Safety Review of M109A3 Howitzer Accident

By
Mr. Lyn Little
Industrial Specialist (Ordnance)
Explosives Safety Test Management Division (SIOAC-EST)
U.S. Army Technical Center for Explosives Safety
Savanna, IL 61074-9639

Abstract

In October 1995, a fire occurred in an M109A3 howitzer while the crew was conducting live fire training. The fire consumed the full combat load of propelling charges onboard the vehicle. One injury (a broken nose) was sustained as the crew exited the vehicle.

A Board of Investigation (BOI) consisting of members from the U.S. Army Safety Center (USASC) and U.S. Army Technical Center for Explosives Safety (USATCES) was convened to determine the most probable cause and any necessary corrective actions. Crew error was determined to be the cause of the incident.

This paper will summarize the event, the resulting damage, and lessons learned from the incident.

Introduction

A regular Army unit was conducting live fire training at the National Training Center (NTC), Fort Irwin, CA. Training rotations at Fort Irwin generally consist of two parts, force-on-force and live fire training. Force-on-force training consists of firing blank or simulated ammunition at real targets from an opposing force or OPFOR. Both sides are equipped with MILES gear which helps score the battle and determine the winner. In live fire training, units fire live ammunition at simulated targets from the OPFOR.

The unit involved in this accident had finished the force-on-force phase of the training and moved to its position for the live fire training. During the time between the end of force-on-force and the beginning of the live fire exercise, the crew conducted preventative maintenance (PM) checks, crew training exercises and rested. On the morning of the exercise the crew arose early to prepare for the anticipated fire mission. Preparations included unpacking the items to be fired and fuzing the projectiles. When the fire mission came down from the fire control center, the unit immediately loaded and attempted to fire the first round. A misfire occurred. In accordance with established procedures, a second attempt to fire the round was made. The round fired. The crew then loaded the second round of the mission. This firing also resulted in a misfire. While attempting to clear the second misfire the fire occurred. The crew evacuated the vehicle and sought cover. The fire eventually propagated to the full combat load of propelling charges contained on the vehicle. The fire eventually spread to the M548 tracked ammunition carrier which was parked approximately six to eight feet behind the howitzer. As the fire progressed,

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
AUG 1996		**00-00-1996 to 00-00-1996**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Safety Review of M109A3 Howitzer Accident	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **U.S. Army Technical Center for Explosives Safety,Explosives Safety Test Management Division (SIOAC-EST), ,Savanna,IL,61074-9639**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM000767. Proceedings of the Twenty-Seventh DoD Explosives Safety Seminar Held in Las Vegas, NV on 22-26 August 1996.

14. ABSTRACT
see report

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report "SAR"**	**4**	

high explosive projectiles located in the M548 ammunition carrier cooked off in a popcorn-like manner.

The fire occurred at approximately 0930 hours. Vigorous fire and explosions continued for approximately four hours. The vehicles continued to smolder into the night. Both vehicles were a total loss.

Incident Description

On the day of the accident, the crew day began at approximately 0500 hours. They did personal hygiene, ate breakfast, and conducted crew drills in preparation for the anticipated fire mission. At approximately 0830 hours, they received notice of the mission and began to prepare the required munitions. At approximately 0930, the crew received permission to begin firing a twelve round mission. The crew loaded and attempted to fire the first round. A misfire occurred. In accordance with established procedures, a second attempt to fire the round was made. The round fired. The crew then loaded the second round of the mission. This firing also resulted in a misfire. While attempting to clear the second misfire the fire occurred. The crew chief opened the breech to clear the stuck primer. When oxygen contacted the smoldering propelling charge it ignited. The crew evacuated the vehicle and sought cover. One minor injury occurred during the evacuation. The fire spread to the full combat load of propelling charges contained on the vehicle. The heat from the fire eventually caused the explosives in the projectile in the tube to ignite. The pressure that developed inside the projectile caused the plug-like section to be propelled rearward. This plug apparently struck the breech block and propelled it along its course. It also appears that this pressure caused the nose of the projectile to split. When this split occurred the fuze was expelled from the tube. The pressure also appears to have forced the projectile from the breech. The fire eventually propagated to the M548 tracked ammunition carrier which was parked approximately six to eight feet behind the howitzer. As the fire progressed, high explosive projectiles cooked off in a popcorn-like manner.

Incident Investigation

This incident was investigated by members from the USASC and USATCES. The investigation consisted of collection and analysis of evidence, development of findings and recommendations, and report preparation. Evidence collected consisted of both physical evidence, such as fragments, witness statements, and interrogatories with witnesses and involved personnel. The cause of the accident was determined to be crew error i.e. the crew chief opened the breech prior to waiting the required time.

Pertinent Information

A great deal of information was gathered during the investigation, not all of which is pertinent to this paper. Some of the most pertinent follows:

The ammunition involved in the accident functioned as intended, considering the circumstances. Although the projectiles involved in the accident were hazard classified as hazard division (HD) (18)1.1, the fire and explosions were characteristic of HD 1.2 events. No fragment map was

developed. The ammunition involved is listed in the following table.

TYPE	MODEL	QUANTITY INVOLVED
Projectile	155mm, HE (TNT) M107	72
Propelling Charge	155mm, M119A2 (Red Bag)	11
Propelling Charge	155mm, M4A1 (White Bag)	62
Fuze	M732 Proximity	72
Primer	M82	Approx. 80

Approximately twenty projectiles and numerous other items were recovered from the accident site by explosives ordnance disposal (EOD) personnel. Ten of the recovered projectiles were recovered in the trench between the two vehicles. They were partially buried by the explosions, creating greater potential hazards for EOD personnel. The projectile in the tube at the time of the accident never went downrange This is known because the rotating band was not imprinted with the rifling from the tube. This round was recovered inside the turret of the accident vehicle by EOD personnel. The nose of the projectile was opened like a banana and the tail had a plug-like section missing. This plug was also recovered. It appears that the heat of the fire caused the explosive in the projectile to ignite. The pressure that developed inside the projectile caused the plug-like section to be propelled rearward. This plug apparently struck the breech block and propelled it along its course. It also appears that this pressure caused the nose of the projectile to split. When this split occurred the fuze was expelled from the tube. The pressure also appears to have forced the projectile from the breech to its final resting place.

The breech block was separated from the breech during the course of the accident. It appeared to have been struck by the projectile which was in the breech at the time of the accident. The breech travelled approximately 120 feet from accident vehicle.

The vehicle involved in the accident was part of a battery that was deployed in "W" shape. There were worries during the progress of the incident that propagation would occur to nearby howitzers. Those vehicles deemed to be at risk were moved with the assistance of an armored recovery vehicle.

A perimeter was established at approximately a 1 kilometer radius from the accident site. Personnel were evacuated beyond that point.

One of the other crews in the battery was found to have pre-fuzed its entire issue of ammunition, in violation of internal procedures. Had this vehicle become involved in the incident, an even greater hazard would have been created for accident responders.

The one injury received was to a crew member that was injured while evacuating the accident site. The crewmen's web gear hung up while he was exiting through a hatch in the hull. When he freed himself, he fell, with his helmet striking him in the nose.

Onlookers approached the accident site prior to establishment of the 1 kilometer perimeter. These personnel evacuated after the first major explosion occurred.

None of the crew involved had ever fired red bag propelling charges prior to this fire mission. The crew had apparently trained on the improper procedure of inserting the charge with the white end to the rear. Crew manuals clearly say that the charges must be inserted with the red end (igniter pad) to the rear. Training aids are not available for the red bag charge. Training aids for other prop charges apparently do not always reflect the color patterns of the live items they represent.

The vehicles involved were in defilade (entrenched) positions. This appears to have had a limiting affect on the travel of fragments and the spread of other damage.

Lessons Learned

Proper crew training is imperative to accident prevention.

Training aids which accurately depict the items involved are desirable for proper crew training.

Conclusions

This accident was preventable if correct procedures were follwed by the crew involved. Members of the crew admitted not following proper misfire procedures. This resulted in the catastrophic destruction of over $1 million dollars of Army property. The potential for greater damage and for loss of life existed but did not occur in this accident.