M855
NSN : 1305011555455 **DODIC:** A058
Status: OFFICIAL

Reported Weight : 42.5600 **Unit :** LB
Reported Weight (lbs): 42.5600
Calculated Weight (lbs): 42.8351 100.65 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	LACQUER CELL NITRATE	B	B	0.0141	GR	1		MIL-L-10287	/1 OR 2////
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	ALT	CITRIC ACID (ALT)	B	B	0.0109	GR	1		MIL-C-11029	
	STD	CITRIC ACID (77-92-9) (99.9%)	Cmpd	B						
	STD	BROMOTHYMOL BLUE (76-59-5) (0%)	Cmpd	B						
	ALT	SEALING COMPOUND (ALT)	B	B	0.0141	GR	1		MIL-S-22473	
	STD	VEHICLE (N/A) (60%)	Cmpd	B						
	STD	SOLVENTS (N/A) (20%)	Cmpd	B						
	STD	PIGMENTS (N/A) (20%)	Cmpd	B						
	STD	PROP WC844	P	X	27.0000	GR	1	6.171552	10542743	
	STD	PROP WC844	Mtl	X					10542743	
	STD	NITROCELLULOSE (9004-70-0) (66.95%)	Cmpd	X					MIL-DTL-244	/ ////
	STD	NITROGEN (7727-37-9) (13.2%)	Cmpd	X						
	STD	NITROGLYCERIN (55-63-0) (11.2%)	Cmpd	X					MIL-N-246	
	STD	DIBUTYL PHTHALATE (84-74-2) (6%)	Cmpd	X					ASTM-D608	
	STD	DIPHENYLAMINE (122-39-4) (1.5%)	Cmpd	X					MIL-D-98	
	STD	ANHYDROUS SODIUM SUL (7757-82-6) (0.5%)	Cmpd	X					A-A-59279	
	STD	GRAPHITE (7782-42-5) (0.4%)	Cmpd	X					MIL-G-155	
	STD	CA CARBONATE (471-34-1) (0.25%)	Cmpd	X					MIL-C-293	
	ALT	PROP WCR845 (ALT)	P	X	27.0000	GR	1		12953490	
	STD	PROP WCR845	Mtl	X					12953490	
	STD	NC (N 13.13%) (9004-70-0) (78.25%)	Cmpd	X					MIL-N-244	
	STD	NITROGLYCERIN (55-63-0) (15%)	Cmpd	X					MIL-N-246	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M855
NSN : 1305011555455 **DODIC:** A058
Status: OFFICIAL

Reported Weight : 42.5600 **Unit :** LB
Reported Weight (lbs): 42.5600
Calculated Weight (lbs): 42.8351 100.65 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	ETHYL CENTRALITE (85-98-3) (4.5%)	Cmpd	X					MIL-E-255	
	STD	DIPHENYLAMINE (122-39-4) (1.1%)	Cmpd	X					MIL-D-98	
	STD	NA SULFATE (7757-82-6) (0.5%)	Cmpd	X					MIL-S-50004	
	STD	GRAPHITE (7782-42-5) (0.4%)	Cmpd	X					MIL-G-155	
	STD	CA CARBONATE (471-34-1) (0.25%)	Cmpd	X					MIL-C-293	
9342869	STD	BULLET M855 5.56MM	C		61.8000	GR	1		MIL-C-63989	
9349678	STD	JACKET POINTED	P	I	19.8000	GR	1	4.525805	MIL-C-21768	//220///
	STD	CU ALLOY	Mtl	I					MIL-C-21768	//220///
	STD	COPPER (7440-50-8) (90%)	Cmpd	I						
	STD	ZINC (7440-66-6) (9.9%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.05%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0109	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B	0.0020	GR	1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B	0.0021	GR	1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B	0.0141	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	ALT	CITRIC ACID (ALT)	B	B	0.0109	GR	1		MIL-C-11029	
	STD	CITRIC ACID (77-92-9) (99.9%)	Cmpd	B						
	STD	BROMOTHYMOL BLUE (76-59-5) (0%)	Cmpd	B						
	ALT	PAINT WATERBASE ACRYLIC (ALT)	B	B	0.0114	GR	1		LCC324	
9342870	STD	CORE	P	I	10.0000	GR	1	2.285760	ASTM-A510	//1045///
	STD	STEEL	Mtl	I					ASTM-A510	//1045///
	STD	IRON (7439-89-6) (98%)	Cmpd	I						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M855
NSN : 1305011555455 **DODIC:** A058
Status: OFFICIAL

Reported Weight : 42.5600 **Unit :** LB
Reported Weight (lbs): 42.5600
Calculated Weight (lbs): 42.8351 100.65 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	MANGANESE (7439-96-5) (0.75%)	Cmpd	I						
	STD	CARBON (7440-44-0) (0.47%)	Cmpd	I						
	STD	SULFUR (7704-34-9) (0.05%)	Cmpd	I						
	STD	PHOSPHORUS (7723-14-0) (0.04%)	Cmpd	I						
9349656	STD	SLUG	P	I	32.0000	GR	1	7.314432	MIL-L-13283	//1///
	STD	PB-SB ALLOY	Mtl	I					MIL-L-13283	//1///
	STD	LEAD (7439-92-1) (99%)	Cmpd	I						
	STD	ANTIMONY (7440-36-0) (1%)	Cmpd	I						
	STD	LACQUER CELL NITRATE	B	B	0.0041	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	ASPHALT COMPOUND	B	B	0.0039	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
9392531	ALT	BULLET M855 (ALT)	C		61.8000	GR	1			
9392530	STD	JACKET POINTED	P	I	21.0000	GR	1		MIL-C-21768	//220///
	STD	CU ALLOY	Mtl	I					MIL-C-21768	//220///
	STD	COPPER (7440-50-8) (90%)	Cmpd	I						
	STD	ZINC (7440-66-6) (9.9%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.05%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0109	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B	0.0141	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M855
NSN : 1305011555455 **DODIC:** A058
Status: OFFICIAL

Reported Weight : 42.5600 **Unit :** LB
Reported Weight (lbs): 42.5600
Calculated Weight (lbs): 42.8351 100.65 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	ALT	CITRIC ACID (ALT)	B	B	0.0109	GR	1		MIL-C-11029	
	STD	CITRIC ACID (77-92-9) (99.9%)	Cmpd	B						
	STD	BROMOTHYMOL BLUE (76-59-5) (0%)	Cmpd	B						
	ALT	PAINT WATERBASE ACRYLIC (ALT)	B	B	0.0114	GR	1		LCC324	
9342870	STD	CORE	P	I	10.0000	GR	1		ASTM-A510	//1045///
	STD	STEEL	Mtl	I					ASTM-A510	//1045///
	STD	IRON (7439-89-6) (98%)	Cmpd	I						
	STD	MANGANESE (7439-96-5) (0.75%)	Cmpd	I						
	STD	CARBON (7440-44-0) (0.47%)	Cmpd	I						
	STD	SULFUR (7704-34-9) (0.05%)	Cmpd	I						
	STD	PHOSPHORUS (7723-14-0) (0.04%)	Cmpd	I						
9349656	STD	SLUG	P	I	32.0000	GR	1		MIL-L-13283	//1///
	STD	PB-SB ALLOY	Mtl	I					MIL-L-13283	//1///
	STD	LEAD (7439-92-1) (99%)	Cmpd	I						
	STD	ANTIMONY (7440-36-0) (1%)	Cmpd	I						
	STD	LACQUER CELL NITRATE	B	B	0.0041	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	ASPHALT COMPOUND	B	B	0.0039	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
10534279	STD	PRIMER #41	C		4.0000	GR	1		MIL-P-46610	
10534281	STD	ANVIL	P	I	0.7000	GR	1	0.160003	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	SHELLAC	B	B	0.0194	GR	1		TT-S-300	/1/B//BODY 4/
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M855
NSN : 1305011555455 **DODIC:** A058
Status: OFFICIAL

Reported Weight : 42.5600 **Unit :** LB
Reported Weight (lbs): 42.5600
Calculated Weight (lbs): 42.8351 100.65 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0194	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	ETHYL ACETATE	B	B	0.0194	GR	1		TT-E-751	
	STD	ETHYL ACETATE (141-78-6) (86.5%)	Cmpd	B						
	ALT	SHELLAC (ALT)	B	B	0.0194	GR	1		TT-S-300	/1/B//BODY 1/
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	SHELLAC (ALT)	B	B	0.0194	GR	1		JAN-S-732	/2////
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0194	GR	1		MIL-L-46075	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
10534280	STD	CUP PRIMER	P	I	2.5000	GR	1	0.571440	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M855
NSN : 1305011555455 **DODIC:** A058
Status: OFFICIAL

Reported Weight : 42.5600 **Unit :** LB
Reported Weight (lbs): 42.5600
Calculated Weight (lbs): 42.8351 100.65 %

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	ALT	ETHYL ACETATE (ALT)	B	B	0.0194	GR	1		TT-E-751	
	STD	ETHYL ACETATE (141-78-6) (86.5%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0201	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0201	GR	1		MIL-L-46075	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
	STD	SHELLAC	B	B	0.0197	GR	1		TT-S-300	
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
10534282	STD	DISC	P	I	0.0100	GR	1	0.002286	MIL-P-60169	/1////
	STD	PAPER SEALING	Mtl	I					MIL-P-60169	/1////
	STD	SHELLAC	B	B	0.0194	GR	1		TT-S-300	
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
10534283	STD	PELLET BOOSTER	P	X	0.3900	GR	1	0.089145	10522388	
	STD	PRIMER COMP FA-956	Mtl	X					10522388	
	STD	PB STYPHNATE (15245-44-0) (37%)	Cmpd	X					MIL-L-757	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM BALL M855
NSN : 1305011555455 **DODIC:** A058
Status: OFFICIAL

Reported Weight : 42.5600 **Unit :** LB
Reported Weight (lbs): 42.5600
Calculated Weight (lbs): 42.8351 100.65 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	BA NITRATE (10022-31-8) (32%)	Cmpd	X					MIL-B-162	///1//
	STD	SB SULFIDE (1345-04-6) (15%)	Cmpd	X					MIL-A-159	///1,2 OR 3//
	STD	AL PWDR (7429-90-5) (7%)	Cmpd	X					MIL-A-512	/3/F/6//
	STD	PETN (78-11-5) (5%)	Cmpd	X					MIL-P-387	///2//
	STD	TETRACENE (92-24-0) (4%)	Cmpd	X					MIL-T-46938	

42.835142

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5.56mm, tracer, M856

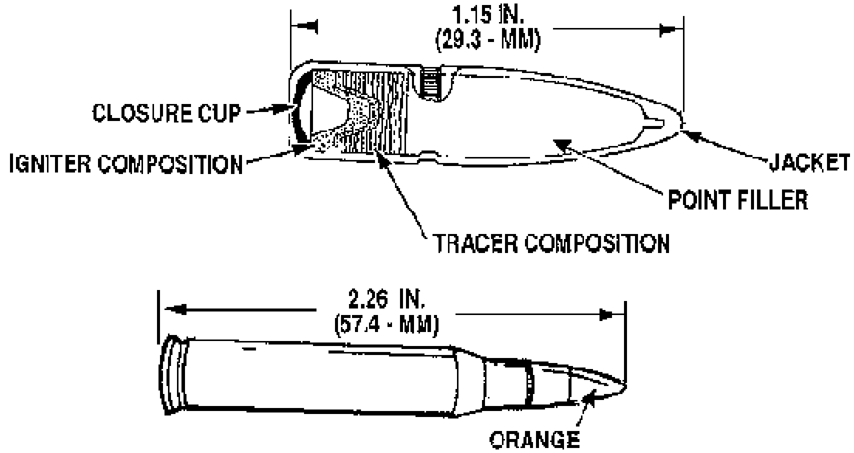

Figure B-4.
5.56mm, tracer, M856

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M856
NSN : 1305011555457 **DODIC:** A063
Status: OFFICIAL

Reported Weight : 191.0000 **Unit :** GR
Reported Weight (lbs): 0.0273
Calculated Weight (lbs): 0.0268 98.17 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
9342865	STD	CTG 5.56MM TR M856	M		191.0000	GR	1		MIL-C-63990	
9342865	STD	CTG 5.56MM TR M856	C				1		MIL-C-63990	
9378276	STD	CASE	P	I	95.0000	GR	1	0.013572	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0109	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B	0.0141	GR	1		MIL-L-10287	/1 OR 2////
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	ALT	CITRIC ACID (ALT)	B	B	0.0109	GR	1		MIL-C-11029	
	STD	CITRIC ACID (77-92-9) (99.9%)	Cmpd	B						
	STD	BROMOTHYMOL BLUE (76-59-5) (0%)	Cmpd	B						
11820451	ALT	CASE (ALT)	P	I	115.0000	GR	1		MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0109	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M856
NSN : 1305011555457 **DODIC:** A063
Status: OFFICIAL

Reported Weight : 191.0000 **Unit :** GR
Reported Weight (lbs): 0.0273
Calculated Weight (lbs): 0.0268 98.17 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	LACQUER CELL NITRATE	B	B	0.0141	GR	1		MIL-L-10287	/1 OR 2////
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	ALT	CITRIC ACID (ALT)	B	B	0.0109	GR	1		MIL-C-11029	
	STD	CITRIC ACID (77-92-9) (99.9%)	Cmpd	B						
	STD	BROMOTHYMOL BLUE (76-59-5) (0%)	Cmpd	B						
	ALT	SEALING COMPOUND (ALT)	B	B	0.0141	GR	1		MIL-S-22473	
	STD	VEHICLE (N/A) (60%)	Cmpd	B						
	STD	SOLVENTS (N/A) (20%)	Cmpd	B						
	STD	PIGMENTS (N/A) (20%)	Cmpd	B						
	STD	PROP WC844T	P	X	26.7000	GR	1	0.003814	9378273	
	STD	PROP WC844T	Mtl	X					9378273	
	STD	NC (N 13.15%) (9004-70-0) (82.87%)	Cmpd	X					MIL-N-244	
	STD	NITROGLYCERIN (55-63-0) (10.1%)	Cmpd	X					MIL-N-246	
	STD	DIBUTYLPHTHALATE (84-74-2) (4.75%)	Cmpd	X					MIL-D-218	
	STD	DIPHENYLAMINE (122-39-4) (1.13%)	Cmpd	X					MIL-D-98	
	STD	NA SULFATE (7757-82-6) (0.5%)	Cmpd	X					MIL-S-50004	
	STD	GRAPHITE (7782-42-5) (0.4%)	Cmpd	X					MIL-G-155	
	STD	CA CARBONATE (471-34-1) (0.25%)	Cmpd	X					MIL-C-293	
	ALT	PROP WCR845 (ALT)	P	X	26.7000	GR	1		12953490	
	STD	PROP WCR845	Mtl	X					12953490	
	STD	NC (N 13.13%) (9004-70-0) (78.25%)	Cmpd	X					MIL-N-244	
	STD	NITROGLYCERIN (55-63-0) (15%)	Cmpd	X					MIL-N-246	
	STD	ETHYL CENTRALITE (85-98-3) (4.5%)	Cmpd	X					MIL-E-255	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M856
NSN : 1305011555457 **DODIC:** A063
Status: OFFICIAL

Reported Weight : 191.0000 **Unit :** GR
Reported Weight (lbs): 0.0273
Calculated Weight (lbs): 0.0268 98.17 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	DIPHENYLAMINE (122-39-4) (1.1%)	Cmpd	X					MIL-D-98	
	STD	NA SULFATE (7757-82-6) (0.5%)	Cmpd	X					MIL-S-50004	
	STD	GRAPHITE (7782-42-5) (0.4%)	Cmpd	X					MIL-G-155	
	STD	CA CARBONATE (471-34-1) (0.25%)	Cmpd	X					MIL-C-293	
9342866	STD	BULLET M856	C		60.5000	GR	1			
9357840	STD	JACKET POINTED	P	I	28.5000	GR	1	0.004072	MIL-S-13468	//220///
	STD	CU ALLOY CLAD STEEL	Mtl	I					MIL-S-13468	//220///
	STD	COPPER (7440-50-8) (99.27%)	Cmpd	I						
	STD	MANGANESE (7439-96-5) (0.42%)	Cmpd	I						
	STD	CARBON (7440-44-0) (0.13%)	Cmpd	I						
	STD	SILICON (7440-21-3) (0.07%)	Cmpd	I						
	STD	SULFUR (7704-34-9) (0.06%)	Cmpd	I						
	STD	PHOSPHORUS (7723-14-0) (0.05%)	Cmpd	I						
	STD	LACQUER CELL NITRATE	B	B			1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	ASPHALT COMPOUND	B	B	0.0917	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	ALT	SEALING COMPOUND (ALT)	B	B	0.4024	GR	1		MIL-S-22473	
	STD	VEHICLE (N/A) (60%)	Cmpd	B						
	STD	SOLVENTS (N/A) (20%)	Cmpd	B						
	STD	PIGMENTS (N/A) (20%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	ALT	CITRIC ACID (ALT)	B	B	0.0659	GR	1		MIL-C-11029	
	STD	CITRIC ACID (77-92-9) (99.9%)	Cmpd	B						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M856 **Reported Weight :** 191.0000 **Unit :** GR
NSN : 1305011555457 **DODIC:** A063 **Reported Weight (lbs):** 0.0273
Status: OFFICIAL **Calculated Weight (lbs):** 0.0268 98.17 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	BROMOTHYMOL BLUE (76-59-5) (0%)	Cmpd	B						
	ALT	PAINT WATERBASE ACRYLIC (ALT)	B	B	0.4795	GM	1		LCC324	
9349660	STD	FILLER POINT	P	I	28.0000	GR	1	0.004000	MIL-L-13283	//1///
	STD	PB-SB ALLOY	Mtl	I					MIL-L-13283	//1///
	STD	LEAD (7439-92-1) (99%)	Cmpd	I						
	STD	ANTIMONY (7440-36-0) (1%)	Cmpd	I						
11740678	STD	CUP CLOSURE	P	I	0.2000	GR	1	0.000029	ASTM-B36	//220///
	STD	BRASS	Mtl	I					ASTM-B36	//220///
	STD	COPPER (7440-50-8) (90%)	Cmpd	I						
	STD	ZINC (7440-66-6) (9.9%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.05%)	Cmpd	I						
	STD	TR COMP	P	X	5.0000	GR	1	0.000714	9342867	
	STD	TR COMP R-528	Mtl	X					9342867	
	STD	SR NITRATE (10042-76-9) (60%)	Cmpd	X					MIL-S-20322	//A OR B///
	STD	MG PWDR (7439-95-4) (22%)	Cmpd	X					MIL-M-382	/3////
	STD	POLYVINYL CHLORIDE (9002-86-2) (18%)	Cmpd	X					MIL-P-20307	
	STD	IGN COMP	P	X	0.5000	GR	1	0.000071	10522419	
	STD	IGN COMP I-194	Mtl	X					10522419	
	STD	SR PEROXIDE (1314-18-7) (84.6%)	Cmpd	X					MIL-S-612	//B///
	STD	CA RESINATE (9007-13-0) (9.4%)	Cmpd	X					MIL-C-20470	/1 OR 2////
	STD	MG PWDR (7439-95-4) (6%)	Cmpd	X					MIL-M-382	/3////
10534279	STD	PRIMER #41	C		4.0000	GR	1		MIL-P-46610	
10534281	STD	ANVIL	P	I	0.7000	GR	1	0.000100	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	SHELLAC	B	B	0.0194	GR	1		TT-S-300	/1/B//BODY 4/
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0194	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M856
NSN : 1305011555457 **DODIC:** A063
Status: OFFICIAL

Reported Weight : 191.0000 **Unit :** GR
Reported Weight (lbs): 0.0273
Calculated Weight (lbs): 0.0268 98.17 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	ETHYL ACETATE	B	B	0.0194	GR	1		TT-E-751	
	STD	ETHYL ACETATE (141-78-6) (86.5%)	Cmpd	B						
	ALT	SHELLAC (ALT)	B	B	0.0194	GR	1		TT-S-300	/1/B//BODY 1/
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	SHELLAC (ALT)	B	B	0.0194	GR	1		JAN-S-732	/2////
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0194	GR	1		MIL-L-46075	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
10534280	STD	CUP PRIMER	P	I	2.5000	GR	1	0.000357	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	ALT	ETHYL ACETATE (ALT)	B	B	0.0194	GR	1		TT-E-751	
	STD	ETHYL ACETATE (141-78-6) (86.5%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0201	GR	1		MIL-L-10287	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M856
NSN : 1305011555457 **DODIC:** A063
Status: OFFICIAL

Reported Weight : 191.0000 **Unit :** GR
Reported Weight (lbs): 0.0273
Calculated Weight (lbs): 0.0268 98.17 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0201	GR	1		MIL-L-46075	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
	STD	SHELLAC	B	B	0.0197	GR	1		TT-S-300	
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
10534282	STD	DISC	P	I	0.0100	GR	1	0.000001	MIL-P-60169	/1////
	STD	PAPER SEALING	Mtl	I					MIL-P-60169	/1////
	STD	SHELLAC	B	B	0.0194	GR	1		TT-S-300	
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
10534283	STD	PELLET BOOSTER	P	X	0.3900	GR	1	0.000056	10522388	
	STD	PRIMER COMP FA-956	Mtl	X					10522388	
	STD	PB STYPHNATE (15245-44-0) (37%)	Cmpd	X					MIL-L-757	
	STD	BA NITRATE (10022-31-8) (32%)	Cmpd	X					MIL-B-162	///1//
	STD	SB SULFIDE (1345-04-6) (15%)	Cmpd	X					MIL-A-159	///1,2 OR 3//
	STD	AL PWDR (7429-90-5) (7%)	Cmpd	X					MIL-A-512	/3/F/6//
	STD	PETN (78-11-5) (5%)	Cmpd	X					MIL-P-387	///2//
	STD	TETRACENE (92-24-0) (4%)	Cmpd	X					MIL-T-46938	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 5.56MM TR M856

NSN : 1305011555457 **DODIC:** A063

Status: OFFICIAL

Reported Weight : 191.0000 **Unit :** GR

Reported Weight (lbs): 0.0273

Calculated Weight (lbs): 0.0268 98.17 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
								0.026786		

7.62mm, tracer, M62

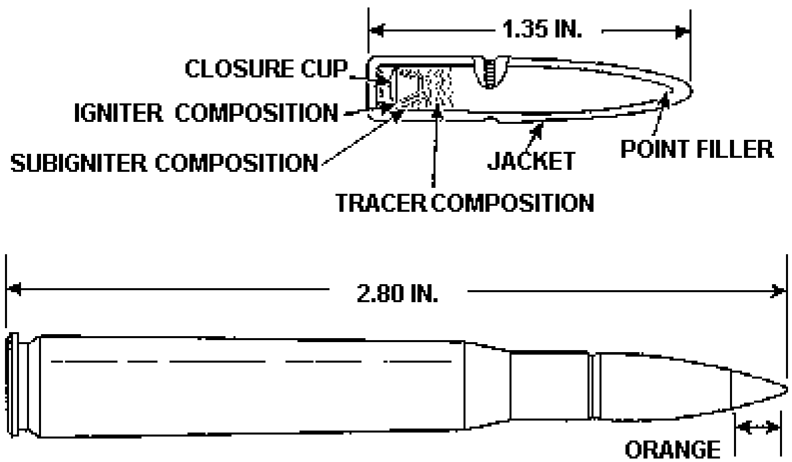

Figure B-5.
7.62mm, tracer, M62

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 7.62MM TR M62
NSN : 1305003011679 **DODIC:** A124
Status: OFFICIAL

Reported Weight : 383.0000 **Unit :** GR
Reported Weight (lbs): 0.0547
Calculated Weight (lbs): 0.0545 99.70 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
10522000	STD	CTG 7.62MM TR M62	M		383.0000	GR	1			
10522000	STD	CTG 7.62MM TR M62	C		383.0000	GR	1		MIL-C-46281	
10521997	STD	CASE	P	I	189.0000	GR	1	0.027001	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0573	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B	0.0485	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	STD	PROP WC846	P	X	46.0000	GR	1	0.006572	10534784	
	STD	PROP WC846	Mtl	X					10534784	
	STD	NC (N 13.15%) (9004-70-0) (82.97%)	Cmpd	X					MIL-N-244	
	STD	NITROGLYCERIN (55-63-0) (9.5%)	Cmpd	X					MIL-N-246	
	STD	DIBUTYLPHTHALATE (84-74-2) (5.25%)	Cmpd	X					MIL-D-218	
	STD	DIPHENYLAMINE (122-39-4) (1.13%)	Cmpd	X					MIL-D-98	
	STD	NA SULFATE (7757-82-6) (0.5%)	Cmpd	X					MIL-S-50004	
	STD	GRAPHITE (7782-42-5) (0.4%)	Cmpd	X					MIL-G-155	
	STD	CA CARBONATE (471-34-1) (0.25%)	Cmpd	X					MIL-C-293	
7553758	STD	BULLET M62	C		146.0000	GR	1			
7553759	STD	JACKET	P	I	60.0000	GR	1	0.008572	MIL-S-13468	//220///

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 7.62MM TR M62
NSN : 1305003011679 **DODIC:** A124
Status: OFFICIAL

Reported Weight : 383.0000 **Unit :** GR
Reported Weight (lbs): 0.0547
Calculated Weight (lbs): 0.0545 99.70 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	CU ALLOY CLAD STEEL	Mtl	I					MIL-S-13468	//220///
	STD	COPPER (7440-50-8) (99.27%)	Cmpd	I						
	STD	MANGANESE (7439-96-5) (0.42%)	Cmpd	I						
	STD	CARBON (7440-44-0) (0.13%)	Cmpd	I						
	STD	SILICON (7440-21-3) (0.07%)	Cmpd	I						
	STD	SULFUR (7704-34-9) (0.06%)	Cmpd	I						
	STD	PHOSPHORUS (7723-14-0) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0573	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	PAINT WATERBASE ACRYLIC	B	B	0.0604	GR	1		AR-PD-112	
7553760	STD	FILLER POINT	P	I	72.0000	GR	1	0.010286	MIL-L-13283	//1///
	STD	PB-SB ALLOY	Mtl	I					MIL-L-13283	//1///
	STD	LEAD (7439-92-1) (99%)	Cmpd	I						
	STD	ANTIMONY (7440-36-0) (1%)	Cmpd	I						
7585159	STD	CUP CLOSURE	P	I	1.0000	GR	1	0.000143	MIL-C-21768	//220///
	STD	CU ALLOY	Mtl	I					MIL-C-21768	//220///
	STD	COPPER (7440-50-8) (90%)	Cmpd	I						
	STD	ZINC (7440-66-6) (9.9%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.05%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	TR COMP	P	X	6.5000	GR	1	0.000929	10522416	
	STD	TR COMP R-284	Mtl	X					10522416	
	STD	SR NITRATE (10042-76-9) (55%)	Cmpd	X					MIL-S-20322	//A OR B///
	STD	MG PWDR (7439-95-4) (28%)	Cmpd	X					MIL-M-382	/3////
	STD	POLYVINYL CHLORIDE (9002-86-2) (17%)	Cmpd	X					MIL-P-20307	
	STD	IGN COMP	P	X	1.0000	GR	1	0.000143	10522421	
	STD	IGN COMP I-280*1	Mtl	X					10522421	
	STD	SR PEROXIDE (1314-18-7) (76.5%)	Cmpd	X					MIL-S-612	
	STD	MG PWDR (7439-95-4) (15%)	Cmpd	X					MIL-M-382	/3////
	STD	CA RESINATE (9007-13-0) (8.5%)	Cmpd	X					MIL-C-20470	
	STD	IGN COMP	P	X	1.0000	GR	1	0.000143	10522417M	
	STD	IGN COMP I-136	Mtl	X					10522417M	
	STD	SR PEROXIDE (1314-18-7) (90%)	Cmpd	X					MIL-S-612	//B///
	STD	CA RESINATE (9007-13-0) (10%)	Cmpd	X					MIL-C-20470	/1 OR 2////

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 7.62MM TR M62
NSN : 1305003011679 **DODIC:** A124
Status: OFFICIAL

Reported Weight : 383.0000 **Unit :** GR
Reported Weight (lbs): 0.0547
Calculated Weight (lbs): 0.0545 99.70 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
10523994	ALT	BULLET M62 (ALT)	C		146.0000	GR	1			
10523993	STD	JACKET	P	I	60.0000	GR	1		MIL-C-21768	//220///
	STD	CU ALLOY	Mtl	I					MIL-C-21768	//220///
	STD	COPPER (7440-50-8) (90%)	Cmpd	I						
	STD	ZINC (7440-66-6) (9.9%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.05%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0573	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	PAINT WATERBASE ACRYLIC	B	B	0.0604	GR	1		AR-PD-112	
7553760	STD	FILLER POINT	P	I	72.0000	GR	1		MIL-L-13283	//1///
	STD	PB-SB ALLOY	Mtl	I					MIL-L-13283	//1///
	STD	LEAD (7439-92-1) (99%)	Cmpd	I						
	STD	ANTIMONY (7440-36-0) (1%)	Cmpd	I						
7585159	STD	CUP CLOSURE	P	I	1.0000	GR	1		MIL-C-21768	//220///
	STD	CU ALLOY	Mtl	I					MIL-C-21768	//220///
	STD	COPPER (7440-50-8) (90%)	Cmpd	I						
	STD	ZINC (7440-66-6) (9.9%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.05%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	TR COMP	P	X	6.5000	GR	1		10522416	
	STD	TR COMP R-284	Mtl	X					10522416	
	STD	SR NITRATE (10042-76-9) (55%)	Cmpd	X					MIL-S-20322	//A OR B///
	STD	MG PWDR (7439-95-4) (28%)	Cmpd	X					MIL-M-382	/3////
	STD	POLYVINYL CHLORIDE (9002-86-2) (17%)	Cmpd	X					MIL-P-20307	
	STD	IGN COMP	P	X	1.0000	GR	1		10522417M	
	STD	IGN COMP I-136	Mtl	X					10522417M	
	STD	SR PEROXIDE (1314-18-7) (90%)	Cmpd	X					MIL-S-612	//B///
	STD	CA RESINATE (9007-13-0) (10%)	Cmpd	X					MIL-C-20470	/1 OR 2////
	STD	IGN COMP	P	X	1.0000	GR	1		10522421	
	STD	IGN COMP I-280*1	Mtl	X					10522421	
	STD	SR PEROXIDE (1314-18-7) (76.5%)	Cmpd	X					MIL-S-612	
	STD	MG PWDR (7439-95-4) (15%)	Cmpd	X					MIL-M-382	/3////
	STD	CA RESINATE (9007-13-0) (8.5%)	Cmpd	X					MIL-C-20470	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 7.62MM TR M62
NSN : 1305003011679 **DODIC:** A124
Status: OFFICIAL

Reported Weight : 383.0000 **Unit :** GR
Reported Weight (lbs): 0.0547
Calculated Weight (lbs): 0.0545 99.70 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
10522621	STD	PRIMER #34	C		5.4300	GR	1		MIL-A-2550	
8594095	STD	CUP PRIMER	P	I	3.5000	GR	1	0.000500	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	SHELLAC	B	B	0.0500	GR	1		TT-S-300	/1/B///
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0485	GR	1		MIL-L-46075	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0485	GR	1		MIL-L-10287	/1 OR 2////
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
10522622	STD	PELLET	P	X	0.6000	GR	1	0.000086	10522388	
	STD	PRIMER COMP FA-956	Mtl	X					10522388	
	STD	PB STYPHNATE (15245-44-0) (37%)	Cmpd	X					MIL-L-757	
	STD	BA NITRATE (10022-31-8) (32%)	Cmpd	X					MIL-B-162	///1//
	STD	SB SULFIDE (1345-04-6) (15%)	Cmpd	X					MIL-A-159	///1,2 OR 3//
	STD	AL PWDR (7429-90-5) (7%)	Cmpd	X					MIL-A-512	/3/F/6//
	STD	PETN (78-11-5) (5%)	Cmpd	X					MIL-P-387	///2//

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 7.62MM TR M62
NSN : 1305003011679 **DODIC:** A124
Status: OFFICIAL

Reported Weight : 383.0000 **Unit :** GR
Reported Weight (lbs): 0.0547
Calculated Weight (lbs): 0.0545 99.70 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	TETRACENE (92-24-0) (4%)	Cmpd	X					MIL-T-46938	
8594098	STD	DISC	P	I	0.1647	GR	1	0.000024	MIL-P-60169	
	STD	PAPER SEALING	Mtl	I					MIL-P-60169	
	STD	ETHYL ACETATE	B	B			1		TT-E-751	
	STD	ETHYL ACETATE (141-78-6) (86.5%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B	0.0201	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	LACQUER	B	B	0.0201	GR	1		MIL-L-46075	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
	STD	SHELLAC	B	B	0.0197	GR	1		TT-S-300	/1/B///
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	SHELLAC (ALT)	B	B	0.0197	GR	1		JAN-S-732	/2////
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
8594096	STD	ANVIL	P	I	1.0700	GR	1	0.000153	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 7.62MM TR M62
NSN : 1305003011679 **DODIC:** A124
Status: OFFICIAL

Reported Weight : 383.0000 **Unit :** GR
Reported Weight (lbs): 0.0547
Calculated Weight (lbs): 0.0545 99.70 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	SHELLAC	B	B	0.0197	GR	1		TT-S-300	/1/B//BODY 4/
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0201	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
								0.054549		

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7.62mm, ball, M80

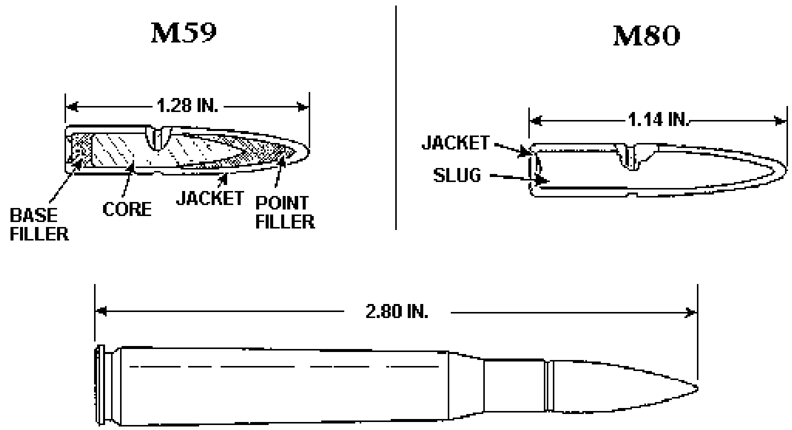

Figure B-6.
7.62mm, ball, M80

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 7.62MM NATO BALL M80
NSN : **DODIC:**
Status: OFFICIAL

Reported Weight : 392.0000 **Unit :** GR
Reported Weight (lbs): 0.0560
Calculated Weight (lbs): 0.0555 99.19 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
10521998	STD	CTG 7.62MM NATO BALL M80	C		392.0000	GR	1		MIL-C-46931	
10521997	STD	CASE	P	I	189.0000	GR	1	0.027001	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0627	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B	0.0156	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						
	STD	PROP WC846	P	X	46.0000	GR	1	0.006572	10534784	
	STD	PROP WC846	Mtl	X					10534784	
	STD	NC (N 13.15%) (9004-70-0) (82.97%)	Cmpd	X					MIL-N-244	
	STD	NITROGLYCERIN (55-63-0) (9.5%)	Cmpd	X					MIL-N-246	
	STD	DIBUTYLPHTHALATE (84-74-2) (5.25%)	Cmpd	X					MIL-D-218	
	STD	DIPHENYLAMINE (122-39-4) (1.13%)	Cmpd	X					MIL-D-98	
	STD	NA SULFATE (7757-82-6) (0.5%)	Cmpd	X					MIL-S-50004	
	STD	GRAPHITE (7782-42-5) (0.4%)	Cmpd	X					MIL-G-155	
	STD	CA CARBONATE (471-34-1) (0.25%)	Cmpd	X					MIL-C-293	
8595669	STD	BULLET M80	C		149.0000	GR	1			
8595668	STD	JACKET	P	I	34.5000	GR	1	0.004929	MIL-S-13468	//220///
	STD	CU ALLOY CLAD STEEL	Mtl	I					MIL-S-13468	//220///

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 7.62MM NATO BALL M80
NSN : **DODIC:**
Status: OFFICIAL

Reported Weight : 392.0000 **Unit :** GR
Reported Weight (lbs): 0.0560
Calculated Weight (lbs): 0.0555 99.19 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	COPPER (7440-50-8) (99.27%)	Cmpd	I						
	STD	MANGANESE (7439-96-5) (0.42%)	Cmpd	I						
	STD	CARBON (7440-44-0) (0.13%)	Cmpd	I						
	STD	SILICON (7440-21-3) (0.07%)	Cmpd	I						
	STD	SULFUR (7704-34-9) (0.06%)	Cmpd	I						
	STD	PHOSPHORUS (7723-14-0) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0627	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
8595667	STD	SLUG	P	I	114.0000	GR	1	0.016286	MIL-L-13283	//1///
	STD	PB-SB ALLOY	Mtl	I					MIL-L-13283	//1///
	STD	LEAD (7439-92-1) (99%)	Cmpd	I						
	STD	ANTIMONY (7440-36-0) (1%)	Cmpd	I						
10522590	ALT	BULLET M80 (ALT)	C		149.0000	GR	1			
10522591	STD	JACKET	P	I	52.0000	GR	1		MIL-C-21768	//220///
	STD	CU ALLOY	Mtl	I					MIL-C-21768	//220///
	STD	COPPER (7440-50-8) (90%)	Cmpd	I						
	STD	ZINC (7440-66-6) (9.9%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.05%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	ASPHALT COMPOUND	B	B	0.0627	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	STD	THINNER METHYL CHLOROFORM	B	B			1		O-T-620	
	STD	1,1,1-TRICHLOROETHAN (71-55-6) (90%)	Cmpd	B						
10522592	STD	SLUG	P	I	97.0000	GR	1		MIL-L-13283	//2///
	STD	PB-SB ALLOY	Mtl	I					MIL-L-13283	//2///
	STD	LEAD (7439-92-1) (94%)	Cmpd	I						
	STD	ANTIMONY (7440-36-0) (6%)	Cmpd	I						
10522621	STD	PRIMER #34	C		5.4300	GR	1		MIL-A-2550	
8594095	STD	CUP PRIMER	P	I	3.5000	GR	1	0.000500	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 7.62MM NATO BALL M80 **Reported Weight :** 392.0000 **Unit :** GR

NSN : **DODIC:** **Reported Weight (lbs):** 0.0560

Status: OFFICIAL **Calculated Weight (lbs):** 0.0555 99.19 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	SHELLAC	B	B	0.0500	GR	1		TT-S-300	/1/B///
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0485	GR	1		MIL-L-46075	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0485	GR	1		MIL-L-10287	/1 OR 2////
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
10522622	STD	PELLET	P	X	0.6000	GR	1	0.000086	10522388	
	STD	PRIMER COMP FA-956	Mtl	X					10522388	
	STD	PB STYPHNATE (15245-44-0) (37%)	Cmpd	X					MIL-L-757	
	STD	BA NITRATE (10022-31-8) (32%)	Cmpd	X					MIL-B-162	///1//
	STD	SB SULFIDE (1345-04-6) (15%)	Cmpd	X					MIL-A-159	///1,2 OR 3//
	STD	AL PWDR (7429-90-5) (7%)	Cmpd	X					MIL-A-512	/3/F/6//
	STD	PETN (78-11-5) (5%)	Cmpd	X					MIL-P-387	///2//
	STD	TETRACENE (92-24-0) (4%)	Cmpd	X					MIL-T-46938	
8594098	STD	DISC	P	I	0.1647	GR	1	0.000024	MIL-P-60169	
	STD	PAPER SEALING	Mtl	I					MIL-P-60169	
	STD	ETHYL ACETATE	B	B			1		TT-E-751	
	STD	ETHYL ACETATE (141-78-6) (86.5%)	Cmpd	B						
	STD	LACQUER CELL NITRATE	B	B	0.0201	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 7.62MM NATO BALL M80 **Reported Weight :** 392.0000 **Unit :** GR
NSN : **DODIC:** **Reported Weight (lbs):** 0.0560
Status: OFFICIAL **Calculated Weight (lbs):** 0.0555 99.19 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	LACQUER	B	B	0.0201	GR	1		MIL-L-46075	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
	STD	SHELLAC	B	B	0.0197	GR	1		TT-S-300	/1/B///
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
	ALT	SHELLAC (ALT)	B	B	0.0197	GR	1		JAN-S-732	/2////
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						
8594096	STD	ANVIL	P	I	1.0700	GR	1	0.000153	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	SHELLAC	B	B	0.0197	GR	1		TT-S-300	/1/B//BODY 4/
	STD	ETHYL ALCOHOL (64-17-5) (87.5%)	Cmpd	B						
	STD	METHYL ALCOHOL (67-56-1) (3%)	Cmpd	B						
	STD	HEXONE (108-10-1) (1%)	Cmpd	B						
	STD	ETHYL ACETATE (141-78-6) (1%)	Cmpd	B						

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 7.62MM NATO BALL M80 **Reported Weight :** 392.0000 **Unit :** GR

NSN : **DODIC:** **Reported Weight (lbs):** 0.0560

Status: OFFICIAL **Calculated Weight (lbs):** 0.0555 99.19 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0201	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	THINNER DOPE/LACQUER	B	B			1		TT-T-266	
	STD	METHYL ETHYL KETONE (78-93-3) (0%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (0%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (0%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (0%)	Cmpd	B						
	STD	BUTYL ALCOHOL (71-36-3) (0%)	Cmpd	B						
	STD	BUTYL ACETATE (123-86-4) (0%)	Cmpd	B						

0.055549

9mm, ball, M882

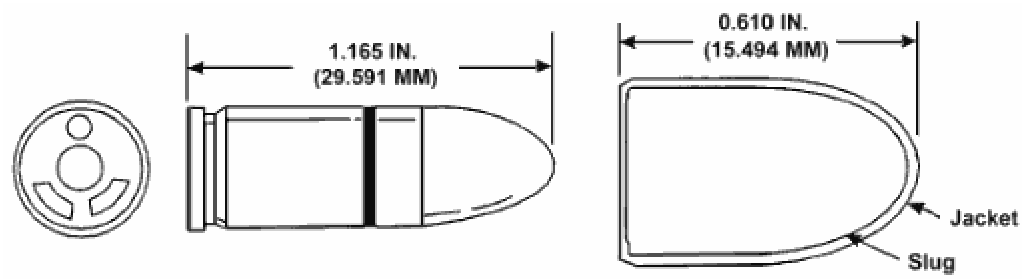

Figure B-7.
9mm, ball, M882

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 9MM BALL M882
NSN : 1305011729558 **DODIC:** A363
Status: OFFICIAL

Reported Weight : 190.0000 **Unit :** GR
Reported Weight (lbs): 0.0271
Calculated Weight (lbs): 0.0270 99.64 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
9345211	STD	CTG 9MM BALL M882	M		190.0000	GR	1		MIL-C-70508	
9345213	STD	CASE	P	I	57.0000	GR	1	0.008143	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	SEALING COMPOUND	B	B	0.0077	GR	1		MIL-S-22473	//E///
	STD	METHACRYLIC ESTER MO (N/A) (47.5%)	Cmpd	B						
	STD	ORGANIC PEROXIDE (110-22-5) (5%)	Cmpd	B						
	STD	SACCHARIN (81-07-2) (1%)	Cmpd	B						
	ALT	ASPHALT COMPOUND (ALT)	B	B	0.0017	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0023	GR	1		MIL-L-450	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0062	GR	1		MIL-L-10287	
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	PROP HPC 33	P	X	5.2000	GR	1	0.000743	12556070	
	STD	PROP HPC 33	Mtl	X					12556070	
	STD	NC (N 13.13%) (9004-70-0) (85.45%)	Cmpd	X					MIL-N-244	
	STD	NITROGLYCERIN (55-63-0) (7%)	Cmpd	X					MIL-N-246	
	STD	VINSOL (61790-51-0) (4%)	Cmpd	X					VENDOR ITEM	
	STD	K NITRATE (7757-79-1) (2%)	Cmpd	X					MIL-P-156	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 9MM BALL M882
NSN : 1305011729558 **DODIC:** A363
Status: OFFICIAL

Reported Weight : 190.0000 **Unit :** GR
Reported Weight (lbs): 0.0271
Calculated Weight (lbs): 0.0270 99.64 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	DIPHENYLAMINE (122-39-4) (0.95%)	Cmpd	X					MIL-D-98	
	STD	GRAPHITE (7782-42-5) (0.6%)	Cmpd	X					MIL-G-155	
	ALT	PROP WPR280 (ALT)	P	X	5.2000	GR	1		12551726	
	STD	PROP WPR280	Mtl	X					12551726	
	STD	NC (N 13.10%) (9004-70-0) (78.68%)	Cmpd	X					MIL-N-244	
	STD	NITROGLYCERIN (55-63-0) (15%)	Cmpd	X					MIL-N-246	
	STD	ETHYL CENTRALITE (85-98-3) (3.5%)	Cmpd	X					MIL-E-255	
	STD	DINITROTOLUENE (25321-14-6) (1%)	Cmpd	X					MIL-D-204	
	STD	DIPHENYLAMINE (122-39-4) (0.92%)	Cmpd	X					MIL-D-98	
	STD	K SULFATE (7778-80-5) (0.5%)	Cmpd	X					MIL-P-193	
	STD	GRAPHITE (7782-42-5) (0.4%)	Cmpd	X					MIL-G-155	
9345212	STD	BULLET BALL 9MM	C		124.0000	GR	1			
9345212	STD	JACKET	P	I	23.0000	GR	1	0.003286	MIL-C-21768	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-21768	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	SEALING COMPOUND	B	B	0.0493	GR	1		MIL-S-22473	//E///
	STD	METHACRYLIC ESTER MO (N/A) (47.5%)	Cmpd	B						
	STD	ORGANIC PEROXIDE (110-22-5) (5%)	Cmpd	B						
	STD	SACCHARIN (81-07-2) (1%)	Cmpd	B						
	ALT	ASPHALT COMPOUND (ALT)	B	B	0.0225	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0296	GR	1		MIL-L-450	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0236	GR	1		MIL-L-10287	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 9MM BALL M882 **Reported Weight :** 190.0000 **Unit :** GR

NSN : 1305011729558 **DODIC:** A363 **Reported Weight (lbs):** 0.0271

Status: OFFICIAL **Calculated Weight (lbs):** 0.0270 99.64 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
9345212	STD	SLUG	P	I	101.0000	GR	1	0.014429	MIL-L-13283	//1///
	STD	PB-SB ALLOY	Mtl	I					MIL-L-13283	//1///
	STD	LEAD (7439-92-1) (99%)	Cmpd	I						
	STD	ANTIMONY (7440-36-0) (1%)	Cmpd	I						
9354609	STD	PRIMER PERC 9MM	C		0.3900	GR	1		VENDOR ITEM	
9354609*1	STD	CUP	P	I	1.7248	GR	1	0.000246	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
	STD	NI COATING	B	B	0.1093	GR	1		VENDOR ITEM	
	STD	NICKEL (7440-02-0) (99%)	Cmpd	B						
	STD	SEALING COMPOUND	B	B	0.0077	GR	1		MIL-S-22473	//E///
	STD	METHACRYLIC ESTER MO (N/A) (47.5%)	Cmpd	B						
	STD	ORGANIC PEROXIDE (110-22-5) (5%)	Cmpd	B						
	STD	SACCHARIN (81-07-2) (1%)	Cmpd	B						
	ALT	ASPHALT COMPOUND (ALT)	B	B	0.0017	GR	1		MIL-C-13783	
	STD	ASPHALT (8052-42-4) (0%)	Cmpd	B						
	ALT	LACQUER (ALT)	B	B	0.0023	GR	1		MIL-L-450	
	STD	ACETONE (67-64-1) (40.5%)	Cmpd	B						
	STD	PROPANE (74-98-6) (10%)	Cmpd	B						
	STD	N-BUTANE (106-97-8) (10%)	Cmpd	B						
	STD	ISOBUTANE (75-28-5) (10%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (7.5%)	Cmpd	B						
	STD	DIACETONE ALCOHOL (123-42-2) (7.5%)	Cmpd	B						
	STD	N-BUTYL ALCOHOL (71-36-3) (2.5%)	Cmpd	B						
	STD	METHYL ETHYL KETONE (78-93-3) (2.5%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (2.5%)	Cmpd	B						
	STD	ISOBUTYL ACETATE (110-19-0) (2.5%)	Cmpd	B						
	ALT	LACQUER CELL NITRATE (ALT)	B	B	0.0062	GR	1		MIL-L-10287	

DAC - MIDAS Detailed Structure For An Item

Nomenclature : CTG 9MM BALL M882
NSN : 1305011729558 **DODIC:** A363
Status: OFFICIAL

Reported Weight : 190.0000 **Unit :** GR
Reported Weight (lbs): 0.0271
Calculated Weight (lbs): 0.0270 99.64 **%**

Drawing #	Std./Alt.	Nomenclature (Material)	Type	Material Code	Reported Weight	Unit	Factor	Factored Weight (Lb)	Specification	TGCS
	STD	ISOBUTYL ACETATE (110-19-0) (29.9%)	Cmpd	B						
	STD	TOLUENE (108-88-3) (15.5%)	Cmpd	B						
	STD	XYLENE (1330-20-7) (12.4%)	Cmpd	B						
	STD	ISOBUTYL ALCOHOL (78-83-1) (4%)	Cmpd	B						
	STD	ISOPROPYL ALCOHOL (67-63-0) (3%)	Cmpd	B						
	STD	PROP WINCHESTER	P	X	0.3200	GR	1	0.000046	VENDOR ITEM	
	STD	WINCHESTER 116-282A	Mtl	X					VENDOR ITEM	
	STD	PB STYPHNATE (15245-44-0) (40%)	Cmpd	X					MIL-L-757	
	STD	BA NITRATE (10022-31-8) (33%)	Cmpd	X					VENDOR ITEM	
	STD	SB SULFIDE (1345-04-6) (16%)	Cmpd	X					MIL-A-159	
	STD	PETN (78-11-5) (6%)	Cmpd	X					VENDOR ITEM	
	STD	TETRACENE (92-24-0) (5%)	Cmpd	X					VENDOR ITEM	
	ALT	PRIMER MIX (ALT)	P	X	0.3900	GR	1		VENDOR ITEM	
	STD	PRIMER COMP FED #200	Mtl	X					VENDOR ITEM	
9354609*2	STD	WHITE KRAFT PAPER	P	I	0.0097	GR	1	0.000001	UU-P-268	
	STD	KRAFT PAPER	Mtl	I					UU-P-268	
9354609*3	STD	ANVIL	P	I	1.0549	GR	1	0.000151	MIL-C-50	//260///
	STD	CU ALLOY	Mtl	I					MIL-C-50	//260///
	STD	COPPER (7440-50-8) (70%)	Cmpd	I						
	STD	ZINC (7440-66-6) (29.88%)	Cmpd	I						
	STD	LEAD (7439-92-1) (0.07%)	Cmpd	I						
	STD	IRON (7439-89-6) (0.05%)	Cmpd	I						
								0.027045		

Appendix C
T Range Inspection Form

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T Range Inspection Form

This form must be completed properly before range will be cleared by range control.

Range Control Observer
(name, rank, and title): ____

Unit Observer
(name, rank, title and unit): ____

Date of Inspection: _______________

NOTE: Sections A through D to be used for bi-weekly inspections by Range Control and per use by range users, weather permitting. Section E to be completed by Range Control 3 times per training year: in the fourth week of March before training begins, in the fourth week of July during training season, and in the fourth week of October once peak training period is completed. Section F to be completed during periodic metals removal from STAPP^{TM} system.

A. General Condition and Order of Facility: Check one for each

	good	fair	poor	comments
Entrance				
Tower				
Bleachers				
Target frames				
Firing line				
Pavilion				
Shed				
Parking areas				

1. Are there any POL leak stains in the parking areas? NO YES
   *If yes, please describe extent and location:*____
   ____

2. Do the sand boxes in front of target frame fully cover/protect the base of STAPP system? NO YES
   *Look for skewed boxes or gaps between the boxes which may allow bullets to damage the bottom frame of STAPP. If no, please describe:*_____
   ____
   ____

3. Does the density of bullets in the face of the sand boxes pose a ricochet hazard? NO YES
   Inspect the amount/density of bullets lodged in the wooden face. Check if present condition of sand boxes would cause ricochet of fired bullets. If yes, please describe condition and location of sand box:____________________
   ____
   ____

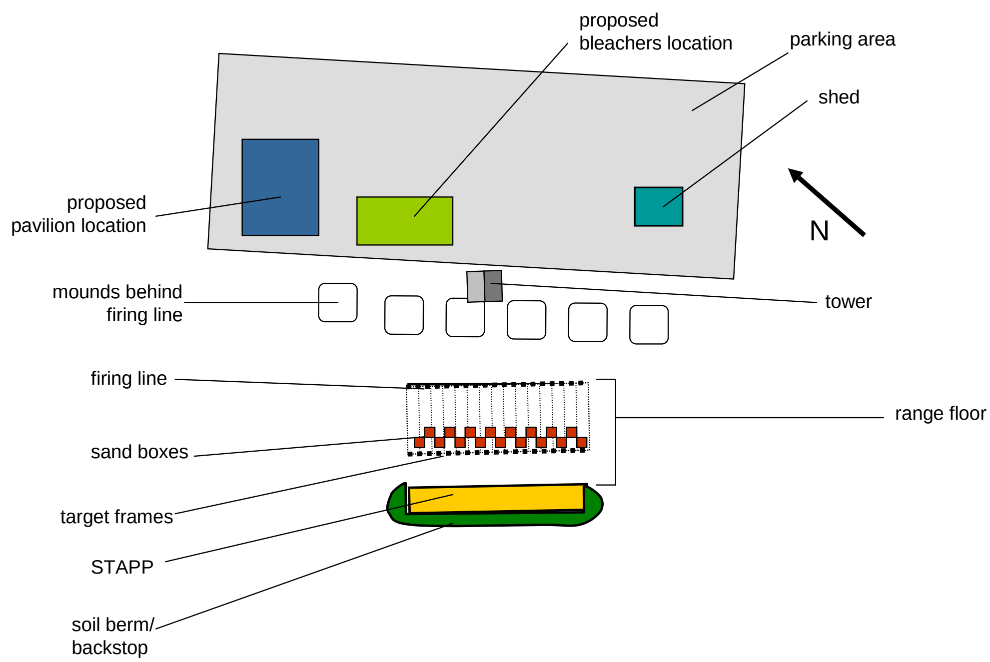
4. Any tears or holes in the surface of sand box tarps? NO YES
   Inspect the tarps covering each sand box.
   Look for holes or tears in the covering that would allow rain to wet the sand within the frame.
   *If yes, please describe condition and location of sand box:*____________________
   ____
   ____

B. Erosion: Circle one and indicate location on range sketch below

1. Firing positions: NONE MODERATE SEVERE
   *If moderate or severe, please describe:*____
   ____

2. Berm/backstop: NONE MODERATE SEVERE
   *If moderate or severe, please describe:*____
   ____

3. Range floor: NONE MODERATE SEVERE
   *If moderate or severe, please describe:*____
   ____



C. Vegetation: Circle one

	Percent Vegetative Coverage		
Mounds behind firing line	0-25%	26-50%	51-100%
Soil berm/backstop	0-25%	26-50%	51-100%
Range floor	0-25%	26-50%	51-100%

1. Please note any need for revegetation:____
   ____
   ____

D. STAPP™ visual inspection:

Circle one answer per question and describe observations as necessary

1. Is the cover in need of repair? NO YES
   See the example photos below. Look for any portion of the cover where the black rubber granular material is visible.

   a. ***If yes***, *Is the rip or tear in the bottom one foot of STAPP?* NO YES

Photo examples of STAPP cover visual inspection:

GOOD condition:
some dimpling of surface, but no black rubber granular material is visible

POOR condition:
any holes in the surface where the black rubber granular material is visible

2. Is there any separation of the cover seams greater than 1 inch in length? NO YES

   a. ***If yes***, *is the location in the bottom one foot of STAPP™?* NO YES

3. Is there any separation of the cover seams greater than 6 inches in length? NO YES
   *If yes, please describe location:*____

4. Any significant irregular settling or bulging of granular rubber material? NO YES
   *If yes, please describe:*____

5. Is the synthetic lumber framing in good condition? NO YES
   *If no, please describe:*____

6. Any signs of over/undershot? NO YES
   *If yes, please describe:*____
   ____

7. Any ponding of water on top of the cover? NO YES
   *If yes, please describe extent and location:*______________________________
   ____

8. Does the external gauge indicate more than 2 inches of water in the reservoir? NO YES

9. Was any smoke released from the STAPP™ during firing? NO YES
   *If yes, please describe:*____
   ____

10. Any liquid seeping from the STAPP™ system during firing? NO YES
    *If yes, please describe:*____
    ____

11. Is the tarp above the STAPP™ system secured? NO YES
    *If no, please describe:*____
    ____

E. STAPP™ detailed inspection

This shaded portion of form to be completed by Range Control.

Units using the range do NOT need to complete this section.
This inspection is to be completed by Camp Edwards personnel 3 times per training year: in the fourth week of March before training begins, in the fourth week of July during training season, and in the fourth week of October once peak training period is completed.

1. What is the depth of water in the reservoir? Less than 2 inches / Greater than 2 inches
   If more than 2 inches deep, how deep is it?:
   ____

2. Is the external water level gauge working properly? NO YES
   *If no, please describe:*____
   ____
   ____

3. Any significant irregular settling or bulging of granular rubber material? NO YES
*This may be indicative of a problem with the liner. The material must be at an even level across the STAPP to stop bullets effectively. The minimum depth of material at any one point should be 15 inches deep. If yes, please describe:*_______________
____
____

5. Complete the photo log at the end of this form, documenting site features listed in log. Photos should be taken of the firing line, the soil berm, bullet containment system, and range floor. Note any field observations on the log.

6. Notes regarding need for repair and maintenance:_______________
____
____

F. STAPP™ internal inspection

This shaded portion of form to be completed by Range Control.

Units using the range do NOT need to complete this section.
This inspection is to be completed by Camp Edwards personnel when the bullet sifting of the STAPP system is conducted after 500,000 rounds have been fired on T Range or every 3 years, whichever occurs first. At that time, all of the granular rubber material is removed.

1. Is the water collection unit in good condition? NO YES
*Look for any holes, punctures, or leaks in the piping which would allow water to be released to ground surface. If no, please describe:*_______________
____
____

2. Any perforations of the impermeable liner? NO YES
*Inspect the liner for any holes, rips, punctures, or seam failures. If yes, please describe:*_______________
____
____

4. Notes regarding need for repair and maintenance:_______________
____
____

Photo Log:

Photo No.	Date	
Location: Firing Line Range: T Range		Place photo here
Description		

Photo No.	Date	
Location: Soil Berm Range: T Range		Place photo here
Description		

<table>
<tr><td>Photo No.</td><td>Date</td><td rowspan="3">Place photo here</td></tr>
<tr><td colspan="2">Location: <u>Bullet Containment System</u>

Range: T Range</td></tr>
<tr><td colspan="2">Description</td></tr>
</table>

<table>
<tr><td>Photo No.</td><td>Date</td><td rowspan="3">Place photo here</td></tr>
<tr><td colspan="2">Location: <u>Range Floor</u>

Range: T Range</td></tr>
<tr><td colspan="2">Description</td></tr>
</table>

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