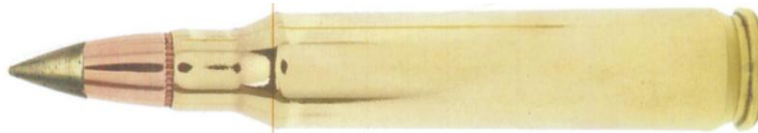




DEPARTMENT OF THE ARMY
OFFICE OF THE PROJECT MANAGER-
MANEUVER AMMUNITION SYSTEMS
(OPM-MAS)
PICATINNY ARSENAL NJ 07806-5000

LIFE-CYCLE ENVIRONMENTAL ASSESSMENT (LCEA)

Cartridge, 5.56mm, Ball, M855A1



28 April 2010

Prepared by:
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Cartridge, 5.56mm, Ball, M855A1
03 March 2010

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SECTION ONE: EXECUTIVE SUMMARY/ENVIRONMENTAL ANALYSIS

This Life Cycle Environmental Assessment (LCEA) is provided for the Cartridge, 5.56mm, Ball, M855A1 and supports a Fielding decision. Army Regulation (AR) 200-1, Environmental Protection and Enhancement defines the policies, responsibilities, and procedures for implementing the National Environmental Policy Act (NEPA). According to this regulation, the Environmental Assessment (EA) is a written analysis that serves to (1) provide analysis sufficient to determine whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI); and (2) aid federal agencies in complying with NEPA when no EIS is required. Consequently, this LCEA is a programmatic review.

The proposed action for this program is to produce a replacement for the current 5.56mm M855 cartridge that both uses materials that are more “friendly” to the environment and addresses the user’s reported field performance issues in a cost-effective manner. The result is the 5.56mm M855A1 Cartridge. Aside from some minor configuration changes, the main material differences between the M855 and the M855A1 cartridges are the materials used for the slug and the propellant. A copper slug replaces the less environmentally friendly lead-antimony slug used in the M855 and SMP842 propellant replaces the M855’s WC-844 propellant.

No environmental impacts are expected from the manufacturing, testing, training, or demilitarization of M855A1 Cartridges as these facilities are expected to comply with local, state and federal regulations. Since no environmental impact is expected, a Finding of No Significant Impact (FoNSI) has been prepared for this program

NOTE: The Environmental Protection Agency (EPA) is currently reviewing air quality standards for lead. Should the EPA tighten these standards, live-fire training operations and ranges may be impacted. In order to avoid these impacts, the Project Manager for Maneuver Ammunition Systems (PM MAS) may want to consider implementing a program that would reduce or eliminate lead from all ammunition used in training.

SECTION TWO: LCEA REQUIREMENT AND METHODOLOGY

In accordance with the President’s Council on Environmental Quality (CEQ) Code of Federal Regulations (CFR) Title 40: Protection of the Environment, Parts 1500 through 1508, implementing the National Environmental Policy Act (NEPA) of 1969, all federal agencies must consider the environmental consequences of a proposed action(s). The intent of this LCEA is to determine program compliance with NEPA as implemented by DOD Instruction 5000.02, AR 200-1, and AR 200-2. Institution of a thorough life cycle environmental program will ensure that the mission requirements for the 5.56mm M855A1 are met in the most cost effective and timely manner while ensuring the Army demonstrates its leadership commitment in meeting its regulatory compliance and moral obligations.

Information for this LCEA was obtained from reviewing program documentation and the Technical Data Package (TDP). A material assessment was performed to identify the hazardous

materials used in the manufacture of the cartridges and the lifecycle environmental impact of these hazardous materials. Environmental concerns of the test ranges were also identified. This LCEA document follows the outline prescribed in AMCCOM Supplement to AR 200-2.

1. PURPOSE AND NEED FOR PROPOSED ACTION

1.1. Purpose

The Cartridge, 5.56mm, Ball, M855A1 is intended to replace the lead-based projectile contained in the current 5.56mm M855 Ball cartridge with a projectile that utilizes materials that are more “environmentally friendly” than those that are now in use. The program objectives are to identify a cartridge configuration that balances cost with performance while reducing possible environmental compliance costs in the future through the elimination of the M855’s lead/antimony core. The M855 is an Army standard item used in both training and combat. The M855 requirements identified in MIL-DTL-63989 are the minimum acceptable performance characteristics for the M855A1.

1.2. Need

The need for the M855A1 is two-fold. First, the current version of the M855 uses a lead/antimony alloy in the core of the projectile. The use of the lead/antimony alloy in the M855 creates environmental compliance burdens on the testers and manufacturers of the M855 as well as the potential to cause significant compliance concerns/issues at firing ranges. Second, users of the current version of the M855 have been reporting performance deficiencies when it is used in the field. The M855A1 program was initiated to address these two issues.

Senior Army leadership has directed that the program be expedited and that a total of 20 million cartridges be manufactured and available by the June 2010 timeframe.

2. GENERAL DESCRIPTION OF PROPOSED ACTION

2.1. Introduction

The 5.56mm, M855 Ball Cartridge is the Army's standard service ammunition for: the M16 Series of Rifles, the M249 Squad Automatic Weapon (SAW), and the M4 Carbine. These weapon systems and ammunition are also used extensively by both the Navy and Marine Corps. The M855 Cartridge is normally produced in quantities in the hundreds of millions. Currently, M855 yearly production is approximately 900 million cartridges. M855 Cartridges are being used for training and overseas operations.

The current 5.56mm M855 Ball Cartridge consists of a 62 grain (4 gram) projectile inside a brass cartridge case with a standard rifle primer (No. 41) and a double-base propellant (WC-844). The projectile jacket, made of gilding metal, encloses a lead/antimony core behind a steel penetrator. The tip of the projectile is colored green in order to distinguish it from the previously fielded M193 Ball originally designed for, and used in, the M16 and M16A1 Rifles. The replacement cartridge the M855A1: (1) replaces the core with a copper core, (2) replaces the WC-844 propellant with SMP842 for better flash suppression, and (3) has a gold colored tip for corrosion protection and which acts as a means of identifying the cartridge. Both cartridges are designed to defeat personnel, and for use against lightly armored targets.

2.2. Operation Description

The cartridges are either loaded into 30 round magazines for rifle use, or belted (200 rounds per belt) for machine gun application, inserted into the weapon and fed to the chambering mechanism of the weapon. Operation of the weapons is beyond the scope of this LCEA, however, there are eight basic steps of functioning: feeding, chambering, locking, firing, unlocking, extracting, ejecting, and cocking. With a cartridge in the chamber of the weapon, the hammer cocked, and the selector set, the soldier squeezes the trigger. This, in turn, causes the hammer spring to drive the hammer forward, striking the head of the firing pin which drives the firing pin into the percussion primer of the cartridge. When the primer is struck, it ignites and causes the powder (propellant) in the cartridge to ignite. The gas generated by the rapid burning of the powder forces the projectile from the cartridge and propels it through the barrel. The projectile jacket is made of gilding-metal that engages the rifling of the gun barrel and causes the projectile to spin during flight. After the projectile has passed the gas port (but before it leaves the barrel), some gas enters the gas port and moves into the gas tube. The gas powers the extracting mechanism to eject the spent brass cartridge case from the weapon.

2.3. Description of Components

The M855A1 Projectile, shown below in Figure 1, utilizes a copper slug (or core) and a steel penetrator encapsulated in a reverse gilded metal jacket. The projectile weighs approximately 62 grains (4.02 grams). The baseline cartridge has a maximum length of 2.26 inches (57.4 mm) and weighs approximately 191 grains (12.4 grams). The ignition system for the cartridge is contained in a standard 5.56mm cartridge case and consists of the No.41 primer and approximately 26 grains (1.7 grams) of SMP842 ball propellant. The cartridge is identified by the gold color of the zinc sanchem coated steel tip.

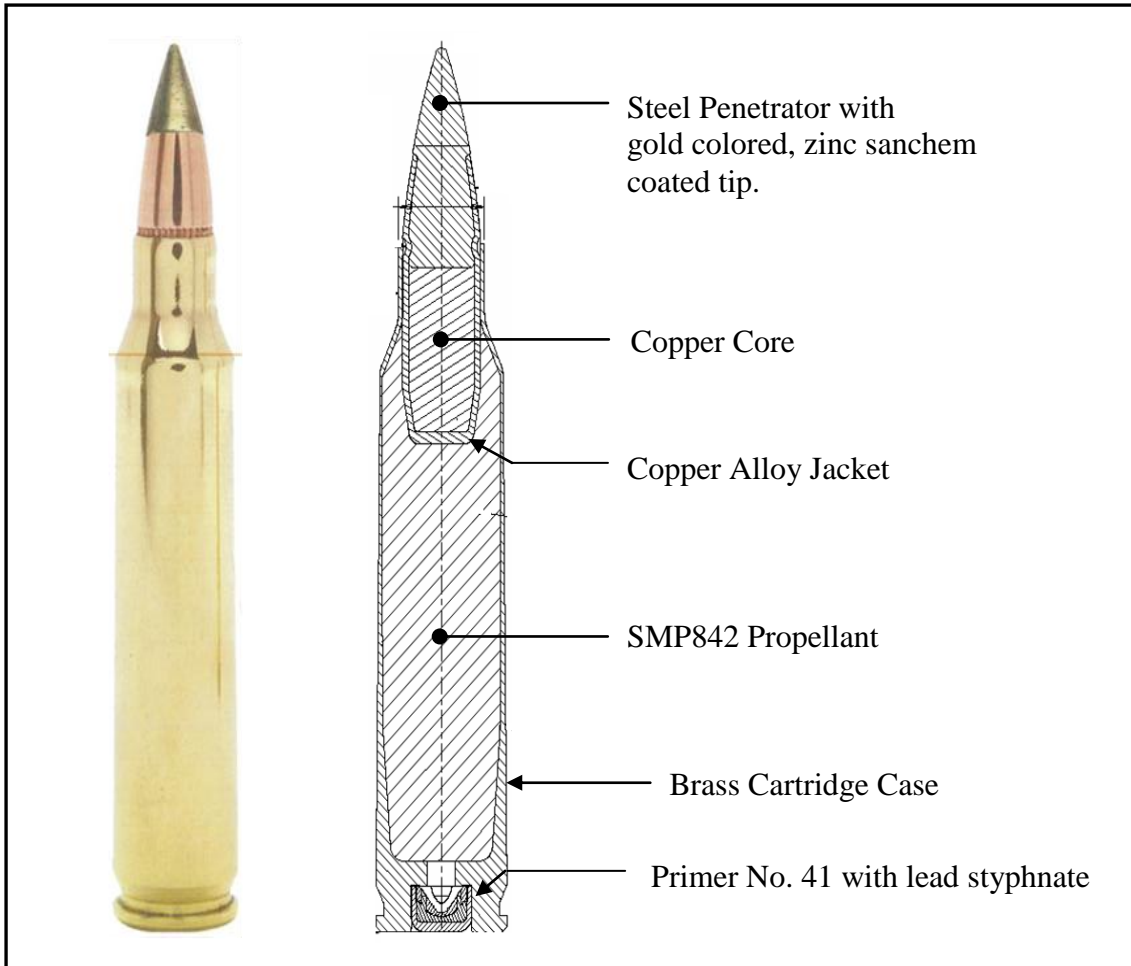


Figure 1: M855A1 Cartridge

2.4. Environment, Safety and Health Analysis of Materials

2.4.1. M855A1 5.56mm Cartridge Materials and Regulation Status Summary

The following tables list the component materials for the M855A1 Cartridge. Table 1 lists the energetic components along with their approximate weights per cartridge. Table 2 lists the non-energetic components and whether or not the component is regulated (energetic materials are always regulated, due to their sensitive nature).

An energetic material is a compound that can undergo rapid, self-sustaining, exothermic, reduction-oxidation reactions. Energetic materials may be categorized according to their intended uses: (a) explosives, (b) propellants, and (c) pyrotechnics. Explosives and propellants evolve large volumes of hot gas when burned; they differ primarily in their rates of reaction. Energetic materials may also be grouped according to their rate of reaction.


M855A1 Energetic Items & Materials Summary	
Item Component	Formulation
No. 41 Primer Mix (Total Weight: 0.036 g)	Lead Styphnate
	Barium Nitrate
	Antimony Sulfide
	Aluminum Powder
	PETN
	Tetracene
SMP842 Propellant (Total Weight: 1.685 g)	Nitrocellulose
	Graphite
	Potassium Salt
	Moisture (Water)
	Nitroglycerin
	Deterrent
	Diphenylamine
Decoppering Agent	
Note:	 Indicates materials that are identical to those used in current M855 Cartridge production.

Table 1: M855A1 Energetic Items & Materials Summary

M855A1 Non-Energetic Items & Materials Summary		
Part Name	Item Materials	Regulated
Slug	Copper	Yes
Penetrator	Steel	Yes
Jacket Cup	Copper	Yes
Cartridge Case	Brass	Yes
Anvil	Brass	Yes
Disc	Paper	No
Note: Indicates materials that are identical to those used in the current M855 Cartridge production.		

Table 2: M855A1 Non-Energetic Items & Materials Summary.

2.4.2. M855A1 5.56mm Cartridge Specific Materials Review

As indicated by Tables 1 and 2, a large portion of the materials used in the proposed M855A1 Cartridge are used in current M855 Cartridge production. The remaining materials, copper and steel, are used to varying degrees in the production of other items used by the Army. The remaining material used in the M855A1 Cartridge, the SMP842 propellant, is a new material that required additional evaluation to determine its potential impacts.

SMP842 Propellant: Due to the fact that numerous M855A1 Cartridges can be consumed over a short period of time (hundreds of cartridges per minute for an M16/M4 rifle and an M249 machine gun), SMP842 propellant needed to be evaluated for the potential impacts of its combustion products on air quality. A total combustion products analysis (both the propellant and primer were inputs) was performed by the Energetics Production and Manufacturing Technology Division using the NASA-Lewis Thermochemical code at a temperature of 300K and a pressure of 3 atmospheres. The results are listed in Appendix A. At 1.685 grams of a total of 1.721 grams, SMP842 constitutes just under 98% of the total input mass. The bulk of the combustion product emissions (i.e. gases) consist of compounds that are naturally abundant in the atmosphere: carbon dioxide, water and nitrogen. The remainder consists of trace amounts of antimony (from the primer mix). Trace amounts of particulate matter (i.e. condensed species) such as lead/lead compounds and barium compounds are emitted from the primer mix combustion products as well. Aside from a small amount of indoor testing in well ventilated ranges, testing and training will be conducted on outdoor ranges where the combustion products will quickly disperse and, thus, have little impact on air quality.

2.5. Overall Health Effects

The inert and energetic materials used in the M855A1 Cartridges were reviewed to identify those materials that are subject to environmental and Occupational Safety and Health Administration (OSHA) regulation and could therefore potentially cause adverse health effects. The relative hazard was assessed by considering the amount of material used, the toxicity of the material, and the potential for exposure. Energetic materials were considered to be the only materials to present potential health risks in the life cycle of this program. These risks are mitigated in all phases of the process by use of approved safety standards and equipment designed to safely handle these materials.

3. ALTERNATIVES CONSIDERED

3.1. Cartridge, 5.56mm, M855, Ball

The first alternative is the “no action” alternative, in which no changes to the 5.56mm M855 Ball Cartridges are introduced. This is not a viable alternative as it would continue the use of the standard lead/antimony cores in the projectiles as well as leave the M855 performance issues unaddressed.

3.2. M862 Short Range Training Ammunition (SRTA)

The second alternative is to use 5.56mm, M862 Ball, Short Range Training Ammunition (SRTA) with the M2 Training Bolt in the M16A2 Rifle, in lieu of using standard 5.56mm, M855 Ball Cartridges for live fire training purposes. This alternative is currently used at certain “Outside the Continental United States” (OCONUS) bases that do not have room for standard rifle firing ranges. At these locations the range is restricted to 400 yards (1200 feet). The 5.56mm SRTA has a maximum range of 250 meters (822 feet) and is therefore suitable and required for these short ranges and is currently used in indoor ranges and MOUT training due to minimal damage it inflicts from its minimal penetration characteristics.

The M862 SRTA consists of a standard cartridge case, standard #41 type primer (lead-styphnate, barium nitrate, antimony sulfide), propellant, and a light weight plastic projectile. The main advantage to the M862 is the rapid loss in ballistic stability, due to its light weight, thus greatly limiting its flight. It provides realistic training capability in scaled-down or restricted areas and provides a trajectory match to 25 meters. The projectile does not disintegrate, or fragment, upon impact with the ground or hard surface. Once fired downrange, it remains as an inert material on the surface. For Military Operations on Urban Terrain (MOUT) purposes the projectile tends to imbed itself in plywood, it does not damage the structure behind the plywood, and is removed when the wall surfaces are replaced.

This alternative, however, is not practical for use throughout the entire Army since standard training requires soldiers to become proficient at longer ranges. Also, standard service ammunition is still required for combat use.

3.3. Small Arms Training Simulator

The third alternative is to use the Small Arms Simulator (or other, similar, electronic training simulators) for training in lieu of live firing of the 5.56mm M855 Ball cartridge. A Small Arms Simulator, Figure 2, has been developed and installed at U.S. Army RDECOM-ARDEC, Picatinny Arsenal, NJ. It is located in the Target Behavioral Response Laboratory. This equipment is able to project an animated graphics target onto a 120 inch screen, detect the simulated rifle aim point through an infrared spot tracker, and calculate the projectile path given the aiming point, distance to target, target movement, projectile characteristics, air temperature, wind conditions, and other factors. It uses a ballistic computer model and fly out routine to

compute a realistic projectile path. It also features audio feedback, data acquisition and hit/miss analysis, and slow motion playback. The result is a highly accurate simulation of the entire aim-shoot-impact sequence. Although it was developed as a tool for improving military firearms design and tactical performance, it can also be effective at improving the skills of marksmen. It has the advantage of not being affected by weather, not causing environmental impact, no down time for target changing, no safety precautions, and would reduce the need for live firing. This alternative, however, is not practical for use throughout the entire Army since standard training requires soldiers to become proficient with actual weapons using live fire of service ammunition. Also, standard service ammunition (or green ammunition) must still be provided, of course, for combat use.

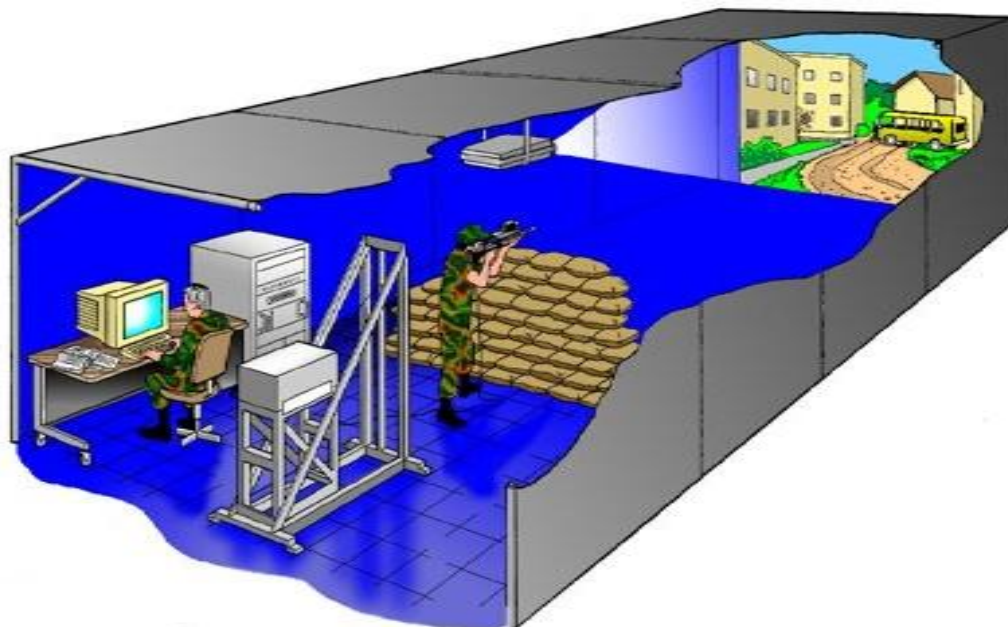


Figure 2: Small Arms Training Simulator Illustration

4. ENVIRONMENTAL IMPACTS OF PROPOSED ACTION

4.1. Non-Recurring Engineering (NRE) Phase

The M855A1 Program was initiated in July 2005 in order to identify a 5.56mm cartridge that will exhibit performance that is both comparable to the current version of the M855 cartridge and utilize materials that are more environmentally friendly than those found in the M855. An iterative Six Sigma process was initiated to study trade-offs between: material environmentally friendliness, material cost, and resultant performance. Great emphasis was placed on the evaluation of the possible environmental impacts of M855A1 candidate materials. The U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM) was consulted early in the program to provide input on the environmental friendliness of the candidate materials. Over 20 potential projectile candidates were evaluated. Thorough testing and evaluation led to the current configuration of the 5.56mm M855A1.

4.1.1. Description of Activities

In addition to modeling and simulation activities, the NRE stage included the following major testing activities:

- (1) Pre-Production Qualification Test (PPQT): The objective of Pre-Production Qualification Testing is to provide data on effectiveness and suitability and the achievability of critical technical parameters, refinement and ruggedization of hardware configurations, and determination of technical risks prior to a Production Qualification Test. Testing was conducted at various locations: Lake City Army Ammunition Plant, Aberdeen Test Center, and Army Research Laboratory.
- (2) Production Qualification Testing (PQT): The objective of the PQT is to obtain confirmation that the configuration will meet the performance, safety and user requirements. It is also used to determine the adequacy and timeliness of any corrective action indicated by previous tests and validates the manufacturer's facilities readiness for Low Rate Initial Production (LRIP). Side-by-side testing was conducted with the M855 and the M855A1 to validate current production reliability.
- (3) Production Verification Testing (PVT): The objectives of PVT are to demonstrate prior to fielding that: (a) any unresolved issues from PQT have been addressed and (b) the production process is sufficiently defined for full-rate production ramp up. PVT includes First Article Acceptance Testing (FAAT) and Lot Acceptance Testing (LAT) both of which are included in LRIP.
- (4) Limited Objective Experiment (LOE) / Live Fire Test and Evaluation (LFT&E): A Limited Objective Experiment (LOE) was conducted to verify that any user-related matter such as any training support issues have been sufficiently addressed prior to fielding. LFT&E will evaluate the M855A1's effectiveness against its intended targets.

Each of these test activities requires the production of M855A1 and M855 test cartridges. An outline of the manufacturing process for the M855A1 cartridge is included in Appendix B. Table 3, below, shows all of the M855A1 testing sites along with a brief summary of the testing that will be conducted at each site.

Test Site	Assigned Testing
Aberdeen Proving Ground (APG) Aberdeen Test Command (ATC)	1. Performance 2. System Safety Verification 3. Reliability, Availability, Maintainability 4.
Armament Research Development & Engineering Center (ARDEC)	1. Transportation and Vibration 2. Rough Handling
Army Research Laboratory (ARL)	1. Engineering Evaluation 2. Live Fire Test and Evaluation
Fort Benning	Limited Objective Experiment
Lake City Army Ammunition Plant	Production Verification and PPQT

Table 3: M855A1 Testing and Test Site Summary

Table 4, below, summarizes the number of test cartridges required for each of these test activities.

Test Article Configuration	Test					Total
	PPQT	PQT	LFT&E	LOE	LRIP (FAATs & LATs)	
Tactical M855A1	60000	840040	1500	25000	116000	1,042540
Controls M855	—	607920	—	—	—	607920

Table 4: Projected Test Cartridge Production for M855A1 Test Activities

The NRE stage also includes the Low Rate Initial Production (LRIP) ramp-up process, where the cartridge production rate escalates as the manufacturing process matures. The final production goal of LRIP for the M855A1 is a total of 20 million cartridges. This number includes the cartridges produced for FAATs and LATs.

The M855A1 Cartridge is manufactured at Lake City Army Ammunition Plant (LCAAP) located in Independence, MO. LCAAP is a Government Owned Contractor Operated (GOCO) facility currently under the management of Alliant Techsystems (ATK). While LCAAP does manufacture components for other cartridges (jackets, penetrators, and slugs/cores, etc), most of the components for the M855A1 are manufactured by subcontractors and shipped to LCAAP for final shaping and assembly. Additionally, LCAAP produces the explosive constituents of the primer mix as well as perform the explosive loading of both the primer and propellant.

4.1.2. Affected Environments

(a) Affected environments will be air, ground and water at production and test facilities within the U.S. The system contractor, ATK, is responsible for ensuring that subcontractors comply with all contract requirements concerning the environment. The subcontractors are responsible for the control of hazardous materials used and hazardous wastes generated in accordance with all local, state, and federal environmental laws and regulations. They are also responsible to obtain all necessary environmental permits and to comply with OSHA regulations. The system contractor’s and subcontractor’s manufacturing facilities are listed, below, in Table 5. These facilities are well established and have previously manufactured components similar to those used in the M855A1.

Component	Material	Vendor
Slug	Copper	Michigan Rod Products
Penetrator	Steel	Machine Labs
Jacket Cup	Copper	Olin
Propellant	SMP842	St. Marks Powder
Primer mix	No. 41 Primer	ATK (LCAAP)
Cartridge Case	Brass	Olin
Anvil	Brass	Olin
Disk	Paper	Mattheas

Table 5: M855A1 Component Manufacturers

(b) A brief summary of projectile tests and test sites is given in Table 3. Air, ground and noise environments will be affected. The test facilities located in the U.S. are shown, below, in Table 6:

Test Site	Test Location
Aberdeen Test Center (ATC)	Aberdeen Proving Ground, Maryland
Army Research Laboratory (ARL)	
Armament Research Development & Engineering Center (ARDEC)	Picatunny Arsenal, New Jersey
Fort Benning	Fort Benning, Georgia
Lake City Army Ammunition Plant (LCAAP)	Independence, Missouri

Table 6: Test Site and Location Summary

(c) Transportation procedures for M855A1 cartridges from production to storage and/or to testing facilities will be the same as those for currently fielded 5.56mm cartridges and will not impose an environmental hazard. The cartridges are shipped in four different configurations. The various configurations will contain somewhere between 1600 and 1800 cartridges per packaging configuration. Storage of the M855A1 cartridges will occur at the same locations, i.e. government depots, as currently fielded 5.56mm cartridges.

4.1.3. Direct and Indirect Environmental Impacts of Activities

(a) Air Quality.

(1) Manufacturing: Impact on air quality is expected to be minimal. Production processes and equipment in the U. S. to be used for 5.56mm, M855A1 Cartridges have been refined in previous production of similar ammunition types (e.g. the M855) to minimize impact on air quality.

(2) Testing: Combustion residues will be emitted into the air within testing areas. Type and amount of byproducts generated by the propellant and primer energetics are listed in Appendix A. The bulk of emissions (i.e. gasses) released from the SMP842 propellant and No. 41 Primer consist of naturally abundant compounds: nitrogen, water and carbon dioxide. The remainder consists of trace amounts of antimony. Trace amounts of particulate matter (i.e. condensed species) such as lead/lead compounds and barium compounds are emitted from the primer mix combustion products as well. Combustion product emissions dissipate quickly in open air.

(b) Surface/Ground Water.

(1) Manufacturing: The impact of 5.56mm M855A1 manufacture on water quality is insignificant. Equipment has been installed to collect and pre-treat industrial process waste water at the contractor's facilities, where required to meet discharge permits for the industrial wastewater treatment plants or municipal wastewater treatment plants. To the best of our knowledge, all accidental spills are contained and cleaned up.

(2) Testing: The impact of 5.56mm M855A1 testing on water quality is expected to be minimal. Both non-destructive testing and testing conducted inside indoor test ranges have no impact on either surface or groundwater. When testing is conducted on outdoor test ranges, M855A1 projectiles and projectile fragments enter the test range impact area and berm soils. Copper, in the form of projectile jackets of various other ammunition types, has had a long history of use at ammunition test ranges. Thus, the use of copper for the slug of the M855A1 will have little to no additional impact to surface and ground water at these facilities. Furthermore, the use of lead/antimony projectiles at test ranges will be reduced as the M855A1 gradually replaces the M855.

(c) **Soil Erosion, Disruption of Wetlands, Farmlands, and Other Lands of Concern**: All facilities for manufacturing and testing 5.56mm M855A1 Cartridges are currently established. No disruption of land is anticipated.

(d) Noise:

(1) Manufacturing: Impact from noise during 5.56mm, M855A1 Cartridge manufacture is insignificant. To the best of our knowledge all operations comply with hearing protection standards of AR 40-5, Preventive Medicine.

(2) Testing: 5.56mm M855A1 Cartridge tests produce noise during gun firing. All test personnel within 30 meters of testing are required to wear single hearing protection. At 30 meters (~100 ft), typical noise levels are 140 db. Per MIL-STD-1474D and DA Pamphlet 40-501, no ear protection is required past the 30 meter distance. Noise levels significantly drop off as distance increases. There will be no consequences associated with these tests due to both the location of the test ranges and the use of hearing protection.

(e) Hazardous Wastes:

(1) Manufacturing: Impact from hazardous wastes during 5.56mm M855A1 Cartridge manufacture is insignificant. All hazardous wastes are handled and disposed of by accepted methods that meet federal, state and local regulations and cause no significant effect on the environment.

(2) Testing: Impact from hazardous wastes during 5.56mm M855A1 Cartridge testing is insignificant. Hazardous wastes generated during M855A1 testing consist of misfired cartridges and cleaning materials used for weapon maintenance at test sites. Cleaning materials are handled and disposed of by accepted methods that meet federal, state and local regulations. M855A1 misfired cartridges are incinerated in an Ammunition Peculiar Equipment (APE) 1236M2 Deactivation Furnace. The remnants are disposed of in accordance with federal, state, and local regulations.

(f) Commitment of Resources/Energy: M855A1 Cartridge manufacturing operations are very similar to the current M855 Cartridge manufacturing operations. Since it is intended that the M855A1 Cartridge will take the place of the current M855 Cartridge, no significant impact on energy usage is anticipated.

(g) Areas of Cultural/Archeological Significance: To the best of our knowledge there is no impact on areas of cultural/archeological significance due to 5.56mm M855A1 manufacture and testing. All M855A1 manufacturing and testing sites are well established.

(h) Flora and Fauna Factors: Impact on flora and fauna from 5.56mm M855A1 manufacturing and testing is insignificant. All manufacturing and testing sites are well established.

4.2. Production/Deployment Phase

4.2.1. Description of Activities

The M855A1 program enters this phase after completing the Fielding process. Once LRIP is successfully completed, the program will begin Full Rate Production (FRP) of the cartridge. An overview of the production process can be found in Appendix B. Currently the M855A1 cartridge is being produced at Lake City Army Ammunition Plant (LCAAP), located in Independence, Missouri.

ATK is currently under contract to produce 128 million M855A1 Cartridges for 2010. Additional contracts for the M855A1 production will be put in place at a later date. Projected quantities for the M855A1 Cartridge production will be dependant on the capability of ATK's manufacturing process. However, the final production goal will be to, eventually, match the current production capability of the original M855 Cartridge.

4.2.2. Affected Environments

(a) Affected environments will be air, ground and water at production and test facilities within the U.S. During this phase, testing is generally limited to Lot Acceptance Testing which is conducted at LCAAP. The system contractor, ATK, is responsible for ensuring that subcontractors comply with all contract requirements concerning the environment. The subcontractors are responsible for the control of hazardous materials used and hazardous wastes generated in accordance with all local, state, and federal environmental laws and regulations. They are also responsible to obtain all necessary environmental permits and to comply with OSHA regulations. The system contractor's and subcontractor's manufacturing facilities are listed in Table 5. These facilities are well established and have previously manufactured components similar to those used in the M855A1.

(b) Transportation procedures for M855A1 cartridges from production to storage and/or to testing facilities will be the same as those for currently fielded 5.56mm cartridges and will not impose an environmental hazard. The cartridges are shipped in four different configurations. The various configurations will contain somewhere between 1600 and 1800 cartridges per packaging configuration. Storage of the M855A1 cartridges will occur at the same locations, i.e. government depots, as currently fielded 5.56mm cartridges.

4.2.3. Direct and Indirect Environmental Impacts of Activities

(a) Air Quality:

(1) Manufacturing: Impact on air quality is expected to be minimal. Production processes and equipment in the U. S. to be used for 5.56mm, M855A1 Cartridges have been refined in previous production of similar ammunition types (i.e. the M855) to minimize impact on air quality.

(2) Testing: Combustion residues will be emitted into the air within testing areas. Type and amount of byproducts generated by the propellant and primer energetics are listed in Appendix A. The bulk of emissions (i.e. gasses) released from the SMP842 propellant and No. 41 Primer consist of naturally abundant compounds: nitrogen, water and carbon dioxide. The remainder consists of trace amounts of antimony. Trace amounts of particulate matter (i.e. condensed species) such as lead/lead compounds and barium compounds are emitted from the primer mix combustion products as well. Combustion product emissions dissipate quickly in open air.

(b) Surface/Ground Water:

(1) Manufacturing: The impact of 5.56mm M855A1 manufacture on water quality is insignificant. Equipment has been installed to collect and pre-treat industrial process waste water at the contractor's facilities, where required to meet discharge permits for the industrial wastewater treatment plants or municipal wastewater treatment plants. To the best of our knowledge, all accidental spills are contained and cleaned up.

(2) Testing: The impact of 5.56mm M855A1 testing on water quality is expected to be minimal. Both non-destructive testing and testing conducted inside indoor test ranges have no impact on either surface or groundwater. When testing is conducted on outdoor test ranges, M855A1 projectiles and projectile fragments enter the test range impact area and berm soils. Copper, in the form of projectile jackets of various other ammunition types, has had a long history of use at ammunition test ranges. Thus, the use of copper for the slug of the M855A1 will have little to no additional impact to surface and ground water at these facilities. Furthermore, the use of lead/antimony projectiles at test ranges will be reduced as the M855A1 gradually replaces the M855.

(c) Soil Erosion, Disruption of Wetlands, Farmlands, and Other Lands of Concern: All facilities for manufacturing and testing 5.56mm M855A1 Cartridges are currently established. No disruption of land is anticipated.

(d) Noise:

(1) Manufacturing: Impact from noise during 5.56mm, M855A1 Cartridge manufacture is insignificant. To the best of our knowledge all operations comply with hearing protection standards of AR 40-5, Preventive Medicine.

(2) Testing: 5.56mm M855A1 Cartridge tests produce noise during gun firing. All test personnel within 30 meters of testing are required to wear single hearing protection. At 30 meters (~100 ft), typical noise levels are 140 db. Per MIL-S-1474D no ear protection is required past the 30 meter distance. Noise levels significantly drop off as distance increases. There will be no consequences associated with these tests due to both the location of the test ranges and the use of hearing protection.

(e) Hazardous Wastes:

(1) Manufacturing: Impact from hazardous wastes during 5.56mm M855A1 Cartridge manufacture is insignificant. All hazardous wastes are handled and disposed of by accepted methods that meet federal, state and local regulations and cause no significant effect on the environment.

(2) Testing: Impact from hazardous wastes during 5.56mm M855A1 Cartridge testing is insignificant. Hazardous wastes generated during M855A1 testing consist of misfired cartridges and cleaning materials used for weapon maintenance at test sites. Cleaning materials are handled and disposed of by accepted methods that meet federal, state and local regulations. M855A1 misfired cartridges are incinerated in an APE 1236M2 Deactivation Furnace. The remnants are disposed of in accordance with federal, state, and local regulations.

(f) Areas of Cultural/Archeological Significance: To the best of our knowledge there is no impact on areas of cultural/archeological significance due to 5.56mm M855A1 manufacture and testing. All M855A1 manufacturing and testing sites are well established.

(g) Areas of Cultural/Archeological Significance: To the best of our knowledge there is no impact on areas of cultural/archeological significance due to 5.56mm M855A1 manufacture and testing. All M855A1 manufacturing and testing sites are well established.

(h) Flora and Fauna Factors: Impact on flora and fauna from 5.56mm M855A1 manufacturing and testing is insignificant. All manufacturing and testing sites are well established.

4.3. Operation and Support Phase

4.3.1. Description of Activities

The M855A1 will, eventually, be used for training at numerous firing ranges across the United States. The overall intent of the M855A1 is to reach current production capability of the M855. Once the production capacity is reached, it can be expected that training activities could consume in excess of 200 million cartridges yearly.

4.3.2. Affected Environments

Affected environments for this phase are the training ranges where the M855A1 cartridge is fired for training purposes as well as depots where the M855A1 is stored. Supply, storage, and transportation systems and procedures for the 5.56mm M855A1 will be the same as for existing 5.56mm cartridges. The cartridges will be transported, stored, requisitioned, and handled as Class V materiel. Storage of the 5.56mm M855A1 will occur at the same locations, i.e. government depots, as currently fielded 5.56mm cartridges.

4.3.3. Direct and Indirect Environmental Impacts of Activities

(a) Air Quality:

(1) Depot Operations: No impact on air quality is expected. These facilities have equipment and processes that have been designed to minimize impact on air quality. Equipment has been installed to utilize alternate processes that reduce or eliminate the use of hazardous materials.

(2) Training Operations: Combustion products will be emitted into the air at training ranges. Type and amount of byproducts generated by the propellant and primer are listed in Appendix A. The bulk of emissions (i.e. gasses) released from the SMP842 propellant and No. 41 Primer consist of naturally abundant compounds: nitrogen, water and carbon dioxide. The remainder consists of trace amounts of antimony. Trace amounts of particulate matter (i.e. condensed species) such as lead/lead compounds and barium compounds are emitted from the primer mix combustion products as well. Combustion product emissions dissipate quickly in open.

(b) Surface/Ground Water:

(1) Depot Operations: No impact on water quality is expected. Equipment has been installed to collect and pre-treat industrial process waste water at the depot facilities, where required to meet discharge permits for the industrial wastewater treatment plants or municipal wastewater treatment plants. To the best of our knowledge, all accidental spills are contained and cleaned up.

(2) Testing/Training: The impact of 5.56mm M855A1 testing on water quality is expected to be minimal. Both non-destructive testing and testing conducted inside indoor test ranges have no impact on either surface or groundwater. When testing/training is conducted on outdoor test/training ranges, M855A1 projectiles and projectile fragments enter the test/training range impact area and berm soils. Copper, in the form of projectile jackets of various other ammunition types, has had a long history of use at ammunition testing/training ranges. Thus, the use of copper for the slug of the M855A1 will have little to no additional impact to surface and ground water at these facilities. Furthermore, the use of lead/antimony projectiles at test ranges will be reduced as the M855A1 gradually replaces the M855.

(c) Soil Erosion, Disruption of Wetlands, Farmlands, and Other Lands of Concern: All depot and training facilities for the M855A1 are currently established. No disruption of land is anticipated.

(d) Noise:

(1) Depot Operations: No impact from noise during 5.56mm M855A1 operations is expected. To the best of our knowledge all operations comply with hearing protection standards of AR 40-5, Preventive Medicine.

(2) Testing: 5.56mm M855A1 Cartridge tests produce noise during gun firing. All test personnel within 30 meters of testing are required to wear single hearing protection. At 30 meters (~100 ft), typical noise levels are 140 db. Per MIL-S-1474D, no ear protection is required past the 30 meter distance. Noise levels significantly drop off as distance increases. There will be no consequences associated with these tests due to both the location of the test ranges and the use of hearing protection.

(3) Training Operations: The impulse noise generated by the firing of the M855A1 Cartridge is very similar to that generated by the current M855 Cartridge. Thus, there will be no change in noise impact with the use of the M855A1 Cartridge at training ranges. The use of hearing protection devices (such as earplugs or earmuffs) is required during small arms training in accordance with army safety regulations [DA PAM 385-63 and AR 385-63].

(e) Hazardous Wastes:

(1) Depot Operations: Impact from hazardous wastes during 5.56mm, M855A1 Cartridge depot operations is insignificant. All hazardous wastes are handled and disposed of by accepted methods that meet federal, state and local regulations and cause no significant effect on the environment.

(2) Testing/Training: Impact from hazardous wastes during 5.56mm M855A1 Cartridge testing/training is insignificant. Hazardous wastes generated during M855A1 testing/training consist of misfired cartridges and cleaning materials used for weapon maintenance at test and training sites. Cleaning materials are handled and disposed of by accepted methods that meet federal, state and local regulations. M855A1 misfired cartridges are incinerated in an Ammunition Peculiar Equipment (APE) 1236M2 Deactivation Furnace. The remnants are disposed of in accordance with federal, state, and local regulations.

(f) Commitment of Resources/Energy: 5.56mm M855A1 depot and training operations will not have a significant impact on energy usage.

(g) Areas of Cultural/Archeological Significance: To the best of our knowledge there is no impact on areas of cultural/archeological significance due to 5.56mm, M855A1 testing, training, and depot operations. All testing, training, and depot sites are well established.

(h) **Flora and Fauna Factors:** Impact on flora and fauna from 5.56mm M855A1 testing, training and depot operations is insignificant.

4.4. Demilitarization/Disposal Phase

The Demilitarization/ Disposal Phase will begin when the 5.56mm M855A1 cartridges are type classified obsolete. The cartridges will then be turned in to the Resource Recovery & Disposition Account. Initially, the inventory of obsolete cartridges will be offered for foreign military sale or assistance programs. The remaining stocks will then be placed in the demilitarization account.

4.4.1. Description of Activities

M855A1 cartridges, in its various packaged forms, will be received and stored at designated demilitarization sites. Upon reception, the cartridges will be inspected both to determine the overall condition as well as the manufacturing information of the cartridges (lot number, place of origin, etc.). The demilitarization process begins with unpackaging cartridges and, if necessary, the deconstruction of belted ammunition by running the belts through an APE 2086 5.56mm de-linker. After the M855A1 cartridges have been separated from their packaging and links, they are incinerated inside an APE 1236M2 Deactivation Furnace. The disposition of both the incinerated remnants of the M855A1 and its packaging materials are summarized in Table 7, below.

M855A1		
Item	Material	Disposition
Pallet	Wood	Burn/Landfill/Recycle/Reuse
Wire Bound Box	Wood	Burn/Landfill
Steel Banding	Steel	Resale (Scrap Metal)
Dunnage	Cardboard	Burn/Landfill/Recycle
Metal Can	Sheet Steel	Landfill/Recycle
Filterboard box	Fiberboard	Burn/Landfill/Recycle
Fiber Tube	Paper	Landfill
M855A1 5.56mm	Scrap Metal	Landfill/Recycle
M855A1 5.56mm	Ash	Landfill
Links	Metal	Recycle (Scrap Metal)

Table 7: M855A1 Demilitarized Item Disposition Summary

4.4.2. Affected Environments

Affected environments are those that are dedicated demilitarization sites that operate APE 1236M2 Deactivation Furnaces. Such sites include McAlester Army Ammunition Plant, Tooele Army Depot, and Lake City Army Ammunition Plant.

4.4.3. Direct and Indirect Environmental Impacts of Activities

Materials and their byproducts resulting from the demilitarization/disposal phase will be recycled or treated at sites dedicated to this type of activity. No significant impact to the local environment is expected from the demilitarization/disposal of the M855A1. All disposal operations will be covered under approved standard operating procedures and safety procedures. Safety and hazard control plans will be in place at all times during demilitarization/disposal operations.

- (a) **Air Quality:** M855A1 disposal will be carried out within government facilities that are off limits to the general public at all times. Combustion products for M855A1 energetics are listed in Appendix A. After burner and scrubber systems are part of the current incinerator furnace design to insure all toxic emissions are reduced to an insignificant amount. No other emission points have been identified to date.
- (b) **Surface/Ground Water Quality:** M855A1 demilitarization and disposal will be achieved in accordance with approved procedures at sites and facilities dedicated for this type of activity. The facilities will be designed to contain and pretreat the effluents generated prior to their release to waste treatment plants. No discharge or run-off will result from this phase that could cause physical, chemical or biological perturbations since it is carried out away from bodies of water. Therefore, no environmental impact on water quality will result from the M855A1 disposal.
- (c) **Solid and Hazardous Waste:** Metal parts that have been in contact with explosives will be decontaminated (flushed) and may need to be disposed as solid waste if not sold for recycling. The ash from Contaminated Waste Processors, deactivation furnaces, explosive waste incinerators and associated air scrubbers may be hazardous waste. The ash residue will be analyzed in accordance with Hazardous Waste Regulations 40 CFR (Code of Federal Regulations) 261.24 and the Toxicity Characteristics Leaching Procedure (TCLP) of the Resource Conservation and Recovery Act (RCRA) and will be disposed of in accordance with applicable guidelines. Any hazardous materials that cannot be recovered and resold, such as sump sludge or other explosive contaminated residue materials from demil operations will be disposed of as hazardous waste. Specific disposal procedures could include transportation off-site by a licensed hazardous waste hauler. No significant generation of waste is anticipated.
- (d) **Flora and Fauna:** Disposal is conducted at facilities dedicated to the disposal of ordinance and will thus have no effect on local flora and fauna.
- (e) **Noise:** There is no significant noise produced during 5.56mm M855A1 Cartridge disposal.

5. CONCLUSIONS

The 5.56mm M855A1 Cartridge is being introduced to, eventually, replace the existing 5.56mm M855 Cartridge. Aside from some minor configuration changes, the main differences between the M855 and the M855A1 are the materials used for the propellant and the slug. The propellant change will primarily enhance the performance of the Cartridge through the introduction of a flash suppressant and a de-coppering agent. The slug material change will both reduce the environmental compliance burdens for testers/manufacturers and help reduce the potential of significant compliance concerns/issues caused by the use of lead/antimony slugs at firing ranges.

The 5.56mm M855A1 Cartridge is currently in the LRIP phase of the program. The system contractor, Alliant Techsystems (ATK), is responsible for ensuring that subcontractors comply with all contract requirements concerning the environment. Various subcontractors manufacture most of the Cartridges subcomponents and ship them to Lake City Army Ammunition Plant for final shaping and assembling operations. After the cartridges are fully assembled, they are either linked together to form belts or inserted into magazines. The belts and magazines are then bundled, packaged and shipped to the user. Potential environmental impacts for the Life Cycle of the 5.56mm M855A1 Cartridge have been evaluated by phases: the Non-Recurring Engineering phase, the Production/Deployment phase, the Operation and Support phase, and the Demilitarization/Disposal phase.

In the preparation of this LCEA, Government personnel visited the system contractor's final assembly and packaging site, Lake City Army Ammunition Plant (LCAAP), in order to assess the environmental impact of: the production process, hazardous materials management and waste management. Necessary precautions are being taken at the fabrication and test sites to minimize any potential health hazards or environmental pollution. All hazardous wastes are handled and disposed of by accepted methods that meet federal, state and local regulations and cause no significant effect on the environment.

Engineering tests were conducted at various locations, including Aberdeen Test Center, ARDEC, Army Research Laboratory, and Fort Benning, GA. All of these test facilities and test ranges are well established. The affected environments at these facilities will be air, ground and water. The bulk of the combustion product emissions consist of gases that are naturally abundant in the atmosphere: carbon dioxide, water, and nitrogen. Indoor test ranges are well ventilated in order to ensure proper air quality for the testers. Indoor ranges do not impact soil or water. M855A1 combustion products will quickly disperse on outdoor test and training ranges. The use of copper for the slug of the M855A1 will have little to no impact to surface and ground water at outdoor test and training areas. Additionally, the use of lead/antimony projectiles at test ranges will be reduced as the M855A1 gradually replaces the M855.

Materials and their by-products resulting from the demilitarization/disposal phase will be recycled or treated at sites dedicated to this type of activity. No significant impact to the local environment is expected from the demilitarization/disposal of the 5.56mm M855A1 Cartridge.

It was concluded that:

- a. This is not an action that will significantly affect the quality of the human environment.
- b. This action will not have a significant impact on the environment.
- c. This action is not likely to be environmentally controversial.
- d. This action does not require an environmental impact statement.

Given that there is no expected environmental impact, A Finding of No Significant Impact has been prepared as the NEPA document for the Cartridge, 5.56mm, Ball, M855A1 program and is attached to this LCEA.

NOTE: The Clean Air Act (40 CFR part 50) requires the Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The EPA Office of Air Quality Planning and Standards (OAQPS) has set the Primary and Secondary Standards for lead to both 0.15 micrograms of lead per cubic meter of air ($0.15 \mu\text{g}/\text{m}^3$) over a rolling, 3 month average and 1.5 micrograms of lead per cubic meter of air ($1.5 \mu\text{g}/\text{m}^3$) for a quarterly average. The EPA is currently reviewing these lead standards for air and may lower the allowed levels of lead to a point that training operations and ranges may be affected by tighter regulations. In order to avoid possible future adverse impacts to training operations, the Project Manager of Maneuver Ammunition Systems may want to consider implementing a program that would reduce or eliminate lead from all small caliber training ammunition.

6. ORGANIZATIONS AND PERSONS CONTACTED

Armament Research Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ:

- John Middleton, Small Caliber Munitions Division [RDAR-MEM-I]
- Marta Gonzales, M855A1 Lead, Quality Engineering & Safety Assurance Directorate [RDAR-QEM-D]
- Albert Ismailov, Quality Engineering & Safety Assurance Directorate [RDAR-QEM-D]
- Chris Collucci, Mechanical Engineer, Ammo Engineering Branch [RDAR-EIL-LA]
- Matthew Volkmann, Small Caliber Munitions Division [RDAR-MEM-I]
- Rosario Lo Cascio, Quality Engineering & Safety Assurance Directorate [RDAR-QEM-D]

Lake City Army Ammunition Plant (LCAAP), Independence, MO:

- George Abbot, Environmental Engineer, Alliant Techsystems
- William Melton, PE, SAIC Contractor, Technical/Program Management Support for PM MAS and JMC

U.S. Army Engineering Research and Development Center, Vicksburg, MS:

- Chris Griggs, Research Physical Scientist, Environmental Engineering Branch [ERDC-EL-EP-E]
- Steve Larson, Research Chemist, Environmental Engineering Branch [ERDC-EL-EP-E]

U.S. Army Center for Health Promotion and Preventive Medicine, Aberdeen Proving Ground, MD:

- Dr. William S. Eck, Biologist, Directorate of Toxicology
- Dr. Glenn Leach, Program Manager, Toxicity Evaluation

7. REFERENCES

1. AMCCOM Supplement to AR 200-2, Environmental Quality; Environmental Effects of Army Actions, dated 16 August 1991.
2. Technical Data Package drawings for Cartridge, 5.56mm, Ball, M855A1.
3. Test and Evaluation Master Plan (TEMP) for Cartridge, 5.56, Ball, Lead Free Slug, M855, dated 19 September 2008.
4. Final Environmental Impact Statement for Base Realignment and Closure Actions at US Army Garrison Aberdeen Proving Ground Hartford and Baltimore Counties, Maryland, dated July 2007.
5. Health Hazard Assessment Report (RCS MED-388) No. 69-MP-0A29-09, M855LFS, 5.56 Millimeter, Ball, Lead Free Slug, Cartridge, dated 25 February 2009.
6. M855 – 5.56mm Cartridge with #41 primer (combustion products results) by Donald Chiu (Power Point Slide, not dated).
7. DRAFT Demilitarization and Disposal Plan for Cartridge 5.56mm M855, Lead Free Slug (LFS), dated January 2009.
8. Toxicity Clearance for SMP842 Propellant used in the new 5.56mm, Ball, M855LF Cartridge, dated 14 December 2007.

NOTE: The M855A1 was also known as the M855, Lead Free Slug (LFS) earlier in the program's life.

Appendix A

5.56mm M855A1 Energetics Combustion Products

Appendix A: 5.56mm M855A1 Energetics Combustion Products

The following major combustion products are calculated by the NASA-Lewis Thermochemical code. The calculation is conducted at a temperature of 300K and a pressure of 3 atm. The total weight per item is 1.721 grams. This combustion products analysis was conducted by Donald Chiu of the Energetics Production and Manufacturing Technology Division [RDAR-MEE-P].

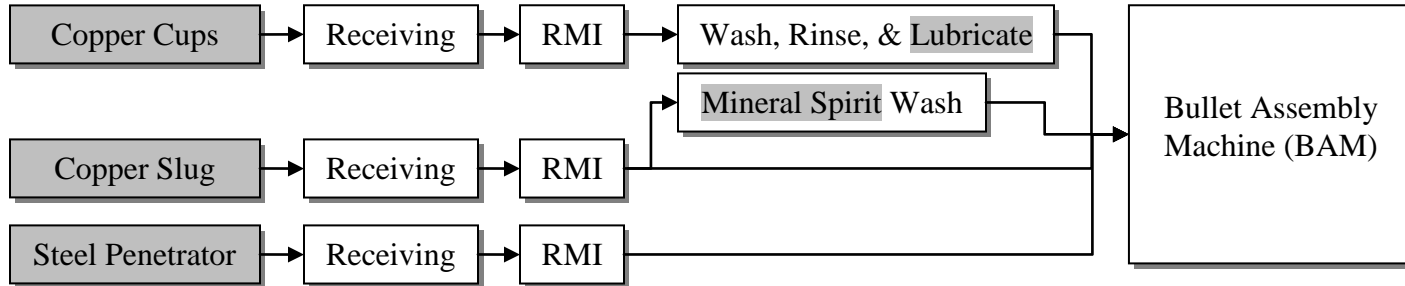
Input		
Component	Mass	
Propellant Charge (SMP842)	1.685 g	
No. 41 Primer (FA956)	0.036 g	
Total	1.721 g	
Output		
Gases		
Species	Mole fraction	Mass of Products
CO ₂	0.25314	0.78025 g
H ₂ O	0.00435	0.00548 g
N ₂	0.11883	0.23316 g
Sb	0.00045	0.00161 g
Condensed Species		
Species	Mole fraction	Mass of Products
Al ₂ O ₃	0.00066	0.00473 g
BaSO ₄	0.00063	0.01025 g
Bi	0.00049	0.00721 g
C	0.28701	0.24143 g
H ₂ O	0.33317	0.42037 g
K ₂ CO ₃	0.00085	0.00826 g
Pb	0.00035	0.00512 g
PbS	0.00005	0.00086 g

Appendix B

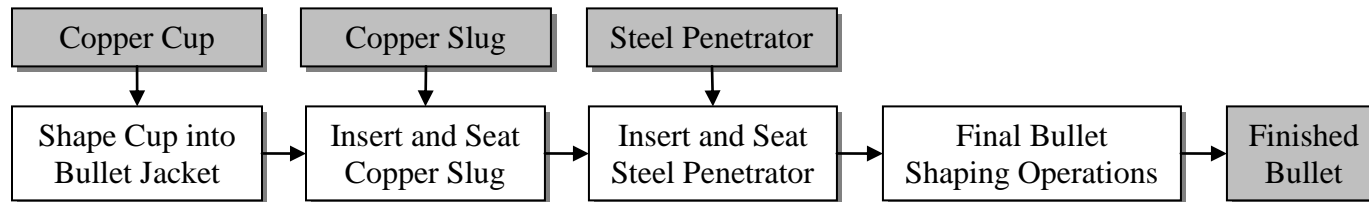
5.56mm M855A1 Manufacturing Process Overview

Appendix B: 5.56mm M855A1 Basic Manufacturing Process Overview

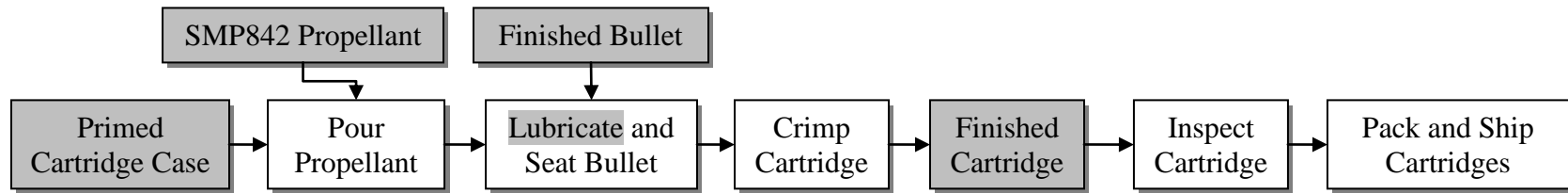
Component Inspection and Preparation



Bullet Assembly Machine Operations



Cartridge Assembly Operations



Appendix C

List of Acronyms

Appendix C: List of Acronyms

A

AMCCOM	Armament, Munitions and Chemical Command
APG	Aberdeen Proving Grounds
APE	Ammunition Peculiar Equipment
AR	Army Regulation
ARL	Army Research Laboratory
ARDEC	Armament Research Development and Engineering Center
ATC	Aberdeen Test Center
ATK	Alliant Techsystems

C

CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CHPPM	Center for Health Promotion and Preventive Medicine
CMR	Conditional Material Release
CONUS	Continental United States
CRTC	Cold Regions Test Center

D

DMWR	Depot Maintenance Work Requirement
DOD	Department of Defense
DODI	Department of Defense Instruction
DT	Development Tests
DT&E	Developmental Test and Evaluation

E

EIS	Environmental Impact Statement
EO	Executive Order
EOD	Explosive Ordinance Disposal
EPA	Environmental Protection Agency
EPCRA	Emergency Planning & Community Right-to-know Act
ERDC	Engineering Development and Research Center

F

FAAT	First Article Acceptance Testing
FAR	Federal Acquisition Regulation
FAT	First Article Test
FHC	Final Hazard Classification
FMR	Full Material Release
FoNSI	Finding of No Significant Impact
FRP	Full Rate Production
FY	Financial Year

G

GOCO	Government Owned Contractor Operated
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I

ICUZ	Installation Compatible Use Zone
IOT	Initial Operational Test
ISCP	Installation Spill Control Plan

J

JMC	Joint Munitions Command
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L

LAP	Loading, Assembly and Packaging
LAT	Lot Acceptance Test
LCAAP	Lake City Army Ammunition Plant
LCEA	Life Cycle Environmental Impact
LF	Live Fire – OR – Lead Free
LFS	Lead Free Slug
LFT&E	Live Fire Test and Evaluation
LRP	Low Rate Production
LUE	Limited User Evaluation
LUT	Limited User Test

M

MOA	Memorandum Of Agreement
MOUT	Military Operations on Urban Terrain
MS	Milestone
MTP	Master Test Plan

N

NAAQS	National Ambient Air Quality Standards
NATO	North Atlantic Treaty Organization
NEPA	National Environmental Policy Act
NTC	National Training Center

O

OAQPS	Office of Air Quality Planning and Standards
OB/OD	Open Burn/Open Detonate
OCONUS	Outside the Continental United States
ODS	Ozone Depleting Substance
OPM-MAS	Office of the Project Manager Maneuver Ammunition Systems
ORD	Operational Requirements Document
OSHA	Occupational Safety & Health Administration
OT&E	Operational Test and Evaluation

P

PESHE	Programmatic Environmental Safety and Occupational Health Evaluation
PM	Project Manager
PM MAS	Project Manager Maneuver Ammunition Systems
POC	Point Of Contact
POL	Petroleum, Oils and Lubricants
PPQT	Pre-Production Qualification Test
PQT	Production Qualification Test
PVT	Production Verification Test

R

RCRA	Resource Conservation and Recovery Act
RDECOM	Research, Development, and Engineering Command
RDT&E	Research, Development, Test and Evaluation
REC	Record of Environmental Consideration
RFP	Request For Proposal
RMI	Raw Material Inspection

S

SAIC	Science Applications International Corporation
SARA	Superfund Amendment and Reauthorization Act
SAW	Squad Automatic Weapon
SCS	Soil Conservation Service
SD&D	System Design and Development
SET-P	Sequential Environments Test-Performance
SET-S	Sequential Environments Test-Safety
SHPO	State Historic Preservation Officer
SMI	Storage Monitoring Inspections
SPCCP	Spill Prevention Control & Countermeasures Plan
SRTA	Short Range Training Ammunition

T

TC	Type Classify
TCLP	Toxicity Characteristics Leaching Procedure
TDP	Technical Data Package
TEMP	Testing and Evaluation Master Plan
TSD	Treatment, Storage and Disposal

U

UMR	Urgent Material Release
UNS	Unified Numbering System
US	United States
UXO	Unexploded Ordinance

V

VOC	Volatile Organic Compound
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W

WC

Western Cartridge

Appendix D

Environmental Regulation Synopsis

Appendix D: Environmental Regulation Synopsis

How To Use This Appendix:

This appendix provides a synopsis of U.S. environmental law/protocol/ regulations and how they apply to the 5.56mm M855A1 Cartridge.

The major environmental issue in contracting is to ensure that all contractual documents comply with a large number of environmental laws/regulations/protocols. Applicable laws for the 5.56mm M855A1 Cartridge are listed here:

Law/Regulation

Synopsis of Applicability to M855A1 Cartridge

Toxic Substance Control Act (TSCA)

Regulates manufacture, import, processing and distribution in commerce, use and disposal of chemical substances. Established a comprehensive inventory of all chemical substances manufactured or processed in the US. EPA is authorized under TSCA to regulate existing and new chemicals if such chemicals are determined to pose an "unreasonable risk" to human health or the environment. Regulatory authority is dependent in part on whether the chemical is new or existing. A chemical is "new" if it is not on the TSCA inventory or if it is an existing chemical for which a new use is being proposed (Significant New Use Rule).

Specific Applicability:

Production sites for components manufactured in the U.S.

Emergency Planning and Community Right-To-Know Act of 1986 (EPCRA)

Sets forth community right-to-know standards for facilities that store, use, process or distribute chemicals.

Specific Applicability:

Storage/test/training/demil sites in U.S. for M855A1 Cartridges. Also, production sites for components manufactured in the U.S.

Superfund Amendment and Reauthorization Act (SARA)

Passed by Congress in October 1986 to reauthorize the CERCLA funding provisions described above for hazardous waste dump sites. Also established a nationwide community right-to-know and emergency planning program under Title III of the Act, known as EPCRA (see above discussion).

Specific Applicability:

Storage/test/training/demil sites in U.S. for M855A1 Cartridges. Also, production sites for components manufactured in the U.S.

Clean Air Act

Establishes program to control air pollution through emission regulations. Authority to implement has been delegated to the states.

Specific Applicability:

Storage/test/training/demil sites in U.S. for M855A1 Cartridges. Also, production sites for components manufactured in the U.S.

Clean Water Act

Establishes program to control wastewater discharge to the environment through the issuance of National Pollutant Discharge Elimination System (NPDES) permits for "point source" discharges. Includes oil and hazardous substances regulations that govern reporting, prevention and remediation of spills.

Specific Applicability:

Storage/test/training/demil sites in U.S. for M855A1 Cartridges. Also, production sites for components manufactured in the U.S.

Water Quality Act of 1987

Adopted revisions and additions to Clean Water Act standards, including greater emphasis on water quality standards for toxics, and stiffer penalties.

Specific Applicability:

Storage/test/training/demil sites in U.S. for M855A1 Cartridges. Also, production sites for components manufactured in the U.S.

National Environmental Policy Act	Sets forth requirements for performance of environmental assessments (EA) that address anticipated impacts to the environment and applicable mitigation, including consideration of alternatives.
	Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S. Also directly applicable to systems engineering and Programmatic Environment, Safety and Health Evaluation (PESHE) for the entire 5.56mm M855A1 Cartridge Program.
Occupational Safety and Health Act	Sets standards for safe and healthy workplaces.
	Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.
Solid Waste Disposal Act	Sets regulations for handling, transport and disposal of solid (nonhazardous) waste.
	Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.
Resource Conservation and Recovery Act	Empowers EPA to define those wastes that are hazardous, sets regulations on generation of hazardous waste, establishes performance requirements for hazardous waste management units and institutes a permit system for hazardous waste treatment facilities.
	Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.
Safe Drinking Water Act	Sets standards of purity for potable water sources.
	Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.

Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) (CERCLA)

Enacted to remedy uncontrolled releases of contaminants from hazardous waste sites. Intended to address past, present and threatened releases. Three major programs cover release reporting, emergency response, and remedial response. Contains provisions governing determination of who is liable and for seeking reimbursement for emergency/remedial response activities.

Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.

Federal Insecticide, Fungicide, and Rodenticide Act

Governs licensing and registration of pesticide products.

Specific Applicability: No specific applicability to M855A1 Cartridge program. Applicable to operations at U.S. storage/test/training/demil sites.

Pollution Prevention Act (PPA)

Establishes a national policy of the US that pollution should be prevented or reduced at the source whenever feasible. Also contains reporting requirements for source reduction processes, recycling processes, amount of chemicals entering the environment and amount of chemicals treated.

Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.

Montreal Protocol to Ban Ozone

Mandates timetable to eliminate production of Ozone Depleting Substances (ODS). Specifically, production of Class 1 ODS cease on 31 December 1995.

National Defense Authorization Act for FY 1993 (ODS restrictions)

Extends specifically to DOD and DOD contractor facilities requirements in the Montreal Protocol to Ban Ozone Depleting Substances. Prohibits appropriation of funds to pay for DOD systems to DOD/DOD contractor facilities that fail to comply with the Montreal Protocol.

Specific Applicability: M855A1 Cartridge production sites in the U.S.

DoDI 5000.02 (formerly the Defense Acquisition Guidebook)

Extends NEPA analysis and environmental compliance of proposed actions to cover all DOD acquisition programs. The Project manager shall identify and evaluate system safety and health hazards, define risk levels, and establish a program that manages the probability and severity of all hazards associated with development, use, and disposal of the system.

Specific Applicability: Applicable to all phases of the M855A1 Cartridge program, from Material Solution Analysis Phase through Demilitarization/Disposal.

AR 200-1, Environmental Protection

AR 200-1 is the Army's main environmental protection document. AR 200-1 sets forth environmental goals and policies, environmental quality and protection enhancement policies and includes discussion on major Army programs including Army Research & Development, water resources management, air pollution abatement, hazardous materials management, solid/hazardous waste management, noise abatement, asbestos abatement, oil/hazardous substance spill contingency planning/control and emergency response and radon reduction.

Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.

AR 200-2, Environmental Effects of Army Actions

Provides format guidance and requirements for preparation of Environmental Assessment (EA) and provides a list of Categorical Exclusions from the EA documentation requirements.

Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.

AR 420-47, Solid and Hazardous Waste Management

Sets forth Army requirements for actions to comply with RCRA, SARA, and CERCLA.

Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.

AR 420-40, Historical Preservation	Sets forth Army requirements for actions to preserve historical sites at Army installations.
	Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.
AR 420-76, Pest Management and DOD Directive 4150.7, DOD Pest Management Program	Sets forth Army requirements for actions to comply with the Federal Insecticide, Fungicide, and Rodenticide Act (see above).
	Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.
Executive Order 11990, Protection of Wetlands	Sets forth a policy for compliance with all applicable wetlands protection regulations at Federal facilities.
	Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.
Executive Order 11988, Floodplain Management	Sets forth a policy for compliance with all applicable floodplain protection and management regulations at Federal facilities.
DOD Directive 4210.15, Hazardous Material Pollution Prevention	Sets forth an instruction and policy for hazardous materials management by the implementation of pollution prevention at DOD facilities.
	Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.
Executive Order 13148, Greening The Government Through Leadership in Environmental Management	Sets forth requirements and goals for a 10% reduction Annually, or 40% overall by December 31, 2006, of reported Toxic Release Inventory releases and off-site transfers of toxic chemicals for treatment and disposal.
	Specific Applicability: U.S. Government Owned production/storage/test/training/demil facilities (including operations involving M855A1 Cartridges).

Federal Facilities Compliance Act

The Federal Facilities Compliance Act extends the breadth of authority of the applicable environmental regulations (especially RCRA, SARA, and CERCLA) and provisions for fines and incarceration to Federal facilities. That is, Federal facilities are no longer able to declare sovereign immunity to lawsuits arising from environmental deficiencies.

Specific Applicability: M855A1 Cartridge production/storage/test/training/demil sites in the U.S.

FINDING OF NO SIGNIFICANT IMPACT

1. Project Identification: Cartridge, 5.56mm, Ball, M855A1

2. Description of Proposed Action:

This action involves all phases of the 5.56mm M855A1 Cartridge program, from the non-recurring engineering phase to demilitarization and disposal

The U.S. Army initiated the 5.56mm M855A1 Cartridge program in order to address two different needs. The first is to address performance issues of the 5.56mm Cartridge, M855. The second is to replace the current lead/antimony alloy projectile slug material with materials that are more “friendly” with the environment. The material selected for the M855A1 slug material is copper.

3. Discussion of Anticipated Environmental Effects:

A Life Cycle Environmental Assessment (LCEA) was prepared to investigate impacts of the M855A1 Cartridge during system design and development, production, testing, deployment, and demilitarization & disposal, and is summarized as follows:

- a. Affected environments will be air, ground and water at production and test facilities within the U.S. The system contractor, Alliant Techsystems, is responsible for ensuring that the subcontractors comply with all contract requirements concerning the environment. The subcontractors are responsible to control hazardous materials used and hazardous wastes generated in accordance with all local, state, and federal environmental laws and regulations. They are also responsible to obtain all necessary environmental permits and to comply with OSHA regulations.
- b. The impact on air quality from manufacturing M855A1 Cartridges will be insignificant because pollution control equipment is installed in the manufacturing facilities to meet federal, state, and local air quality regulations. Lake City Army Ammunition Plant has an active pollution prevention programs to reduce emissions and to reduce the use of hazardous material. The components are manufactured in facilities that are well established and have the required air emission permits. Air pollution during testing and training will be limited to that derived from gun firing test quantities at M855A1 test and training sites. The bulk of emissions released from M855A1 energetics consist of naturally abundant compounds: nitrogen, water and carbon dioxide. Combustion product emissions dissipate quickly in open air.
- c. Water quality is not expected to be significantly impacted by the M855A1 Cartridge at manufacturing, testing, and training sites. Equipment has been installed to collect and pre-treat industrial process wastewater at the contractors plants to meet permit requirements.

- d. Solid wastes generated during manufacturing and testing of the M855A1 Cartridge consists primarily of metal chips and metal scrap that are recovered and recycled or disposed of in accordance with existing environmental regulations.
- e. Hazardous materials in the manufacture of components, and in the loading, assembling, and packaging of the M855A1 Cartridge are identified in the Environment, Safety and Health Analysis of Materials (Section 2.4 of the M855A1 LCEA). The hazardous materials used (energetic materials) are encapsulated in the Cartridge and pose no significant hazard while the cartridges are in storage or use. To the best of our knowledge, all hazardous wastes generated by the manufacturers are collected, stored, treated, and disposed of by methods that meet federal, state, and local regulations and cause no significant effect on the environment.
- f. Noise levels will be consistent with site specific requirements of manufacturing, testing and training facilities. They will pose no threat to the quality of the environment.
- g. Demilitarization and disposal will be accomplished using resource recovery and recycling to the maximum extent possible. All remaining components will be disposed of in accordance with local, state, and federal law & regulations.

4. Conclusions:

Based on preparation of the LCEA, the proposed M855A1 Cartridge Acquisition and Deployment Program will not significantly impact the environment. The following determinations for this program are noted:

- a. It is not an action that will significantly affect the quality of the human environment.
- b. It will not have a significant impact on the environment.
- c. It is not likely to be environmentally controversial.
- d. It does not require an environmental impact statement.

5. Point of Contact (POC) for Public Comments:

Project Manager, Maneuver Ammunition Systems
ATTN: SFAE-AMO-MAS
C/O John Middleton, Bldg. 65 North
Picatinny, NJ 07806-5000

6. Public Comment Period:

Comments regarding these findings should be forwarded to the POC within thirty (30) days of public notification.