Unexploded Ordnance is a Myth: It Actually Explodes

Vijay Singh

The fire in the Central Ammunition Depot (CAD), Pulgaon, on the night of May 30, 2016, resulting in the loss of stores and human life, was widely debated in the national media with a lot of apprehensive concern. Following a wide range of comments from a cross-section of experts, in the next few days, the topic lost its relevance, as has been the history of fires/accidents in other ammunition depots. It is understandable that every piece of news comes with a shelf life , but what is of concern is that there has never been a debate over the resultant Unexploded Ordnance (UXO) that gets scattered all over and the debilitating effect it has on human life, stores and the environment for years to come, if necessary precautions are not taken. Of course, the causes for UXO are many, with fire in ammunition depots being just one of them.

Unexploded ordnance derives its name from the term 'explosive ordnance' which can be defined as any munition, weapon delivery system or ordnance item that contains explosives, propellant or any other kind of payload. When this explosive ordnance is armed or otherwise prepared for action, launched, placed, fired, released or accidentally dispersed in such a way that it fails to explode as intended, either through malfunction or design, it is termed as UXO. A major problem with unexploded ordnance is that over the years, the detonator and main charge deteriorate,

Colonel **Vijay Singh** is Senior Fellow, Centre for Land Warfare Studies, New Delhi.

N.B. The views expressed in this article are those of the author in his personal capacity and do not carry any official endorsement.

frequently, making them more sensitive to disturbance, and, therefore, more dangerous to handle. There are countless examples of civilians tampering with unexploded ordnance that is many years old – often with fatal results. Before coming to the remedial/ management issues of UXO, it is important to first understand the various types of UXO.

Types of UXO

Ammunition becomes UXO under various circumstances and it is generally referred to by using different nomenclature such as blinds, Explosive Remnants of War (ERW) and explosive debris from an ammunition accident in storage or manufacturing.

Blinds: Such UXO is typically found in field firing ranges where the troops carry out their annual training exercises or where new weapon systems and ammunition are tested. This is a universal phenomenon and is common to almost all countries which have standing Armies. The density and risk vary from country to country, depending upon the quantum of ammunition used periodically and the effectiveness of the procedures used by the troops during range clearance to dispose of blinds.

Explosive Debris from Accident in Storage: In the past 15 years alone, there have been more than 200 explosive accidents in ammunition depots across the world, including some prominent ammunition depots in India. These resulted in a large quantum of UXO spread in the near vicinity, and its density is very high due to the large stockpiles stored in these depots. The disposal and management of such UXO is most difficult due to the quantity and variety of ammunition involved and the effect of accidental initiation of an UXO on other UXO. This continues to be a major problem in India and is a lurking threat with the kind of stockpiles that we have.

Explosive Remnants of War (ERW): This type of UXO is more widespread in the war affected areas and is a result of armed conflict between nations or a civil war. It includes blinds, damaged or destroyed ammunition dumps and abandoned ammunition caches. Though its density per square metre may be less, it covers vast areas which were involved in conflict. The major problem in such UXO is the lack of any

record about the areas covered and the quantum of ammunition used or cached. In India's neighbourhood, Sri Lanka and Afghanistan are two major countries having a major problem due to ERW.

The Indian Context

A decade or two earlier, the armed forces were the primary contributors of UXO found in firing ranges, ammunition depot fires and Counter-Insurgency (CI) operations. While the armed forces continue to be the formidable factor, the role of the Central Armed Police Forces (CAPFs) and Paramilitary Forces (PMFs) in the current security scenario is invariably making them contribute to the menace of UXO. With the growing number of security forces in the country, there is a requirement of storing close to a million tonnes of ammunition at any given time. This is stored all across the country and is growing older by the day. We cannot afford to consume the lots within their estimated shelf life due to various reasons like short supply (ex-import), cost, and wear and tear of equipment. So we keep extending the shelf life after sample tests. Today, Europe is facing a similar problem of ageing ammunition, deteriorating fast across the continent which, at times, results in massive accidents even from small mistakes.

In our country, there has been a number of accidents of ammunition in storage. What is more serious is the number of near misses every ammunition storage echelon undergoes every year, though there are no official records maintained of such near misses. With over 50 storage echelons across the country which store more than a 1,000 metric tonnes of ammunition, it is no surprise that the laws of probability catch up with us every few years. It is, therefore, imperative that this issue be addressed in a holistic perspective. The types of UXO that are the most likely to be encountered in our context are small arms ammunition, hand grenades, projectiles (shells), mortar bombs, rockets, missiles, sub-munitions, fuses, mines and projected grenades.

Yet another major issue faced in this regard is disaster management related to UXO. Disaster mitigation is a major aspect in management of UXO and in prevention of UXO incidents. The National Disaster Management Authority (NDMA) in its website has listed the various

disasters it is geared up for. There is no mention of UXO or ammunition accidents in its planning, though there is a mention of mine disaster in the site, about which no details are given. It is essential to have a disaster management organisation equipped with the requisite database for effective management of UXO incidents to meet any eventuality. Whenever an accident in ammunition storage occurs, the biggest challenge faced by the crisis management team is the lack of detailed information about the location, types of ammunition stored, terrain conditions, surrounding areas and availability of resources. Thus, there is a requirement of a central organisation within each branch of the armed forces and the ammunition manufacturing facilities of the Ordnance Factories Board.

Available Options and New Technologies

Several options and technologies are available to manage, characterise and remediate property containing UXO so that the hazards and risks are reduced or eliminated. The applicability of the options and technologies depends on various factors such as type and density of UXO present, depth of UXO, topography, land use and degree of risk posed by the UXO. In addition, existing technologies are being improved and new technologies are being developed to increase the effectiveness of UXO characterisation and remediation. The various options available can be clubbed under the ambit of *Management Options and Remediation Options*, discussed as under.

Management Options

These options provide a means of reducing immediate risks by controlling potential encounters with UXO. However, they do not eliminate the risk as the UXO remains in place. Management options, include restricting property access, conducting community education and awareness programs. These options, are typically used as a readily available, proven method of addressing risk when UXO characterisation and removal cannot be conducted in a safe, efficient, or cost-effective manner**.**

Options for Remediation

Unlike management options, remediation options reduce risks from the

UXO by removing all or some of the UXO present in an area. Procedures of remediating property with the UXO include various techniques. The techniques will be different for different types of UXO, i.e., blinds found in ranges, ERW and explosive debris of an ammunition accident. It will include the excavation of the UXO, and its transportation and disposal. In the case of explosive debris of an ammunition accident, it will also involve techniques for segregation of the UXO from other apparently safe ammunition, separate storage for the UXO based on its hazard potential, safe storage to protect it from the vagaries of weather and ground conditions, and its ultimate disposal onsite or offsite.

Excavation Technologies: Historically, the UXO excavation phase primarily involved manual methods that were very labour-intensive. Research and development efforts over the past years have focussed on increased mechanisation to improve efficiency and enhance operator safety. The effectiveness of any excavation technology, however, depends on the effectiveness of the technology used to detect the UXO. If a detection system generates a high number of false alarms over a large area, that area will require otherwise unnecessary excavation. Available UXO excavation technologies are grouped into three categories i.e., manual, mechanised and remote controlled systems.

Manual Methods: It is an accepted fact by professionals that the best equipment to handle UXO are the eyes and hands of a qualified person for the simple reason that they respond to their neural analysis better and faster than any mechanical means. Therefore, whenever it is felt by the experts that the risk of handling is minimal, they resort to manual handling of the UXO. Though it may appear to be a highly risky operation, the specialist, over a period of time, gains experience in handling various types of UXO and whenever possible, prefers using the manual methods in handling the UXO.

Mechanised Systems: The most commonly used mechanical system in identification of UXOs is the Deep Scan Metal Detector (DSMD). It is used to probe suspected contaminated areas to identify the UXO by probing for metallic content. These detectors tend to raise far too many false alarms, as any metal object, including splinters, could

trigger a find. Where the density of UXO is very high and its state is assessed to be reasonably safe, even dozers and back hoes are used in UXO clearance operations. Telescopic manipulators, mostly used in mechanical handling of *Improvised Explosive Devices (*IEDs), can also be used to retrieve, UXO, if it is not very heavy and can be held firmly by the manipulators.

Remote Controlled Systems: Remote controlled systems used for retrieval/excavation of UXO can be as complex as Remotely Operated Vehicles (ROVs) or as simple as pulleys. The ROVs are versatile all terrain vehicles which can be used to remotely retrieve the UXO. They are equipped with extendable arms to pick up the UXO several feet away from their bodies. They are radio controlled and are also equipped with cameras to give visual feedback to the operator. Till recently, they were being imported for use by our security forces, but now, for the first time in India, the Defence Research and Development Organisation (DRDO) has developed an indigenous ROV named 'Daksh'.

Recommended Array of New Technologies

Traditional disposal techniques for disposal of UXO included Open Pit Burning and Open Pit Demolition (OBOD). This comprises the oldest and most used technique for disposal of all types of explosive articles by various ammunition echelons in India. Though OBOD is the most environmentally damaging way to dispose of UXO, in most places there is just no other way. Some new technologies that can be frequently used are given below.

Abrasive Water Jet Cutting Technology

The abrasive water jet cutting technique is primarily used in industrial applications for cutting of metals. Abrasive water jet cutting is gaining popularity as a means for cutting a wide variety of materials. Ease of programming and the jet's ability to cut almost all types of material and of any thickness, make it suitable for all shape cutting applications, except for extremely hard materials. Its most significant attribute is an accurate cold cutting process that allows it to cut metals without leaving a heat affected zone.

Freezing Technique

Use of various coolants to make the explosive filling inert is another technique used in the disposal of UXO. Various cryogenic mixtures have been tried to freeze UXO. A technical manual on the use of the freezing technique in Explosive Ordnance Disposal (EOD) was published by the US Department of Defence (DoD) in 1987, in which methyl alcohol was recommended to be used as the coolant. There are numerous US patents for the use of various cryogenic materials to render UXO inert for disposal. Some of them are for handling individual UXO and some are meant for area clearance.

Cryofracture

Cryofracture is one the fast emerging technologies in the field of demilitarisation. Cryofracture involves cooling a munition in liquid nitrogen and fracturing its casing in a press, followed by the decontamination of the fragments either by an incinerator or by an alternative system such as a neutralisation reactor, followed by a supercritical water oxidation system.

Conclusion

UXO is considered the most dangerous category of military munitions. Military ammunition is designed to explode at the time it is used, but for a variety of reasons, some of it fails to do so, whether by design or accident. Whatever the reason, UXO poses a great risk of injury, fire and death, and is a major fire hazard in ammunition depots, capable of collateral damage. If disturbed (touched, picked up, played with, kicked, thrown, etc.), UXO may explode without warning. It is a serious hazard in today's world and especially in India, where the armed forces of the union are actively engaged along the northern, western and Eestern frontiers of the country and the paramilitary forces are combating the Red Corridor. The requirement of a definite goal-based strategy towards the management and disposal of UXO cannot be ignored. There is an urgent requirement of capacity building in all aspects of UXO management, including modern equipment, operational procedures and skilled manpower to minimise foreseeable disasters.