A Guide

to Ammunition

Storage

GICHD | CIDHG

The Geneva International Centre for Humanitarian Demining (GICHD) works for the elimination of anti-personnel mines and for the reduction of the humanitarian impact of other landmines and explosive remnants of war.

To this end, the GICHD shall, in partnership with others, strive to provide capacity development support, undertake applied research, and develop, all aimed at increasing the performance and professionalism of mine action. To the same end, the GICHD shall support the implementation of relevant instruments of international law.

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A GUIDE TO AMMUNITION STORAGE

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FOREWORD

The international community has increased its efforts to minimise the risks of unintended explosions of ammunition. A 1997 UN General Assembly resolution requested the Secretary-General to prepare a study on the problems of ammunition and explosives in all their aspects. In December 2006, the Assembly requested that the Secretary-General appoint a group of governmental experts to consider further steps to enhance cooperation on the issue of conventional ammunition stockpiles in surplus.

Within the context of the 1980 Convention on Certain Conventional Weapons, States Parties adopted Protocol V on Explosive Remnants of War in 2003. This provides for the first time an international legal basis for reducing the risks from abandoned explosive ordnance and unexploded ordnance. The Protocol's entry into force on 12 November 2006 provided a welcome opportunity to strengthen international efforts to address ammunition risks.

Despite these efforts, undesired explosions have continued to occur in ammunition storage areas, with appalling loss of life. Over the past eight years, available records show that thousands have been killed and injured by such explosions. In 2008 alone, explosions in Albania, Bulgaria, Iran, Iraq, Ukraine and Uzbekistan are reported to have caused hundreds of casualties and scattered munitions over many kilometres of previously safe land.

This publication identifies and promotes good practice in the safe storage of ammunition, and contributes to international efforts to address this important issue. It complements a previous report issued by the GICHD in 2002, *Explosive Remnants of War (ERW) – Undesired Explosive Events in Ammunition Storage Areas*. It is intended to provide guidance in a complex area and does not attempt to serve as or replace operating procedures for ammunition storage.

This report has been prepared thanks to funding from the Netherlands, which is gratefully acknowledged.

S. Husy

Ambassador Stephan Husy
Director
Geneva International Centre for Humanitarian Demining

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abandoned explosive ordnance (AXO)

explosive ordnance that has not been used during an armed conflict, that has been left behind or dumped by a party to an armed conflict, and which is no longer under control of the party that left it behind or dumped it. Abandoned explosive ordnance may or may not have been primed, fuzed, armed or otherwise prepared for use (CCW Protocol V).

ammunition storage area

an area used for the storage of military ammunition and explosives. The structure or structures used to house the ammunition and explosives may be temporary or permanent and may be located above or below ground.

explosives

a substance or mixture of substances which, under external influences, is capable of rapidly releasing energy in the form of gases and heat.

explosive remnants of war (ERW)

unexploded ordnance (UXO) and abandoned explosive ordnance (AXO) (CCW Protocol V).

fuze

a device that initiates an explosive train (a succession of initiating and igniting elements arranged to cause a charge to function).

hazard

potential source of harm.

igloo

a magazine, normally built at ground level, with earth-covered roof, sides and rear, and constructed in corrugated steel or reinforced concrete, provided with a strong headwall and door(s).

munition (or ammunition)
a complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions.

risk
combination of the probability of occurrence of harm and the severity of that harm.

small arms and light weapons (SALW)
all lethal conventional munitions that can be carried by an individual combatant or a light vehicle, that also do not require a substantial logistic and maintenance capability.

theft resistant
construction designed to deter and/or delay illegal entry into facilities used for the storage of explosives.

underground storage
storage, normally in solid rock, in a cavern or chamber storage.

unexploded ordnance (UXO)
explosive ordnance that has been primed, fuzed, armed or otherwise prepared for use and used in an armed conflict. It may have been fired, dropped, launched or projected and should have exploded but failed to do so (CCW Protocol V).

"Catastrophic explosions at other munitions storage depots in populated areas in Uzbekistan and Bulgaria ... are among the most recent manifestations of an international problem that has worsened since the end of the Cold War – government arms depots filled with ageing, unstable, poorly maintained, improperly stored, and weakly guarded munitions. These "dangerous depots" have the potential to create even more casualties on an annual basis than landmines and explosive remnants of war." [1]

The amount and type of ammunition held in ammunition storage areas (ASAs) is unknown. According to one source, however, global stocks of small arms and light weapons (SALW) ammunition are "several orders of magnitude more numerous" than those of SALW themselves, which number around 600 million worldwide. Moreover, "stocks of thousands of tons of ammunition that are well beyond their shelf life are quite common. The sheer scale of ammunition stocks means that in many countries the resources and institutions required for safe management, secure storage and responsible disposal are not available."[2]

During the past decade stocks of surplus ammunition in many countries have increased dramatically, often as a result of reductions in the size of armed forces.[3] Indeed, a number of States have recognised that the extent of their surplus ammunition poses a significant challenge. For instance, in April 2007, Bosnia and Herzegovina reported that its armed forces used 23 locations for keeping and storing some 35,000 tons of ammunition and explosive ordnance, of which around 25,000 tons were surplus to requirements.[4] The same month, Serbia observed that its surplus ammunition stockpiles amounted to 23,859 tons: "Due to insufficient storage space, 9,640 tons of these quantities are stored in open-air facilities; they are a burden to military storage capacities and represent security and other risks."[5]

Consequently, Germany has expressed its conviction that the problems caused by surplus ammunition stockpiles deserve "the urgent attention of the international community. Deficient administration and insufficient security of public ammunition stockpiles worldwide represent a major source of illegal ammunition transfer. At the same time, aged and insufficiently secured stockpiles endanger both the civilian population and the environment."[6]

Box 1 | Explosion of an ammunition storage area in Gerdec, Albania | March 2008

Explosions at an ammunition storage area in Gerdec, Albania, killed at least 24 people on 15 March 2008. More than 300 people were injured; 40 seriously. The accident occurred during a programme to destroy ammunition at the depot.

400 houses were completely destroyed, ten times more were damaged and 4,000 residents were evacuated from the area. Thousands of unexploded artillery shells, mortar shells, grenades, and small arms munitions were scattered up to five kilometres away. Many secondary explosions continued through the night.

The Minister of Defence declared the zone a Disaster Area and advised that residents would not be allowed to return until the area was deemed safe. Vehicles travelling on the Tirana-Durres highway had windscreens and side windows blown out. The highway was closed temporarily and reopened the next morning. The blast shattered windows of the terminal building at the country's only international airport and flights were temporarily suspended.

The Albanian government declared a national day of mourning on 18 March 2008. It has requested international assistance to safely destroy more than 100,000 tonnes of obsolete ammunition stored in stockpiles throughout the country.

* Sources: The International Action Network on Small Arms (IANSA), "20 dead in ammunition explosion, Albania", www.iansa.org/regions/europe/ammo_explosion_albania08.htm; and Office for the Coordination of Humanitarian Affairs, Situation Report 1 – Albania Ammunition Depot Explosion – 18 March 2008.

INTERNATIONAL EFFORTS TO REDUCE THE RISK

In response to growing concern—and continuing tragedies—the international community has been mobilising to address the risks from unsafe storage of ammunition. Bilaterally as well as through regional and international organisations, concerned states have significantly increased their support for demilitarisation of surplus stocks and the safer storage of ammunition, especially in post-conflict contexts or unstable situations. The continuing occurrence of undesired explosions, such as in Mozambique in March 2007 (see Chapter 1), or Albania a year later (see Box 1 above), serves as a sobering reminder of the importance of this effort.

Role of the United Nations

Internationally, the UN has become increasingly active in addressing the problems associated with unsafe storage of ammunition. In 1997, the UN General Assembly asked the Secretary-General to initiate a study on "the problems of ammunition and explosives in all their aspects".[7] In 1999, the Secretary-General presented the results of the study, which was conducted under the auspices of a Group of Experts, to the Assembly.[8] The Group of Experts found that clear and comprehensive data on the location and extent of ammunition stocks and surpluses was lacking, but noted: "While the resulting stockpiles cannot be quantified, their careful management, and their reduction where appropriate, are considered especially important by the Group." [9]

The Group recommended the creation of a UN advisory group in order to enhance coordination and implementation of UN activities on ammunition and explosives. One of the advisory group's functions would be the provision of technical assistance and exchange of information to countries with "less developed ammunition and explosives management systems."[10]

In 2001, States participating in the UN Conference on the Illicit Trade in Small Arms and Light Weapons in All Its Aspects adopted a Programme of Action which called for, among other things, the effective storage of small arms and light weapons, particularly in post-conflict situations.[11] In December 2005, the General Assembly adopted Resolution 60/74 on Problems arising from the accumulation of conventional ammunition stockpiles in surplus, which encouraged all interested States to:

> "assess, on a voluntary basis, whether, in conformity with their legitimate security needs, parts of their stockpiles of conventional ammunition should be considered to be in surplus, and recognizes that the security of such stockpiles must be taken into consideration and that appropriate controls with regard to the security and safety of stockpiles of conventional ammunition are indispensable at the national level in order to eliminate the risk of explosion, pollution or diversion."[12]

A year later, the Assembly adopted resolution 61/72 in which it requested the Secretary-General to establish a group of governmental experts to consider further steps to enhance cooperation with regard to the issue of conventional ammunition stockpiles in surplus; the report of the group was to be sent to the General Assembly for consideration in 2008.[13] The resolution also repeated a call for States "in a position to do so" to assist others to elaborate and implement programmes to eliminate surplus stockpiles or to improve their management.[14] A number of States have provided significant financial and technical assistance in the safe storage of ammunition.[15]

General Assembly Resolution 61/72 also requested the Secretary-General to seek the views of Member States regarding the risks arising from the accumulation of conventional ammunition stockpiles in surplus and regarding national ways of strengthening controls on conventional ammunition. A number of States submitted their views, which were transmitted to the Assembly in July 2007.[16] Bangladesh, for instance, recommended that Member States agree on a "minimum standard" for safeguarding conventional ammunition, and "should ensure that their own stockpiles are subjected to proper national inventory accounting control procedures and measures."[17]

There has also been ongoing discussion of the problems caused by unsafe storage of ammunition within the context of the UN Convention on Certain Conventional Weapons (CCW). CCW Protocol V on Explosive Remnants of War, which entered into force in November 2006, requires that States Parties seek to minimise the occurrence of explosive remnants of war (unexploded ordnance—UXO—and abandoned explosive ordnance, AXO) through generic preventive measures (see Chapter 2). In November 2007, the First Conference of States Parties to the Protocol decided that an informal meeting of experts in July 2008 would focus on a number of issues, including generic preventive measures.[18]

Role of regional bodies

At a regional level, the North Atlantic Treaty Organization (NATO), the Organisation for Security and Cooperation in Europe (OSCE) and the South Eastern and Eastern Europe Clearinghouse for the Control of Small Arms and Light Weapons (SEESAC) have led the way in efforts to promote safe storage of ammunition. There have also been contributions from the Southern African Development Community (SADC) and the Economic Community of West African States (ECOWAS).

The OSCE has arguably gone the furthest among regional intergovernmental organisations in directly addressing ammunition issues, particularly safe storage.[19] In November 2003, the OSCE adopted its Document on Stockpiles of Conventional Ammunition, which outlines the importance of stockpile management and security, and procedures for securing assistance from other OSCE states in the storage and destruction of ammunition.[20] This was followed in 2004 by the Handbook of Best Practices on Small Arms and Light Weapons. This publication includes guidelines relating to ammunition in the context of small arms and light weapons (SALW) management and control. These and other standards and guidelines are reviewed in Chapter 2.

ENDNOTES

1 US Department of State, "Dangerous Depots: The Growing Humanitarian Problem Posed by Ageing and Poorly Maintained Munitions Storage Sites Around the World", Fact Sheet, Bureau of Political-Military Affairs, Office of Weapons Removal and Abatement, Washington DC, 4 August 2008, available at: www.state.gov/t/pm/rls/fs/107694.htm.

2 Owen Greene, Sally Holt and Adrian Wilkinson, Ammunition Stocks: Promoting Safe and Secure Storage and Disposal, Briefing Paper No. 18, South Eastern and Eastern Europe Clearinghouse for the Control of Small Arms and Light Weapons (SEESAC), February 2005, pp. 3, 4. (Hereinafter, SEESAC, Biting the Bullet.)

3 SEESAC, Biting the Bullet, p. 4.

ENDNOTES

4 "Problems arising from the accumulation of conventional ammunition stockpiles in surplus, Report of the Secretary-General," UN General Assembly doc. A/62/166, 27 July 2007, p. 6.

5 ibid., p. 5.

6 ibid., p. 8.

7 UN General Assembly Resolution 52/38J, 9 December 1997, Operative Paragraph 3.

8 UN General Assembly doc. A/54/155, 29 June 1999.

9 Report of the Group of Experts on the problem of ammunition and explosives, paras. 59 and 60, annexed to UN General Assembly doc. A/54/155, 29 June 1999.

10 ibid., para. 110.

11 UN Programme of Action to Prevent, Combat and Eradicate the Illicit Trade in Small Arms and Light Weapons in All Its Aspects, 2001, para. 21.

12 UN General Assembly Resolution 60/74 on Problems arising from the accumulation of conventional ammunition stockpiles in surplus, adopted without a vote on 8 December 2005, Operative Paragraph 1.

13 UN General Assembly Resolution 61/72 on Problems arising from the accumulation of conventional ammunition stockpiles in surplus, adopted by 175 votes to 1, with one abstention, on 6 December 2006, Operative Paragraph 7.

14 ibid., Operative Paragraph 3. As the SEESAC Briefing Paper, Biting the Bullet, notes, "National authorities have primary responsibility for ensuring safe and secure management and disposal of the ammunition stocks that they hold or authorise. But many lack the capacity to discharge this responsibility, and international assistance is urgently required." SEESAC, Biting the Bullet, p. 4.

15 The SEESAC Briefing Paper, Biting the Bullet, notes, for instance, that in the Asia-Pacific region, Australia and New Zealand have both contributed to improving the storage and management of ASAs. The Australian Defence Force has provided assistance to Pacific Island nations, including training in stockpile management practices and advice how to improve the physical security of a number of ASAs. SEESAC, Biting the Bullet, p. 26. In August 2008, the United States (US) Department of State issued a fact sheet in which it noted many instances of US support in preventing or addressing the threat from ASAs. See US Department of State, "Dangerous Depots: The Growing Humanitarian Problem Posed by Ageing and Poorly Maintained Munitions Storage Sites Around the World", op. cit.

16 Bangladesh, Bolivia, Bosnia and Herzegovina, Czech Republic, Germany, Germany (on behalf of the European Union), Guatemala, Hungary, Japan, Lebanon, Mexico, Nicaragua, Portugal, Russian Federation, Senegal, Serbia, Spain, and Turkey. "Problems arising from the accumulation of conventional ammunition stockpiles in surplus, Report of the Secretary-General," UN General Assembly doc. A/62/166, 27 July 2007.

17 ibid., p. 4.

18 "First Conference of States Parties to Protocol V on Explosive Remnants of War: Final Document", UN doc. CCW/P.V/CONF/2007/1, 12 November 2007, para. 40.

19 SEESAC, Biting the Bullet, p. 11.

20 In 2007, for example, OSCE assistance to member states included help to refurbish storage sites for small arms and light weapons and to construct storage areas for conventional ammunition in Tajikistan, and support for the clean-up after the explosion at an ASA in Novobohdanivka, Ukraine. OSCE, "Annual Report 2007", pp. 72, 93.

CHAPTER 1

RISKS FROM AMMUNITION STORAGE AREAS

RISKS FROM AMMUNITION STORAGE AREAS

"The frequency of undesirable explosions of ammunition storage depots has been increasing over the last five years. This trend can only continue as the surplus stockpiles remaining from the cold war and previous conflicts continue to deteriorate. Ineffective stockpile management in many countries, combined with the slow pace of destruction, means that further explosive events will inevitably occur and more innocent lives will be lost." [1]

There are two main risks arising from the unsafe storage of ammunition. Firstly, the population and environment close to ammunition storage areas (ASAs) are at risk from the unintended explosion of ammunition. Secondly, unless sufficiently protected, such ASAs are vulnerable to theft, especially by terrorists and other criminal groups. In developing countries ASAs may also be targeted for theft by civilians seeking to earn income from the sale of scrap metal or explosives.

RISK TO CIVILIANS

The presence of ASAs in or near populated areas is a major hazard to civilians living or working nearby. The force of a blast generated by an explosion of hundreds or thousands of items of ammunition can create a lethal radius of several kilometres, and with power to destroy buildings and property even further away. According to SEESAC, 120 ASA explosions occurred between 1997 and 2007, killing more than 3,500 people and injuring almost 4,000.

One of these was the explosion of an ASA in the Mozambican capital, Maputo, on 22 March 2007. A series of explosions at a military ASA in the Malhazine district showered rockets and other ballistic debris into densely populated neighbourhoods. Nearly 100 people were killed and hundreds more injured; many of the survivors had surgical amputations in the days that followed the disaster.

The ASA was in a residential area of the city and several buildings, including schools and medical facilities, were also badly damaged. The blasts began in the late afternoon and continued for six hours. Shockwaves were felt 10 kilometres away in central Maputo, and windows shattered as far as 25 kilometres away. It is believed that hundreds of tons of decaying munitions exploded, sending columns of fire high into the air.

In Magoanine, a village about one kilometre from the weapons dump, unexploded rockets crashed through the walls or came to rest outside 10 houses in one street alone. At least one home was completely destroyed. Nobody in the street was injured, but a family of 13 was killed as they sheltered nearby.

Officials suspected the hot weather conditions prevailing in the capital were the catalyst for the explosions. The same cause was blamed for a smaller explosion at the munitions depot in January 2007, which seriously injured three people.

The humanitarian community and the government have long recognised the dangers posed by the 17 national armouries of Mozambique's armed forces, which are poorly maintained and secured, and where tons of un-inventoried munitions are decaying. In 2003 an electrical storm set off an explosion at the Beira arms depot, killing three people and destroying 130 houses. Five more people were killed at the site in December 2006, when they caused an explosion while scavenging for scrap metal. In 1985 an explosion, again at the Malhazine in Maputo, killed 13 and injured 100.[2]

RISK OF LOSS AND DIVERSION

Vast quantities of ammunition are legally held by armed forces, police and other state bodies, as well as by authorised private organisations and individuals. These stocks are vulnerable to loss through capture, theft, corruption or neglect. They are said to be "by far the main source of ammunition obtained by criminals, bandits, armed opposition forces and terrorists."[3]

Indeed, many of the world's ammunition stockpiles remain critically insecure. In some countries, it is common to find unlocked and unguarded ASAs that present "very few obstacles to even the most casual intruder." [4] Problems of inadequate management or security are reported to be "particularly acute for 'surplus' arms and ammunition, since there is a tendency to devote inadequate resources for secure storage of 'redundant' goods."[5]

The term 'diversion' refers to the "unauthorized transfer of arms and ammunition from the stocks of legal users to the illicit market. Throughout the world, it sustains the activities of non-state armed groups, terrorist organizations and armed criminality. It is one of the principal sources of illicit weaponry and represents a grave threat to the safety of civilian populations, as well as to the security of the state itself... Diversion takes many forms, ranging from large international transfers organized by corrupt military officials to low-level, localized theft and resale of munitions by military and police forces. Diversion affects all countries, and it occurs at all points in the national stockpile chain."[6]

Box 2 illustrates some of the potential consequences of insecure storage of ammunition. It helps to show why ensuring stockpile security is—or should be—a "primary consideration for all conventional ammunition stockpiles, whether they are small or large in volume."[7]

Box 2 | The looting of stockpiles in Albania | 1997

Civil unrest in Albania in early 1997 was accompanied by widespread looting and ransacking of arms and ammunition depots of the military, allegedly with the active involvement, in some cases, of officers and soldiers guarding the depots. It was initially estimated that 1,200 military storehouses were destroyed, and 'around 652,000 weapons, 1.5 billion rounds of ammunition, 3.5 million hand grenades, 3,600 tons of explosive devices and 1 million mines' looted.

Looting also took place from police storage. More than 1,300 people were killed in shootings and more than 1,400 were wounded during March and September 1997. Looted small arms and ammunition reportedly found their way into armed violence in neighbouring Kosovo and have fuelled international organised crime.

Sources: Oxfam, Ammunition: the fuel of conflict, Oxfam Briefing Note, 15 June 2006, p. 6, citing P. Holtom, H. Smith, B. Mariani, S. Rynn, L. Attree, and J. Sokolová, Turning the Page: small arms and light weapons in Albania, Saferworld, London, 2005, pp. 6, 7.

CAUSES OF EXPLOSIONS IN AMMUNITION STORAGE AREAS

There are many possible causes of undesired explosions in ASAs, but these typically fall within the following categories:

- fire, lightning strike or spontaneous combustion caused by high temperatures
- deterioration of the physical or chemical condition of the ammunition and explosives
- unsafe storage practices and infrastructure
- unsafe handling and transport practices
- deliberate sabotage[8]

In one review of ASA explosions between 1995 and 2007, where it was possible to make a determination of the cause, two-thirds were deemed to be the result of fire, movement/handling, or security/sabotage.[9] Some combined more than one cause, such as occurred in the case of Cambodia in late March 2005.

The Cambodia Daily quoted Bun Seng, commander of RCAF Division 5, as saying "The warehouse stored 50 tons of ammunition that were destroyed in the blast."

Fourteen homes were destroyed in the blast and subsequent detonations left more than 1,300 artillery shells scattered as far away as Phnom Sampov, about 10 kilometres from Battambang town.[10]

Handling of ordnance at an ASA can also result in an undesired explosion. In Iraq on 3 June 2008, six Eastern European soldiers were killed while disposing of ammunition from an Iraqi depot near the city of al-Suvariya in the Polish-run zone. According to a spokesman for the Polish contingent, the soldiers were "removing munitions from depots and detonating them, and while they were unloading them from a vehicle something exploded, most likely an air-launched bomb." Three Slovaks, two Poles and one Latvian were killed in the explosion, and several others were wounded.[12]

As has been observed, the consequences of an ammunition explosion normally make the key witnesses to the event its first victims. Subsequent investigations therefore tend to concentrate on the practices and regulations in force at the time. Due to the degree of technical knowledge typically required for an effective investigation, the investigating authority is often the one responsible for the ammunition management and storage in the first place. This can challenge the impartiality and independence of the investigation, and may lead to reluctance to allocate responsibility.[13]

Deterioration of ammunition and explosives

The shelf life of ammunition depends on types and storage conditions, but on average is around 20 years. After that, ammunition becomes increasingly unreliable, and in some cases unstable. Virtually all countries have accumulated large stocks of ammunition over the years, and in some countries the scale is enormous. Stocks of hundreds or thousands of tons of ammunition well beyond their shelf life are said to be "not uncommon".[14]

However, shelf life only provides an indication of the performance of ammunition, and not necessarily of its safety and stability in storage. These factors can only be established by ammunition surveillance, which evaluates the characteristics and properties that the ammunition type possesses and measures how the ammunition performs throughout its entire life cycle.[15]

Some industrial explosives (e.g. nitro-glycerine-based, or nitro-guanidine-based) can also become unstable in storage with time and especially at high temperatures and humidity (see Box 3). Detonators are prone to corrosion and can become unsafe in storage. Military explosives, on the other hand, tend to have good storage characteristics and can be safely stored for decades in good storage conditions.[16]

Box 3 | Explosion at an ammunition storage area in Taipei County, Taiwan | May 2006

The results of an initial examination by the Ministry of National Defense (MND) indicated that an explosion on 10 May 2006 at an ammunition dump in Hsichih township, Taipei County, was the result of spontaneous combustion. The Minister of National Defense Lee Jye told the Legislative Yuan's National Defense Committee that experts believed the explosion, which killed two soldiers and injured eight others, was caused by spontaneous combustion of the nitrocellulose in the explosives, apparently triggered by high temperatures at noon.

The explosion at the Hsichih ammunition storage area caused a major fire and left the surrounding area "looking like a battlefield". The heat and impact instantly killed two soldiers in an administrative building 150 metres away. Households nearby have become alarmed that the location of the ammunition dump is too close to residential areas and have demanded that the military relocate it.

Source: "Explosion at Ammunition Dump Caused by Spontaneous Combustion", ROC Central News Agency, Taipei, 15 May 2006, www.globalsecurity.org/wmd/library/news/taiwan/2006/taiwan -060515-cna01.htm.

IMPACT OF EXPLOSIONS IN AMMUNITION STORAGE AREAS

The damage, casualties and impact on communities of an explosion within an ASA can be devastating, as has been seen in the examples cited.

The economic costs of the subsequent explosive ordnance disposal (EOD) work—and the loss of ammunition—can be far greater than the prior implementation of safer procedures, limited infrastructure development and stockpile disposal would have been.[17] A publication by SEESAC cites the example of the ammunition explosion in Bharatpur, India, on 28 April 2000, which resulted in an estimated ammunition stock loss of US$90 million. The explosion was the result of a fire at the ammunition depot, which was aggravated by excessive vegetation. The grass had not been cut for two years—as a cost-saving measure.[18]

ENDNOTES

[1] SEESAC, Biting the Bullet, p. 4.

[2] IANSA, "Mozambique armoury explodes: Nearly 100 killed," March 2007, www.iansa.org/regions/Mozambiquearmouryexplodes.htm; and "Mozambique: Weapons depot explosion kills 76 and injures hundreds more," IRIN, Maputo, 23 March 2007, www.irinnews.org/Report.aspx?ReportId=70909.

[3] SEESAC, Biting the Bullet, p. 3.

[4] Michael Ashkenazi, "Chapter 7: Stockpile Management: Security", in James Bevan (ed.), Conventional Ammunition In Surplus, A Reference Guide, Small Arms Survey, Geneva, January 2008, p. 74. (Hereinafter, Bevan (ed.), Conventional Ammunition In Surplus)

[5] SEESAC, Biting the Bullet, p. 3.

[6] James Bevan, "Chapter 15: Conventional Ammunition Diversion", in Bevan (ed.), Conventional Ammunition In Surplus, p. 145.

[7] Michael Ashkenazi, "Chapter 7: Stockpile Management: Security", in Bevan (ed.), Conventional Ammunition In Surplus, p. 67.

[8] Adrian Wilkinson, "Chapter 13: Ammunition Depot Explosions", in Bevan (ed.), Conventional Ammunition In Surplus, p. 134; and SEESAC, Biting the Bullet, p. 16.

[9] Adrian Wilkinson, "Chapter 13: Ammunition Depot Explosions", in the SAS Reference Guide, p. 131.

[10] "Cambodia's RCAF identifies causes of ammunition explosion", 4 April 2005, People's Daily Online, english.peopledaily.com.cn/200504/04/eng20050404_179380.html.

[11] "Cambodian Arms Depot Explodes, Causing Deaths, Injuries", Voice Of America, Phnom Penh, 31 March 2005, www.globalsecurity.org/military/library/news/2005/03/mil-050331-2f7d21c6.htm.

[12] "Six Troops Killed in Iraq Ammunition Explosion", Reuters, Warsaw, 4 June 2008, www.democraticunderground.com/discuss/duboard.php?az=view_all&address=102x609224.

[13] SEESAC, Biting the Bullet, p. 16.

[14] SEESAC, Biting the Bullet, p. 13.

[15] Wilkinson, "Chapter 6: Stockpile Management: Surveillance and Proof", in Bevan (ed.), Conventional Ammunition In Surplus, p. 62.

[16] Report of the Group of Experts on the problem of ammunition and explosives, para. 61, annexed to UN General Assembly doc. A/54/155, 29 June 1999.

[17] SEESAC, Biting the Bullet, p. 18.

[18] ibid, p. 18.

CHAPTER 2

OVERVIEW OF STANDARDS AND NORMS ON AMMUNITION STORAGE

OVERVIEW OF STANDARDS AND NORMS ON AMMUNITION STORAGE

An appropriate international organisation should consider the development of international standards and guidelines for the safe storage of ammunition and explosives in order to reduce the risk to the community in the post-conflict environment. Such standards and guidelines should be based on current United Nations classification of ammunition, and should be based on easily-achieved methodology and technology. [1]

The development of international standards and guidelines on the safe storage of ammunition and explosives was one of the main recommendations of the GICHD's 2002 publication on ASAs.[2] Today, there are an increasing number of standards that address the production, storage and transport of ammunition. As the International Mine Action Standards (IMAS) note, there are not yet specific international regulations governing the safe storage of ammunition and explosives.[3] International alliances do have consolidated literature that covers this technical area, for example NATO's May 2006 Manual of Safety Principles for the Storage of Military Ammunition and Explosives.[4]

Applicable international law—notably, as set out in CCW Protocol V—is mainly generic and advisory in nature, rather than prescriptive, but lays down some important principles for States Parties. The IMAS have a standard specific to explosives safety, which provides more detailed guidance on appropriate procedures and approaches. At regional level, NATO, the OSCE and SEESAC have proposed norms and procedures to govern ammunition safety. Their full implementation, however, especially in the case of guidance from NATO, has significant cost implications.

CCW PROTOCOL V ON EXPLOSIVE REMNANTS OF WAR

Under Protocol V, each State Party is encouraged "(B)earing in mind the different situations and capacities ... to take generic preventive measures aimed at minimizing the occurrence of explosive remnants of war."[5] Examples of such measures, which are set out in the Technical Annex to the Protocol, include appropriate management of the manufacturing process as well as subsequent management of the ammunition itself, particularly its storage, transport, field storage, and handling.[6]

The guidance is mainly broad in nature. For instance, in the case of manufacturing, states are advised that production processes "should be designed to achieve the greatest reliability of munitions" and should be subject to "certified quality control measures." An issue of particular importance is acceptance testing, to determine whether ammunition meets the required military and international legal standards of reliability. The Technical Annex specifies that this should be conducted through live-fire testing over a range of conditions (or through other validated procedures).[7]

With respect to management of ammunition once it has been produced, guidance in the protocol is more detailed. Explosive ordnance should be logged and tracked to include information on the date of manufacture of each number, lot or batch of explosive ordnance, and information on where the explosive ordnance has been, under what conditions it has been stored, and to what environmental factors it has been exposed. Periodically, stockpiled explosive ordnance should undergo live-firing testing to ensure that munitions function as desired. Where necessary, the expected shelf-life of munitions should be amended as a result of information from testing.[8]

More generally, explosive ordnance should be stored in secure facilities or containers that protect the explosive ordnance and its components "in a controlled atmosphere". The risk of explosions in stockpiles should be minimised by the use of appropriate stockpile arrangements.[9] The protocol does not, though, specify what such arrangements might be. Finally, States should therefore adopt and maintain suitable training programmes to ensure that personnel are properly trained to deal with the relevant munitions.[10]

INTERNATIONAL MINE ACTION STANDARDS

IMAS 10:50 addresses the storage, transportation and handling of explosives and explosive materials used by demining organisations, within the context of safety and occupational health in mine action. As the standard observes, the need to reduce risk and to provide a safe working environment are fundamental principles of mine action management. The provision of a safe working environment includes the safe storage, transportation and handling of explosives and explosive materials. This in turn demands that appropriate storage facilities, equipment and transportation be made available, and that National Mine Action Authorities and demining organisations develop and maintain appropriate policy and procedures.[11]

IMAS 10:50 also addresses environmental requirements for the storage of ammunition and explosives and explosive materials, and identifies general requirements for the design of magazines and containers used to store and transport explosives.[12] The environmental requirements (temperature, humidity and vibration) of ammunition and explosives vary, and are dependent on their intended storage conditions (including shelf life), transportation, handling and use. The IMAS cautions that the performance of explosives is unpredictable, but safety will be reduced if the manufacturers' environmental conditions are not met.[13]

REGIONAL STANDARDS

NATO

NATO's Manual of Safety Principles for the Storage of Military Ammunition and Explosives establishes detailed safety principles to be used as a guide between host countries and NATO forces for the layout and storage of conventional ammunition and explosives in ASAs. The manual is intended to serve as a guide for authorities who are engaged in the planning and construction of ASAs of a capacity of not less than 500kg of net explosives quantity (NEQ) per storage area and for those who are responsible for the safe storage of ammunition. It also provides principles and criteria for other related matters such as design environment criteria.[14]

Separate chapters in the manual cover, among others, the following issues:

- mixing of ammunition and explosives in storage
- above-ground storage
- underground storage
- fire-fighting principles
- reports on accidental explosions

OSCE

OSCE members (known as "participating States") have recognised that the risks posed by surplus stockpiles of conventional ammunition, explosive material and detonating devices are "often created by precarious and unsatisfactory conditions of storage". Accordingly, they have agreed that proper national security and safety control over stockpiles of conventional ammunition, explosive material and detonating devices is essential in order to prevent risks of explosion and pollution, as well as loss through theft, corruption and neglect.[15]

OVERVIEW OF STANDARDS AND NORMS ON AMMUNITION STORAGE

The OSCE has developed a Best Practice Guide on National Procedures for Stockpile Management and Security.[16] The guide suggests procedures for the following:

- the appropriate characteristics of stockpile locations
- lock-and-key and other physical security measures
- access control measures
- inventory management and accounting control procedures
- protection measures in emergency situations
- procedures aimed at maximising transport security
- precautions and sanctions in the event of loss and theft
- security training for personnel regarding SALW stockpile locations/ buildings
- assistance for improving stockpile management and security procedures

It also emphasises the importance of a security plan for an ASA and puts forward a model plan, an adapted version of which is set out in Figure 1 in Chapter 4.

Africa

There has been increasing attention to the issue of ASAs sub-regionally in Africa, although most of the focus has been on restricting the illicit circulation of SALW. The greatest detail is set out in the 2006 ECOWAS Convention on Small Arms and Light Weapons, Their Ammunition and Other Related Materials. States Parties must ensure the safe management, storage and security of national stockpiles, including the establishment of effective standards and procedures related to:[17]

- appropriate site
- physical security measures of storage facilities
- inventory management and record keeping
- staff training
- security during manufacture and transportation
- sanctions in case of theft or loss[18]

The parties also undertake to conduct regular reviews of storage facilities and conditions of storage, and to identify surplus and obsolete stocks for disposal. Ammunition at the place of manufacture, or collected in peace operations, is to be subject to appropriate and effective “standards and procedures”.[19]

OVERVIEW OF STANDARDS AND NORMS ON AMMUNITION STORAGE

In 2004, states in Eastern Africa adopted the Nairobi Protocol for the Prevention, Control and Reduction of Small Arms and Light Weapons in the Great Lakes Region and the Horn of Africa. Under the Protocol States Parties undertake to establish and maintain complete national inventories of SALW held by security forces and other state bodies, "to enhance their capacity to manage and maintain secure storage" of state-owned SALW.[20]

Previously in Southern Africa, the 2001 Protocol on the Control of Firearms, Ammunition and Other Related Materials in the SADC Region had stressed the need to maintain effective control over ammunition, especially during peace processes and in post-conflict situations, and to establish and implement procedures for ensuring that firearms ammunition is securely stored, destroyed or disposed of in a way that prevents it from entering into illicit circulation.[21]

European Union

The Council of the European Union Joint Action of 12 July 2002 explicitly identifies SALW ammunition as a cause for concern and recognises the importance of the safe storage as well as quick and effective destruction of SALW ammunition.[22] The Joint Action is a commitment by EU states to provide financial and technical assistance to programmes and projects to combat the proliferation of small arms and light weapons. While the EU Joint Action does not set out specific measures to address poor stockpile management or the accumulation of ammunition surpluses, it aims to provide assistance for surplus disposal or destruction, as well as safe storage.[23]

SEESAC

Last but by no means least, SEESAC has developed a number of standards for South East Europe, notably the Regional Micro-Disarmament Standards/Guidelines (RMDS/G) on Ammunition and Explosives Storage and Safety.[24] The RMDS/G note that:

> "modern ammunition and explosives are safe if they are stored, transported and handled in accordance with the manufacturers' instructions. SALW Control organisations should not use explosives of uncertain origin or age, or when the environmental storage conditions have not met the manufacturers' requirements. The national SALW control authority or SALW Control organisation may impose additional requirements based on local experience and conditions."[25]

ENDNOTES

[1] GICHD, Explosive Remnants of War (ERW), Undesired Explosive Events in Ammunition Storage Areas, Geneva, November 2002.

[2] ibid.

[3] IMAS 10:50 (Safety & occupational health – Storage, transportation and handling of explosives), Second Edition, 1 January 2003, Section 5.2, p. 2.

[4] Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives, AASTP 1, Edition 1, May 2006; see also NATO Allied Ammunition Storage and Transportation Publications 2 (AASTP 2) – Safety Principles for the Storage and Transport of Military Ammunition and Explosives, September 2005.

[5] Article 9, para. 1.

[6] Article 3, Technical Annex.

[7] Article 3(a)(iv), Technical Annex. It is well known that testing of ammunition in the laboratory can produce very different results to real-life use.

[8] Article 3(a)(iv), Technical Annex.

[9] Article 3(b), Technical Annex.

[10] Article 3(c), Technical Annex.

[11] IMAS 10:50 Safety & occupational health – Storage, transportation and handling of explosives, Second Edition, 1 January 2003, p. v.

[12] ibid., pp. 2–3.

[13] ibid., p. 2.

[14] Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives, AASTP 1, Edition 1, May 2006, p. I-1-1.

[15] OSCE, OSCE Document on Stockpiles of Conventional Ammunition, November 2003, p. 3.

[16] OSCE, Best Practice Guide on National Procedures for Stockpile Management and Security, Vienna, September 2003, www.osce.org/publications/fsc/2003/12/13550_29_en.pdf.

[17] Article 16 (1), 2006 ECOWAS Convention on Small Arms and Light Weapons, Their Ammunition and Other Related Materials.

[18] Article 16 (2).

[19] Article 16 (3), (4) and (5).

[20] Article 6 (a), 2004 Nairobi Protocol for the Prevention, Control and Reduction of Small Arms and Light Weapons in the Great Lakes Region and the Horn of Africa.

[21] 2001 Protocol on the Control of Firearms, Ammunition and Other Related Materials in the SADC Region, www.smallarmssurvey.org/files/portal/issueareas/measures/Measur_pdf/r_%20measur_pdf/Africa/20010814_sadc_protocol.pdf; see SEESAC, Biting the Bullet, pp. 10 –11.

[22] SEESAC, Biting the Bullet, p. 11.

[23] Article 4(c), Council Joint Action of 12 July 2002 on the European Union's contribution to combating the destabilising accumulation and spread of small arms and light weapons.

[24] RMDS/G 05.40: Ammunition and Explosives Storage and Safety, 5th Edition, 20 February 2007.

[25] ibid., Section 4 (General Requirements), p. 2.

CHAPTER 3

SAFE STORAGE OF AMMUNITION | BASIC PRINCIPLES

Risks during storage of ammunition and explosives are significantly reduced by correct storage, handling and transportation methods. Ammunition is designed to be as lethal as possible when used and as safe as possible in storage, but by its very nature it contains highly reactive compounds. The level of risk is primarily dependent on:

- physical and chemical condition of the ammunition and explosives
- training and education of the personnel responsible for the storage and surveillance of the stockpiles
- handling, repair, maintenance and disposal systems in place
- storage infrastructure and environment[1]

In order to ensure the safety of ammunition up to the point of its final use it should meet the following criteria:

- have been manufactured under controlled conditions and subject to quality control standards
- be subjected to handling and storage tests
- be assigned a shelf life
- be the subject of periodic inspection
- be stored with other ammunition that will not add additional effects should an undesired explosion occur

ENVIRONMENTAL FACTORS AFFECTING AMMUNITION

Ammunition is susceptible to the following environmental factors:

- extremes of temperature
- rapid changes of temperature
- physical impact
- high levels of electro-magnetic radiation
- ingress of moisture
- (some components are) susceptible to attack by vermin, and
- tampering by inquisitive unqualified personnel

In general, therefore, explosives should be:

- kept dry and well ventilated
- kept as cool as possible and free from excessive or frequent changes of temperature
- protected from direct sunlight, and
- kept free from excessive and constant vibration

Some substances used in ammunition and explosives attract and hold moisture, which may result in the degradation of explosive performance. It may also cause them to become dangerous to handle, due to the potential for the formation of sensitive explosive crystals between the fuze and main body of the munition. Rain, dampness and humidity can cause enormous damage to ammunition and explosives in a very short time. Every effort must be made to ensure dry conditions prevail in storage and transportation. Good ventilation of explosives will keep them cool and prevent condensation.[2]

AMMUNITION PACKAGING

Ammunition packaging is a crucial factor in maintaining the integrity of the ammunition. It protects ammunition in the following ways:

- helps to mitigate the extremes of temperature
- acts as a shock absorber for impact
- forms an electro-magnetic shield
- prevents the ingress of moisture, and
- excludes vermin

In some groups of ammunition, the packaging may contain the explosive effects of its contents and prevent it from spreading to adjacent packages or alter the explosive effects. It therefore follows that packaging that has been allowed to degrade due to poor storage conditions, is far more likely to cause or unduly contribute to undesired explosions.

STACKING OF AMMUNITION

All ammunition stored in the same storehouse should be compatible; if this is not possible because of limited space then internal divisions and separate shelving must be erected. Each stack should be stable and consist of the same ammunition nature preferably of the same lot or batch. All stacks should have a tally card recording the receipt and issue of ammunition, as an aid to accounting and a deterrent of theft.

The ammunition should be stored on light wooden material to keep it dry and avoid friction with other material. There should be an air gap of at least 150mm from walls to allow for the circulation of air and to prevent condensation. All boxes should be closed and preferably sealed; no ammunition should be removed from its packaging in the storehouse.

Ammunition and explosives should not be stored together with other goods which can hazard them. Examples are highly flammable materials, acids, and corrosives.[3]

ENDNOTES

[1] SEESAC, Biting the Bullet, p. 15.

[2] IMAS 10:50, Section 6, p. 2.

[3] 2006 NATO Manual, I-2-1.

Improving stockpile security can be resource-intensive, but it need not be in the short-term. In the world's worst-secured stockpiles, mere marginal improvements in security—such as the addition of a padlock or posting a guard—could drastically improve the security of national stockpiles... In many countries, the only real barrier to achieving basic security, rather than a complete absence of security, is political will and recognition of the problem at hand.[1]

LOCATION OF AMMUNITION STORAGE AREAS AND SUPPORT BUILDINGS AND SAFETY DISTANCES

It will normally be most practical to locate stockpiles close to where they are required to be issued to personnel. Wherever stockpiles are located, they should be regularly reviewed in terms of requirement and the stocks should be kept to the minimum levels consistent with the role of the personnel and/or the capacity of the site.[2] As Box 4 illustrates, an assessment of whether it is more cost-effective to destroy stockpiles deemed surplus than to pay for their careful maintenance, should always be made.

Box 4 | Cost Benefit Analysis of SALW Storage versus Destruction*

SEESAC has developed a Cost Benefit Analysis Model in partnership with UNIDIR and Bradford University to allow SEE states to estimate the real costs involved in ammunition and weapon storage. It allows each storage depot to calculate its full running costs, and how much time it would take to break even in terms of the alternative costs of destruction. The CBA Model is in the form of an EXCEL spreadsheet, which comes on the accompanying CD-Rom. For more information about the Cost Benefit Analysis CD-ROM, please contact the SEESAC Communications Officer.

*SEESAC Activity Report, AR/071, 22 June 2006.

Within an ASA, there may be one or more separate ammunition storehouses. The purpose of the ammunition storehouse is to continue and expand upon the protective cocoon formed by ammunition packaging. An ammunition storehouse could be anything from a purpose-built igloo[3] in an ASA to an open stack of ammunition in a field storage site. The principles to be observed in order to safely store the ammunition are the same; it is only the degree of emphasis placed upon those factors that will determine if a storage site is at risk.

In general, an ammunition storehouse should provide the following:

- protection from weather conditions, including electrical storms
- physical security from intruders
- fire protection
- protection from explosions in adjacent storehouses

In case of a permanent structure (which may be a building, igloo, tunnel or dugout), NATO requires[4] that the ammunition storehouse be bullet-resistant, fire-resistant, theft-resistant, weather-resistant and ventilated.

Footings for concrete, concrete blocks, stone or brick construction shall be designed and constructed in accordance with national building standards. If piers or posts are used the area under the building should be enclosed with metal.

Walls must be constructed of a combination of steel, wood, masonry or other materials, which are fire resistant and structurally sound. Any wood on the exterior of the building must be covered with fire-resistant material. Where possible, wood should be avoided due to the inherent fire risk.

The roof must be constructed of structurally sound materials, which are or have been made fire and weather resistant. The roof or ceiling should include a thermal shield designed to assist in maintaining interior temperatures below 40 degrees Celsius.

Doors must fit tightly. Hinges and locking-ware are to be rigidly attached by welding, riveting or bolting that cannot be removed when the door is locked. The doors should be fitted so as to open outward.

Adequate ventilation shall be provided to prevent dampening and heating of stored explosives. Climatic conditions, size of magazine and location will determine the amount of ventilation required. Ventilation openings in walls of magazines should have as a minimum a total surface area of 60 cm^2 per one m^3 of volume inside the ammunition storehouse.

The magazine should be equipped with at least a five tumbler steel padlock that has at least a 9.5mm diameter case-hardened shackle. Hardware used with the padlock should be of a comparable quality.

Other permanent structures such as buildings, stacks and vehicles (trucks, trailers and railcars) present an obvious risk to personnel and property. Such sites are located at carefully calculated distances from each other and from other buildings and installations to ensure the minimum practicable risk to life and property (including ammunition). These distances are called Quantity-Distances.[5]

Underground storage typically includes natural caverns and excavated chambers.[6] Singapore, for example, explicitly advocates the use of underground rock caverns to store ammunition.[7] They offer a number of advantages:

- releasing valuable land above ground for other uses
- safety is greatly improved because the rock mass is able to confine and reduce the effects of accidental explosion
- underground installations in rock provide excellent protection against various types of weapons, compared to conventional protection of above ground installations by reinforced concrete
- the relatively constant temperature underground is very suitable for ammunition storage
- rock caverns can have almost unlimited life span, compared to above ground structures which are subject to the effects of weather
- the cost of the installation over its life cycle will be lower, due to lower operating and maintenance costs

Designing and developing an underground ASA, however, requires expertise in three areas:

- ammunition safety. In the unlikely event of an accidental explosion, the design must ensure the safety of its surroundings
- protective design. The design must be able to survive any foreseeable weapons attack. Important openings and entrances must be protected against external attack
- rock engineering. Cavern design has to overcome the engineering uncertainty in the structure of the rock mass, formed millions of years ago, and subject to complex variations due to weather and other factors through the ages. Specialised technology in site investigation and rock engineering are required in the design and development process.

PROTECTION FROM FIRE

Fire is a major cause of undesired explosions at ASAs. Buildings should therefore be constructed of non-combustible materials and capable of withstanding an external fire. Internally the building may be fitted with a sprinkler system and fire detection equipment. Fire-fighting equipment such as fire extinguishers should be provided to enable first-aid fire-fighting (fire-fighting action taken by those who discover the fire, before the arrival of professional fire-fighters). None of the internal fittings, fixtures or surfaces should be spark-producing, either from friction or electrically.

The area surrounding the explosive storehouse should be kept clear of all combustible material, including trees and undergrowth. Grass should be cut regularly and the trimmings immediately removed.

RESTRICTIONS ON ACCESS

The most effective means to ensure stockpile security is by limiting the access of unauthorised personnel. As one expert observed, it is important to stress that ensuring physical security is only one component of comprehensive security measures applicable to the national stockpile. Planning, accounting, and marking "also have a critical role to play in discouraging or disrupting malevolent actions."[8]

Physical security measures should be a combination of:

- security staff
- active or passive systems, and
- devices

These measures depend on the location and type of the stockpiles and should be based on a thorough security assessment.[9]

The careful and systematic selection and recruitment of all personnel involved in tasks regarding stockpile management and security is essential. According to the OSCE, requirements should include reliability, trustworthiness, and conscientiousness, as well as the appropriate professional qualifications. In addition, every individual should be subject to security clearance.[10]

Key personnel should receive periodic training on regulations, behaviour and procedures relating to security within stockpile locations, inventory management and record-keeping. This specific security training should be provided at the time of assignment to duty and should be regularly refreshed.[11]

DAY-TO-DAY MANAGEMENT OF THE AREAS

All ammunition in the ASA should be accounted for and a record of the account kept in a location that would not be destroyed in the event of one or more of the storehouses being destroyed. Regular stock checks should be undertaken as a deterrent to, and an identifier of, theft. The number of years included in the records should be clear to all those involved in inventory management and accounting.[12]

Sites at which stockpiles are located should ideally have a specific security plan for each location (see Figure 1 below for a model security plan). According to the OSCE, the security plan can be used for the following purposes:

- analysis. The plan can be used as an analytical tool for planning and updating the security system of a site
- allocating responsibilities. After a thorough risk assessment, the head of the responsible authority will have the fullest information readily available for deciding security priorities, as well as for addressing any residual risk not covered by the security system
- inspections. Examination of a security plan will allow well-prepared inspections to focus on the weakest areas of the security system
- investments in security. These priorities should be a consequence of the security plan
- determining the role of personnel. In assessing the situation, distribution and functions of the security staff and others with access to ASAs[13]

Figure 1 | Model security plan for an ammunition storage area[14]

ITEM	DETAILS
Establishment Security Officer	Registration of the name, location and telephone number of the establishment security officer. There must be one, single security authority. This person, or a deputy, must be contactable 24 hours a day.
Scope of the plan	What does the plan cover: which areas, individuals and possible scenarios?
Content of the stockpile	Types of weapons; types of ammunition.
Security risk	What sorts of interests might try to remove weapons, and when (eg night-time theft, armed robbery, children)?

Figure 1 | Model security plan for an ammunition storage area[14]

ITEM	DETAILS
Detailed map of the site location and surroundings	The map should clearly indicate fences, access roads, bunkers/storage areas, access points and the safety zone at around 1:20,000 resolution.
Detailed diagram of the layout of the site	Ideally, a proper survey map of the site at around 1:5,000 scale or smaller, to include: all buildings and structures; entry and exit points; electricity generators/substations; water and gas main points; road and rail tracks; wooded areas; hard- and soft-paved areas; and guard points.
Outline of site security measures	These should include: details of fences, doors, and windows; lighting; perimeter intruder detection systems; intruder detection systems; automated access control systems; guards; guard dogs; locks and containers; control of entry and exit of persons; control of entry and exit of goods and material; secure rooms; hardened buildings; and closed-circuit television.
Security responsibilities	These should include: security officer; guards and guard commanders; transport officer; inventory management and verification personnel; and all personnel authorised to have access to the site. The greatest possible specificity of responsibilities is desirable, even on a case-by-case basis, eg: 'In the event of an attempted break-in, the security officer shall be responsible for ...'
Security procedures	The security procedures to be followed in: stock reception areas; pre-storage processing; bunkers; and during all stock withdrawals. For example, how are people to be admitted to perform these functions? What security procedures should be followed when withdrawing stocks?
Control of access to buildings and compounds	Details of fences, gates, how they operate, for whom they are to be opened, etc.
Transport procedures	Who provides security? How is handover to another authority to be secured? How are external recipients to be identified?
Control of security keys	Both those in use and their duplicates. Where are keys to be located? Who can have access to them?

Figure 1 contd. | Model security plan for an ammunition storage area[14]

ITEM	DETAILS
Security education and staff briefing	How are the staff to be briefed? When? By whom? New personnel must be briefed as soon as possible. Refresher briefings should be conducted as a matter of course.
Action on discovery of loss	The security aspects of every loss must be investigated. Lessons must be drawn and amendments made to the security plan if necessary.
Details of response force arrangements	This should include size, response time, orders, means of activation and deployment. How and when to activate the site's guard response force? How to contact the police/ security forces?
Response to activation of alarms	Who must deploy where, when an alarm is sounded?
Response to security emergencies	Security actions to be taken in response to robbery or attack. Clear instructions on the use of force, alerting police and security services and post-event investigation.
Response to non-security emergency	In case of fire or flood, the procedures in place to coordinate activities of rescue and emergency teams with the security needs of the site (access in times of emergency, securing keys, avoiding theft during the confusion).

Field storage of ammunition

Field storage is normally of small quantities of ammunition, such as for small-scale military operations, quarrying or demining. For this reason, safety procedures are less stringent than for more permanent structures. In the case of a day box, for example, the IMAS recommend the following:

- a day box or other portable magazine shall be theft-resistant, fire-resistant and weather-resistant. It need not be bullet resistant
- the day box shall be constructed of not less than 2.6mm of steel with an interior lining of not less than 12.7mm of plywood or particleboard
- the door of the day box shall overlap the door opening by not less than 25mm. Hinges and locking-ware shall be rigidly attached by welding, riveting or bolting which cannot be removed when the door is locked

- the magazine should be equipped with at least a five tumbler steel padlock that has at least a 9.5mm diameter casehardened shackle. Hardware used with the padlock should be of a comparable quality
- explosive materials shall not be left unattended in a day box and shall be removed to a portable or mobile magazine or permanent magazine

ENDNOTES

1 Michael Ashkenazi, "Chapter 7: Stockpile Management: Security", in Bevan (ed.), Conventional Ammunition In Surplus, p. 75.

2 2004 OSCE Guide, p. 4.

3 A magazine, normally built at ground level, with earth-covered roof, sides and rear, and constructed in corrugated steel or reinforced concrete, provided with a strong headwall and door(s). NATO Specialist Glossary of Terms and Definitions on Ammunition Safety, AOP-38, Edition 4.

4 NATO, 2006 Manual, I-3-1.

5 NATO, 2006 Manual, I-3-24.

6 NATO, 2006 Manual, I-4-1.

7 Singapore Ministry of Defence, "Factsheet – Underground Ammunition Storage", www.mindef.gov.sg/imindef/news_and_events/nr/1999/aug/12aug99_nr/12aug99_fs.html.

8 Michael Ashkenazi, "Chapter 7: Stockpile Management: Security", in Bevan (ed.), Conventional Ammunition In Surplus, p. 67.

9 2003 OSCE Best Practice Guide, p. 5.

10 ibid. p. 10.

11 ibid.

12 2003 OSCE Best Practice Guide, p. 7.

13 ibid, p. 12.

14 Adapted from Michael Ashkenazi, "Chapter 7: Stockpile Management: Security", in Bevan (ed.), Conventional Ammunition In Surplus, pp. 72–73, and the 2003 OSCE Best Practice Guide.

Adequate guidelines and standards now exist for safe storage of ammunition and effective control of ammunition storage areas. The many explosions that have occurred since the early 1990s, and the appalling loss of life they have caused, clearly demonstrate the importance of implementing these norms. Accordingly, in dozens of countries there is an urgent need to improve the conditions of storage of ammunition to ensure that the tragedies of the past decade are not repeated.

Although improving safety demands investment of time and resources, even a relatively modest effort can increase safety levels significantly. Practical measures need to remain realistic and affordable, and thus can be determined on a case-by-case basis.

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GLOSSARY OF TERMS AND ABBREVIATIONS

ASA
ammunition storage area

AXO
abandoned explosive ordnance

ECOWAS
Economic Community of West African States

EOD
explosive ordnance disposal

ERW
explosive remnants of war

IANSA
International Action Network on Small Arms

IMAS
International Mine Action Standards

IMSMA
Information Management System for Mine Action

NATO
North Atlantic Treaty Organization

OSCE
Organization for Security and Co-operation in Europe

RCAF
Royal Cambodian Armed Forces

SADC
Southern African Development Community

SALW
small arms and light weapons

SEESAC
South Eastern and Eastern Europe Clearinghouse for the Control of Small Arms and Light Weapons

UXO
unexploded ordnance

ANNEX 2

UNDESIRED EXPLOSIONS AT AMMUNITION STORAGE AREAS JANUARY 2000 TO AUGUST 2008

The following list summarises reports of major accidents at ASAs[1] between 2000 and August 2008. It is based on the US Department of State Fact Sheet, "Dangerous Depots: The Growing Humanitarian Problem Posed by Ageing and Poorly Maintained Munitions Storage Sites Around the World";[2] research by Adrian Wilkinson, the head of SEESAC;[3] and independent research by the GICHD. A lack of systematic reporting means the list cannot be considered exhaustive. It has not been possible to verify the details of each report.

2008

27 August, Ukraine. The ASAs of the 61st southern operational command of the army in Lozov district in Kharkov region exploded. Number of lives lost was not known.

10 July, Uzbekistan. An explosion at an ASA in Kagan, south-east of Bukhara, killed at least three people and injured 21, according to the government. There have been unconfirmed reports of more casualties.

3 July, Bulgaria. A series of explosions at the Chelopchene ASA in Sofia forced the evacuation of residents within a six kilometre radius. Tons of ammunition and explosives blew up immediately. Some of the remaining munitions and explosives are believed to be damaged, constituting a danger.

3 June, Iraq. Six soldiers from eastern Europe were killed while disposing of ammunition from an Iraqi ASA in the Polish-run occupation zone. Three Slovaks, two Poles and one Latvian were killed in the explosion near the city of al-Suvariya, and several others were wounded.[4]

14 April, Iran. An explosion in a southern Iranian mosque that killed 10 people and wounded 160 after evening prayers Saturday night was caused by negligent handling of live munitions. A police commander said the munitions were apparently left behind after a "Sacred Defence" exhibition was held at the mosque, which also serves as a cultural centre. Iran's official news agency, IRNA, put the number of casualties at 10 dead and 160 wounded. Survivors were being treated at 12 hospitals, IRNA reported.[5]

15 March, Albania. A massive explosion at an ASA in Gërdec, northwest of the capital Tirana, killed some 24 people, injured more than 300, destroyed over 400 homes, and resulted in the evacuation of over 4,000 nearby residents. The depot was being used as a munitions demilitarisation facility. The precise cause of the explosion was not known, although preliminary findings pointed to unsafe procedures that triggered a spontaneous explosion, which in turn created numerous secondary explosions.

UNDESIRED EXPLOSIONS AT AMMUNITION STORAGE AREAS JANUARY 2000 TO AUGUST 2008

2007

29 December, Colombia. A series of approximately six explosions at an army base in Medellin killed two people, injured seven, and caused neighbouring civilian residents to flee. The first explosion was reportedly caused by a grenade that detonated inside an ASA.

11 August, India. A fire at a key Indian ASA in Kashmir killed at least six people and left 25 missing. Another 24 people were hurt as security forces began clearing UXO from villages near the depot. The fire started in southern Khandroo village, the location of one of the biggest ASAs in the Himalayan state.[6]

26 July, Syria. An explosion at an ASA in a military complex approximately 6 miles north of Aleppo killed 15 soldiers and wounded 50. Officials blamed the explosion on a extremely hot weather.

17 June, Democratic Republic of Congo. A Congolese Army ASA near Mbandaka in Equateur Province was destroyed in an explosion, which killed three people and injured 52.

7 April, Sudan. The international airport in Khartoum was closed temporarily due to an explosion in an adjacent ASA. There were no reported casualties.

22 March, Mozambique. Over 100 people were killed and more than 500 injured when the Malhazine ASA exploded in a densely populated neighbourhood 10 kilometres from the centre of Maputo. Unexploded ordnance from that explosion continued to injure people for several days afterwards. Hot weather and negligence were cited as the cause. The depot was constructed in 1984 by the Soviet Union and stockpiled with obsolete Soviet-era weapons and munitions. A previous explosion in January injured three people.

2006

19 October, Serbia. An explosion in an ASA injured approximately 20 people in the adjacent town of Paracin and caused damage, some of it significant, in that town and in the villages of Cuprija and Jagodina.

10 May, Taiwan. An explosion at an ASA in Hsichih township, Taipei County, killed two soldiers and injured eight others. The explosion was said to be the result of spontaneous combustion of nitrocellulose in the explosives, apparently triggered by high temperatures. Those in charge of the management of the ASA had reportedly admitted that the amount of explosives kept at the area, and waiting to be scrapped, exceeded the allowed limit.[7]

23 March, Afghanistan. Two civilians were killed and almost 60 injured, along with 18 Afghan Army soldiers, when a fire and explosion occurred in

a storage area for confiscated weapons and ammunition in Jabal Saraj, northeast of Kabul. The munitions had been collected as part of the Disarmament of Illegal Armed Groups Program sponsored by the UNDP. Leaking white phosphorus munitions may have caused the accident.

2005

1 October, Russia. A fire in a Russian Pacific Fleet ASA on the Kamchatka Peninsula forced the evacuation of five local towns. Subsequent explosions in the depot scattered flying ordnance over an eight kilometre area. No reported casualties.

2 May, Afghanistan. An illicit collection of munitions in Bajgah, north of Kabul, exploded, killing 28 people, injuring 13 and destroying 25 houses. The munitions had been stockpiled by a local militia commander.

1 April, Cambodia. A combination of dangerously high room temperature and the haphazard storage of aging artillery shells and TNT powder caused a massive explosion at a Royal Cambodian Armed Forces ASA in Battambang town. The explosion killed at least six people and injured more than 20 others. Fourteen homes were destroyed in the blast and subsequent detonations that left more than 1,300 artillery shells scattered as far away as Phnom Sampov, about 10 km away from Battambang town. The warehouse stored 50 tons of ammunition, all of which was either destroyed in the blast or scattered in the surrounding area.[8]

9 January, Iraq. Seven Ukrainian soldiers and a Kazakh soldier were killed in an explosion at an ASA south of As Suwayrah; seven other Ukrainians and four Kazakh soldiers were wounded. The explosion occurred while members of the 2nd Brigade Combat Team Explosive Ordnance Disposal were clearing the ASA.[9]

2004

6 May, Ukraine. Five people were killed and more than 300 wounded in explosions in ammunition-loaded railroad cars at an ASA near Melitopol (Novobogdanovka) in the Zaporozhye region of Ukraine. The explosions also forced the evacuation of over 5,000 people living within a 15 kilometre radius of the disaster site. Over 300 buildings were destroyed, and six villages – Novobogdanovka, Vorozhdeniye, Privolnoye, Spaskoye, Oriovo and Vysokoye – within 40 kilometres of the depot were reported to be partially or totally destroyed. Some reports attributed the accident to cigarette smoking within the depot.

19 February, India. 30 persons were injured by an explosion at an ASA in Amritsar.

UNDESIRED EXPLOSIONS AT AMMUNITION STORAGE AREAS JANUARY 2000 TO AUGUST 2008

February, Paraguay. No casualties were reported after an explosion at an ASA in the capital, Asuncion.

February, DPR Korea. Deaths were unofficially estimated at 1,000 or more after an explosion at an ASA in Seonggang.

30 January, Afghanistan. An explosion at an ASA near the southern Afghan town of Ghazni left seven soldiers dead, one missing and three people injured. The seven soldiers killed in the incident were working near the ASA.[10]

2003

11 October, Ukraine. Several thousand people were evacuated from their homes after a series of explosions ripped through an ASA at Artemovsk (Artyomovsky) in the eastern Donetsk region. The explosions, caused by a fire, shattered the windows of several apartment blocks.

30 June, Fallujah, Iraq. Five people were killed and a further four injured in an ASA explosion.

28 June, Iraq. Approximately 30 Iraqis were killed, and scores injured, when an artillery ammunition dump they were looting north of Haditha blew up.

6 May, Vietnam. An explosion at an ASA (location unknown) reportedly killed one and injured 31 others.

26 April, Iraq. At an ASA in Zafrania, 10 people were killed and a further 51 injured.

23 March, Ecuador. An explosion at a navy base in Guayaquil killed one, injured 22 and damaged at least 360 homes. A second explosion occurred on March 30 but reportedly caused no new casualties.

23 January, Peru. An explosion killed seven Peruvian military personnel who were inspecting ammunition at an ASA, and injured 15 other military personnel and 80 civilians on the base, which is located about half a mile from the city of Tumbes.

2002

21 November, Ecuador. Two explosions in the ASA at Ecuador's largest military installation near the city of Riobamba killed seven people and injured 274. The incident was attributed to the accidental detonation of a grenade during a munitions handling operation.

UNDESIRED EXPLOSIONS AT AMMUNITION STORAGE AREAS JANUARY 2000 TO AUGUST 2008

30 October, Mozambique. The explosion of an ASA in Beira reportedly killed six people, injured 50 others, and affected approximately 900 more. Three more people who lived in the area were killed in November 2006 after encountering an item of UXO that had been projected from the explosion.

16 October, Russia. An ASA at Vladivostok exploded causing 26 injuries.

28 June, Afghanistan. Nineteen people (some reports state 32) were killed and as many as 70 injured when an ASA blew up in Spin Boldak. The explosion (cause unknown, although there was one report of a rocket attack) scattered rocket-propelled grenades, anti-aircraft rounds, and small arms ammunition over a wide area.

8 March, Sri Lanka. An ASA at Kankesanturai exploded. No one reported injured.

29 January, Thailand. A second, smaller explosion occurred in an ASA in Pak Chong and resulted in 11 casualties. The cause of the accident was the munitions damaged during a previous incident in 2001 (see below).

27 January, Nigeria. Catastrophic explosions at the Ikeja ASA in the centre of Lagos, and the resulting panic which caused as many as 600 people to drown in a canal as they fled, resulted in more than 1,100 deaths, and 5,000 injured. The accident displaced 20,000 people and destroyed much of the northern part of Lagos. A fire near the depot reportedly initiated the explosion. However, other reports blamed the accident on the deteriorated condition of old munitions stored there.

11 January, India. An explosion at an ASA in Bikaner killed two persons and injured 12.

5 January, Sierra Leone. An ASA at Tongo exploded causing the deaths of five people, injuring 13 more.

2001

25 October, Thailand. A series of explosions killed 19 military personnel and injured 90 others at an ASA in Nakhon Ratchasima's Pak Chong area (Korat). The incident occurred during the movement of unserviceable ammunition. It prompted the evacuation of the nearby town of Pak Chong. (See also related incident in 2002.)

16 August, India. An explosion at an ASA in Tamil Nadu killed 25 persons and injured three.

UNDESIRED EXPLOSIONS AT AMMUNITION STORAGE AREAS JANUARY 2000 TO AUGUST 2008

8 August, Kazakhstan. Spontaneous combustion reportedly ignited a fire that caused munitions to explode at an ASA 30 miles from the town of Balkhash. Several villages were evacuated. There were no reports of casualties. According to the BBC, the depot reportedly contained "ammunition for the entire ground troops and the air force" of Kazakhstan.

21 July, Russia. An explosion at an ASA in Buryatia killed three and injured 17.

11 July, Thailand. An explosion at an ASA at Pakchong killed two and injured 70.

8 June, Vietnam. At least four people were injured and 100 homes damaged in an explosion at an army base in central Vietnam when approximately three and half tons of explosives and ammunition blew up.

24 May, India. Fire and explosions destroyed an Indian Army ASA near the town of Suratgarh in the state of Rajasthan, killing one person and injuring between five and 15 others. The initial fire which triggered the explosions was reportedly caused by the spontaneous ignition of artillery propellant. Explosions and fires caused an evacuation of about 3,000 people from adjoining villages.

20 May, Yemen. Fourteen people were killed and 50 wounded when munitions blew up in Al-Bayda.

29 April, India. A fire at an ASA on the outskirts of the city of Pathankot in the state of Punjab forced the evacuation of thousands of residents and destroyed more than 500 tons of ammunition. There were no reports of casualties.

3 March, Guinea. Ten people were killed after a fire caused a series of explosions at an ASA at an army base in the Guinean capital, Conakry.

2000

24 October, Iran. IRNA reported the evacuation of three villages due to an explosion at an ASA along the Mashhad to Neyshabur/Torbat-i Heidarieh route. No reason for the alleged explosion or fire was given and the number of casualties is not known.[11]

28 April, India. A fire at the Bharatpur munitions depot in Rajasthan killed five personnel, and injured seven. The fire and explosion affected 20 open storage areas and nine warehouses holding approximately 12 tons of munitions, including missiles. There was extensive damage to 20 surrounding villages. This accident was reported to have severely depleted the Indian Army's munitions reserves.

UNDESIRED EXPLOSIONS AT AMMUNITION STORAGE AREAS JANUARY 2000 TO AUGUST 2008

14 April, Democratic Republic of Congo. A suspected electrical fire triggered a series of explosions in a hangar being used as an ASA at Kinshasa airport, killing 101 people and injuring more than 200.

Date unknown, Guinea-Bissau. A fire in Cufar village in Tombali region caused a major explosion at a nearby ASA that killed 15 people, including 11 children. The explosion also littered the surrounding area with significant numbers of mines and items of UXO. According to local people there are approximately 10,000 items of ERW in and around the village. Each year when agricultural land is burnt by local farmers large explosions are heard.[12]

ENDNOTES

1 Explosions at ammunition factories have not been included in the list.

2 US Department of State, "Dangerous Depots: The Growing Humanitarian Problem Posed by Ageing and Poorly Maintained Munitions Storage Sites Around the World", Fact Sheet, Bureau of Political-Military Affairs, Office of Weapons Removal and Abatement, Washington DC, 4 August 2008, available at: www.state.gov/t/pm/rls/fs/107694.htm.

3 See, for example, Adrian Wilkinson, "Ammunition Depot Explosions", Chapter 13, in James Bevan (ed.), Conventional Ammunition in Surplus, A Reference Guide, Small Arms Survey, January 2008, available at: hei.unige.ch/sas/files/sas/publications/b_series_pdf/CAiS/CAiS%20book.pdf.

4 "Six Troops Killed in Iraq Ammunition Explosion", Reuters (Warsaw), 4 June 2008.

5 CNN, "Deadly blast in Iran caused by munitions", 14 April 2008, www.cnn.com/2008/WORLD/meast/04/12/iran.explosion/index.html.

6 "Six dead after army depot fire," IOL (Srinagar), 13 August 2007, www.int.iol.co.za/index.php?set_id=1&click_id=3&art_id=nw20070813105928119C548161.

7 "Explosion at Ammunition Dump caused by Spontaneous Combustion", ROC Central News Agency, Taipei, 15 May 2006, www.globalsecurity.org/wmd/library/news/taiwan/2006/taiwan-060515-cna01.htm.

8 "Cambodia's RCAF identifies causes of ammunition explosion", People's Daily Online, 4 April 2005, english.peopledaily.com.cn/200504/04/eng20050404_179380.html.

9 "Explosion at Ammunition Storage Point", As Suwayrah, January 2005, www.global security.org /military/ library/news/2005/01/mil-050109-mnfi-mnci18.htm.

10 "Afghanistan: US Military Investigating Cause of Blast Near Ammunition Dump", Ayaz Gul (Islamabad), 30 January 2004, www.globalsecurity.org/military/library/news/2004/01/mil-040130-voa02.htm.

11 "Insurgency in the East?", RFE/RL Iran Report, Vol. 3, No. 41, 30 October 2000, 2ww.globalsecurity.org/military/library/news/2000/10/war-001030-meirn.htm.

12 Source of information: Landmine Action UK.

SUMMARY OF KEY NORMS AND STANDARDS APPLICABLE TO AMMUNITION STORAGE

CCW Protocol V on Explosive Remnants of War | November 2003

Article 9. Generic preventive measures

1. Bearing in mind the different situations and capacities, each High Contracting Party is encouraged to take generic preventive measures aimed at minimising the occurrence of explosive remnants of war, including, but not limited to, those referred to in part 3 of the Technical Annex.

2. Each High Contracting Party may, on a voluntary basis, exchange information related to efforts to promote and establish best practices in respect of paragraph 1 of this Article.

Technical Annex

3. **Generic preventive measures**
States producing or procuring explosive ordnance should to the extent possible and as appropriate endeavour to ensure that the following measures are implemented and respected during the life-cycle of explosive ordnance.
(a) Munitions manufacturing management
   (i) Production processes should be designed to achieve the greatest reliability of munitions.
   (ii) Production processes should be subject to certified quality control measures.
   (iii) During the production of explosive ordnance, certified quality assurance standards that are internationally recognised should be applied.
   (iv) Acceptance testing should be conducted through live-fire testing over a range of conditions or through other validated procedures.
   (v) High reliability standards should be required in the course of explosive ordnance transactions and transfers.

(b) Munitions management

In order to ensure the best possible long-term reliability of explosive ordnance, States are encouraged to apply best practice norms and operating procedures with respect to its storage, transport, field storage, and handling in accordance with the following guidance.

   (i) Explosive ordnance, where necessary, should be stored in secure facilities or appropriate containers that protect the explosive ordnance and its components in a controlled atmosphere, if necessary.

(ii) A State should transport explosive ordnance to and from production facilities, storage facilities and the field in a manner that minimises damage to the explosive ordnance.

(iii) Appropriate containers and controlled environments, where necessary, should be used by a State when stockpiling and transporting explosive ordnance.

(iv) The risk of explosions in stockpiles should be minimised by the use of appropriate stockpile arrangements.

(v) States should apply appropriate explosive ordnance logging, tracking and testing procedures, which should include information on the date of manufacture of each number, lot or batch of explosive ordnance, and information on where the explosive ordnance has been, under what conditions it has been stored, and to what environmental factors it has been exposed.

(vi) Periodically, stockpiled explosive ordnance should undergo, where appropriate, live-firing testing to ensure that munitions function as desired.

(vii) Sub-assemblies of stockpiled explosive ordnance should, where appropriate, undergo laboratory testing to ensure that munitions function as desired.

(viii) Where necessary, appropriate action, including adjustment to the expected shelf-life of ordnance, should be taken as a result of information acquired by logging, tracking and testing procedures, in order to maintain the reliability of stockpiled explosive ordnance.

(c) Training

The proper training of all personnel involved in the handling, transporting and use of explosive ordnance is an important factor in seeking to ensure its reliable operation as intended. States should therefore adopt and maintain suitable training programmes to ensure that personnel are properly trained with regard to the munitions with which they will be required to deal.

(d) Transfer

A State planning to transfer explosive ordnance to another State that did not previously possess that type of explosive ordnance should endeavour to ensure that the receiving State has the capability to store, maintain and use that explosive ordnance correctly.

(e) Future production
A State should examine ways and means of improving the reliability of explosive ordnance that it intends to produce or procure, with a view to achieving the highest possible reliability.

IMAS 10:50 Safety & occupational health – Storage, transportation and handling of explosives

5. International legislation

5.2 Storage of ammunition and explosives

There are no specific international regulations or codes of practice that relate directly to the safe storage of ammunition and explosives, this is a national responsibility. However, international alliances do have consolidated literature that covers this technical area. An excellent example is the NATO Allied Ammunition Storage and Transportation Publications 2 (AASTP 2) - Safety Principles for the Storage and Transport of Military Ammunition and Explosives.

6. Environmental requirements

The environmental requirements (temperature, humidity and vibration) of ammunition and explosives vary, and are dependent on their intended storage conditions (including shelf life), transportation, handling and use. The performance of explosives will be unpredictable and the safety will be reduced if the manufacturers' environmental conditions are not met.

In general, explosives should be:

a) kept dry and well ventilated;

b) kept as cool as possible and free from excessive or frequent changes of temperature;

c) protected from direct sunlight; and

d) kept free from excessive and constant vibration.

Note: Some substances used in ammunition and explosives attract and hold moisture, which may result in the degradation of explosive performance. It may also cause them to become dangerous to handle, due to the potential for the formation of sensitive explosive crystals between the fuze and main body of the munition. Rain, dampness and humidity can cause enormous damage to ammunition and explosives in a very short time. Every effort shall be made to ensure dry conditions prevail in storage and transportation.

Note: Good ventilation of explosives will keep them cool and prevent condensation.

Note: Non-explosive materials, fabric including felt, paper and other materials which absorb water create the conditions which may cause the corrosion and decay of other materials in the same container.

7. Storage requirements

7.1. Storage design

General requirements for the design of magazines and containers used for the storage and transport of explosives used in the demining process are given in Annex D.

Annex D (Informative):
General requirements for the construction of Magazines

D.1. Permanent structure

A permanent structure magazine may be a building, igloo, tunnel or dugout. It shall be bullet resistant, fire-resistant, theft resistant, weather resistant and ventilated. Consideration should be given to ground and local features during design and siting of such structures.

Footings for concrete, concrete blocks, stone or brick construction shall be designed and constructed in accordance with national building standards. If piers or posts are used the area under the building should be enclosed with metal.

Walls shall be constructed of a combination of steel, wood, masonry or other materials, which are fire resistant and structurally sound.

Note: Any wood on the exterior of the building shall be covered with fire resistant material. (Where possible, wood should be avoided due to the inherent fire risk).

Note: Voids in concrete blocks or clay blocks should be filled with well tamped dry sand or well tamped sand cement mixture.

Note: Interior walls should be clad with wood or other suitable non-sparking material.

Floors should ideally be concrete, coated with a suitable non-sparking material.

The roof shall be constructed of structurally sound materials, which are or have been made fire and weather resistant. The roof or ceiling should include a thermal shield designed to assist in maintaining interior temperatures below 40 degrees Celsius.

Doors shall fit tightly. Hinges and locking-ware shall be rigidly attached by welding, riveting or bolting which cannot be removed when the door is locked. The doors should be fitted so as to open outward.

Adequate ventilation shall be provided to prevent dampening and heating of stored explosives.

Climatic conditions, size of magazine and location will determine the amount of ventilation required.

Note: Ventilation openings in walls of magazines should have as a minimum a total surface area of 60 cm^2 per 1.0 m^3 of volume inside the magazine.

The site shall have adequate drainage to prevent water damage to the contents of the magazine. The magazine should be equipped with at least a five tumbler steel padlock that has at least a 9.5 mm diameter casehardened shackle. Hardware used with the padlock should be of a comparable quality.

D.2. Portable or mobile magazine
A portable magazine is a portable structure such as a skid-mounted container, trailer or semitrailer.

A portable or mobile magazine shall be theft-resistant, fire-resistant, weather-resistant and bullet resistant. The magazine should be constructed of steel with an interior lining of timber.

Note:
15.9 mm steel with an interior lining of any spark-proof material.

12.7 mm steel with an interior lining of not less than 9.5 mm plywood or particleboard.

9.5 mm steel with an interior lining of 57 mm of plywood or particle board.

The magazine should be supported in a manner that will prevent the magazine from being in contact with the ground. Magazines of less than one cubic metre in size should be fastened to a fixed object to prevent theft of the entire magazine.

Doors shall fit tightly. Hinges and locking-ware shall be rigidly attached by welding, riveting or bolting which cannot be removed when the door is locked.

Adequate ventilation shall be provided to prevent dampening and heating of stored explosives.

Climatic conditions, size of magazine and location will determine the amount of ventilation required.

Note: Ventilation openings in walls of magazines should have as a minimum a total surface area of 60 cm^2 per 1.0 m^3 of volume inside the magazine.

The magazine should be equipped with at least a five tumbler steel padlock that has at least a 9.5 mm diameter casehardened shackle. Hardware used with the padlock should be of a comparable quality.

Trailers or semi-trailers used as portable magazines should be immobilised my removing the wheel, or by locking with a wheel locking device approved by the NMAA.

D.3. Day box

A day box or other portable magazine shall be theft-resistant, fire-resistant and weather-resistant. It need not be bullet resistant.

The day box shall be constructed of not less than 2.6 mm steel with an interior lining of not less than 12.7 mm plywood or particleboard.

The door of the day box shall overlap the door opening by not less than 25 mm. Hinges and locking-ware shall be rigidly attached by welding, riveting or bolting which cannot be removed when the door is locked.

The magazine should be equipped with at least a five tumbler steel padlock that has at least a 9.5 mm diameter casehardened shackle. Hardware used with the padlock should be of a comparable quality.

Explosive materials shall not be left unattended in a day box and shall be removed to a portable or mobile magazine or permanent magazine.

SUMMARY OF KEY NORMS AND STANDARDS APPLICABLE TO AMMUNITION STORAGE

OSCE Document on Stockpiles of Conventional Ammunition

Section IV: Stockpile management and security

20. The participating States recognize that the risks posed by surplus stockpiles of conventional ammunition, explosive material and detonating devices are often created by precarious and unsatisfactory conditions of storage. Therefore, they agree that the stockpile security should be taken into account and that proper national security and safety control over stockpiles of conventional ammunition, explosive material and detonating devices is essential in order to prevent risks of explosion and pollution, as well as loss through theft, corruption and neglect.

European Union Council Joint Action of 12 July 2002

on the European Union's contribution to combating the destabilising accumulation and spread of small arms and light weapons and repealing Joint Action, 1999/34/CFSP

Article 4

In pursuing the objectives set out in Article 1, the efforts of the Union shall aim at building consensus in the relevant international forums, and in a regional context as appropriate, for the realisation of the following principles and measures to reduce existing accumulations of small arms and their ammunition:

(c) the effective removal of surplus small arms encompassing safe storage as well as quick and effective destruction of these weapons and their ammunition, preferably under international supervision;

(d) the rendering of assistance through appropriate international organisations, programmes and agencies as well as regional arrangements.

ANNEX 3

SUMMARY OF KEY NORMS AND STANDARDS APPLICABLE TO AMMUNITION STORAGE

2006 ECOWAS Convention on Small Arms and Light Weapons, Their Ammunition and Other Related Materials

Article 16: Management and Security of Stockpiles

1. Member States shall take the necessary measures to ensure the safe and effective management, storage and security of their national stocks of small arms and light weapons;

2. To this effect, Member States shall establish effective standards and procedures for stockpile management, storage and security. These standards and procedures shall include:

   a) appropriate site;

   b) physical security measures of storage facilities;

   c) inventory management and record keeping;

   d) staff training;

   e) security during manufacture and transportation;

   f) sanctions in case of theft or loss.

3. Member States shall ensure that stockpiles of small arms and light weapons by manufacturers, dealers as well as individuals are securely stored in accordance with the appropriate standards and procedures.

4. Member States shall undertake to regularly review, in accordance with national laws and standards, the storage facilities and conditions of small arms and light weapons held by their armed and security forces and other authorised bodies in order to identify, for disposal, surplus and obsolete stocks;

5. The Executive Secretary shall ensure, in collaboration with Member States, that effective standards and procedures for stockpile management of weapons collected in the context of peace operations are duly observed.

SUMMARY OF KEY NORMS AND STANDARDS APPLICABLE TO AMMUNITION STORAGE

2004 Nairobi Protocol for the Prevention, Control and Reduction of Small Arms and Light Weapons in the Great Lakes Region and the Horn of Africa

Article 6: Control and Accountability of State-owned Small Arms and Light Weapons

States Parties undertake to:

(a) establish and maintain complete national inventories of small arms and light weapons held by security forces and other state bodies, to enhance their capacity to manage and maintain secure storage of state-owned small arms and light weapons;

(b) ensure strict national accountability and the effective tracing of all small arms and light weapons owned and distributed by the state.

2001 Protocol on the Control of Firearms, Ammunition and Other Related Materials in the SADC Region

Article 8: State-Owned Firearms

State Parties undertake to:

(a) establish and maintain complete national inventories of firearms, ammunition and other related materials held by security forces and other state bodies;

(b) enhance their capacity to manage and maintain secure storage of state owned firearms;

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