PHYSICAL SECURITY AND STOCKPILE MANAGEMENT
A PRACTITIONERS' HANDBOOK 2019

REGIONAL CENTRE ON SMALL ARMS

Co-operating to Disarm

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2019

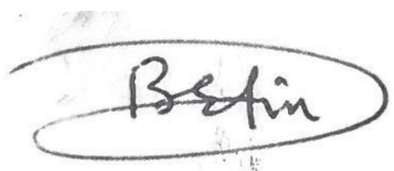
FOREWORD

Physical Security and Stockpile Management (PSSM) best practices are identified in the Nairobi Protocol and other SALW regional and international instruments as one of the priority areas in the fight against illicit SALW proliferation. They provide ways for potential improvements to stockpile safety and management. While the quality of practices varies from member state to member state, the objective of PSSM interventions is to ensure that weapons will be operational when needed and that only authorized personnel will have access to them.

Thus, the existence of effective procedures and practices to control the trafficking of SALW constitutes an important element in efforts to control the destabilizing accumulation and uncontrolled spread of such weapons. In order to further strengthen the PSSM implementation capacity, RECSA Secretariat has produced this PSSM handbook to act as a simplified practitioners' guide (reference material) for those charged with the day-to-day storage and safety of stockpiles.

This handbook heavily refers to the International Small Arms Control Standards (ISACS) and the International Ammunition Technical Guidelines (IATGs) but in a simplified version taking cognizance of the existing infrastructure in RECSA member states. If operationalized, this handbook will be instrumental in improving the capacity of member states to assess stockpiles, Standard Operating Procedures (SOPs), infrastructure and provide ways of potential improvement to the safety and management of stockpiles.

Finally, I would like to reiterate the commitment of RECSA Secretariat in promoting and building the capacity of member states in PSSM aimed at controlling diversion and unintended explosions at munition sites. I call upon all those in charge of safety and management of stockpiles to refer to this handbook in their day-to-day operations.



Lt. Gen. Badreldin Elamin Abdelgadir
EXECUTIVE SECRETARY

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ACRONYMS AND ABBREVIATIONS

AFV	Armored Fighting Vehicle
ALARP	As Low As Reasonably Practicable
ATO	Ammunition Technical Officer
ATT	Arms Trade Treaty
AUC	African Union Commission
CBA	Cost Benefit Analysis
CCTV	Closed Circuit Television
COM	Council of Ministers
CSO	Civil Society Organization
DDR	Disarmament Demobilization and Reintegration
ECOWAS	Economic Community for West African States
EOD	Explosive Ordnance Disposal
ERP	Emergency Response Plan
ES	Exposed Site
HE	High Explosive
HME	Home-Made Explosive
HQ	Headquarters
HRVA	Hazard Risk and Vulnerability Analysis
IATGs	International Ammunition Technical Guidelines
ICP	Incident Command Post
IED	Improvised Explosive Device
IRF	Individual Risk and Fatality
ISACS	International Small Arms Control Standards
ITI	International Tracing Instrument
KDF	Kenya Defense Forces
MANPADS	Man Portable Air Defense Systems
MHE	Material Handling Equipment
MSC	Ministerial Standing Committee
NATO	North Atlantic Treaty Organization
NEC	Net Explosive Content

NEQ	Net Explosive Quantity
NEW	Net Explosive Weight
NFP	National Focal Point Coordinator
NGO	Non-Governmental Organization
NSASC	National Small Arms Steering Committee
OBC	Overall Body Cover
OR	Operational Requirement
PES	Potential Explosion Site
PIDS	Perimeter Intrusion Detection Systems
PSSM	Physical Security and Stockpile Management
QD	Quantity Distance
RC	Reinforced Concrete
RECSA	Regional Centre on Small Arms
RPG	Rocket Propelled Grenade
RRPL	Risk Reduction Process Level
SALW	Small Arms and Light Weapons
SARPCCP	Southern African Regional Police Chiefs' Cooperation
SOPs	Standard Operating Procedures
SR	Societal Risk
TNOC	Transnational Organized Crime
UEMS	Unplanned Explosion at Munition Sites
UN	United Nations
UNODA	United Nations Office for Disarmament Affairs
UNODC	United Nations Office on Drugs and Crime
UNSC	United Nations Security Council
UPDF	Uganda Peoples' Defense Forces
UXO	Unexploded Ordnance
VoD	Velocity of Detonation
WRA	Weapons Removal and Abatement

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CHAPTER ONE
1.0 INTRODUCTION

The question of uncontrolled arms, their illicit acquisition and their transfer is a recurring security dilemma in the world. It is estimated that there are 875 million small arms in circulation in the world today. Of this number, civilian ownership, both legal and illegal, accounts for about 75%. From the global estimates over 100 million are in Africa, most of them in the hands of civilians. The situation is further compounded by the fact that black market value of small arms and light weapons (SALW) stands at US$ 1 billion. Consequently, one person dies from armed violence as a result of the proliferation of small arms every minute, while 16 become refugees., In that same minute, 15 new weapons are manufactured.[1]

Small arms and light weapons continue to account for tens of thousands of people killed or wounded each year in and outside conflict zones and crime-ridden areas. According to the UN and Nairobi Protocol, small arms and light weapons are weapons that can be transported and used by one person or a small crew. Small arms include revolvers and self-loading pistols, rifles and carbines, assault rifles, sub-machine guns, and light machine guns. Light weapons include heavy machine guns, hand-held under barrel and mounted grenade launchers, portable anti-tank and anti-aircraft guns, recoilless rifles, portable launchers of anti-tank and anti-aircraft missile systems, and mortars with calibres of less than 100 millimetres.

A wide range of humanitarian and socio-economic consequences are associated with the manufacture, transfer and circulation of small arms and light weapons and their excessive accumulation and un-controlled spread in many regions of the world. Apart from sustaining armed conflict, abetting terrorism, and facilitating cattle rustling and other serious crimes, these arms pose serious threat to peace, reconciliation, safety, security and stability and sustainable development at the individual, local, national,

[1]www.smallarmssurvey.org/weapons-and-markets.html.

regional and international levels (UNPoA Preamble Para 2). In realization of these adverse effects, the world came together in the late 1990s to take action on the scourge of small arms and light weapons proliferation. In particular, the 1997 United Nations Report of the Panel of Governmental Experts on Small Arms provided the definition and framework for addressing the proliferation of small arms and light weapons. The section that follows highlights the international and regional responses to the fight against SALW proliferation.

CHAPTER TWO
2.0 INTERNATIONAL RESPONSE

The response of the international community to proliferation of SALW has been through number of agreed upon instruments. Below are the highlights of the instruments that are being used to curb the spread of illicit SALW proliferation.

2.1 The UN Programme of Action (UNPoA), 2001

This is an international instrument that aims at developing or strengthening agreed norms and measures with a view to promoting concerted and coordinated international efforts to curb the illicit SALW manufacture, export, import, transfer and retransfers. It provides a normative framework for activities to counter the illicit trade in SALW.

The UNPoA was adopted in 2001 by the resolution of UN Member States who attended the UN Conference on Illicit SALW in New York. It provides actions and commitments by the Member States. During the Conference, the State Parties, bearing in mind the different situations, capacities and priorities of States and regions, agreed to undertake national, regional and international level measures to prevent, combat and eradicate the illicit trade in SALW in all its aspects.

The key actions under UNPoA include putting in place legislative measures to prevent, control and regulate SALW (Art.2); criminalizing acts of illegal manufacture, possession, stockpiling and trade of SALW (Art.3); establishing , or designating national coordination agencies or bodies and institutional infrastructure responsible for policy guidance, research and monitoring of efforts to prevent, combat and eradicate the illicit trade in SALW (Art.4); establishing , or designating a national point of contact to act as liaison between States on implementation of the UNPoA (Art.5&24); identifying groups and individuals engaged in illegal manufacture, trade, stockpiling, transfer, possession, as well as financing for acquisition, of illicit SALW, and taking action under national law against such groups and individuals (Art.6); marking (Art.7, 8 & 16); tracing (Art.10&36); keeping comprehensive and accurate records on the

manufacture, holding and transfer of SALW (Art.9); assessing applications for export authorizations (Art.11&12) and; regulating the export, transit, brokerage, licenses, storage, stocking and use of SALW (Art.14).

The UNPoA also provides for actions on disarmament, demobilization and re-integration (DDR) (Art.21, 30 & 35), stockpile management, disposal and destruction (Art.19 & 21), regional and international cooperation (part III (2), public awareness, ratification of instruments, information sharing, UN Security Council (UNSC) arms embargoes (Art.32) and, management of security agencies' SALW.

2.2 Firearms Protocol, 2001

The Firearms Protocol is the primary global legally binding instrument that establishes common procedures, for the prevention and suppression of the illicit manufacture of firearms. It is a UN Protocol that establishes mechanisms against the illicit manufacturing and trafficking in firearms, their parts and components and ammunition. Its purpose is to promote, facilitate and strengthen cooperation among States Parties in order to prevent, combat and eradicate the illicit manufacturing of and trafficking in firearms, their parts and components and Ammunition (Art. 2). It supplements the United Nations Convention against Transnational Organized Crimes and complements the UNPoA. The coordination of its implementation is entrusted to the United Nations Office on Drugs and Crime (UNODC).

The Protocol applies to the prevention of illicit manufacturing of and trafficking in firearms, their parts and components and Ammunition and to the investigation and prosecution of transnational offences (Arts. 4 & 5) and it defines key SALW issues including firearms, ammunition, illicit manufacturing, illicit trafficking, and tracing (Art. 3).

Article 5 of the protocol provides for criminal acts and requires state parties to adopt legislative and other measures, as may be necessary, to establish as criminal offences the following conducts when committed intentionally: a) illicit manufacturing of firearms,

their parts and components and ammunition; b) illicit trafficking in firearms, their parts and components and ammunition; and falsifying or illicitly obliterating, removing or altering the marking(s) on firearms.

Similarly, Article 6 provides for confiscation, seizure and disposal of state-owned, confiscated or unlicensed SALW by State Parties. It requires states to adopt legislative measures for confiscation, seizure and disposal of SALW.

The following preventive measures to control illegal acquisition, possession and use of SALW are provided for in Articles 7 – 15: record keeping (Article 7); marking (Article 8); deactivation (Article 9); export, import and transit licensing or authorization systems (Article 10) ; security and preventive measures to detect, prevent and eliminate the theft, loss or diversion of, as well as the illicit manufacturing of and trafficking in firearms (Article 11); sharing of information by State Parties on SALW regulations and activities (Article 12); cooperation by State Parties (Article 13); training and technical assistance (Article 14) and brokers and brokering (Article 15). All these Articles enjoin State Parties to make legislative measures to deal with the issues identified.

2.3 International Tracing Instrument (ITI), 2005

This instrument is intended to enable States to identify and trace, in a timely and reliable manner, the illicit Small Arms and Light Weapons. It focuses on three key areas: *firearms marking, record keeping and cooperation in information sharing (tracing).* The instrument was developed within the Policy Framework established by the 2001 Programme of Action and makes reference to the 2001 Firearms Protocol.

The ITI was promulgated to;

a) enable State Parties (SP) to identify and trace, in a timely and reliable manner, illicit small arms and light weapons;

b) promote and facilitate international cooperation and assistance in marking and tracing; and

c) to enhance the effectiveness of, and complement, existing bilateral, regional and international agreements to prevent, combat and eradicate the illicit trade in SALW in all its aspects (Arts. 1 & 2).

The ITI recognizes the need to preserve the security and interests of States. It does not restrict the right of States to acquire, manufacture, transfer and retain SALW for their self-defense and security needs or for their participation in peacekeeping operations, in a manner consistent with the UN Charter (Art. 3). However, it prohibits illicit transfer, which includes transfer in violation of UN embargo or transfer without authorization by a competent national authority or transfer of unmarked or manufactured SALW without a license [Art. II (6)].

Other key aspects of this instrument include marking of SALW, which is provided for Articles 6 to 9. These Articles enjoin states to mark (when captured) both legal and illegal SALW in SP's territory. Record keeping is provided for in Articles 11-13. The Articles require SPs to ensure that accurate and comprehensive records are established and maintained for all marked SALW within their territory.

There are also provisions in Articles 14 – 23 on cooperation in tracing by states including those on initiating requests for tracing and prompt response to requests (Arts. 16, 17 & 18). Whereas Article 14 requires SPs to undertake traces and respond to tracing requests in prompt, timely and reliable manner, Article 16 mandates SP to initiate tracing request for illicit SALW found within its territory. Article 17 requires that tracing requests contains sufficient information including markings, type, and caliber of firearm as well as the intended use of the information being sought.

The ITI further requires states to ensure that SALW manufactured in their jurisdiction are marked with unique identifications (including manufacturer's name, country and year of manufacture, serial number and weapon type) to facilitate tracing (Art. 8(a)). Timelines for record keeping are provide for in Article 12, which gives up to 30 years

for manufacturing records and 20 for other records. The instrument also restricts sharing of tracing information to competent authorities (Art. 5(a).

Articles 24-35 provides for cooperation by States, Interpol, International Agencies and UN on tracing of SALW. In Article 24, States are required to put in place, where they do not exist, the laws, regulations and administrative procedures needed to ensure the effective implementation of the ITI. Other requirements include designation of focal point of contact by each state (Article 25); regional and international cooperation (Article 26); technical assistance (Article 27); technology (Article 28); cooperation to implement the UNPoA (Article 29) cooperation with the UN (Article 30) and cooperation with Interpol (Article 34).

The mechanisms for reporting and follow-up are provided for in Articles 36 to 38. Whereas Article 36 requires SPs to report on a biennial basis to the UN Secretary-General on their implementation of the ITI including, where appropriate, national experiences in tracing illicit SALW, Article 37 provides for biennial meeting of States to consider their reports. In Article 38, the review of the implementation and future development of the ITI using the UNPOA review conference framework is provided for.

2.4 The Arms Trade Treaty, 2013

The Arms Trade Treaty (ATT) is a multilateral treaty that aims at regulating the international trade in conventional arms, from small arms to battle tanks, combat aircraft and warships. The treaty is intended to foster peace and security by eradicating and destabilizing arms flows to conflict regions and preventing supply of arms to human rights abusers and violators.

The ATT was promulgated to establish the highest possible common international standards for regulating or improving the regulation of the international trade in conventional arms. It aims to prevent and eradicate illicit trade in conventional arms and/or their diversion. This is to contribute to international and regional peace, security

and stability, reduce human suffering and promote cooperation, transparency and responsible action by States Parties in the international trade in conventional arms.

The ATT applies to all conventional arms, such as missiles and missile launchers, battle tanks, armored combat vehicles, caliber artillery systems, combat aircraft, attack helicopters, warships and SALW. The Treaty does not apply to the international movement of conventional arms by, or on behalf of, a SP for its use provided that the conventional arms remain under that SP's ownership.

The ATT further provides for control and regulation of sale of Ammunition (Art. 3); trade in parts and components (Art. 4) and; requires its implementation to be broad, consistent, objective and non-discriminatory (Art. 5). The Treaty requires SPs to establish and maintain a national control system, including a national control list that shall be provided to the ATT Secretariat (Art. 3).

Article 6 of the ATT provides for prohibitions. It prohibits a SP from authorizing a transfer of conventional arms or items, if the transfer would violate a UN Security Council resolution or imposed arms embargo. The transfer is also barred if there is suspicion or knowledge that the arms or parts would be used to commit genocide, crimes against humanity, war crimes or used against civilians' objects or civilians' protected areas. The ATT further provides for export and export assessment (Article. 7), imports (Article. 8), transit and trans-shipment (Article. 9), brokering (Article. 10), record keeping (Article. 11), prevention of diversion (Article. 12), reporting (Article. 13), and enforcement (Article. 14).

Regarding exports, the Treaty puts an obligation on a state party to assess whether the conventional arms or items would contribute to or undermine peace and security. The SP is further required to assess if the export could be used to commit or facilitate a serious violation of international humanitarian law or human rights, and commit or facilitate terrorism or transnational organized crime (TNOC). While on transportation, transit and transshipment the Treaty requires each importing state to take measures to

regulate transit or trans-shipment and to ensure that appropriate and relevant information is provided, upon request, pursuant to its national laws, to the exporting state, to assist the exporting SP in conducting its national export assessment.

The Treaty specifically promotes international cooperation of states in its implementation. Article 15 provides for international cooperation, Article 16 for international assistance, Article 17 for conference of states within one year of the Treaty coming into force and Article 18 establishes a Secretariat to facilitate effective implementation of the Treaty.

At the African continental level, there is the Bamako Declaration (2000) on the Common African Position on the Illicit Proliferation, Circulation and Trafficking of Small Arms and Light Weapons. It aims to promote peace, security and sustainable development through addressing the problem of the illicit proliferation, circulation and trafficking of SALW in a comprehensive integrated sustainable and efficient manner. The implementation of this declaration is vested with the Member States while follow-up and coordination is undertaken by the African Union Commission.

CHAPTER THREE

3.0 REGIONAL RESPONSE ON PROLIFERATION OF ILLICIT SALW

The fight against the illicit SALW proliferation necessitated countries in regional blocs to cooperate through enactment of SALW regional instruments. The following are the key regional instruments:

3.1 Nairobi Protocol, 2004

The Nairobi Protocol is key because of its relevance and applicability in RECSA region. That is why in this chapter the Nairobi Protocol Articles have been covered in more detail. The protocol focuses on prevention, control and reduction of small arms and light weapons in the great lakes region, the horn of Africa and bordering states. In particular, Article 2 aims to;

a) prevent, combat and eradicate the illicit manufacturing of, trafficking in, possession and use of SALW in the sub-region;

b) prevent the excessive and destabilizing accumulation of SALW in the sub-region;

c) promote and facilitate information sharing and cooperation between governments and the sub-region as well as between governments, inter-governmental organizations and CSO in all matters relating to illicit trafficking and proliferation of SALW;

d) promote cooperation at the sub-regional level as well as in the international forum to effectively combat the SALW problem in collaboration with relevant partners and;

e) encourage accountability, law enforcement and efficient control and management of SALW held by state parties and civilians.

Other key provisions of the Nairobi Protocol are as follows:

(i) The requirement of the SPs that have not done so to adopt legislative measures to establish as criminal offences under their national law acts of illicit trafficking, illicit manufacturing and illicit possession and misuse of SALW, falsifying or illicitly obliterating, removing or altering the markings on SALW and violation of UNSC mandated arms embargoes on SALW (Article 3).

(ii) The provision for the strengthening of operational capacity of national law enforcement and security agencies to enhance combating of SALW proliferation in the Member States and the sub region (Article 4)

(iii) The provision for control of civilian possession of SALW while Article 6 provides for control and accountability of State-owned SALW (Article 5).

(iv) The requirement that all SPs are enjoined to marking and tracing of all SALW in their possession and also at the time of manufacture and import (Article 7).

(v) The provision for disposal of state-owned, confiscated or unlicensed SALW by State Parties (Articles 8 and 9).

(vi) The provision for voluntary surrender of SALW by illegal holders and destruction thereof by the State (Article 12)

(vii) The provision for creation of public awareness (Article 13). This requires SPs to develop local, national and regional public and community education and awareness programmes to enhance the involvement of the public and communities and support for efforts to tackle the proliferation and illicit trafficking of SALW.

(viii) The provision for regional cooperation on SALW issues (Article 14). This provides for mutual legal assistance and requires States Parties to create a mutual legal assistance system to enhance their cooperation in mutual legal assistance in a concerted effort to eradicate the illicit manufacturing and trafficking, and control the possession and use of SALW.

(ix) The obligation on SPs to establish appropriate mechanisms for cooperation among law enforcement agencies to promote effective law enforcement (Article 15)

(x) The Provision for mechanisms for cooperation through transparency, information exchange and harmonization (Articles 16 and 17). It also commits States to establish National Focal Points to facilitate the rapid information exchange to combat cross-border small arms and light weapons trafficking. In Article 17 States Parties commit to institute appropriate and effective measures for cooperation between law enforcement agencies to curb corruption associated with the illicit manufacturing of, trafficking in, illicit possession and use of SALW.

3.2 SADC Protocol, 2001

The SADC Protocol on Control of Firearms, Ammunition and other Related Materials signed by States in the Southern African Development Community, aims at preventing, combating and eradicating the illicit manufacturing of firearms, ammunition and other related materials, and their excessive and destabilizing accumulation, trafficking, possession and use in the region.

The implementation of this protocol is the responsibility of signatory Member States, while coordination and follow-up is by the Southern Africa Regional Police Chiefs Cooperation Organization (SARPCCO).

3.3 ECOWAS Convention, 2006

The ECOWAS Convention on Small Arms and Light Weapons, Their Ammunition and Other Related Materials, agreed upon by States in the Economic Community of West Africa, aims at preventing and combating the excessive and destabilizing accumulation of SALWs within ECOWAS; and to continue the efforts for the control of SALW. The coordination and follow-up of this Convention is entrusted with the ECOWAS Commission, while implementation is by the Member States.

3.4 Kinshasa Convention 2010

The Central African Convention for the Control of SALW, Their Ammunition and all Parts and Components that can be used for their Manufacture, Repair or Assembly (also known as the Kinshasa Convention), was negotiated within the framework of the UN Standing Committee on Security questions in Central Africa (UNSAC). It aims at regulating SALWs and combating their illicit trade and trafficking in central Africa. The follow-up and coordination of this Convention is vested in the ECCAS Secretary General while the implementation is with the Member States.

International, Regional, and National Frameworks for SALW Control

The diagram below highlights SALW control and management framework flows from the international, continental, regional and to national level

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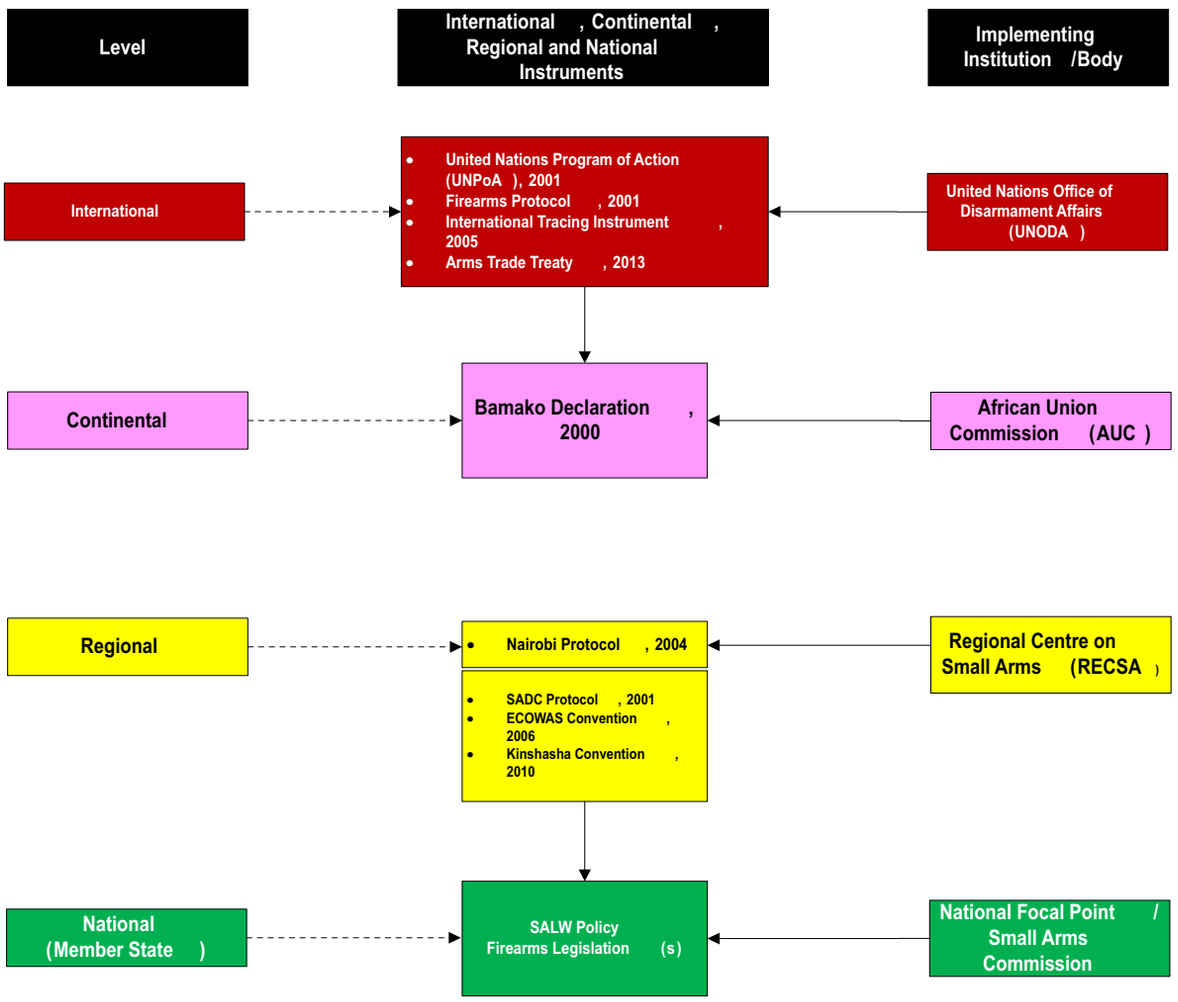
Diagram 1: International, Regional and National Frameworks for SALW Control and Management



CHAPTER FOUR
4.0 ESTABLISHMENT OF THE REGIONAL CENTRE ON SMALL ARMS (RECSA)

The Regional Centre on Small Arms in the Great Lakes Region and Horn of Africa (RECSA) was established on 21st June, 2005. This followed the ratification of the Nairobi Protocol on the Prevention, Control and Reduction of Small Arms and Light Weapons in the Great Lakes Region, the Horn of Africa and Bordering States on 5th May, 2005 by 2/3 of the member states after it had been signed on 21 April, 2004 by twelve countries.

The goal was to facilitate and institutionalize the intent of member states through a legally binding instrument to address the problem of illicit SALW. The current Membership is 15 Member States. RECSA is the only intergovernmental organization on the African continent whose sole mandate is to fight the proliferation of illicit small arms and light weapons.

Concerned with the persistent problem of the proliferation of SALW and the devastating consequences they have had in sustaining conflicts, abetting terrorism, cattle rustling, poaching and other serious crimes, the Nairobi Declaration on the Problem of Illicit Proliferation of Small Arms and Light Weapons in the Great Lakes Region was signed on 15 March, 2000 by ten Countries.

Well aware that the proliferation of SALW knows no political borders, and convinced that the establishment of an inter-governmental entity was the only way to coordinate the successful implementation of the Nairobi Declaration and the Nairobi Protocol at a sub-regional level,

4.1 Principles and Objectives of RECSA

The principle objective of RECSA is to ensure efficient and effective implementation of the Nairobi Protocol and the Nairobi Declaration as per Article 8 of the Agreement establishing RECSA. The key functions of the Secretariat as outlined in the Article 12(2) of the Agreement establishing RECSA are to:

a) Coordinate the implementation of the Nairobi Declaration, the coordinated agenda for action and its implementation plan, and the Nairobi Protocol in consultation with member states;
b) Consult with sub-regional, regional and international agencies, including Civil Society Organizations (CSO) and other experts in the implementation of the Nairobi Declaration and Nairobi Protocol;

c) Prepare draft proposals and agreements on matters arising from the decisions and recommendations of the Council of Ministers;
d) Prepare surveys, studies, information and guidelines on legal, political, economic, social, cultural and technical matters of common concern to and essential for broadening and deepening cooperation among member states;
e) Identify, initiate, coordinate, monitor and harmonize initiatives for realizing the objectives of the Centre;
f) Organize and facilitate the meetings of the Council of Ministers and those of the Technical Advisory Committee and other relevant meetings;

Coordinate and assist the national focal points in the implementation of the Nairobi Declaration and the Nairobi Protocol; and perform other functions as entrusted to it by the Council of Ministers.

4.2 Organs of RECSA

Article 9 of the Agreement Establishing RECSA, establishes three organs namely;

a) Council of Ministers;
b) Technical advisory Committee and;
c) The Secretariat.

The Council of Ministers is composed of Ministers in charge of Internal Security (different Member States use different names). The Council meets once every two years in ordinary sessions and the venue is the country of the chairperson. On the other hand, the Technical Advisory Committee is comprised of all the 15 National Focal Point Coordinators, representatives of Civil Society and the Executive Secretary of RECSA Secretariat. The Committee sits twice in ordinary sessions one of which is held immediately preceding the session of the council of ministers.

In addition, there is a Ministerial Standing Committee (MSC) created during the 7th Council of Ministers Meeting held in Djibouti to handle urgent issues affecting RECSA that cannot wait for the ordinary sessions of the COM. The MSC is composed of the Former Chair, Current Chair and incoming Chair.

4.3 Key Responsibilities of RECSA

RECSA as an institution has extensive expertise in implementing practical and measurable interventions in the following areas:

a) Establishment of National SALW management and control institutions;
b) Formulation of SALW management and control guidelines;
c) SALW National Action Plan Development;
d) Firearms marking to facilitate identification;
e) Electronic record keeping to facilitate tracing;
f) Collection and destruction of firearms and unexploded ordinance (UXOs);
g) Public awareness campaigns for "heart and mind disarmament" towards civilian disarmament;
h) Facilitating Legal harmonization of SALW legislation with regional and international instruments;
i) Facilitating safe storage. RECSA has developed specifications for fabrication of steel arms boxes and construction of armories to improve on safe storage towards curbing diversion.

CHAPTER FIVE

5.0 NATIONAL INSTITUTIONAL FRAMEWORK FOR SALW MANAGEMENT AND CONTROL

5.1 Introduction

The fight against the illicit SALW proliferation requires putting in place national mechanisms to spearhead SALW management and control interventions. This topic is intended to enable readers and practitioners to appreciate the need for a national institution on SALW management and control, its mandate, structure and functions.

A National SALW institution is needed in each Member State to act as a coordinating body and focal point. This is because the lack of effective coordination and sharing of information between the many government departments and agencies that have a role to play in small arms control is often a significant barrier to tackling small arms-related problems and implementing regional and international small arms agreements. The proliferation and illicit trafficking of SALW remain complex and multidimensional problems that affect the state, individuals and communities. Given the array of people and activities involved at the local, national, regional and international levels in combating SALW proliferation, it is crucial that small arms control efforts are coordinated by governments at the national level.

The establishment of a national SALW institution is a legal obligation for the countries which are party to those legally binding instruments and treaties. It includes a commitment to establish a national coordinating mechanism.

5.2 Mandate of the National Institution

The mandate of the national institution as derived from the international and regional instruments is to guarantee coherence and effective coordination in the management of small arms and light weapons by that all relevant parts of the government work together with national and international partners to conceive, direct, monitor and evaluate relevant, efficient and effective SALW control measures.

5.3 Organizational Structure of the National Institution

The implementation of SALW intervention measures require a multi-disciplinary team to deliver on the mandate of the national institution. The team should comprise, as a minimum the head of

the institution, and other experts in the areas of communication, finance and administration, small arms control, legal affairs, research and monitoring and evaluation.

5.4 Linkage with National Organs

There is need to link the national structure with other relevant national organs and stakeholders for coherence and effective coordination.

a) National Small Arms Steering Committee

The National Small Arms Steering Committee (NSASC) is a guiding organ for the national institution on policy and program implementation.

Members of the NSASC shall be appointed for a renewable term, ranging from 3 to 5 years. In its first meeting, the members shall elect a Chairperson and Vice-Chairperson amongst themselves, while the position of the Secretary shall always be designated to the Head of the National Institution of Small Arms and Light Weapons. The NSASC shall meet quarterly for purposes of providing policy and program guidelines or any other time as need arises.

Roles of National Small Arms Steering Committee

The following are the responsibilities of the National Small Arms Steering Committee:

a) Identifying and prioritizing common areas of intervention in line with Nairobi Protocol

b) Supporting the NSASC in resource mobilization and advocacy programs

c) Reviewing progress reports before being presented to various stakeholders

d) Reviewing the Institution's annual work plan and budget

e) Identifying and endorsing complimentary multi prolonged strategies to be undertaken by institution advising on internal and external coordination with other relevant issues in other Ministries.

b) Composition of the National Small Arms Steering Committee

The NSASC draws its membership from ministries and departments within the government that have a direct role in arms control and management. The members of the NSASC are nominated

by the respective ministries/institutions constituting the Small Arms Steering Committee. The respective institutions/ministries include the following:

c) Law Enforcement Agencies:

These are the ministry agencies that enforce existing laws and regulations pertaining to SALWs and related issues and should always be represented on the NSASC. These include: Police, Customs, Immigrations, Judiciary, and Gendarmerie (where applicable)

d) Security Agencies:

Other security forces and agencies have got important roles to play in the prevention, eradication and combating of the proliferation of SALW in the Sub-region, and should therefore be included in the NSASC. These include Defense, Intelligence and Prisons/ Correctional Services.

5.5. Functions of the National Institution

While the mandate of the national institution is broadly to ensure coherence and effective coordination in the management of SALWs, the institution has specific functions as explained below (for more details refer to the RECSA Guidelines for the Establishment of National Institutions Responsible for SALW Management and Control):

a) Planning and Implementation
b) Cooperation and Coordination
c) Research
d) Awareness Raising, Information Management and Communication
e) Resource Mobilization and Allocation
f) Training
g) Reporting

CHAPTER SIX

6.0 PHYSICAL SECURITY AND STOCKPILE MANAGEMENT (PSSM)

6.1 Introduction

This topic is intended to enable readers and practitioners appreciate the concept of Physical Security and Stockpile Management (PSSM) with the objective of mitigating risks of diversion and unintended explosions.

Stockpile management refers the procedures and activities regarding the safe and secure accounting, storage, transportation, handling and disposal of conventional ammunition. Poorly managed conventional ammunition and arms stockpiles *threaten public safety and pose a risk to the security of States*. One of the interventions that can control the proliferation of illicit SALWs, if handled well is physical security and stockpile management.

6.2 Impact of Poor Physical Security and Stockpile Management

While it is up to each State to determine the system of stockpile management, there has been a growing concern among the international community on what the adverse effects would be, if not adequately addressed. This is because of the following reasons:

- The impact on *social and economic development* within developing nations, especially when there has been an unplanned explosion; and;
- The cross-border consequences of *poorly managed stockpiles*, especially those that end up in hands of non-state actors, among other reasons.

PSSM is therefore designed to address the above gaps, among others. The biggest risk posed by the accumulation of ammunition surpluses is that of explosive events in ammunition storage areas. There have been cases of unplanned ammunition depot explosions in some RECSA member states. Often these events result in a large number of casualties, widespread destruction of infrastructure, and the disruption of the livelihood of entire communities. In addition to the human suffering, such explosions can have devastating effects on the environment and high clean-up costs.

Diagram 2. Blast at Mpila Military Munitions Depot at Congo Brazzaville on 4 March 2012

Diagram 3. Fireworks disaster at Tutepec in Mexico on 21 December 2016

Another serious risk that should not be overlooked is that of diversion of ammunition and arms from unsecured and poorly managed stockpiles. Ammunition and arms diverted from national stockpiles can find their way into the hands of non-state actors resulting into civil wars, insurgencies, terrorism, crime and other armed violence, thus fueling *national and regional instability and threatening the security of individuals and States.*

Diagram 4. Child Soldiers and Non-state actors with RPGs

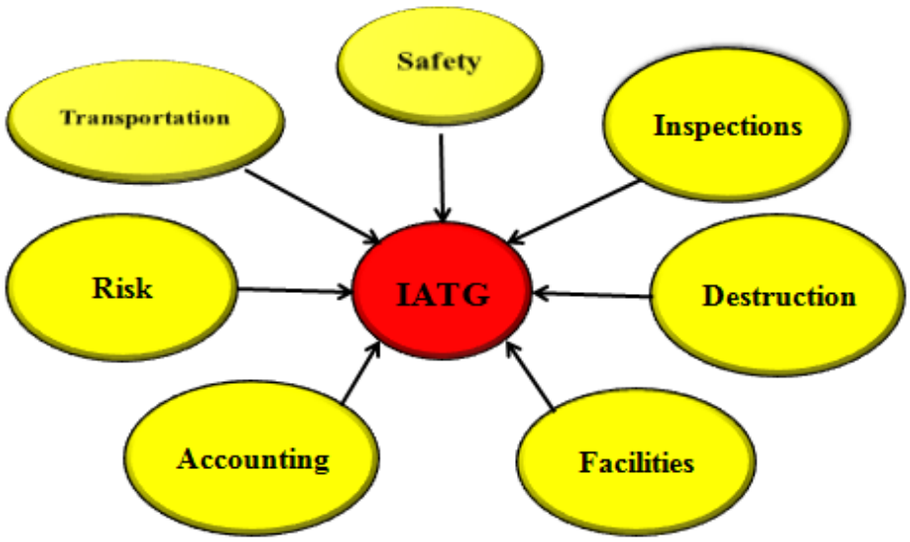
To mitigate the above risks, RECSA Secretariat has developed this Handbook to serve as a guideline of best practices in the areas of PSSM covering the areas of safety, security and management of arms, ammunition and explosives. The Handbook heavily borrows from the best practices recommended in the International Small Arms Control Standards (ISACS) and International Ammunition Technical Guidelines (IATGs). For more information on IATGs and ISACS go to: www.un.org/disarmament/un-safeguard/guide-lines and www.smallarmsstandards.org/isacs/

6.3 Principles of International Ammunition Technical Guidelines (IATGs)

The application of IATGs is shaped by four guiding principles:

a) The right of national governments to apply national standards to their national stockpile.
b) The need to protect those most at risk from undesirable explosive events, (e.g. local civilian communities and explosives workers).
c) The requirement to build a national capacity to develop, maintain and apply appropriate standards for stockpile management.
d) The need to maintain consistency and compliance with other international norms, conventions and agreements.

The chart below illustrates some of the key areas in Arms, Ammunition and Explosives management (IATG 1.10).



Broadly, PSSM is intended to achive three main goals:

a) Reduce Risk
b) Minimize Casualties
c) Protect Stockpiles.

CHAPTER SEVEN

7.0 RISK MANAGEMENT IN ARMS AND AMMUNITIONS

7.1 Introduction

The objective of this topic is to enable readers and practitioners know what a risk is, be able to identify risks and know how to handle and reduce risks in Arms and Ammunitions management.

Risk management is the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities.

Risk may be defined mathematically as Risk = Likelihood x Consequence. Once a measure of risk is chosen, then the terms Likelihood and Consequence can be expanded using accepted mathematical protocol. For instance, one measure of risk may be the likelihood that a person will be killed during one year of exposure (Annual Individual Risk of Fatality (IRF).

A critical element of conventional ammunition stockpile management planning and operations should be the implementation of a robust, effective and integrated risk management system. This system should examine organizational, management, administrative and operational processes and procedures. The physical phenomena of blast, fragmentation and thermal radiation resulting from explosions are well understood, as are the mechanisms that cause fatalities, injury and damage as a result of these effects.

As a result of this understanding, a range of techniques and models have been developed by which these effects can be estimated; these techniques and models form a key element of the overall risk management process. The term ‘estimated’ is important because the range of variables involved means that exact damage effects are unlikely to be accurately predicted; appropriate safety margins are therefore engineered into preventative measures.

Risk management should be seen by States as a fundamental preventative measure to support safe conventional ammunition stockpile management. Decisions based on more complete knowledge can be made if the likelihood of an explosive(s) accident can be taken into account as well as the consequences.

7.2 Definition of Terms

- **Explosive event**: This refers to an unexpected and undesired initiation of an explosive substance or article within an ammunition depot leading to significant or catastrophic consequences.
- **Harm**: This refers to physical injury or damage to the health of people, or damage to property or the environment.
- **Hazard**: This refers to a potential source of harm.
- **Risk analysis**: This refers to the systematic use of available information to identify hazards and to estimate the risk. Risk assessment' refers to the overall process comprising a risk analysis and a risk evaluation.
- **Risk evaluation**: This refers to the process based on risk analysis to determine whether the tolerable risk has been achieved.
- **Risk management**: This refers to the complete risk-based decision-making process.
- **Risk reduction**: This refers to actions taken to lessen the probability, negative consequences or both, associated with a particular risk.
- **Safety**: This refers to the reduction of risk to a tolerable level.
- **Tolerable risk**: This refers to the risk that is accepted in a given context based on the current values of society.

Parameters for Risk-Based Decisions and Knowledge Required

Parameter	Generic Risk Types	Example Knowledge Requirement
Frequency Physical Effects	▪ Individual Risk (I(R)) ▪ Collective Risks ▪ Perceived Risks	▪ How often are there undesirable explosive events within ammunition depots in country A? ▪ How much explosive is stored within a depot? ▪ What will be the blast over-pressure and impulse levels against range if it detonates?
Consequences		▪ What is the distance at which fatalities and injuries may be expected? ▪ What is the distance at which structural damage is to be expected?
Exposure		▪ How many civilian buildings are within the danger area, and what levels of damage should

		each expect? ▪ How many civilians are in the blast and fragmentation danger area at any one time?

7.3 The Concept of Safety

Safety is achieved by reducing risk to a tolerable level. There can be no absolute safety; some risk will remain and this is the residual risk. Therefore, in the context of conventional ammunition stockpile management, the enabling processes of storage, handling, destruction, among others, can never be absolutely safe; they can only be relatively safe.

7.4 Risk Reduction Process Levels

Based on the IATG 01.20, the different tasks and activities necessary for safe, efficient and effective stockpile management are considered to equate to one of three Risk Reduction Process Levels (RRPL) as in the table below.

RRPL	MEANING
LEVEL 1	▪ Basic safety precautions are in place to reduce the risk of undesirable explosive events during ammunition storage, but fatalities and injuries to individuals in local civilian communities may still occur. ▪ Although some potential causes of such explosions have been addressed (external fires, smoking, mobile phones etc), others remain (propellant instability, handling, lightning strike). ▪ Risk of explosion still remains as routine physical inspection of the ammunition does not occur and the chemical stability of ammunition during storage cannot be determined by analysis. ▪ Basic security precautions are in place to reduce the risk of theft by external actions. ▪ ammunition has been accounted for by quantity, and a basic system of identifying loss or theft is in place. ▪ A minimal investment of resources has taken place in organizational development, operating procedures and storage infrastructure.

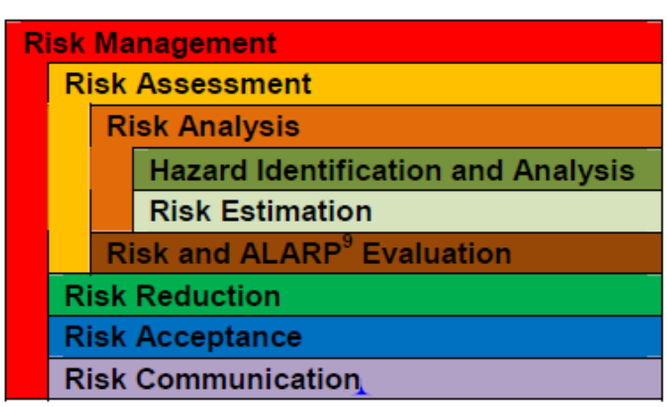
LEVEL 2	▪ Safety precautions, in the form of appropriate separation and quantity distances, have been implemented to reduce the risk of fatalities and injuries to individuals within local communities to a tolerable level. ▪ Significant damage to ammunition stocks and storage infrastructure should still be expected as inadequate protection remains in terms of infrastructure robustness and safe internal separation distances. ▪ Ammunition can be identified down to type, lot or batch number, but surveillance and/or in-service proof systems are not yet in accordance with international best practices. Explosions due to chemical stability of ammunition may still be expected. ▪ Medium level investment of resources has taken place in organizational development, staff technical training, storage and processing infrastructure.
LEVEL 3	▪ A safe, secure, effective and efficient conventional ammunition stockpile management system is in place that is fully in line with international best practices. ▪ A significant investment of resources has taken place in organizational development, staff technical training, storage and processing infrastructure.

The basic aim of a conventional ammunition stockpile management organization should be to make sure that stockpile management processes are maintained at RRPL 1 as a minimum.

7.5 Components of Risk Management

Risk management is sometimes a misunderstood term, within which there are common misconceptions in terms of the relationship between, for example, risk assessment and risk analysis.

The matrix below identifies the relationship between the different components of risk management that is used in the IATG guidelines.

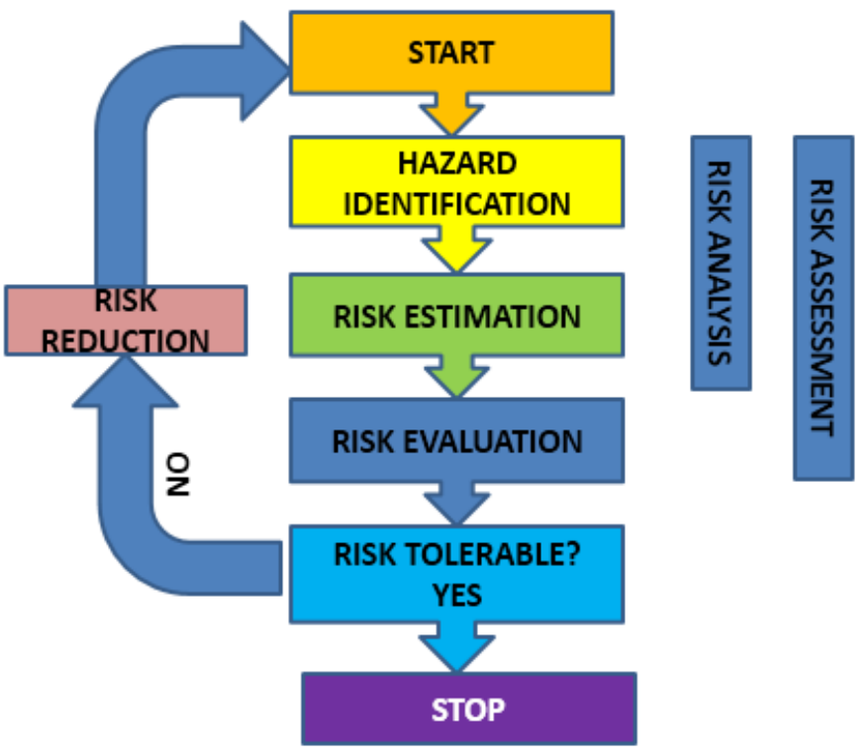


There are two generic types of risk that may be considered during the risk management process for explosive facilities:

a) Individual risk (IR). This is the chance of a fatality or serious injury to a particular individual in a specific location as a result of an accidental initiation of explosives;

b) Societal risk (SR). This expresses the probability of the largest number of people that might be fatalities or seriously injured as a result of an explosives accident.

Tolerable risk is achieved by the interactive process of risk assessment (risk analysis and risk evaluation) and risk reduction as illustrated below.



7.6 Hazard Identification and Analysis

Hazard identification and analysis is a reasonably simple process for the risk management process that supports conventional ammunition storage. Since hazards are defined, as potential sources of harm, then the hazard from, for example, individual explosive storehouses (ESH) will depend on the quantity, hazard classification, physical condition and chemical stability of the ammunition contained within that ESH. If the inter-magazine distances (IMD) are not in accordance with the recommendations contained in IATG 02.20 quantity and separation

distances, then further risk analysis will be required. Normally each ESH is considered to be an individual Potential Explosion Site (PES). Yet, if there is a risk of practically instantaneous propagation (PIP), due to inadequate IMD between the ESH, then they may have to be treated as one PES, and the explosive quantity aggregated.

7.7 Risk Estimation

Risk is defined as a combination of the probability of occurrence of harm and the severity of that harm. Therefore, for explosive events in ammunition storage areas the estimation of risk should establish and/or estimate:

a) The probability of an unplanned and undesirable explosive event;
b) The physical effects of such an explosion;
c) The number of casualties to be expected;
d) The levels of damage to be expected.

7.8 Risk and ALARP Evaluation

The aim of risk evaluation is to compare the estimated effects, in terms of human fatalities and injuries, financial costs and political impact of an explosive event against what is tolerable in society. If the risk is assessed as tolerable, then no remedial action should be required, although it should also be considered if that risk is As Low As Reasonably Practicable (ALARP).

A method of assessing the estimated IR Fatality against tolerable risk in a particular society may be to compare against other IR Fatality that may be available for events such as, fatalities due to road traffic accident, fatalities from industrial processes or fatality through disease etc.
If the risk is not assessed as being tolerable, then appropriate remedial action should be taken in order to reduce the risk.

7.9 Risk Reduction

In order to reduce the estimated risk from an unplanned or undesirable explosive event at an ammunition storage area, one or a combination of the following actions should be taken:

a) A reduction of Ammunition stock levels within the explosive storage area until appropriate predicted blast over-pressure levels are reached at the exposed site (LEVEL 1)

b) An increase in the separation distance between the potential explosion site and the exposed site until tolerable blast over-pressure levels are reached at the exposed site; (LEVEL 2)

c) Improvements in the physical infrastructure of Ammunition storage to achieve tolerable estimated blast over-pressure levels at the exposed site; (LEVEL 2 and 3)

d) Instigation of effective Ammunition surveillance and proof systems to identify Ammunition and propellant that has deteriorated to a dangerous condition (LEVEL 3)

e) Closure of the Ammunition depot and the transfer of stocks to an Ammunition depot with spare capacity; (LEVEL 1)

f) The probable impact of the estimated risk to the local community is formally accepted at the appropriate political level. (LEVEL 1)

Risk Reduction Process Levels (RRPL)

	Likelihood of Accidents	Safety	Security	Technical Expertise	Quantity Distance Compliance	Compatibility Compliance	Ammunition Surveillance	Accountability
LEVEL 3	Low	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
LEVEL 2	Moderate	Adequate	Adequate	Adequate	Acceptable	Acceptable	Acceptable	Acceptable
LEVEL 1	High	Acceptable	Acceptable	Acceptable	Low	Low	Low	Low
None	Imminent	Low	Low	Low	None	None	None	None

Risk Acceptance (LEVEL 1)

Risk acceptance criteria will result from three factors:

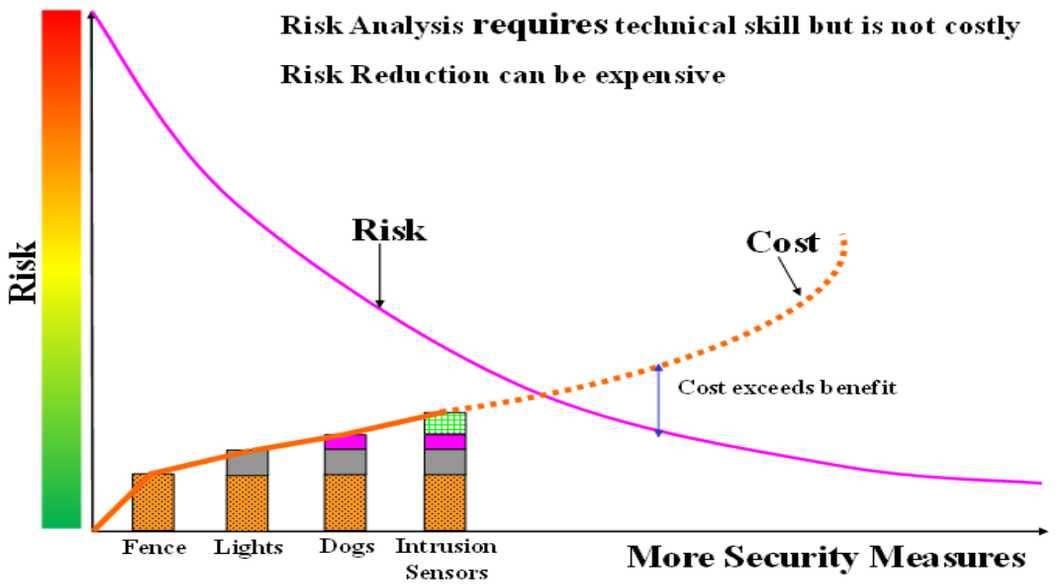
a) Local perceptions of societal risk and hence the detailed specification of ‘tolerable risk’;

b) The potential economic cost and losses due to an undesired explosive event;

c) Environmental Impact. Where tolerable risk has been achieved, and if necessary, supported by CBA, then that risk and the residual risk should be formally accepted by the appropriate authority within a conventional ammunition stockpile management organization. In terms of ammunition storage, this should usually take the form of issuing explosive licenses for the ammunition storage area.

A supporting Cost Benefit Analysis (CBA) may be required before the risk may be formally accepted as it could impact on *Tolerable Risk*and hence require a reiteration of the risk assessment process.

Diagram 5 on Cost Benefit Analysis



The diagram indicates that as the number of protective measures increase (lights, guards, locks, better buildings, fences, alarms, cameras, ground sensors, guard dogs, etc), the cost increases (red line). Likewise, as I add safety and security to the site, the risk of damage (theft, fires, sabotage, etc.) goes down – to a point. (Pink line. At some point, the cost of adding more security exceeds the benefit. We can graph this by averaging the red and yellow lines (green line). The point lowest is the most cost effective point.

A risk may be accepted for the following reasons:

a) The cost of elimination exceeds the benefit so that acceptance is the only option (applies particularly to lower ranked risks)
b) The level of the risk is so low that specific action is not appropriate with available resources.

c) The opportunities presented outweigh the threats to such a degree that the risks are justified.
d) The risk is such that there is no solution available, for example transporting Ammunition to the destruction site.

3.10 Benefits of Risk Assessment

Effective risk assessment has a range of benefits that include:

a) It helps in ranking the importance of individual risk contributions to the overall risk;
b) It helps to identify risks that are easily reduced or eliminated;
c) It helps to clarify what is known and what is not known about the potential risk;
d) It can provide an objective basis for decisions on controlling risks, especially those applying to the local civilian communities near ammunition storage areas;
e) It can provide important quantitative information as input to decisions for allocating resources to conventional ammunition stockpile management;
f) It makes it possible to rank risk reduction or remediation alternatives in terms of risk to workers, the environment, and the public; and
g) It can provide a process for consensus-building and a forum for the participation of stakeholders in the development of the risk assessment process and the identification of tolerable risk. This process will hopefully lead to greater acceptance of that risk.

3.11 Achieving Tolerable Risk

The following procedures should be used to reduce risks to a tolerable level during conventional ammunition stockpile management:

a) Identify the likely stakeholders in the conventional ammunition stockpile management process, (i.e. local civilian community, ammunition depot workers, management etc);
b) Identify each hazard (including any hazardous situation and harmful event) arising in all stages of the stockpile management process.
c) Judge if that risk is tolerable e.g. by comparison with other risks to the user and with what is acceptable.

d) If the risk is not tolerable then reduce the risk until it becomes tolerable.

When conducting the risk reduction process, the order of priority should be as follows:

a) Inherently safe design of equipment and processes;

b) Imposition of appropriate safe separation distances between ammunition storage and potentially exposed sites.

c) Inherently safe operating procedures, where the risk has been reduced to a tolerable level for each procedure and activity;

d) Appropriate and effective training of staff;

e) Use of personal protective equipment during ammunition processing and

f) Information for stockpile management personnel and local communities.

3.12 Risk Communication (LEVEL 1)

Risk communication is an interactive process of exchanging of information and opinion on risk among risk assessors, risk managers, and other stakeholders, which may include representatives from the local civilian community that may be impacted by the risk. Risk communication is an integral and ongoing part of the risk management process, and ideally all stakeholder groups should be involved from the start. Risk communication makes stakeholders aware of the results of the risk assessment, the logic behind the risk analysis process and the remedial measures taken to ensure a level of tolerable risk.

The identification of particular interest groups and their representatives should comprise a part of an overall risk communication strategy. This risk communication strategy should be discussed and agreed upon between risk managers early in the process to ensure two-way communication. This strategy should also cover who should present information to the public, and the manner in which it should be done. The risk communication strategy should aim to improve the perceptions of safety for the personnel within the ammunition depot and also the local community.

CHAPTER EIGHT

8.0 AMMUNITION BASICS

The purpose of this topic is to establish an understanding of common ordnance terms as well as introduce the basic functioning of different types of ordnance. The objective is to enable readers and practitioners recognize general characteristics and sequences of explosives and the different types of Ammunition and their effects.

8.1 Definition

Ammunition is any component filled with either high/low explosive (HE/LE) chemical compositions or an incendiary and is manufactured conventionally with an intention for use in war.

8.2 Primary Types and Uses of Ammunition

The following are the most common types of ammunition and their uses:

a) Ball (B)

This ammunition is used primarily for training and against personnel.

b) Tracer (T)

This ammunition is used as an aid in observing fire.

c) Armor Piercing (AP)

This ammunition is used against lightly armored vehicles.

d) Incendiary (I)

This ammunition is used for incendiary effect. (Fire)

e) Armor Piercing Incendiary (API)–

This ammunition utilizes both the incendiary and armor piercing effects.

f) Armor Piercing Incendiary-Tracer (API-T)–

This ammunition utilizes the effects of fire and penetration.

g) Armor Piercing High Explosive Incendiary with Tracer (APHEI-T)

This ammunition utilizes the effects of fragmentation, penetration and fire.

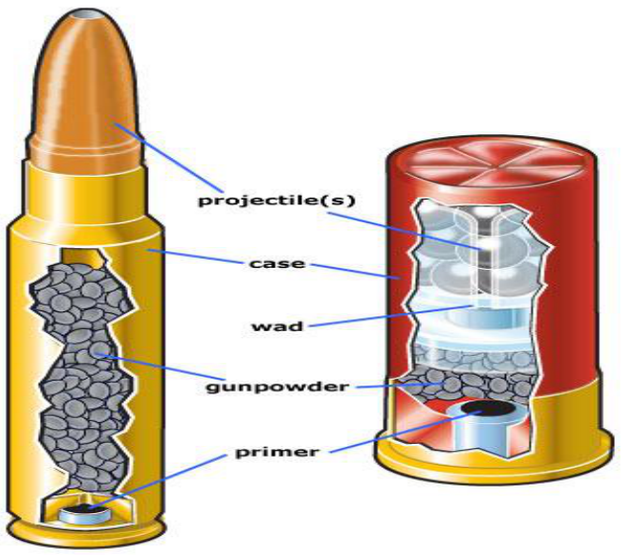
h) Blank

This ammunition contains no projectile and is mainly used for training purposes.

I) Dummy/Inert

This ammunition is used as a training aid.

Diagram 6 below illustrates parts of a typical ammunition (bullet)



8.3 Explosives

An *explosive* is either a chemically or energetically unstable substance which when suitably initiated will exert a *sudden and intense pressure* to its environment/surrounding with a simultaneous evolution *of heat and gas.*

8.4 Categories of Explosives

It is worth noting that explosives are categorized by the speed at which they decompose:

a) High Explosives (HE)

All High Explosives (HE) Detonate. *Detonation* is the rapid decomposition of an explosive material. The effects of detonation are: *Blast, Flash, Heat* and *Sound*

The chemical reaction in HE progresses through the material in a wave – called the *detonating wave*. This occurs effectively throughout the entire material. The speed at which the detonating wave travels is significantly supersonic and this is called *velocity of detonation* (VoD). For example, the VoD for high explosive (HE) often used in *detonating code*, is between 7000 and 9000 meters per second.

Diagram 7: Images of Rolls of Detonating Code

High Explosives are further subdivided into two, according to their degree of sensitivity:

a) *Primary Explosives:* These are extremely sensitive to *heat, mechanical shock and friction* to which they will respond by detonating. They are used as initiators. Examples include explosives used in detonators such as lead azide, lead stephenite and mercury fulminate.

b) *Secondary Explosives:* Also called "base explosives", are relatively insensitive to mechanical shock, friction, and heat. They may burn when exposed to heat or flame in small, unconfined quantities, but detonation can also occur. It is for this reason that they are used primarily as *Bulk Explosives* or as *Main Charges* in weapons. Secondary Explosives are often added in small amounts to detonators to boost their power (boosters).

It is important to note that, HE produces a shock wave with pressure up to *500,000 times that of the Earth's atmosphere*. The detonation wave travels up to *9 kilometers per second.* The temperatures can soar to *5,500 Kelvin*, and power approaches *20 billion watts per square meter*.

b) Low Explosives

Low Explosives *burn or deflagrate* at a rate dependent on the type of explosive and the level of confinement. Low explosives are a mixture of a combustible substance and an oxidant that decomposes rapidly at speeds from a few *centimeters per second to approximately 400 meters per second.* They are used in propelling ammunition through a gun tube or by use in a rocket motor. Low explosives are basically propellants, black

powder and pyrotechnics. They are relatively sensitive to *heat, shock and friction* but are less powerful than high explosives.

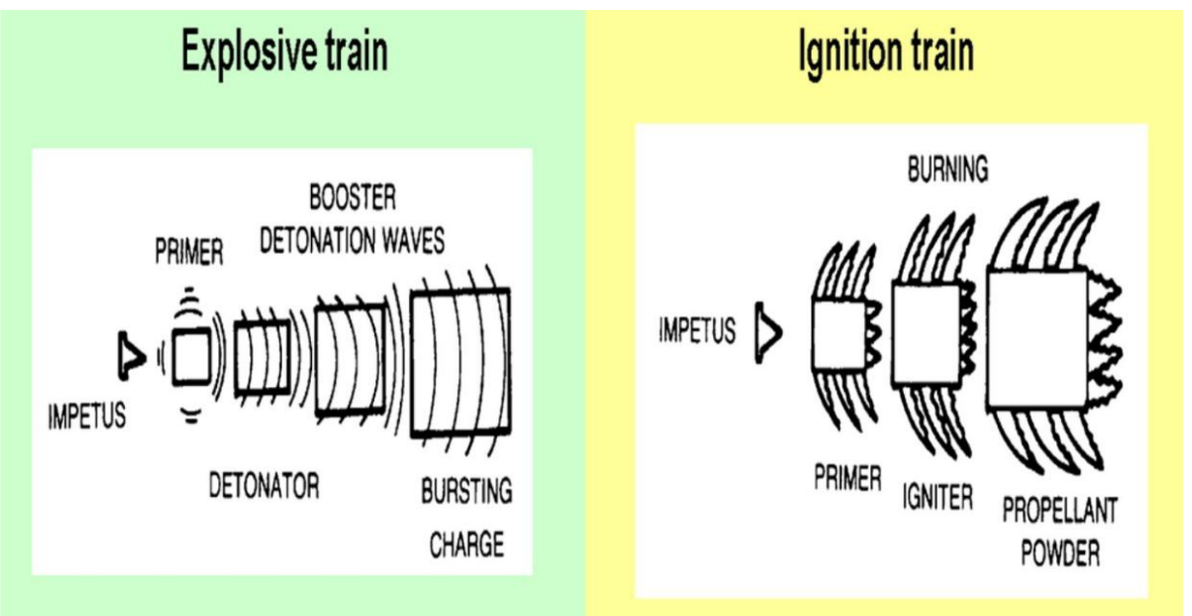
Explosives therefore, should be handled with extreme caution and if possible left to ONLY technical personnel to handle.

8.5 Basic Explosive Sequence

An explosive sequence can also be referred to as an *explosive train*. This is the sequence of events that progresses from relatively low levels of energy to cause a chain reaction to initiate the final explosive material or the main charge. They can either be low or high explosive trains.

A basic explosive train or chain will include; -Primer, Detonator, Booster, Main charge

Diagram 8: Showing Explosive and Ignition Train



8.5.1 Explosive Train Simplified

This is similar to building a fire. It can begin with a paper (Primer) and add twigs (Detonator), large sticks (Booster) and finally a big log (**Main charge**). If any of this is skipped, the process of making fire will fail and this is exactly what happens to an ideal explosive sequence. If any

step is removed, shock wave will not be transferred and there will therefore be no initiation of the main charge.

Low explosive trains are as simple as a rifle cartridge including a primer and a propellant charge. High explosive trains can be more complex either two step (e.g. detonator and dynamite) or three step (e.g. detonator booster of primary explosive and a main charge of a secondary explosive).

The large quantities of explosives must be comparatively insensitive to permit safe handling in storage and transportation. Yet, means of initiating these explosives at the desired time must be dependable. As a safety measure, so called "separable munitions" can be disassembled, thereby breaking the firing train and precluding an explosion of the main charge.

8.6 Small Arms Ammunition

This is ammunition whose caliber is up to but not including 20mm. This is because the ammunition below 20mm normally does not contain high explosives, only low explosives (propellant). From a storage stand point, this is an important distinction.

Small Arms Ammunition has percussion primers, relatively small propelling charges and not ignitors. Initially, the firing pin explodes the primer. The flame then passes through the vent leading to the powder chamber and ignites the propelling charges. Expansion of the resultant gases ejects the bullet.

Diagram 9: Examples of ammunition used in rifles and pistols.

Types of Small Arms Ammunition

There are several types of small arms ammunition:

a) Fixed Ammunition

This is ammunition that is manufactured ready to fire. i.e. it comes complete with a permanently attached cartridge case. The amount of propellant cannot be changed.

Advantages

a) It is sealed and therefore protected from external damages.
b) It is easy to transport.
c) It can be fired rapidly when required.

Disadvantage

Because the firing train is always together, it may cause safety concerns as it can easily malfunction, causing immense loss of lives and property during:

a) Storage
b) Transportation

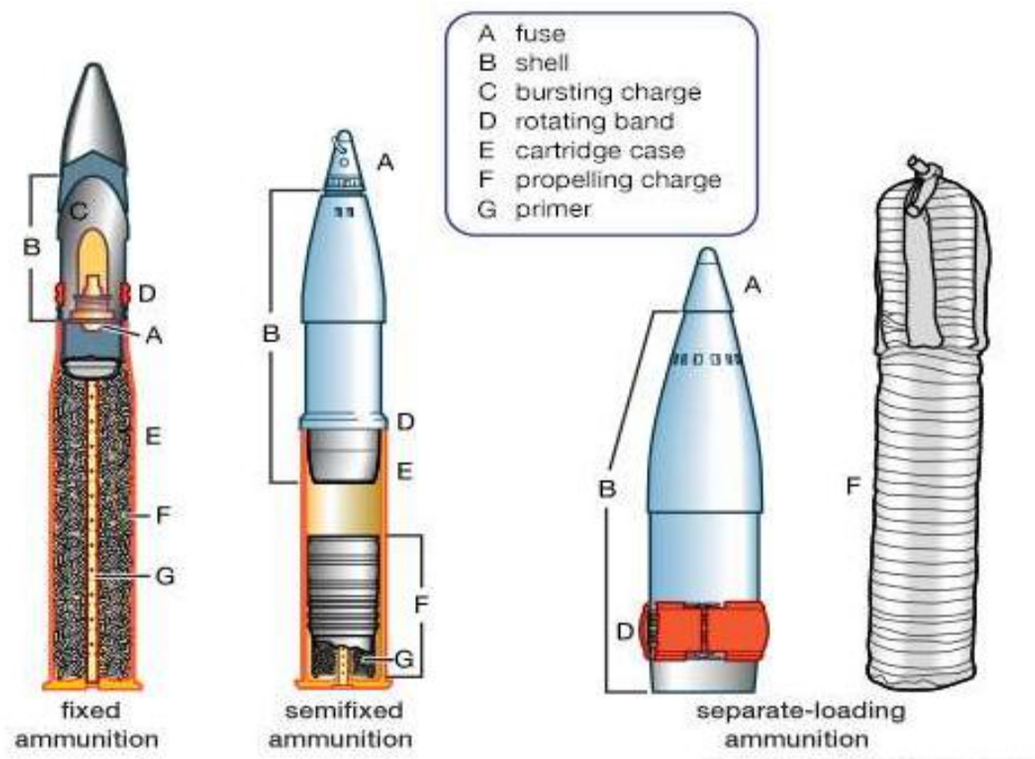
b) Semi Fixed Ammunition

This is ammunition that has an adjustable propelling charge. It may be *fuzed* or *unfuzed.* The propellant is divided into *incremental* charges and each increment of propellant is contained in a charge bag. The primer is an integral part of cartridge case, and is located at the base.

c) Separate Loading Ammunition

This ammunition has four separate components: *projectile, propellant, a fuze and a primer/primary cartridge (initiator)*. The four components are ordered, stored and issued separately. Upon preparation for firing, the projectile and the propellant are loaded into the weapon system separately.

Diagram 10: Separate loading ammunitions are used in *artillery ammunition*



Advantage

The main advantage of separate loading ammunition is that it is relatively safe during storage and transportation.

Disadvantage

The disadvantage is that it can be slow during preparation for firing especially during emergencies.

8.7 Methods of Ammunition Stabilization.

Every item of ammunition must be stabilized in some way during flight (when fired) in order to achieve the desired range. There are basically two methods of stabilization as outlined below:

a) **Spin stabilization** – Spin is achieved when a bullet is pushed through the barrel of weapon and the rotating band engages the engraving (called "lands and grooves") in the weapons barrel. This is called "*rifling*". These groves engrave the soft copper rotating band on the

projectiles, making it easy to determine if the projectile has been fired. However, this is NOT a positive way to know if a projectile is armed or not. Some weapons such as motors and rockets, have a smooth bore (non –engraved) and the projectile are stabilized by fins.

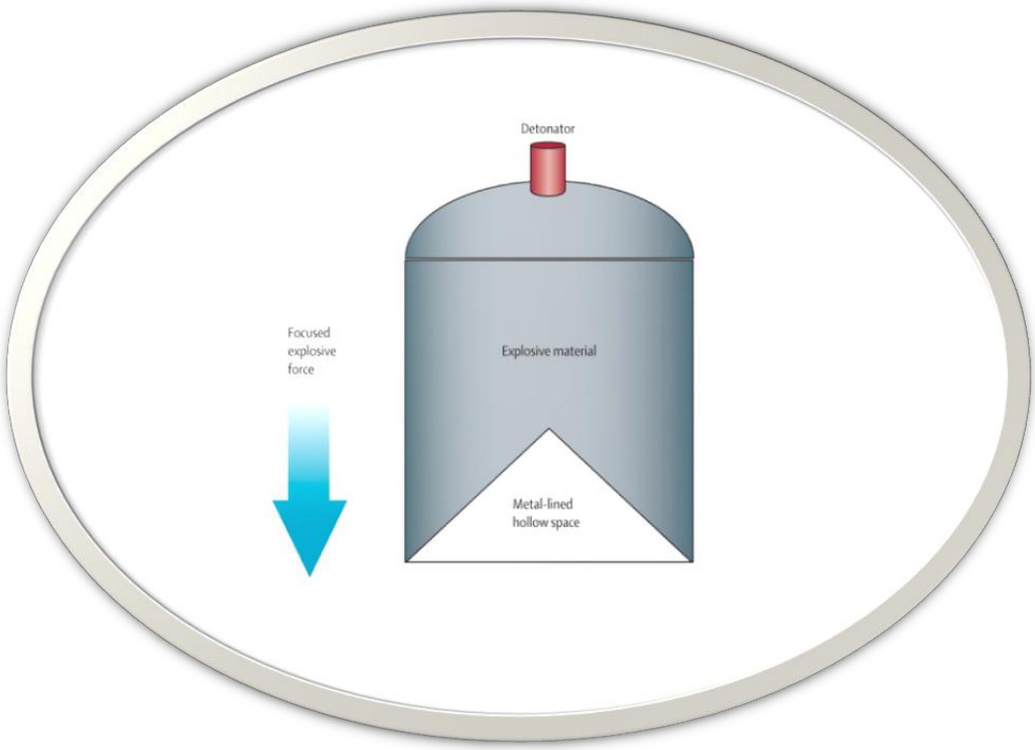
b) **Fin stabilization**

Items of ammunition are manufactured with fins to achieve stability during flight. The fins can either be fixed or folding.

8.8 Shaped Charge in Ammunition

Different items of ammunition use different principles to achieve their intended/desired effect on the target. One of those principles is the hollow charge principle used in armor defeating ammunition such as: RPG and 84mm Carl Gustav.

Diagram 11: Illustration of the Hollow Charge Principle



8.9 Fuzes

These are items of ammunition that work in conjunction with the main charge to ensure proper functioning of the ammunition. They can be categorized by either where they are placed on ammunition or by most commonly how they function.

Categorization of Fuzes

This categorization is by function and includes:

1. **Impact Fuzes**: When ammunition is fitted with this type of fuze, it is meant to function upon impact/point detonating.

2. **Time/delay fuzes:** These types of fuzes are normally meant to function a few seconds after impact and will function effectively when deployed to attack bunkers.

3. **Proximity fuzes:** These are normally fitted to ammunition that is intended to attack a large area and are expected to function in the general proximity from the ground.

Diagram 12: Images of various types of Fuzes

8.10 Grenades

There are several types of grenades but they will basically consist of a body, a fuze and a main charge. Fragmentation grenades are the most common type of grenades. They have metallic or plastic bodies that hold explosive filler.

Various types of hand grenades include:

a. **Fragmentation Grenades**: These are the most common types of grenades. They have metallic or plastic bodies that hold the explosive filler. They can either be used for offense or defense.

b. **Anti - Tanks Grenades**: These are designed to defeat tanks and other armored vehicles. They have a shaped – charge explosive warhead and are stabilized by a parachute or a cloth streamer. These grenades use impact fuzzing.

Diagram 13: Parts of a Grenade (External)

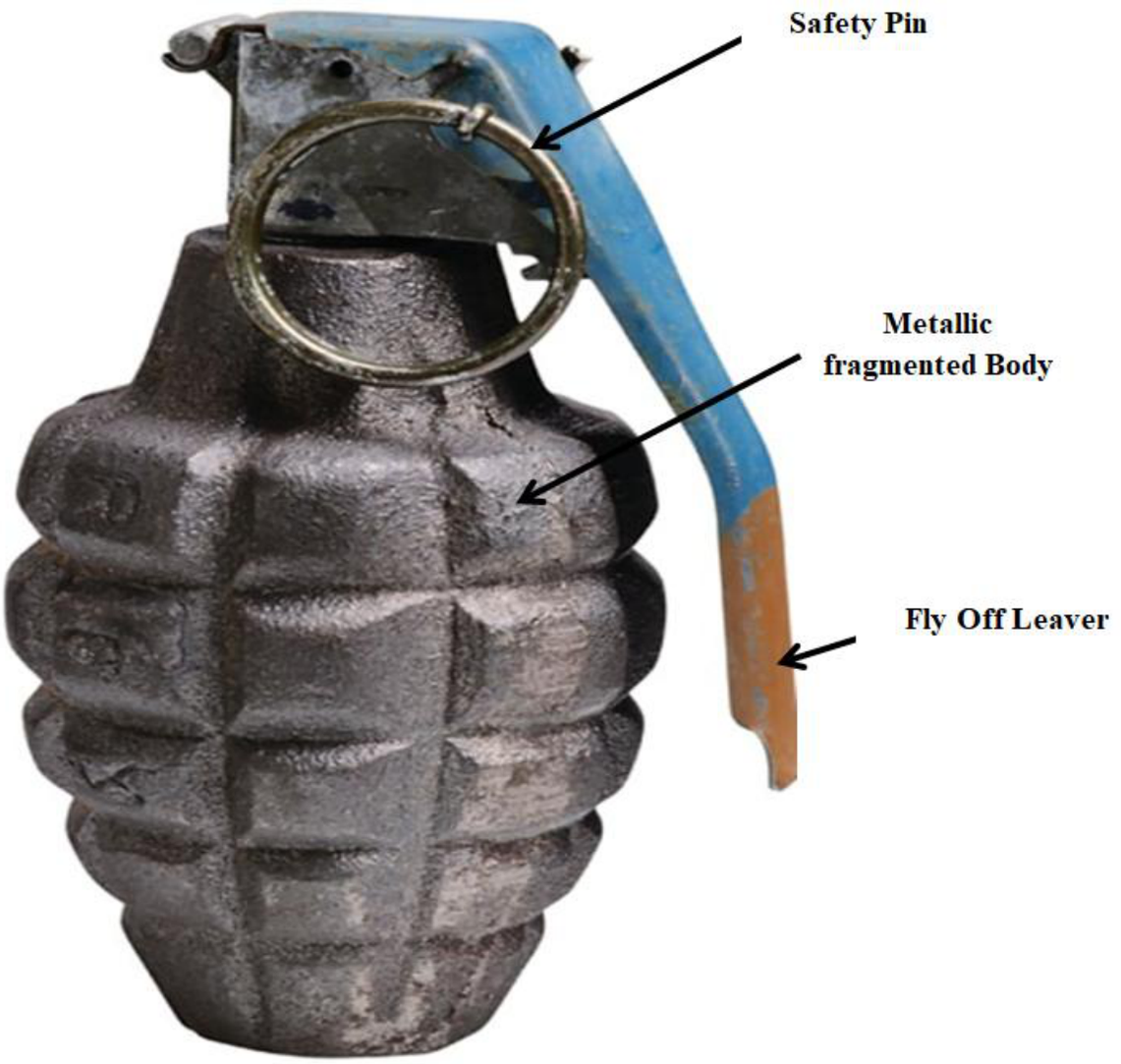
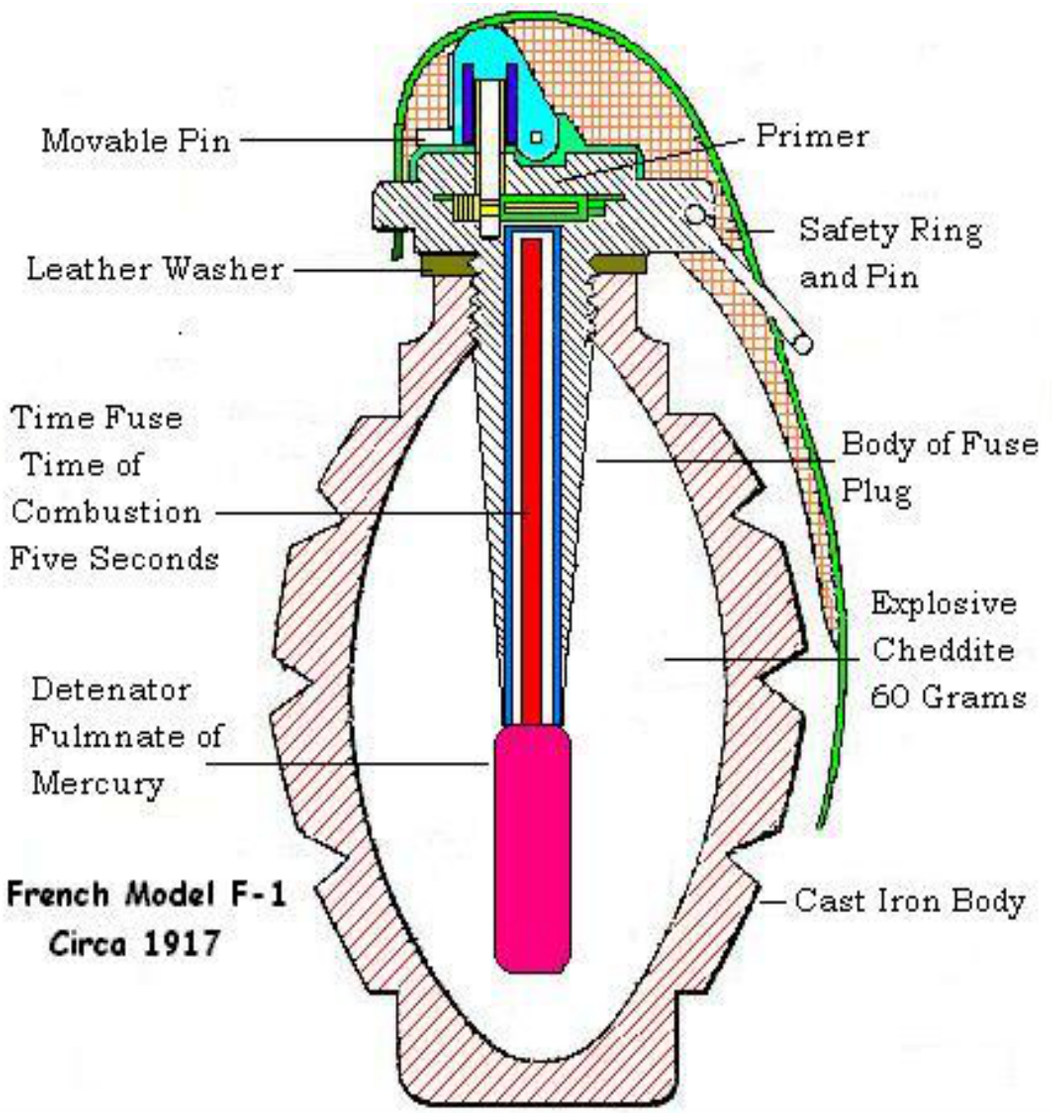


Diagram 14: Parts of a Grenade (Internal)



8.11 Mines

They are basically divided into two:

a) **Anti-Tank**: These are larger than anti-personnel mines and are usually pressure fuzzing. Some modern anti-tank mines have plastic bodies.

b) **Anti-Personnel** – These are generally small and come in different shapes and sizes. Some Anti-Personnel mines are even made of wood. Anti-Personnel mines function in a variety of ways and are commonly fitted with booby trap fuzing. Anti-personnel mines

can be further categorized into four sub categories: blast, bounding fragmentation, directional and fragmentation mines.

Diagram 15: Different Images of Anti-Personnel Mines

8.12 Rockets

Rockets are self-propelled projectiles that cannot be controlled in flight and consist of a war head, rocket motor, fuze and a method of stabilization. Rockets are stabilized by fins while others are spin stabilized. Unlike other projectiles, rockets do not have rotating bands. Instead, they have motor nozzles (venturi) that are angled to produce a spin. Rockets are delicate and are therefore easily damaged. Special care should therefore be given to them during storage and transportation. They are sensitive to electricity because they are electrically primed.

Diagram 16: S-25 Rocket

8.13 Guided Missiles

Guided missiles are items of self-propelled ammunition which when fired are guided to the target using different methods such as command wire, radio frequency and laser. The major components of a guided missile include;

a) Control and guidance system.
b) War head
c) Safety and arming device
d) Electrical power system.

Diagram 17: AIM – 9L Sidewinder Missile

8.14 Bombs

A bomb is an item of ammunition with a metallic body container that holds an explosive filler/sub munitions/propaganda material.

General purpose bombs are all similar in construction. Stabilization in flight is by either a fin or parachute assemblies. These assemblies are attached at the rear of the bomb and keep the bomb nose down during decent.

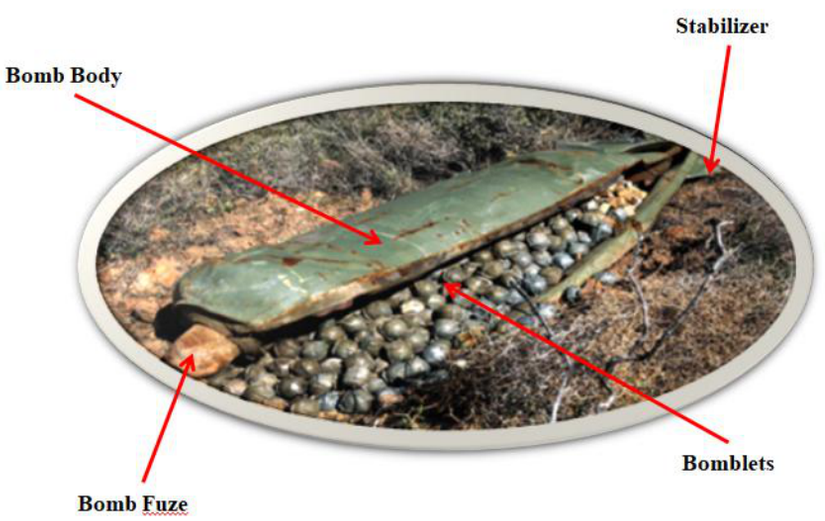
Diagram 18: Bolt-117 Laser guided bomb

8.15 Sub Munitions

These are small explosive-filled items designed for saturation and coverage of a large area. They may be anti -personnel, anti -material, dual purpose or incendiary.

Sub munitions may be spread by dispensers, missiles, rockets or projectiles. The delivery system ejects the sub munitions over the target. In storage configuration, sub munitions are located inside the delivery system.

Diagram 19: Example of a cluster bomb



NB: ***You Should Never See Them***

If found outside their delivery system, consider them armed. They should never be moved.

CHAPTER NINE

9.0 AMMUNITION PAINTING AND MARKINGS

The objective of this topic is to enable readers and practitioners understand that all Ammunition and explosives are marked in different ways (depending on their manufacturing source), know the characteristics of painting and marking and be aware that you cannot rely on painting to classify Ammunitions.

9.1 Definition

Ammunition marking and painting can be defined as application of marks including colors, descriptive texts, and symbols to ammunitions, parts and components, thereof, and associated packaging for the purpose of identifying, among other things, their role, operational features, age and their potential hazards.

9.2 Learning Objectives

The objectives of learning ammunition marking and painting are as follows:

a) To explain the purpose of painting ammunition.
b) To describe the meanings of markings found on ammunition.
c) To comprehend the meanings of color codes found on ammunition.
d) To explain the lotting and batching system.

Ammunition painting is applied for protective or distinctive purposes as follows: A *protective paint* is applied to the entire body of the ammunition item except the obuturating ring since this may affect the ballistic characteristics of the ammunition.

Distinctive painting is applied as overall body cover (OBC) or as color bands on the ammunition body or packages.

However, these colors should not be relied on entirely since with time, colors fade away due to exposure to the weather and also different manufacturers (NATO , Chinese and Russian Federation among others) use various color codes to designate various hazards. There is also a possibility of initial wrong markings on the ammunition. Expertise on ammunition identification is required since the shapes of Ammunition items can also be used to identify the item of ammunition.

The diagrams below show protective/preservation painting and color codes and also a comparison between color codes used by different manufacturers.

Markings (above 30mm)

Type	NATO	Russian Federation
High Explosive (HE)	Yellow	
Low Explosive	Brown	
Illumination	White	White
Smoke, Screening		Black
Incendiary	Red	Red
Practice/Training	Blue	
Armor Defeating	Black	
Concrete Piercing		Blue
Ball/Shrapnel		Yellow

Diagram 20: Russian Federation Markings and their Meanings

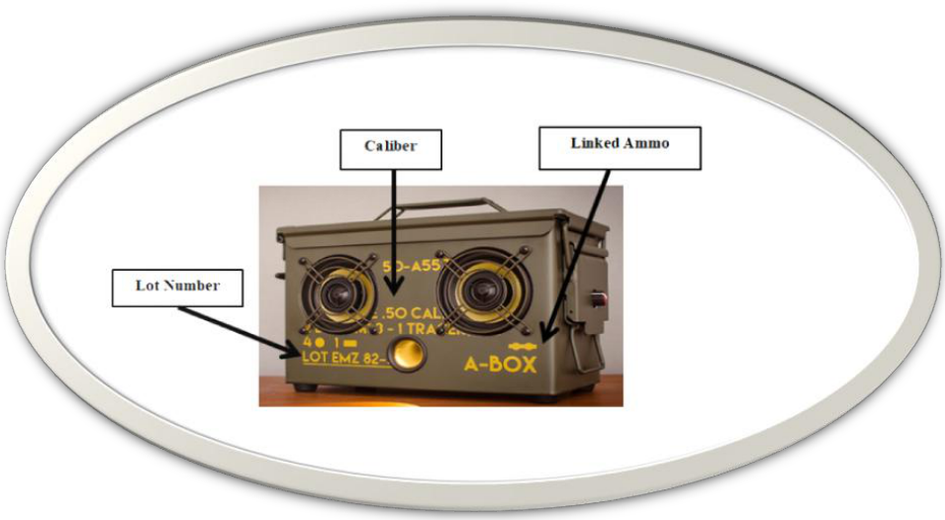
Cyrillic	Latin	Meaning	Cyrillic	Latin	Meaning
А	**A**	Propaganda or Fragmentation	**ОФР**	**OFP**	Fragmentation, High Explosive with Tracer
Б	**B**	Armor Piercing	**ОФЗТ**	**OFZT**	Fragmentation, High Explosive, Incendiary with Tracer
З	**Z**	Incendiary	**ОР**	**OR**	Fragmentation with Tracer
Р	**R**	Tracer	**ОЗ**	**OZ**	Fragmentation, Incendiary
БР	**BR**	Armor Piercing with Tracer	**ОХ**	**Okh**	Fragmentation, Gas
БЗ	**BZ**	Armor Piercing, Incendiary	**ПБР**	**PBR**	Armor Piercing, Target Practice
БЗА	**BZA**	Armor Piercing, Incendiary (improved)	**ПГ**	**PG**	HEAT (launched grenades)
БЗР	**BZR**	Armor Piercing, Incendiary with Tracer	**ПУ**	**PU**	Target Practice
БМ	**BM**	Armor Piercing Discarding Sabot	**РПО**	**RPO**	Infantry Flame Weapon
БП	**BP**	HEAT Spin Stabilized	**С**	**S**	Illumination
БК	**BK**	HEAT Fin Stablized	**СП**	**SP**	Solid Shot, Armor Piercing
Д	**D**	Smoke	**Ш**	**Sh**	Shrapnel
ДЦ	**DTs**	Target Marker Smoke	**Щ**	**Shch**	Canister
О	**O**	Fragmentation (Oskolochno)	**Х**	**Kh**	Gas
Ф	**F**	High Explosive (Fugaasnymi)	**ИНЕРТ**	**INERT**	Inert

ОФ	**OF**	Fragmentation, High Explosive		**МАКЕТ**	**MAKET**	Model
Г	**G**	Concrete Piercing		**ОСКОЛ**	**OSKOL**	Fragmentation
ОГ	**OG**	Fragmentation (Launched Grenades)		**ПРАКТ**	**PRACT**	Practice

In all NATO countries, the ammunition is painted in these colour codes. The *non-preferred* colors are usually painted on ammunition for in country training and for foreign military sales.

Diagram 21: Protective painting still on ammunition body Rust formation on ammunition body without paint.

Diagram 22: Example of Ammunition marking



9.3 Significance of Ammo Marking

Ammo marking is useful in providing information on:

a) Caliber of ammunition
b) The manufacturer of the ammunition

c) The date of manufacture
d) The lot and batch number.
e) The serial number for more complex ammunition such as MANPADS, guided missiles etc.

Other uses of ammo marking include:

a) To identify the hazard classification and compatibility group
b) To show the way an ammunition functions on the target e.g. API, APHE-T
c) To show the type of weapon for which the ammunition is designed for (gun, howitzers, mortars etc)

Additional information on ammo painting may include *Umbrella symbol* which indicates protection against rain and sunshine; *Glass symbol* which indicates fragile, hence handle with care; *Hook symbol*, which means do not use hook while lifting; and *Upward Arrow symbol, wh*ich –indicates the upright position of the boxes or containers.

9.4 Principles of Ammo Marking

The following principles MUST be observed at all times in all ammunition markings:

a) Clear and simple
b) Easy to read and interpret
c) Brief but must not exclude what must be known.
d) Follows a certain known pattern (uniformity).

9.5 Ways of Marking Ammunition

There are three ways of marking ammunition as described below:

a) Inscription – use of a sequence of letters or numbers
b) Color codes – use of a color coat of paint on ammunition body.
c) Symbols – use of symbols to provide information on ammunition handling.

In all the NATO countries, the preferred color codes are painted on all ammunition. The *non-preferred* colors are usually painted on Ammunition for in country training and for foreign military sales.

Diagram 23. Ammunition marking above 30mm

Markings (above 30mm)

Type	NATO	Russian Federation
High Explosive (HE)	Yellow	
Low Explosive	Brown	
Illumination	White	White
Smoke, Screening		Black
Incendiary	Red	Red
Practice/Training	Blue	
Armor Defeating	Black	
Concrete Piercing		Blue
Ball/Shrapnel		Yellow

The markings on the ammunition body and packages indicate the Lot and the Batch numbers. This number indicates a group of ammunition that was manufactured at the same time using the same raw materials, processes and is therefore expected to perform uniformly.

Diagram 24: An Example of Russian Markings on an Ammunition Package

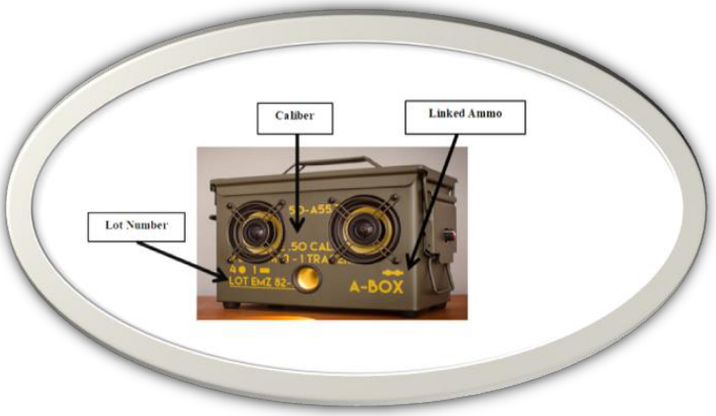


Diagram 25 below: Chinese markings on an Ammunition package

Diagram 26: Markings on Ammunition

9.6 Special Symbols

There are special symbols which are used in conjunction with color codes to indicate some special features of an item. These include;

a) Diamond bands

White diamond shows that the ammo is filled with *flechettes or small metal spikes* as pay load. The white diamonds may be accompanied by a yellow band indicating that it is a high explosive charge used to scatter the metal spikes. *Yellow diamond* means that the item is filled with smaller items of explosive sub-munitions to be expelled from the ammunition during flight.

b) Triangle Band

Yellow triangles mean ammo is filled with small explosives to be expelled and scattered during flight.

c) Broken band

Broken bands around the circumference of the ammo indicate binary ammunition items. *Binary means* that the item contains two separate elements that remain inert until mixed. A *yellow broken band* indicates that the item contains explosive binary elements. A *dark green broken band* indicates that the item contains toxic chemical binary elements.

Diagram 27: Special Symbols

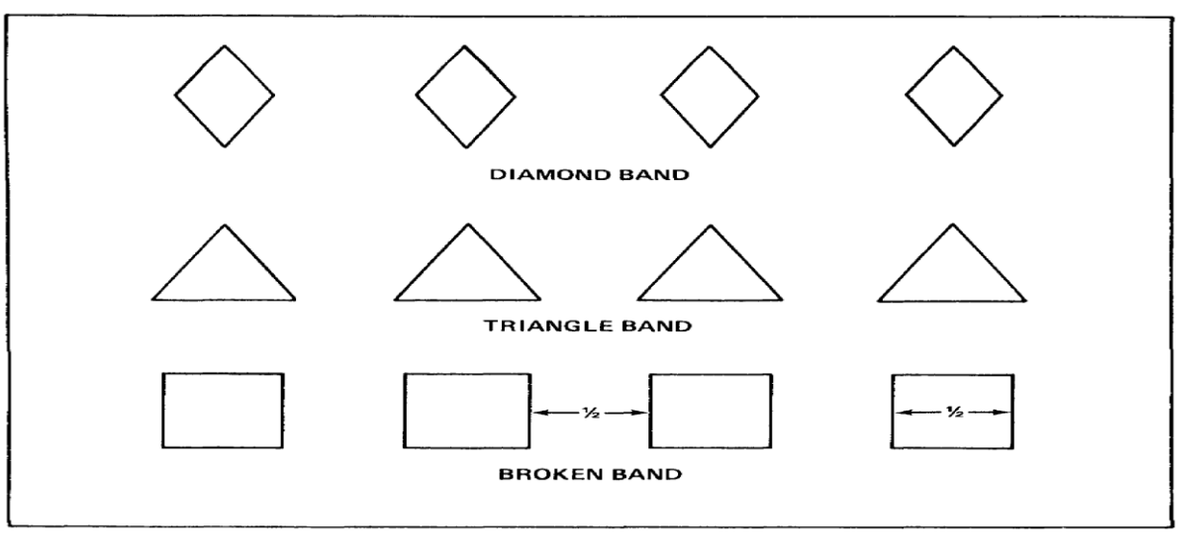
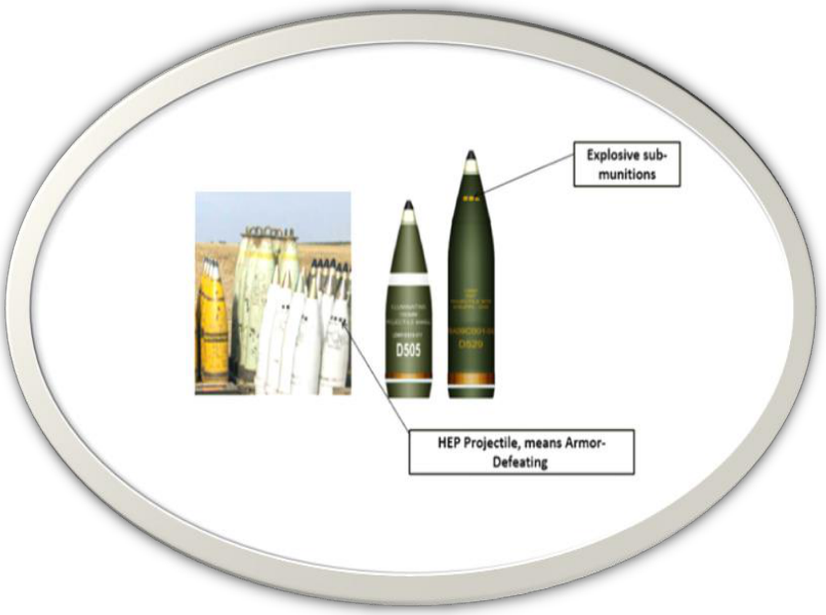


Diagram 28: Illustration of Special Symbols on Ammo



9.7 Exceptions

Some ammo may have white markings but are not illuminating and some items black markings but are not *armor-defeating*. This is because some colors have no significance the way they are applied. Examples of these are:

a) **White,** when used on guided missiles, mine dispensers, and rocket launchers.

b) **Black or white, w**hen used for lettering or special markings.

c) **Gray, black, green, or white,** when used on underwater ammunition.

d) **Unpainted. This means** the natural color of ammunition items has no significance.

9.8 Special Color Codes

Some ammunition items have colors applied on them that do not comply with the standard color coding. Examples include;

a) **Smoke grenades.** If a smoke grenade is to emit colored smoke on functioning, the color on top of the grenade will be the same as that of the smoke emitted e.g. red, green, or violet.

b) **Signals and flares (pyrotechnics).** The color of the flare or star clusters is indicated on pyrotechnics by a band of C's in the same color.

c) **Tracer Ammunition.** Some projectiles containing tracers have a series of T's above the markings of the projectile in the same color as the flame of the tracer.

CHAPTER TEN

10.0 UN HAZARD CLASSIFICATION

The objective of this topic is to enable readers and practitioners recognize the UN Hazard Classification System and understand Class 1 with different divisions (1 to 4), be able to understand the mixed storage techniques and how the magazines are marked and have knowledge about signs for emergency water supplies and supplementary requirements.

10.1 Introduction

Ammunition hazard classification system is primarily used globally to ensure safety of ammunition in storage and transportation.

10.2 Learning Objectives

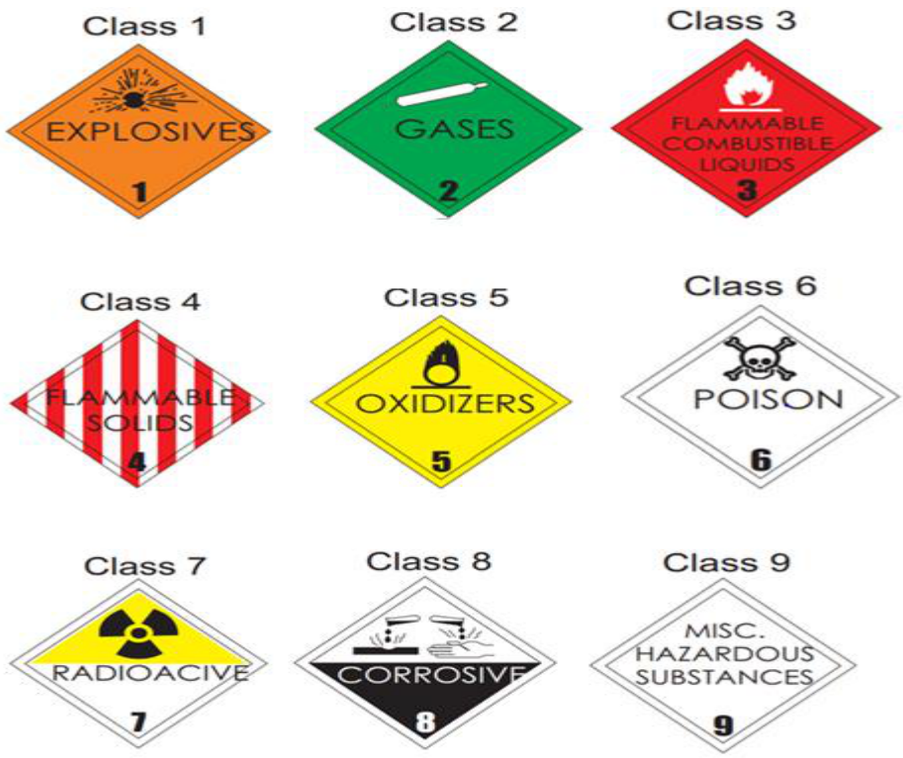
The objectives of learning the UN hazard classification system are as follows:

a) Recognize the importance of the UN hazard classification system in preventing accidents associated with Ammunition/Explosives.
b) Appreciate the mixed storage techniques based on the UN hazard classification system.
c) Recognize classes, divisions and supplementary signs used on Ammunition/Explosives storage sites and vehicles transporting the same.
d) Identifying the best locations to place the signs/measurements for ease of recognition in case of emergency services.

10.3 The UN Hazard Classification

The UN hazard classification system comprises hazard divisions that indicate the type of hazard expected from a site in case of unplanned ammunition/explosives functioning. The hazard divisions are reinforced by compatibility groups which are applied in storage to minimize the effects of an accident involving ammunition/ explosives.

Diagram 29: UN Hazard Classifications



The chart above illustrates the different classes of hazardous materials recognized by the UN and the signs used to indicate them (IATG 1.50).

Hazard Code and Description

Code	Description
1	Explosives.
2	Gases.
3	Flammable liquids.
4	Flammable solids.
5	Oxidizing substances.
6	Toxic/infectious substances.
7	Radioactive substances
8	Corrosive substances.
9	Miscellaneous material/considered together.

The military explosives fall in class 1 of the UN Hazard Classification system as shown above. To indicate the type of hazard from the military explosives, the UN designates six hazard divisions as follows:

a) 1.1 for explosives with a mass explosion hazard.
b) 1.2 for explosives with a projection hazard.
c) 1.3 for explosives with a mass fire hazard.
d) 1.4 for explosives with a moderate fire hazard/ No significant blast hazard.
e) 1.5 for explosives insensitive but with a mass explosion hazard.
f) 1.6 for extremely insensitive materials with no mass explosion hazard.

The hazards from the military explosives fall in hazard divisions 1.1, 1.2, 1.3 and 1.4 as shown in the chart above. The placards are usually placed on explosives sites, vehicles transporting explosives and also the packages containing the same.

The shapes of the signs indicating the above hazards are different for ease of identification by especially emergency services in case of an accident. The standard measurement for the signs is 24 square inches (0.6m), metal made with an orange background and numbers in black for ease of identification.

To augment the above hazard division signs, fire supplementary and emergency water supply signs are also used to give different messages to the emergency services when fighting the hazard. Examples of these signs are as follows: References IATG 2.50

Diagram 30: Examples of Emergency Service signs

The above signs should be placed at the entrances of explosives storage sites together with the site plan.

CHAPTER ELEVEN

11.0 AMMUNITION COMPATIBILITY

The objective of this topic is to define the most common compatibility groups and enable readers and practitioners understand the mixing rules for various common types of Ammunition, understand the storage compatibility chart and learn how to maximize the efficient use of available storage space. This topic also covers the concept of Net Explosive Weight which is intended to enable readers understand the relationship between the amount of explosives and safety distances. It also enables readers to learn how to determine safety distances for different objects dependent on the amount of explosives.

11.1 Introduction

The ammunition /explosives handled by armed personnel are considered compatible if they can be stored or transported together to either lower the probability of an accident or the magnitude of the effects of an accident if it occurs.

11.2 Compatibility Group Descriptions

The UN Hazard Classification system also integrates the compatibility groups. The compatibility group is designated by a letter after the hazard division. The compatibility group descriptions are as below:

a) Compatibility Group A – Bulk initiating explosives extremely sensitive to heat, shock and friction.
b) Compatibility Group B – Primary explosives designed to initiate an explosive sequence.
c) Compatibility Group C - Propellants or devices containing propellants.
d) Compatibility Group D – Explosives or black powder.
e) Compatibility Group E – HE *without* an initiator *but* with a propulsive charge.
f) Compatibility Group F – HE *with* an initiator and *with or Without* propelling charge.
g) Compatibility Group G - *Fire*works/illuminating*/incendiary/smo*ke and tear gas producing devices. (NOT White Phosphorus, Flammable liquids).
h) Compatibility Group H – Ammunition containing White Phosphorus.
i) Compatibility Group J – Ammunition containing both explosives and flammable liquids or gels

j) Compatibility Group K – Munitions that contain both explosives and toxic chemical agents with incapacitating effects.

k) Compatibility Group L – Damaged suspect Ammunition of any group.

l) Compatibility Group N – Munitions containing only Electronic Information Delivery Systems (EIDs) e.g. bombs and warheads.

m) Compatibility Group S – Ammunition that have no significant hazard.

Diagram 31: Storage Compatibility Chart

Compatibility Group	A	B	C	D	E	F	G	H	J	K	L	N	S
A	X												
B		X	X (1)	X (1)	X (1)	X (1)	X (1)						X
C		X (1)	X	X	X	X (2)	X (3)					X (4)	X
D		X (1)	X	X	X	X (2)	X (3)					X (4)	X
E		X (1)	X	X	X	X (2)	X (3)					X (4)	X
F		X (1)	X (2)	X (2)	X (2)	X	X (2,3)						X
G		X (1)	X (3)	X (3)	X (3)	X (2,3)	X						X
H								X					X
J									X				X
K										X			
L											(5)		
N			X (4)	X (4)	X (4)							X (6)	X (7)
S		X	X	X	X	X	X	X	X			X (7)	X

The chart above depicts two standards of ammunition/explosives storage that is in *peace time* locations and *field conditions*. The green color denotes ammunition/explosives that are compatible all the time, *orange* denotes those that are compatible for field *storage with limitations*, the *red* denotes those that are *never compatible* both in *peacetime and field conditions*.

Due to limited resources, the above chart is much applicable in situations where a big consignment is to be stored taking into account the requirement to avoid occurrence of an accident and minimize the magnitude of the hazard, should the accident occur. The limitations (barricades between certain compatibility groups) eventually lead to cost reductions.

11.3 Net Explosive Weight and Hazards

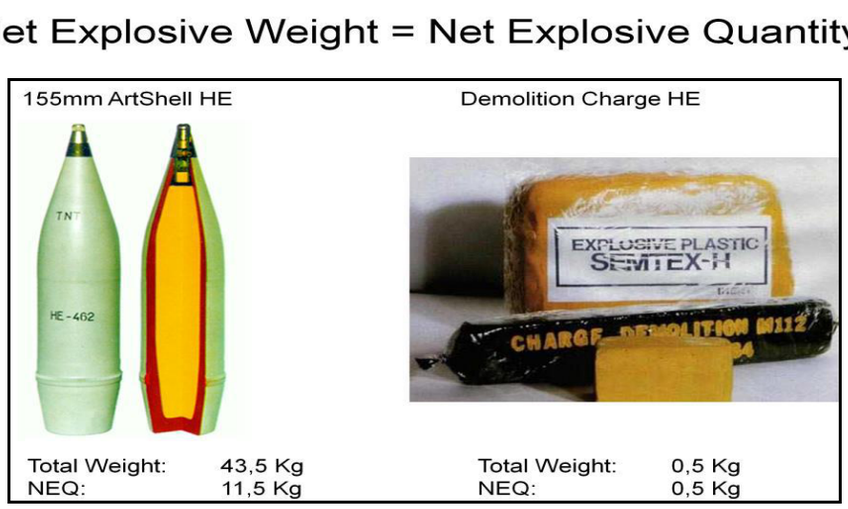
The *Net Explosive Weight* (NEW) also known as *Net Explosive Quantity* (NEQ) also known as *Net Explosive Content* (NEC) is the total *mass* of the contained *explosive substances*, without the packaging, casings, bullets etc. This is the actual weight of explosive mixtures or compounds, including the *trinitrotoluene* (TNT) equivalent of energetic material that is used in determination of explosive limits and explosive quantity data NEW *is* a key factor in determining quantity distances.

The objectives of learning NEW and Quantity Distance Calculations (QDC) are to:

a. Understand the relationship between the amount of explosives and the safety distances.
b. Recognize how to determine safety distances for different installations dependent on the amount of explosives.

To understand the NEW and QDC, please refer to IATG 2.20 (Quantity and Separation Distances) and IATG 1.80 (Formulas for Ammunition Management).

The storage and handling of ammunition and explosives presents a high risk to lives and property. Therefore, armed units should ensure that any risks involving storage or handling of ammunition and explosives are as low as reasonably practicable (ALARP) should an explosive event occur. One of the best ways to protect against an explosive event is to use adequate separation distances. *A point to remember is the greater the separation distance, the greater the protection afforded.*



Net Explosive Weight = Net Explosive Quantity [5]

11.3.1 Quantity – Distance Principles

In addition to the NEW, the safety distances will be determined by the amount of explosive charge, the type of material (ammunition casing) and the power (VoD) of explosives. In determining the safety distances, consideration is taken between a Potential Explosion Site (PES) and an Exposed Site (ES). *However, there is a minimum separation distance required up to a certain threshold.* Quantity Distances (QD) do not, however, exclude the risk to the public from projections, broken glass, displaced tiles etc, or the risk of some minor injury to occupants.

11.3.2 Types of Quantity Distances

There are two major types of QDs: the Inside Quantity Distance (IQD) and the Outside Quantity Distance (OQD). These in turn have sub-types, summarized in the table below.

Types of Quantity Distances

S/No.	QD Type	Applicability	QD Sub-Types
(a)	**(b)**	**(c)**	**(d)**
1	Inside Quantity Distance (IQD)	Only usually inside the designated explosives area.	Process Building Distance (PBD)
			Inter-Magazine Distance (IMD)
			Intra-line Distance (ILD)
2	Outside Quantity Distances (OQD)	Only outside the designated explosives area	Public Traffic Route Distance (PTRD)
			Inhabited Building Distance (IBD)
			Vulnerable Building Distance (VBD)

11.3.3 Inside Quantity Distances (IQD)

IQD are the minimum distances that should be observed between PES and ES. IQD is further subdivided into three sub-types:

a) ***Process Building Distances (PBD)***

PBDs provide a high degree of protection against immediate or subsequent propagation of explosion in the APB. PBD are generally intended for situations where personnel are regularly

employed in the preparation or processing of explosives. PBD are the minimum distances that should be observed either between PES and APBs, or between APBs. They are intended to give a reasonable degree of immunity to personnel within a hardened and barricaded APB from the effects of a nearby explosion. Light structured APBs are likely to be damaged if not completely destroyed, and as such offer minimal protection to personnel inside them.

b) **Inter-Magazine Distances (IMD)**

IMDs are the minimum distances to be observed between individual PES and ES that contain explosives (which are in effect also PES), and are designed to provide specified degrees of protection to explosives at an ES. Primarily, these distances are intended to prevent direct propagation expected at each ES for each Hazard Division (HD). An explosion at a PES may lead indirectly to explosions at a nearby PES due to secondary fires, but this situation is more likely at the lowest degree of protection, detailed below.

c) **Intra-Line Distance (ILD):**

This is the distance between two operating areas (Ammo maintenance for instance) or between magazine storage and operating area/building

11.3.4 Outside Quantity Distances (OQD)

OQD are minimum distances to be observed between PES and non-explosives area related ES such as public roads, railways, civil airport facilities, inhabited buildings and other buildings/areas, whether they be inside or outside the explosives area, which are used by the general public and/or government personnel. OQD is further subdivided into three sub-types:

a) <u>Public Traffic Route Distance (PTRD)</u>

Is the distance to be observed between PES and routes (ES) used by the general public, which are generically referred to as Public Traffic Routes. These include Roads, Railways, Waterways, Airport buildings and facilities (unless considered as a Vulnerable Building Distance - VBD).

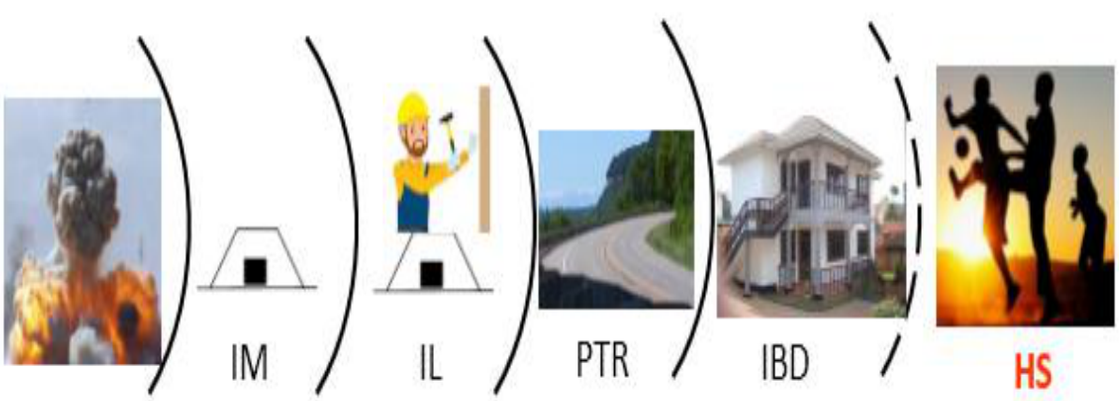
b) Inhabited Building Distance (IBD)

IBD should be the minimum distances to be observed between PES and buildings or sites where members of the general public or personnel not involved in explosives-related operations either work, live or congregate. The distances are intended to prevent serious structural damage to traditional types (i.e. 230 mm solid brick or equivalent) of inhabited buildings or caravans, and any consequential death or serious injury to their occupants. Persons in the open would not suffer direct injury from the effects of blast and radiant heat at these distances.

c) Vulnerable Building Distance (VBD)

Where an inhabited building is of vulnerable construction, (e.g. glass facade), or is a large facility of special importance, (e.g. a school), larger distances shall be applied from PES containing HD 1.1 to afford a high degree of protection. This is also referred to as Human Safe (HS). HS is the distance from a Potential Explosion Site (Magazine Storage) to people standing unprotected out in the open; at this distance, no injuries will occur.

Diagram 33: Quantity – Distance Principles



IM - Inter-Magazine Distance

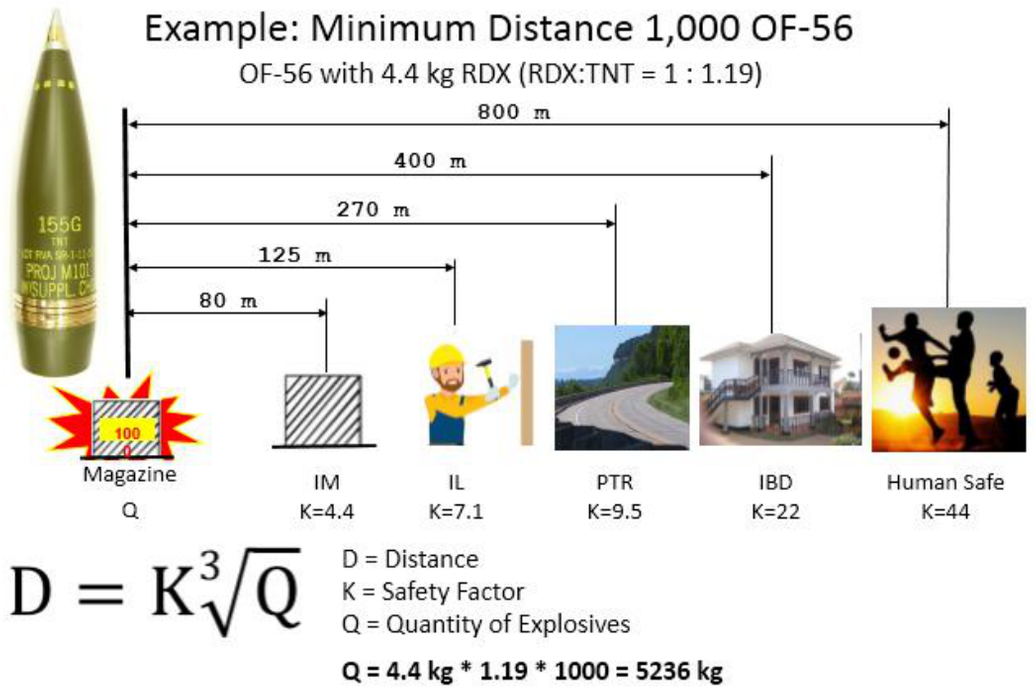
IL - Intra-Line Distance

PTR - Public Transportation Route

IBD - Inhabited Building Distance

HS - Human Safe

11.4 Blast Calculations



$$D = K\sqrt[3]{Q}$$

D = Distance
K = Safety Factor
Q = Quantity of Explosives

Q = 4.4 kg * 1.19 * 1000 = 5236 kg

It is worth noting that IM distance protects against propagation of explosions from one storage site to the next and that IBD distance provides some degree of protection to people in buildings. Human Safe Distance (HSD) is safest distance and should be strived for especially when people are out in the open (i.e. public place).

11.5 Flight Restrictions

Major explosives areas shall be protected from the potential hazards of aircraft crashes by national technical authority measures, which shall designate these areas as avoidance zones. These zones should preclude aircraft from over-flying such sites at heights of less than 1000m above ground level. Persistent incursions of these avoidance zones should be reported to the national technical authority. Local military air traffic at military airfields with explosives facilities is not generally restricted by such avoidance zones. In this case, the facility explosives safety representative should contact the senior air traffic control officer to request a suitable entry in the aircraft unit standing orders, which highlights the dangers of potential disaster at large co-located explosives storage sites. In this way, aircrew can avoid such explosives facilities. Conversely, explosives areas and facilities shall not be intentionally constructed in locations that would be over flown by existing or planned flight paths.

Military helicopter operations that over-fly explosives facilities may be permitted for training and exercise purposes provided that:

a) A risk assessment has been conducted by the unit explosives safety representative that demonstrate that the risks are tolerable and ALARP.
b) They are authorized beforehand by the head of the establishment.
c) Only passenger or non-explosive transfers are involved.
d) No over-flight of PES is permitted.

11.6 Types of Storage Buildings

The ammunition/arms storage buildings are categorized into two main structures and can either be *above the ground* or *earth covered*. The above ground buildings can further be subdivided into *light structured/open stack buildings*, *medium walled buildings*, *heavy walled without protective roof buildings* and *heavy walled buildings.*

11.6.1 Above the Ground Buildings

a) Light Structured/Open Stack Buildings:

Light structured/open stack buildings are constructed of light frangible materials that should not produce very many dangerous projections when used as a PES. As an ES, this structure could collapse but the debris produced should not initiate explosives. This type of structure is typically a single-storey building, clad with lightweight steel, aluminium or glass reinforced plastic (GRP) sheeting or similar materials. A light structure provides little resistance to high velocity fragments, lobbed ammunition or debris from an HD 1.1 and HD 1.2 explosive event, and from the fire hazard of a HD 1.3 event. As an ES, light structures should be barricaded to reduce the IMD but shall be barricaded where used as a Process Building.

b) Medium Walled Building:

Medium-walled building is one constructed of a minimum thickness of 215mm solid or 280mm cavity masonry walls or 150mm RC and a 150mm RC roof slab. As an ES, this type of structure may collapse and damage ammunition stored inside because it is not normally designed to resist blast over-pressure. The debris produced by a PES, dependent on the quantity of explosives

involved, may have a high enough velocity to initiate explosives or seriously injure personnel within the ES. This type of building will not resist the penetration of high velocity fragments at an ES or PES and should be barricaded to reduce the IMD. A medium walled building is reasonably effective in resisting fragments and lobbed items of HD 1.2 explosives and provides adequate protection against the fire hazard from HD 1.3 explosives. A medium-walled building is to be considered a light structure when determining QD for other than HD 1.2.

c) Semi-Reinforced Explosive Store House

This building is also referred to as the heavy walled building without protective roof. Walls are 450mm reinforced concrete (RC) or 680mm brick with no protective roof. The door is barricaded if it faces a potential explosion site.

d) Reinforced Explosive Store (ES) House

The reinforced explosive store house is also referred to as the heavy walled building. A heavy-walled building is one with a minimum of 680mm thick masonry or 450mm thick concrete walls, and a minimum 150mm RC roof. A receptor barricade is not generally required because the heavy walls fulfill this function. However, if the stocks are vulnerable to attack by debris, a separate barricade should be provided and consideration should be given to increasing the strength of the roof to prevent perforation and back-face spalling. If building doors are exposed to fragments from a PES, they should be shielded by a barricade. As a PES, the building may intercept some or all of the high velocity primary fragments, but the amount of debris is increased by the nature of its construction. As an ES, this type of building will:

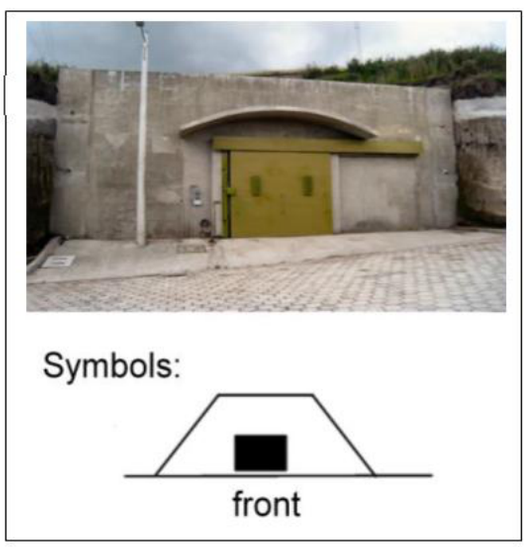
a) Prevent initiation of explosives inside by preventing penetration of high velocity fragments, but it may collapse and damage stocks because it is not normally designed to resist blast.
b) Be effective in resisting incoming fragments and lobbed munitions from HD 1.2 explosives, but only when the roof is constructed from RC.
c) Provide adequate protection against the fire hazard from HD 1.3 explosives.

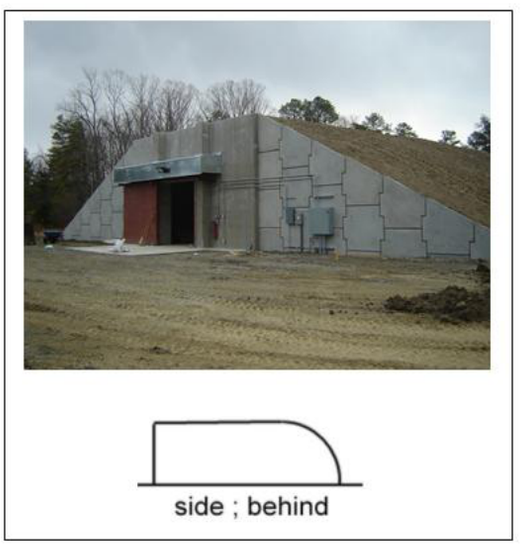
11.6.2 Earth Covered Buildings

An earth covered building is any structure, except an igloo, which has a minimum thickness of 600mm of earth on the roof and earth cover to the sides and rear walls. The slope of the earth

against the walls is dependent upon the material used. A barricade should be provided to shield doors and walls that are not earth covered and which face a PES. As an ES, this type of building behaves similarly to a heavy-walled building for all hazard divisions.

Diagram 34: Front and side view drawings for earth earth-covered magazines also called below ground or buried storages





a) Igloo

An igloo is an explosives storehouse with earth cover as described above. The structure and doors are designed to resist blast and high velocity fragments so that the contents will not be initiated or seriously damaged at the required IMD. The supporting structure for the earth cover can be constructed of corrugated steel and RC but is normally an RC box structure. As an ES, this type of building behaves similarly to an earth covered building with the additional advantage of having been specifically designed to resist the blast loading and therefore giving stored explosives complete protection from initiation at reduced IMD. As an ES, there are several categories of structural strength associated with the headwall and doors, based on their abilities to withstand specific external pressure loading and high velocity fragment threats, as discussed herein.

The doors and headwall do not normally require a barricade provided they have been designed to resist blast loading and high velocity fragment penetration. As a PES, an igloo has reduced QDs due to attenuation of the blast by the earth cover. In order to gain the most efficient land usage , where more than one igloo is used, igloos should be orientated side-by-side with the headwalls

on a common line. Where more than one row of igloos is used, the front walls in one row should face the rear of the other igloos in the second row.

Diagram 35: Images of Igloos

b) Open Bay or Site

The floor of such a bay or site is preferably to be of concrete with any required battens firmly attached. Consolidated hard-core or other suitable material may be used, but this form of a base will require constant maintenance to keep vegetation under control. Barricades may be required.

c) Container Storage

Any container being used as a storage facility e.g. an ISO or similar container shall be treated as an open stack when being used for storage of explosives. Barricades may be required. See IATG 04.10:2015[E].

d) Process Building

A process building (PB) is a building or site in which explosives are manufactured or worked upon. This includes such facilities as missile test rooms, preparation buildings, explosives workshops and all maintenance and preparation procedures.

11.6.3 Magazine Construction Standards

To ensure that the storage areas meet the required standards, they should be designed to offer protection against projected objects. Explosives storage buildings should provide protection

against penetration by debris, low velocity fragments and lobbed munitions. This is achieved by a combination of appropriate separation distances and the minimum construction thicknesses listed below:

a) Roof -150mm in-situ reinforced concrete slab.
b) Walls -150mm in-situ reinforced concrete or 215mm solid brickwork.
c) Doors -16mm mild steel or equivalent.

To give protection against high velocity fragments, a barricade or earth cover should be provided. However, if this is not possible, the following material thicknesses will generally be sufficient to prevent initiation of the explosives at an ES:

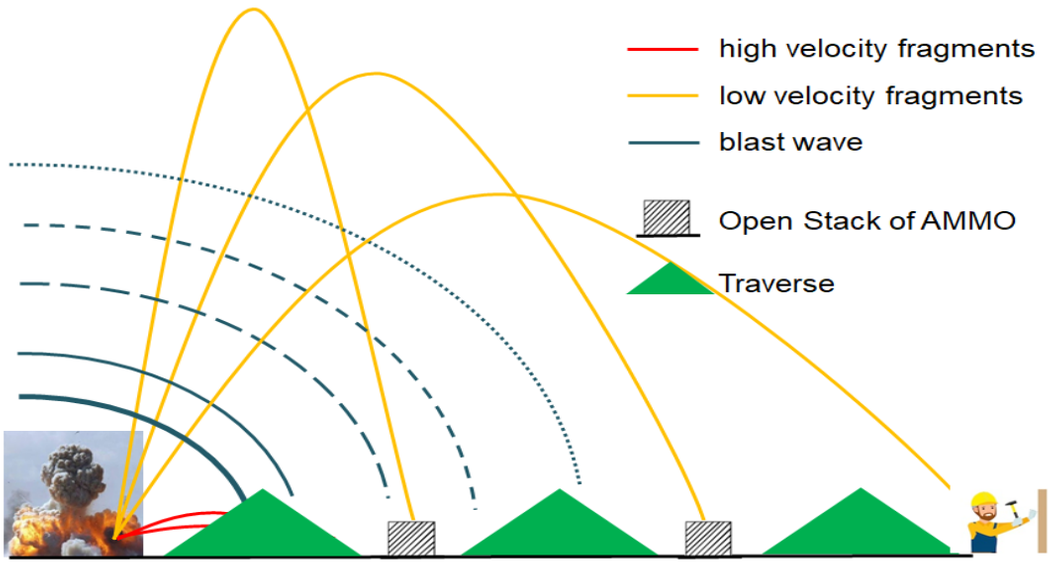
a) Walls - 450mm in-situ reinforced concrete or 680mm solid brickwork.
b) Doors - 50mm mild steel or equivalent.
c) Barricade - 2400mm of earth. Specially designed structures can be constructed to provide protection from specific threats, but such structures must be designed by a specialist in this area.

11.6.4 Traverses and Barricades

The term ‘barricade’ refers to a natural ground feature, artificial mound, or wall which is capable of intercepting high velocity low angle projections from a potential explosion site and preventing initiation of explosives stocks stored nearby.

High and low velocity fragments and the blast affect the other stacks of ammunition. Traverse protects the other stacks of ammunition against the high velocity fragments but the risk of low velocity fragments and the blast cannot be reduced by traverses.

Diagram 36: Blast and fragment effect with traverses



The commonest barricades are earth mounds, reinforced concrete (RC) and masonry walls, or a combination of these types. A barricade may be completely destroyed in an explosion, but its design should enable it to stop or sufficiently slow down high velocity fragments before it collapses or is dispersed.

To be effective, a barricade must be constructed of properly specified materials to a minimum effective thickness. It should be noted that barricades will also protect personnel from low angle, high velocity missiles, and fragments, and can provide some protection at an Exposed Site (ES) from blast and flame. However, its primary function is the prevention of initiation of explosives by low angle, high velocity fragments, which the predominant threats are leading to such an occurrence.

A barricade is not considered to stop high angle fragments and debris, which travel over the barricade and are generally the basis for minimum inhabited building distances. However, for smaller quantities of net explosive quantity (NEQ), a building and barricade concept can be designed to reduce inhabited building distances. A full-scale test shall be conducted to validate the design.

11.6.4.1 Types of Barricade

Barricades may be divided into four functional areas and are defined by the type of protection they provide. However, it is not always possible to distinguish clearly between barricade types because their functions change and merge according to their position relative to an ES or a Potential Explosion Site (PES). Yet classification by function is still useful because it indicates a measure of the barricade strength required. The four types of barricades are:

a) A Receptor Barricade

This protects the explosives within the ES it surrounds from direct attack by low angle, high velocity fragments and debris from an explosion in an adjacent PES. This type should be used for ES where the explosive quantities are too large for an interceptor barricade at the PES to be effective at a specified quantity distance that cannot be changed. A receptor barricade should be as close as possible to the ES it is protecting.

b) An Interceptor Barricade

An interceptor barricade is positioned close to the PES and is designed to protect explosives at the ES from direct attack by low angle, high velocity fragments. The barricade may be undermined by the crater created by the explosion and destroyed by the blast loading. However, it must remain in position long enough to intercept and retard fragments before it collapses.

c) Container Barricade

This type is designed to contain the high velocity fragments projected from an explosion within. It protects personnel and ES in the vicinity from the effects of an internal explosion and therefore it must remain substantially intact after an explosion. In real terms, a container barricade is only practical for small quantities of explosives (<1000kg) and is only of value around process buildings or relatively small ammunition stacks.

d) A Screening Barricade

This is a barricade designed to act as a screen between a PES and an ES. It is designed to intercept fragmentation at a higher angle than is normal for a barricade. It may be situated at the ES but is usually more effective if situated at the PES. If it is located at a PES, it should be high

enough to intercept all fragments projected at 40° or less and remain substantially intact after an explosion. The 40° line shall be measured from the Centre of the top of the explosives stack if the roof is lightweight and from the Centre of the roof if it is not of lightweight construction. The effects of potential blast overpressure loading should also be considered in the design phase to insure that the barricade would not collapse on the structure it was protecting.

11.6.4.2 Other Barricade Types

There may be occasions, such as field storage of ammunition, when the use of improvised barricades will be required. Full scale testing quite often is the basis for validating the effectiveness for use of these other non-traditional barricade designs. New tests should be conducted for situations where the limitations or conditions associated with the initial approval for use of the barricade involved are exceeded or the impacts unknown. The following are other types of barricade:

a) *Use of HD 1.4 Ammunition as a Barricade:*
   Ammunition of HD 1.4 may be stacked so as to provide buffered storage protection between stacks of other HD. However, these stocks of HD 1.4 may be destroyed in the event of the explosion of an adjacent stack. This use of HD 1.4 should only be considered in an emergency.
b) *Water Barriers*
   Several propriety water barriers are currently on the market. They are effective but should only ever be considered as temporary due to log term survivability and maintenance issues. Water is an effective medium for slowing down high velocity fragments. Maintenance of the water tanks in extremes of temperature is also problematic.
c) *Soil Barriers:* Several proprieties soil-filled barriers are currently on the market. The filling of these should meet the requirements of the materials.
d) *Unitization.* Unitization is the partitioning of explosives in individual compartments using dividing walls or by using internal barricades and in some cases allows reduced QDs to be used. The subject of unitization is a complex one and specialist Ammunition technical advice should be obtained before its application and subsequent reduction in QDs is authorized. This concept is generally only applicable to small NEQ < 200 kg.

11.6.4. 3 Design of Barricades and their Variable Functions

There are six constructional designs of barricades:

a) ***Type I:*** This is a double slope earth mound construction.
b) ***Type II:*** A single slope vertical face earth mound or partial vertical face mound.
c) ***Type III:*** A steep double slope earth mound sometimes referred to as a 'Chilver' type.
d) ***Type IV:*** Often described as a bunker building or combined barricade. This type includes fully buried buildings not more than 600 mm below ground level.
e) ***Type V:*** These are wall barricades constructed of brick, reinforced concrete and composite construction.
f) ***Type VI:*** Natural features of a site such as mounds, hillocks and so forth. As a minimum, they are to be the same size as a type I.

It would be unwise to tightly define the use of each type of barricade because the functions and protective features often overlap but in general *Types I, II and III*, comprising sloping barricades, are the most commonly used for storage purposes. They are the most functional because they can function in all four protective roles. *Type IV barricades* make use of the PES structure to support the earth and *Type V barricades* are primarily used as receptor barricades or are designed as container barricades.

11.6.4.4 Barricade Protection Against Blast Overpressure

General procedures to predict pressure mitigation versus general barricade design types and their location have to date not been developed. Yet based on direct-experimental work, the overpressure loading on a surface area shielded by a barricade is reduced by approximately 50 percent when the following conditions are met:

a) ***Location:*** The barricade's stand-off is within two barricade heights of the protected area.
b) ***Height:*** The top of the barricade is at least as high as the top of the protected area.
c) ***Length:*** The length of the barricade is at least two times the length of the protected area.

Diagram 37: How to Organize an Ammunition Depot

The *Yellow arrows* - indicate the minimum distances between the magazines.
The *White arrow* - indicate the position of the doors.

The weakest point of an ammunition bunker is the door which acts as a pressure release valve. The strongest point of an ammunition bunker is the side or the back because there are strong walls and this is covered by earth.

CHAPTER TWELVE

12.0 AMMUNITION STORAGE AND HANDLING

The objective of this topic is to enable readers and practitioners understand storage management and handling procedures, know the various storage techniques, know how to reduce lightening hazards and be able to manage Ammunition storage, handling and maintenance standards.

12.1 Introduction

Ammunition is manufactured using chemicals that can cause accidents if not handled properly both in storage and transportation. Safe handling of ammunition and explosives reduce the risk of damage to it and is a critical component of explosive safety. Any mishandling may result to accidental initiation causing explosion.

When handling ammunition/explosives, care should be observed to avoid *heat, shock and friction* that can result from tampering or drops. Special attention should be given to the following due to their sensitivity:

a) Rockets and missiles (Shaped charge)
b) Carrier shells (Sub – munitions)

12.2 Objectives of Learning Ammunition Storage and Handling

The aim of learning ammunition storage and handling is as follows:

a) Understand inventory control.
b) Understand safe handling of ammunition/explosives.
c) Understand storage techniques.
d) Understand maintenance programs.
e) Understand protective measures.

12.3 Inventory Control and Maintenance

Inventory control and maintenance in an ammunition/explosive storage site is carried out to:

a) Identify serviceable/unserviceable stocks.
b) Keep track of Lot/Batch numbers.
c) Identify suspect Lots.
d) Identify/track malfunctions.
e) Maintain reliability.

f) Reduce accidents.

g) Facilitate forecasting.

h) Plan testing/proof firing.

12.4 Storage Techniques

In storage, ammunition/explosives should properly be *stacked* to the correct height. These stacks will allow ventilation by use of a dunnage and free movement of both personnel and equipment in the storage site as per IATG 3.10 para15.

Fraction Ammunition should be minimized but if not placed in an easily identifiable position (preferably on top). The markings should be visible. The stacks allow for segregation according to ammunition:

a) Natures (Compatibility groups)

b) Lot/Batch numbers.

c) Country of origin.

d) Condition classification (Serviceable/Unserviceable)

Diagram 38: Good Storage-Ventilation, segregation and dunnage

Diagram 39: Poor storage site (no dunnage, segregation)

12.5 Maintenance Program

Maintenance program for an ammunition depot should be enhanced for identification of:

a) Structural defects.
b) Debris (fire hazard).
c) Overgrown vegetation (Obstruction, fire hazard).
d) Pests (Structural, packages defects).

Diagram 40: Overgrown vegetation on Ammunition storage site

12.6 Protective Measures

Ammunition/Explosives storage sites should have designated areas for refreshments (eating, smoking) to avoid fire hazards and also pests/rodents that are attracted by foodstuffs (IATG 6.10). Appropriate hazard division markings, licenses and SOPs should be placed at the entrance.

A license for an Ammunition/Explosive storage site stipulates the following, among others:

a. Approved NEQ for the store house.
b. Personnel/man limits for the site.
c. Type of electrical connection
d. Type of explosive store house (ESH)

Lightening protection and flight restrictions over a storage site for Ammunition should also be enforced IATG 5.40

CHAPTER THIRTEEN

13.0 AMMUNITION SURVEILLANCE

This topic is intended to enable readers and practitioners understand the scope and importance of implementing an effective Ammunition surveillance program, classify Ammunition conditions, understand the role of surveillance programs in Ammunition forecasting and understand the role of surveillance safety in stockpile management.

13.1 Introduction

Ammunition surveillance is a method of evaluating the properties, characteristics and performance of ammunition throughout its life cycle. Various chemicals, both sensitive and insensitive are used to manufacture the main filling. These chemicals deteriorate with time if ammunition in storage is not monitored. Majority of Ammunition manufacturers give a shelf life of 10 – 15 years. However, this shelf life can go for many years depending on storage conditions.

13.2 Learning Objectives

The objectives of learning ammunition storage and surveillance are as follows:

a) To explain purpose of surveillance.
b) To describe causes ammunition/explosives deterioration
c) To comprehend conduct of ammunition/explosives surveillance.
d) To investigate ammunition/explosives malfunction
e) To recognize Ammunition/Explosive condition classification.
f) To forecast on ammunition performance and conditions of storage

13.3 Purpose of Ammunition/Explosives Surveillance

The purpose of Ammunition/Explosives surveillance is to ensure:

a) Safety in performance.
b) Reliability/effectiveness
c) Economic utilization of funds (Ammunition/Explosives procurement)

13.4 Causes Ammunition/Explosives Deterioration

Ammunition/Explosives in storage and transportation/handling deteriorate as a result of (IATG 7.20):

a) Exposure to extreme low/high temperatures.

b) Exposure to Humidity/water.

c) Shock (vibration, pressure).

The deterioration above affects the components that make up the ammunition outlined as below:

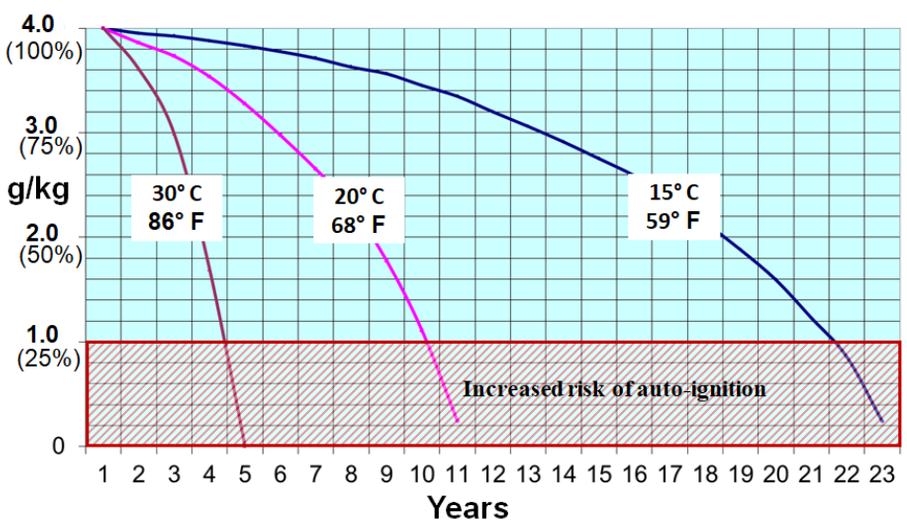
a) Main filling – Chemical deboning, depletion and cracking.

b) Fuzes (electrical) – Component aging, shock damage.

c) Obuturating ring (mechanical) – Gasket rotting, damage due to vibration and impact.

Propellant stabilizer in the main filling is affected by exposure to extreme high and low temperatures as shown in the graph below:

Diagram 41: Propellant Stabilizer Degradation



Ammunition/Explosives quality standards are as outlined in IATG 7.20:

Ammunition Quality Standards

Ammunition Type	Operational	Limited
Small Arms Ammo	96%	92%
High Explosive Ammo	92%	85%

13.5 Conduct of Ammunition/Explosives Surveillance

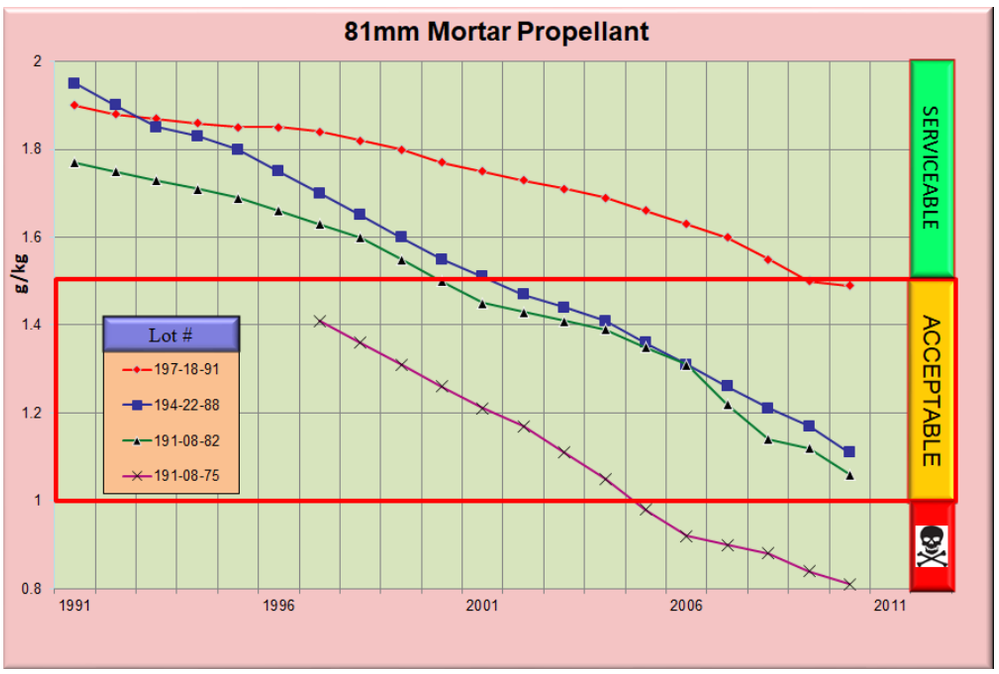
Ammunition/Explosives surveillance is conducted using the following methods:

a) Visual inspection to detect leakages of the main filling, damaged outer packages, corrosion and obsolete (lot numbers).

b) Chemical analysis of the main filling/stabilizer.

c) Proof firing to test the condition and functioning of the propellant and fuzes (range and exploding on the target).

Chemical analysis carried out on propellant charge for 82mm bombs below shows that the older the propellant is, the lesser the duration for its effectiveness.



13.6 Investigation of Ammunition/Explosives Malfunction

Whenever a malfunction involving ammunition/explosives occurs, an investigation should be conducted to establish the cause. The chart below shows the methodology used to guide the investigator.

The aim of the above investigation is for *condition classification* of the ammunition involved and the one already in storage. IATG 3.10 gives the condition classification of ammunition after inspection/investigations/sentencing as below:

a) Condition A - Serviceable Ammunition.
b) Condition B – Serviceable Ammunition but with reduced shelf life.
c) Condition C - Serviceable Ammunition but with very short shelf life.
d) Condition D - Ammunition requiring testing before issuance.
e) Condition E - Ammunition requiring minor repairs.
f) Condition F - Ammunition requiring major repairs.
g) Condition G - Ammunition with missing parts.
h) Condition H - Ammunition that is condemned.
i) Condition J - Ammunition that is suspended.
j) Condition K – Ammunition that is unknown/not positively identified.
k) Condition C - Ammunition pending investigation/litigation.
l) Condition N - Ammunition for emergency use only.

After condition classification of ammunition/explosives as above, an armed unit is able to make informed decisions/forecasting on the areas below:

a) Procurement.
b) Consumption of ammunition in training.
c) Sale to authorized entities.
d) Disposal.

CHAPTER FOURTEEN

14.0 PHYSICAL SECURITY - EXTERNAL

14.1 Introduction

This topic is intended to enable readers and practitioners understand the concept of layered security, types of fences, doors and hinge requirements.

Physical security describes *security* measures that are designed to deny unauthorized access to facilities, equipment and resources and to protect personnel and property from damage or harm (such as espionage, theft, or terrorist attacks). Physical security involves the use of multiple layers of interdependent systems which include CCTV surveillance, security guards, protective barriers, locks, access control protocols, and many other techniques.

Physical security systems for protected facilities are generally intended to:

a) Deter potential intruders (e.g. warning signs and perimeter markings);
b) Detect, monitor and record intrusion (e.g. intruder alarms and CCTV systems); and
c) Trigger appropriate incident responses (e.g. by security guards and police).

To understand the physical security measures (external) in detail, please refer to IATG 9.10 and Security Principles and Systems, IATG 6.10, IATG 1.20 .

Effective security of arms and Ammunition stockpiles is an essential part of any PSSM program, as it *reduces the risks of loss, theft, leakage and proliferation*. The systematic control of ammunition stockpiles, while keeping up with the philosophy of 'due care' and armed units, should take a *proactive*, *rather than reactive* stance in ensuring that ammunition and firearms are accounted for and secured to the highest standards.

14.2 Concept of Layered Security

Effective physical security of an asset is achieved by multi-layering the different measures, what is commonly referred to as *layered security or* '*defense-in-depth'*. The concept is based on the principle that security of an asset is not significantly reduced with the loss of any single layer. Each layer of security may comprise different elements, including:

a) Measures to assist in the detection of threat weapons, for example explosives, knives, firearms, chemical/biological/radiological material etc.

b) Measures to assist in the detection, tracking and monitoring of intruders and other threats, such as unmanned aerial vehicles
c) Access control and locking systems
d) Physical and active barriers to deny or delay the progress of adversaries
e) Measures to protect people or assets from the effect of blast or ballistic attack
f) Measures to protect against or limit the spread of chemical, biological or radiological material
g) Measures to protect sensitive (e.g. classified) materials or assets
h) Command and control
i) The response to an incident
j) Security personnel (covered within the Personnel and People Security)

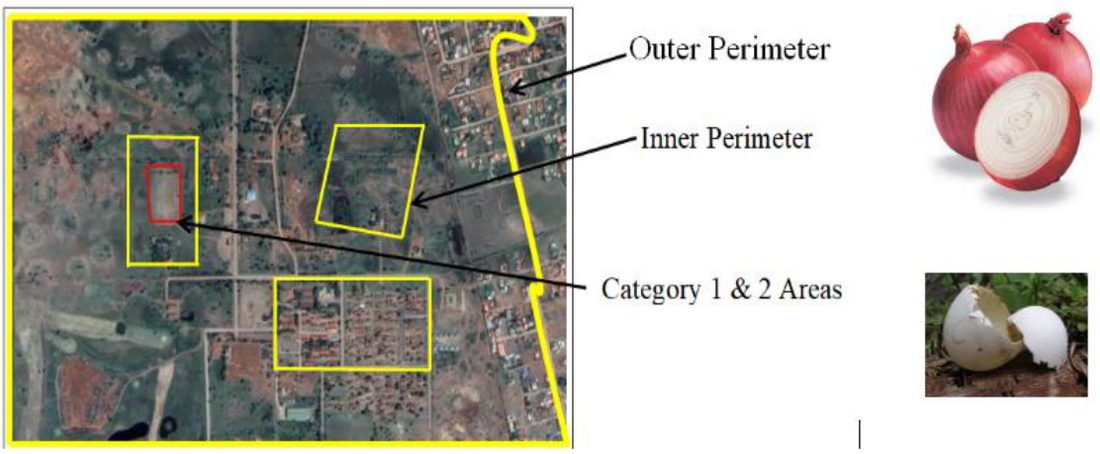
The above measures are interdependent and their effectiveness will be dictated by their ability to support one another. For this and a variety of other reasons, it is recommended that all security measures be developed following the Operational Requirements (OR) process. It is very important that the OR is based upon the correct threat planning assumptions and that exercises are conducted to ensure that planned security measures will work together to deliver the intended effect.

Considering the physical security requirements at the outset, as part of the building or facility design, will often result in more effective and lower cost security. For new buildings, high level security requirements should be incorporated into the original brief. Physical security requirements should also be considered during the construction phase of new buildings or the modification of existing facilities, as these are likely to be subject to different risks and issues.

Consideration should be given to:

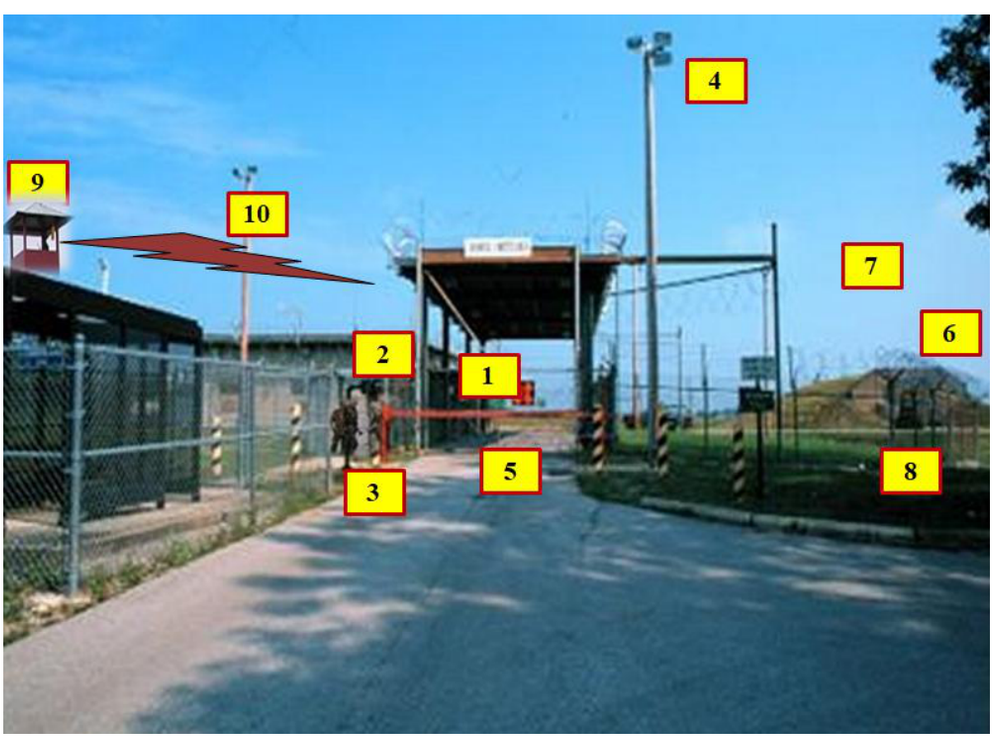
a) Identification and assessment of existing and new security risks.
b) Identification of security requirements for both the construction works and any changes to the security of the facility itself (this will depend on whether the construction works are adjacent to or within the facility)
c) Determination of the transition of the security measures from ‘construction phase’ into normal operations.

Diagram 42: Illustration of a Layered Security Military Compound



The layered security borrows from the concept of peeling an onion. In the above diagram, Category 1 and 2 areas are for more sensitive items such as the Man Portable Air Defense Systems (MANPADS).

Diagram 43: Layered Security: Entry Control



The above diagram shows a typical restricted access area and should have: -

i. Check-in-point: This is an area where the ID is checked and issue of Access Badges to different levels.
ii. Guards/Escorts
iii. Pedestrian Gate
iv. Area Lights/cameras
v. Vehicle Gate (NO private vehicles)
vi. Barbed wire or razor ribbon on fence
vii. Outer perimeter fence NOT transparent
viii. Clear Area
ix. Watchtower with armed guard
x. Communication (minimum of 2 types)

For more details on Entry Control, refer to IATG 6.10 and IATG 9.10.

14.3 Visitors

All visitors to an ammunition or weapon storage facility MUST be vetted and the visits must be limited to unrestricted areas. The leadership should be convinced that WHAT WE STORE AND HOW WE SECURE IT IS A SECRET! The fewer people that know specifics, the safer we and our stockpile will be.

14.4 Fencing Classes and Standards

A fence is a structure that encloses an area, typically outdoors, and is usually constructed from posts that are connected by boards, wire, rails or netting. A fence differs from a wall in not having a solid foundation along its whole length. For more details, refer to IATG 9.10.

14.5 Fence Specifications

A fence or wall forms a useful barrier and also delineates the boundary of a protected or restricted area. The level of protection offered by a fence will depend on its height, construction, the material used to increase its performance or effectiveness such as topping, perimeter intrusion detection systems (PIDS), lighting or CCTV.

The type of fence used should reflect the type of threat i.e. terrorist, criminal, vandals or armed attack. Fences are graded according to the level of protection they offer with Class 4 offering the highest security and Class 1 the lowest.

The different security classes have different risk reduction process levels (RRPL) in accordance with IATG 1.20. The risk management will dictate the type of fence required.

The effectiveness of any security barrier will depend to a large extent on the level of security at the points of entry. Gates shall be constructed to the same security standard as the fence and control of entry shall be maintained, otherwise, the security of the fence will be negated. The perimeter fence shall have a minimum number of pedestrian and vehicular access gates, consistent with operational requirements.

Signs should be prominently displayed on all approaches to the perimeter to indicate to persons that they are approaching a restricted area to which access is not permissible. If appropriate, such signs should also indicate the presence of armed guards and dogs.

14.6 Class 1 Security Fencing (LEVEL 1)

This is a fence designed with no particular security requirements and is at least 1.5m high. The fence is only intended to mark a boundary and to offer a minimum of deterrence or resistance to anyone other than a determined intruder.

Diagram 44: Class 1 Security Fencing

Class 1 (Level1): 1.5m high

14.7 Class 2 Security Fencing (LEVEL 1)

This is an anti-intruder fence that offers a degree of resistance to climbing and breaching by an opportunist intruder not having particular skills and only using material and breaching items that are ready to hand. A Class 2 fence should be supported by other perimeter security systems.

Diagram 45: Class 2 Security Fencing

Class 2 (Level 1): 2.9m high

14.8 Class 3 Security Fencing (LEVEL 2)

This is an intermediate security barrier designed to deter and delay an intruder who has access to a limited range of hand tools. The design and construction will offer resistance to attempts at climbing and breaching. *A Class 3 fence should normally be supported by other perimeter security systems.*

Diagram 46: Class 3 Security Fencing

Class 3 (Level 2): 4m high

14.9 Class 4 Security Fencing (LEVEL 3)

A high-security barrier designed to offer the maximum deterrence and delay to a skilled and determined intruder who is well equipped and resourced. *It should be designed and constructed to offer a high degree of resistance to a climbing or breaching attack*. A Class 4 fence shall be supported by other perimeter security systems.

Diagram 45: show a High Security Welded Mesh Fence. It is constructed using narrow aperture welded mesh with an additional layer up to 3m. High security fences provide the highest level of delay to attack, however, they are expensive to construct. *Class 4 security fences should always be used in conjunction with CCTV and an intruder detection system.*

Diagram 47: Class 4 Security fencing

Class 4 (Level 3): 4.8m high

14.10 Perimeter Fence signs

Signs should be properly integrated with the fences to warn the would-be intruder. It is important also to have signs with images for those who cannot read properly. The signs should be placed after every 50M for each individual to be able to see. Some examples of signs at the fence are: -

a) Interior Fencing

The interior fencing is a barrier within a barrier. This small area is within the installation boundaries and it encloses the storage to very sensitive items such as the Man Portable Air Defense Systems (MANPADS). *This area encompasses the "inner layer" of security and has the same fence specifications as for the outer perimeter*.

This inner area is manned by a minimum of two guards.

b) Intrusion Detection Systems (IDS)

An Intrusion Detection System (IDS) is a system that monitors network traffic for suspicious activity and issues alerts when such activities are discovered. While anomaly detection and reporting is the primary function, some intrusion detection systems are capable of taking actions when malicious activity or anomalous traffic is detected. For more details, refer to IATG 9.10.

Buildings and structures used for the storage of conventional ammunition should be fitted with appropriate Intrusion Detection Systems (IDS). IDS should be fitted to all doors, windows and other openings. Interior motion or vibration detection systems may also be fitted. All alarm

signals from such systems should be received at a central control or monitoring system from which response force can be dispatched. The response force should respond to activated IDS as soon as possible, but the response shall be no later than 15 minutes after receipt of the alarm signal.

A daily record should be maintained of all alarm signals received which should be reviewed to identify and correct IDS reliability problems. The log should reflect the following:

a) Nature of the alarm, (nuisance, system failure or illegal entry).
b) Date, time and location of alarm; and
c) Action taken in response to the alarm

IDS should be tested weekly to ensure the proper functioning of the alarm sensors.

14.11 Perimeter Illumination (LEVEL 2)

External and internal perimeter illumination shall be of sufficient intensity to allow detection of unauthorized activity by the guard force. *All access points to a storage area should have direct illumination above all entry points.* Switches shall be installed in such a manner that they are only accessible to authorized personnel. An automatic backup generator and power system is essential on high risk and high value sites. All perimeter illumination systems of the facility should radiate slightly outwards in order to facilitate night vision of the guard force and restrict that of those looking into the inner perimeter. The perimeter lighting should be placed inside the compound where it will be difficult to sabotage or destroy.

14.12 Perimeter Intrusion Detection Systems (PIDS) (LEVEL 3)

Perimeter Intrusion Detection Systems, (PIDS), is a generic term which covers a wide range of technologies designed to provide advance warning of an intruder gaining access to a secure area.

All detection systems demand a compromise between detection capabilities and unwanted or nuisance alarm rates. By their nature PIDS are designed to operate in a less favorable environment than internal intruder detection systems.

Perimeter fences around structures and buildings used for the storage of conventional Ammunition should be fitted with appropriate PIDS. The performance of any PIDS will depend not only on the intrinsic characteristics of the technology employed but also on the specific site conditions under which it is deployed. For this reason, it is strongly recommended that specialist technical advice is sought before any system is procured. *Installation of a PIDS shall not be taken in isolation. To be effective it should operate as part of an integrated security system.*

This may include physical measures such as fences and barriers, providing both detection and delay together with visual surveillance systems and perimeter illumination providing alarm verification. The specific type of PIDS employed should depend upon the site conditions, operational requirement and other constraints that will be placed on its operation.

14.13 Perimeter Intrusion Detection Systems (PIDS) Types

There are a range of PIDS types, which may be considered for deployment. These include:

a) Buried detection systems
b) Fence mounted systems
c) Electric fence systems
d) Field effect systems
e) Continuity monitoring systems
f) Free standing systems
g) Taut wire systems
h) Rapid deploy systems

The range of systems and factors involved in deployment means that it is not realistic to provide a cost estimate until the system requirements have been refined further.

14.14 Visual Surveillance Systems (LEVEL 3)

Visual surveillance may be used to increase the effective range and area of ground covered by the individuals of the security staff, thereby minimizing staff requirements. Technology is available that can provide day, low-light and night coverage, but such technology should not be used to replace an appropriate level of physical presence by security staff.

Visual surveillance systems, usually close-circuit television (CCTV) or motion initiated systems may be used to:

a) Cover all gates, doors, perimeters and interiors of conventional Ammunition storage facilities;

b) Provide constant, real time monitoring; and

c) Record activity for review in the event of loss or theft.

Available camera systems technology, which can be supported by a range of data transmission technologies, includes:

a) Normal visible light range;

b) Low light capable; and

c) Infra-red.

There should be a recommended Centralized monitoring area of IDS sensors. Properly designed CCTV (Closed Circuit Television) assessment system provides a rapid and cost-effective supplement to guards for determining the cause of intrusions, alarms, and assessing potential threats. The requirements of PIDS for records and tests should also apply to visual surveillance systems.

14.15 Patrols and Dogs (LEVEL 1)

A guard and response force should check the security integrity of *ammunition storage areas during non-duty hours at both prescribed and random occasions.* These checks should be recorded and records maintained for a minimum of 90 days. Staff should be properly trained and equipped to perform their duties in accordance with the appropriate SOPs. Trained working dogs may be used as a complementary measure to the guard and response force.

Irregular spot checks and unannounced tests call outs of guard force and back up personnel by night and by day are essential to check and practice both individuals and procedures.

Diagram 48: Intrusion Detection systems

a) Door and Hinge Standards

Access doors and gates shall be sufficiently robust and comply with national security standards. As a minimum, the doors should be made of solid hardwood with steel on the outside face. Door frames should be rigidly anchored to prevent disengagement of the lock bolt by prying or jacking of the door frame. Door and gate hinges should be located on the inside and should be of the fixed pin security type or equivalent. Access doors and gates shall be secured with high security padlocks. For more details, refer to IATG 9.10.

The photo on the right shows:

a) Door made of 16mm Steel (or 4.5cm wood with 12 gauge/2.6 mm steel plate).
b) High security lock.
c) Frame anchored to building at 8 places.
d) Hinges must be welded to prevent pin removal and should be as strong as lock. (Lock does no good if hinges can be beaten off easily.) Hinges should be mounted so that the door opens outwards
e) Marked with UN Fire Division symbol (small arms ammo = moderate fire hazard inside) – normally not required for arms room.
f) Doors open OUTWARDS – can't be rammed.
g) Light gauge handles break off easily – cannot be used to pull off door.
h) Door seam covered with metal strip – prevents lever from fitting inside.
i) Illuminated at night.

The doors are designed to delay intruders for some time.

b) Locks, Padlocks and Seal Requirements

Padlocks for the gates and explosive storehouses should be compliant with acceptable standards. They should be resistant to:

a) Hand tools for specific amounts of time.
b) Different types of attacks (torque, cutting, impact, pulling, etc).
c) Temperature resistance (high and low).
d) Power tools for specific amounts of time.

c) Seals

Seals are meant to assist in detection of tampering on locks and entry points. They allow for easy identification of tampering. Seals can be serialized or have special markings to track who was the last one in an area. *Seals do not delay entry; they merely leave evidence of entry.*

d) Anti-Intrusion Lock Barriers

These are delay mechanisms and they are locally made. They have the following properties:

a) Must protect against manual manipulation (hammers, bars, etc) for at least 15 minutes.

b) Must protect against powered tools (drills, saws, etc) for at least 5 minutes. It is not necessary to have an expensive lock. Anti-intrusion system can be produced cheaply and locally.

CHAPTER FIFTEEN

15.0 PHYSICAL SECURITY - INTERNAL

15.1 Introduction

This topic is intended to enable readers and practitioners understand how to organize internal security in a magazine (amoury), the importance of personnel selection, requirements and training, understand the levels of access and the need or objectives of Standard Operating Procedures (SOPs) in the management of stockpiles.

Physical security describes security measures that are designed to deny unauthorized access to facilities, equipment and resources and to protect personnel and property from damage or harm (such as espionage, theft, or terrorist attacks). It involves the use of multiple layers of interdependent systems which include CCTV surveillance, security guards, protective barriers, locks, access control protocols, and many other techniques.

The primary role of physical security is to protect material and less tangible – information assets from physical threats: unauthorized access, un-availabilities and damages caused by human actions, and detrimental environmental and external events. For more details, refer to IATG 9.10, IATG 6.10 and ISACS 5.20.

Physical security systems for protected facilities are generally intended to:

a) Deter potential intruders (e.g. warning signs and perimeter markings);
b) Detect intrusions and monitor/record intruders (e.g. intruder alarms and CCTV systems); and
c) Trigger appropriate incident responses (e.g. by security guards).

15.2 Internal Control Measures

Internal control measures are simply policies and procedures that are implemented to deter or prevent internal theft by employees. Most of these controls involve the accounting system and the related books and records. When effective internal controls are in place, employees usually have to collude with other employees to facilitate theft. Collusion is where two or more employees work as accomplices or co-conspirators to steal, thereby defeating a control procedure. This scenario may apply to any military installation/depot.

a) Sources of Loss

The common sources of loss in connection to stockpile is due to:

a) Employees
b) Customers
c) Suppliers and
d) Internal errors

Employees can be your soldiers, customers can be the people making authorized withdrawals from your stockpile, suppliers can be anyone delivering your stockpile materials, internal errors are errors necessitated by omissions or commissions of human. The human error rate is a constant regardless of the country. *Loss of stockpiles can be reduced through training and quality control.*

b) Personnel Selection

The personnel to manage the storage facilities must be vetted. For more details, refer to IATG 8.4. Physical security and ammunition inventory management systems are all vulnerable to failure should staff not accept their responsibilities, fail to follow SOPs or become subverted. This means that organizations shall make every effort to ensure that all staff working in ammunition and weapons stores shall:

a) Not have criminal convictions and are unlikely to possess criminal tendencies.
b) Be trained effectively.
c) Undergo security vetting, before the commencement of service and at regular intervals during service.
d) Maintain loyalty, be well-motivated and appropriately rewarded.

Conversely, poorly paid, trained and motivated staff are more likely to be involved in malfeasance, (including laxity in carrying out duties, being susceptible to bribery, failure to follow procedures or even active involvement in conventional ammunition theft and sale).

Stockpile management units should ensure that appropriate procedures are developed and followed for the security vetting of staff prior to employment in ammunition and weapons

storage areas and that they are security vetted at regular intervals throughout their employment. It should also be a condition of their contracts that they shall report any relevant changes in personal circumstances to security vetting staff.

c) Training and Supervision

The backbone of any SALW protection program is adequate training for all personnel involved with the security and management of the stockpile. *Poor training will only result in poor standards and procedures.* For more details on training and supervision, refer to IATG 6.10.

Armed units must establish security standards and criteria for the physical security for ammunition and weapons. These standards and policies must be applied throughout the force. Training and refresher courses shall cover areas including:

a) Safekeeping and stockpile management methods.
b) Weapon systems and equipment.
c) Physical security.
d) Maintenance of buildings and security of the perimeter.
e) Security awareness

The following principles of physical security should be applied to ammunition storage and processing areas:

a) Physical security systems should be derived from an effective risk assessment process.
b) Physical security should be built into new storage facilities at the design stage.
c) An effective perimeter security infrastructure shall be in place.
d) Access shall be controlled at all times.
e) Access shall be restricted to authorized personnel only.
f) Only trusted individuals, who have been security cleared, shall be nominated as authorized personnel to work within the facility.
g) Temporary personnel should be accompanied at all times.

d) Standard Operating Procedures (SOPs)

Security regulations, which are a legislative and regulatory issue, should be underpinned by detailed standing operating procedures that set out clear operational activities and responsibilities. They should be written as opposed to verbal to reduce the chance of misunderstanding the intent of the SOPs. The SOPs allows new personnel to see exactly what the commander desires and what is expected of him/her. They *standardize the procedures, reduce training, improve safety, and save time and money*. For more details, refer to ISACS 5.20.

All personnel working at a weapons storage area should be trained in the application of the standard operating procedures. Specific SOPs should be developed for each individual weapons' storage location and should contain, at a minimum, the following information:

a) The scope of the instructions.
b) The individual official in charge of the location (professional title, physical location within the facility and telephone number).
c) Details of any generic security threats.
d) The names, functions and telephone numbers / call signs of all those at the location with security responsibilities (including security officers, safety officers, armaments officers, transport officers, stores offi cers, accounting officers etc).
e) The individual terms of reference of all functions with security responsibilities (in simple unambiguous language).
f) The access control policy.
g) The policy for the control of security keys.
h) Inventory and accounting procedures.
i) Security procedures to be followed in the different areas of the weapons storage facility.
j) Actions to be taken on the discovery of incursion, theft, loss or accounting inconsistencies.
k) Actions to be taken in response to alarms.

e) Landscaping and Vegetation Cover

Uncontrolled growth presents a major fire risk particularly during dry weather conditions. For more details on vegetation cover, refer to IATG 6.7 and 6.8.

Diagram 49: Controlling vegetation covert

Grass, trees and vegetation shall be controlled so that they do not present a hazard to explosives storage.

15.3 Ammunition and Weapons Site Risk Assessment

The major objective of undertaking an ammunition and weapons site risk assessment is to come up with measures to reduce the risks associated with storage of stockpiles. Assessment of the risks facing the facility is the *responsibility of the head of the establishment*. A risk assessment team should be formed and its membership should consist of specialists such as:

a) The explosives safety representative.
b) The fire focal point.
c) The security officer.
d) Estate management staff.
e) Any other personnel considered necessary by the head of the establishment.

15.4 Lightning Protection Systems

It is essential that effective lightning protection measures are provided for facilities involved in the manufacture, processing, handling, or storing of ammunition. Although statistically the

probability of a structure or building being struck by lightning is relatively low, nevertheless it is of the utmost importance to provide lightning protection to facilities containing ammunition. For more details on lighting protection systems, refer to IATG 5.40.

15.5 Forms of Communication

Communication transmitters include mobile telephones, wireless communication links to high-powered transmitters, electronic data transmission, asset tracking and radar. These items produce and receive Radio Frequency (RF) fields of varying intensity. This intensity is controlled by their output power and antenna gain and this is *potentially hazardous and may have enough power to initiate electrically initiated devices.* A SOP should be developed to ensure the correct personnel are called in the case of an emergency. *At any given time two forms of communication are required.*

15.6 Key Control

Keys to ammunition and weapons storage areas, buildings, containers and Intruder Detection Systems (IDS) shall be stored separately from other keys and shall not be left unsecured or unattended to at any time. They shall be accessible only to those individuals whose duties require them to have access to the conventional ammunition storage areas. *A roster of authorized personnel (custodians) should be kept by the authority responsible for ammunition security.* A record shall be kept each time an individual removes keys from the secure key cabinet. *The number of keys shall be kept to an absolute minimum, and master keys should be prohibited.*

As a minimum, the following guidelines on key control are recommended:

a) Lock and key custodians should be appointed in writing.
b) Must NOT be the unit armorer.
c) Ammunition and weapons building keys are not stored alongside other keys.
d) Authorized roster kept in public view.
e) Keep the number of copies of key to a minimum.
f) Master key is prohibited.
g) Category 1&2 should be stored in a high security container.
h) Extra locks and keys should also be stored in a secure area.

i) Keys should not be removed from the storage site.

The lost keys must be reported immediately and the locks changed even if keys are found. Inventory should be conducted randomly to ensure nothing is missing. A key register must be kept and all keys have to be signed for before being released and upon return.

Keys stored in a safe

15.6 Combination Locks

The combinations to locks shall be dealt with in exactly the same manner as keys. Combinations should be changed at regular intervals and when individuals change or move on appointments. Records of combinations should be held in sealed envelopes by the security officer even if they are logged onto secure computer systems. Every combination lock guarded facility or container must have a record of access by individual, date and time prominently displayed on its door.

CHAPTER SIXTEEN

16.0 ARMS SECURITY

16.1 Introduction

This topic is intended to enable readers and practitioners understand the concepts of arms risk assessment, arms storage structures and arms inventory and control.

Stockpile management of weapons is the term used to describe those procedures and activities that are necessary for the safe and secure accounting, storage, transportation and handling of small arms and light weapons.

One of the main sources of illicit SALWs are poorly managed stockpiles, from which weapons leak, through loss and/or theft, into the illicit market. The effective and effi cient management of weapon stockpiles is, therefore, an essential element of any small arms and light weapons control program, since it reduces the risk of loss and theft of weapons (and, thereby, their illicit proliferation), and can be used to identify obsolete and/or surplus weapons, as well as future procurement requirements.

The systematic control of weapon stockpiles is in keeping with a philosophy of 'due care' and requires being pro-active, rather being reactive.

16.2 Risk Assessment

To mitigate proliferation, frequent risk assessments must be undertaken. Because SALW are a threat to the local population and some SALWs contain explosives components, such as MANPADS, which present explosive hazards. Assessments must consider both financial value of both the facility and contents, theft, attacks (active threats) and fire, floods, etc (passive threats) and ascertaining the extent to which the facility is susceptible to espionage or terrorists attacks.

To further improve on arms security, the following must be adhered to when designing and constructing an arms store (for more details, refer to ISACS 5.20 and IATG 6.10).

a) Door should be made of 16mm steel (or 4.5cm wood with 12 gauge/2.6 mm steel plate)
b) Arms stores should have high security locks and lock covers
c) Door frames should be anchored to the building to at least 8 places
d) Door hinges should be welded to prevent pin removal

e) Arms store doors should open outwards

f) Light gauge handles break off easily – cannot be used to pull off door

g) Door seam covered w/metal strip – prevents lever from fitting inside

h) Arms store must be illuminated at night

Additional security considerations include:

- Guards must be armed
- Panic alarm must be easily accessible
- Receipt/Issuing window is small to only allow weapons to pass through.
- Door is locked from the inside
- change codes when personnel leave the organization.
- Ensure that alarms and sensors are working

11.3 Arms Racks and Steel Boxes

The main benefit of using arms racks is for security and ease of identification of a missing weapon. Arms racks can be locally manufactured. They should be bolted, chained or welded together to prevent easy removal. In permanent installations, the bolts should be welded to prevent disassembly of the rack. Steel arms boxes can also be used in the arms stores but most suited for the field operations, where there are no permanent structures. For more information on arms racks, refer to ISACS 5.20.

Diagram 50: Gun Racks and Steel Boxes used in storage of firearms and Ammunitions

16.4 Weapons Inventory and Control Measures

Weapons inventory and control measures cover areas such as separation of powers, where the same individual should not be responsible for store keeping, accounting, and inventories and auditing. For more details on this section refer to ISACS 5.20.

Stockpile inventories should cover:

i. Spot checks by those not involved in storage or accountability
ii. Matching with records
iii. Reviews for accuracy and authorized recipients
iv. Loss reporting systems

As an important feature of stockpile management, accurate inventory should concentrate on the following:

a) Having an overall inventory policy
b) Undertaking concurrent inventories with reconciliations
c) Executing cyclic/random inventories
d) Having authorized and verified personnel to undertake inventory
e) Undertaking independent verification of the inventory
f) Resolving discrepancy in outcomes
g) Having backup documentation in different locations.
h) Subjecting inventory reports to independent bodies.

CHAPTER SEVETEEN

17.0 TRANSPORT OF ARMS, AMMUN ITION AND EXPLOSIVES

17.1 Introduction

This topic is intended to enable readers and practitioners to understand the common safety and security considerations for transportation of Arms, Ammunitions and Explosives and also recognize the requirements for transportation of Arms, Ammunitions and Explosives (by road, rail, water and air).

The transportation of arms, ammunition and explosives is the movement or carriage from one location to another using various means of transportation using either land, sea or air. It is regulated to prevent accidents that could lead to damage to the environment or loss of lives and property. The United Nations has developed mechanisms of hazard classification for safe transport conditions. For more information, refer to Reference: IATG 8.10.

If every country had different regulations for different modes of transport, the international movement for arms, ammunition and explosives would be seriously impeded, to the point where it could be unsafe. The United Nations has developed mechanism to ensure consistency between various regulatory systems. This harmonizes the criteria for hazard classification for ammunition and explosives in terms of transportation. *Its worthy noting that there is a high probability of ammunition accidents occuring during movement and handling than when in storage. Therefore special attention should be given to the transportation process.*

17.2 Security

SALW and ammution is "exposed" to theft while outside storage facilities. Ammunition is considered a hazardous material (HAZMAT) during shipment. Such shipments may be regulated by a different set of national and international directives, however security should always be emphasized.

17.3 Safety

To ensure safety of Ammunition during transportation, its mandatory to perform a risk assessment to (*Reference: IATG 8.10: Transport of Ammunition):*

a) Ensure that the ammunition is inspected by a technical team before transportion
b) Inspect ammo packages for damage

c) Check for shelf-life details as ammunition that has outlived their shelve life is more sensitive and has more transportation constraints and

d) Vehicles transporting ammunition MUST be serviceable and refuelled before loading.

17.4 Documentation

a) Details of what is being transported . This includes *Nature, Quantities, Lot numbers and Serial Numbers* as applicable which MUST BE clearly indicated in the documents accompanying the consignment.

b) A copy of the above must be signed by the person in charge of the transportation with one copy accompanying the cargo while the other is left at the HQS.

c) Transportation documents MUST be filled without alterations. Information contained in the documents must be kept secret and the physical documents must be secured at all times.

17.5 Marking

a) Packaging MUST be properly marked with identifiable marks of the ammunition or arms.

b) Placards can be displayed where applicable.

c) Maintain original packages where possible.

17.6 General Considerations During Transportation Process

Good transportation planning practices are essential as they reduce the risks associated with the transportation of arms and ammunition. Please remember that lack of proper planning can lead to safety and security concerns. Below are the general considerations to be noted:

a) Ammunition and weapons are always at risk of theft. They must have a 24 hour, 7 day a week security.

b) Protect the advance planning information. Classification could be an effective option. Share information with the smallest number of individuals as possible.

c) Conduct a complete risk assessment of the shipment in order to develop a security plan.

d) Use random routing and travel times to reduce the predictability of the transportation operation.

e) Accountability needs to be simple and understood by all.

f) Training in and practice of this process will help to make it easier to accomplish the transportation task.

g) Vehicles used for transportation should be serviceable and the engines should be switched off during loading and offloading.

h) Drivers should be competent and well trained in driving that type of vehicle and also well informed on the risks posed by moving arms and ammunition.

i) The drivers should also be aware of the procedures to take in the event of an accident.

j) Effective cargo and shipment verification, along with an inspection process can help eliminate illicit transfers.

k) When moving weapons and ammunition, they should be carried in separate vehicles.

l) If possible, disable weapons and move components separately.

m) Weapons should be secured within the transporting vehicle.

n) Determine Material Handling Equipment (MHE) and personnel requirements

o) Estimate the amount of time to handle, inspect, load, secure, and document the process.

p) Establish a safe and secure route from where the shipment begins to its final destination. The convoy should AVOID bridges, tunnels, geographic considerations and populated areas.

Diagram 51: The above photo shows fallen unsecured Ammo boxes during transportation

The inspection of military or commercial vehicles carrying ammunition should occur:

a) At the entry of the vehicles into the Ammunitionand weapon operational/storage area
b) Prior to loading the vehicles
c) The area where the inspection is done should be away from other hazardous sites or populated areas.

CHAPTER EIGHTEEN

18.0 SMALL ARMS AND LIGHT WEAPONS MARKING AND TRACING

This topic is intended to enable readers and practitioners to understand the concept of marking of firearms, importance of marking and know the different technologies (strengths and limitations) used in marking of firearms.

18.1 Definition of Terms

Marking refers to unique marks applied to a weapon to enable its identification among potentially millions of similar weapons. That is, putting a form of traceability on an item. Marking is not *stickers, labels or tags*. These are forms of identification – NOT item specific marking!

Tracing refers to the systematic tracking of firearms from their point of manufacture through their lines of supply to their last legal title holders. The ITI defines tracing as the systematic tracking of illicit SALW found or seized on the territory of a State from the point of manufacture or the point of importation through the lines of supply to the point at which they became illicit (Art. 5 of the International Tracing Instrument).

18.2 Learning Objectives

The following are the objectives of learning SALW marking and tracing:

a) To explain the international and regional normative framework on marking
b) To comprehend the International Marking Standards.
c) To apply the marking techniques and technologies
d) To understand record keeping and its challenges.

18.3 Why we mark Firearms

There are three broad advantages of marking. These are;

a) Marking facilitates proper identification,

b) Marking facilitates easy traceability, and

c) Marking improves individual and institutional accountability.

Below are some of the advantages of marking as per institution:

i. To the Police, marking helps in traceability of crime guns
ii. To the Society, marking helps in enforcing accountability – who, when?
iii. To the manufactures, marking helps in inventory management and warranty issues
iv. To the user, marking helps in establishing ownership and transfers
v. To institutions, marking is useful in inventory control
vi. To courts, marking gives prosecution evidence

18.4 Marking Technologies

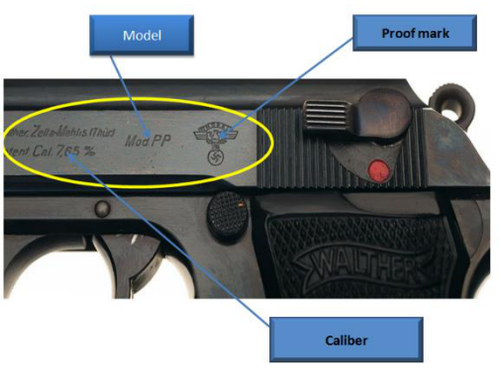
There are different marking technologies that can be used in the marking of firearms. However, the following factors must be considered when choosing a marking technology.

a) Ability to mark different materials (Metal, Plastic)
b) Recoverability of the mark in case of alteration or defacing
c) Damage risk assessment – not to tamper with the internal functioning of a firearm
d) Marking speed and marking rate
e) Cost including maintenance requirements

18.4.1 Types of Marking Technologies

The following are the various types of marking technologies

a) Stamping (Press & Roll marking)- These leave a permanent deformation of the structure of the material being marked.



b) **Dot Peen/ Micro-percussion-** This like stamping also leaves a deformation in the material by imprinting a series of individual dots.

c) **Mechanical Engraving** – Unlike stamping and dot peen marking that deforms the material, mechanical engraving removes the material of the part being marked.

d) **Laser Engraving-** This is based on a focused laser beam that removes material from the component without requiring physical contact.

e) **Radio frequency identification** – This method uses an electronic chip embedded in a weapon that carries information about the weapon. These electronic chips can be read from a certain distance using an RFID reader and if needed information on the chip can be modified.

The Table below highlights the strengths and limitations of the various types of technologies

Technology	Strengths	Limitations
Stamping	▪ Low Price ▪ High chances of recoverability	▪ Cant mark plastics ▪ Not good for post manufacture marking
Dot Peen	▪ High Speed ▪ Low Price ▪ Low stress on components ▪ High chances of recoverability	▪ Very noisy process ▪ Need locking system ▪ Not optimal on plastics

Mechanical Engraving	▪ High quality of the mark ▪ Quiet process	▪ Relatively Low speed ▪ Need locking system ▪ Not optimal on plastics ▪ Hard to recover marks
Laser Engraving	▪ High speed ▪ High quality of the mark ▪ Marks both Metals & Plastics ▪ No physical contact with component	▪ High Price ▪ Low chances of recoverability ▪ Special safety requirements
Radio frequency	▪ Easy to conceal	▪ Very expensive ▪ Needs other technologies for it to function

18.4.2 RECSA Preferred Marking Machine

The machine commonly used in the RECSA region is the **Couth Mc 2000 Marking Machine**. It uses the *Dot Pin marking technology* and it is preferred because of the following reasons.

a) Portable and very handy.
b) Does not interfere with the normal functioning of the firearm- dot peen marking.
c) Compatible with computer hardware and software.
d) Marks numerically and bar code consecutively.
e) High speed of marking (12 characters per sec.).
f) Machine is conducive given the infrastructural conditions of RECSA Countries.

Diagram 52: HE the Vice President of the United Republic of Tanzania witnessing a marking exercise

The International Marking Standards require that the following information (easily seen and interpreted) be captured when marking SALW. (For more information refer to ISACS 05.30, Art 7 Nairobi Protocol, and Chapter 1 of the Best Practice Guidelines for Implementation of the Nairobi Protocol).

a) Country of origin.

b) Name of the manufacturer.

c) A unique serial number.

d) Weapon type and model.

18.5 Record Keeping

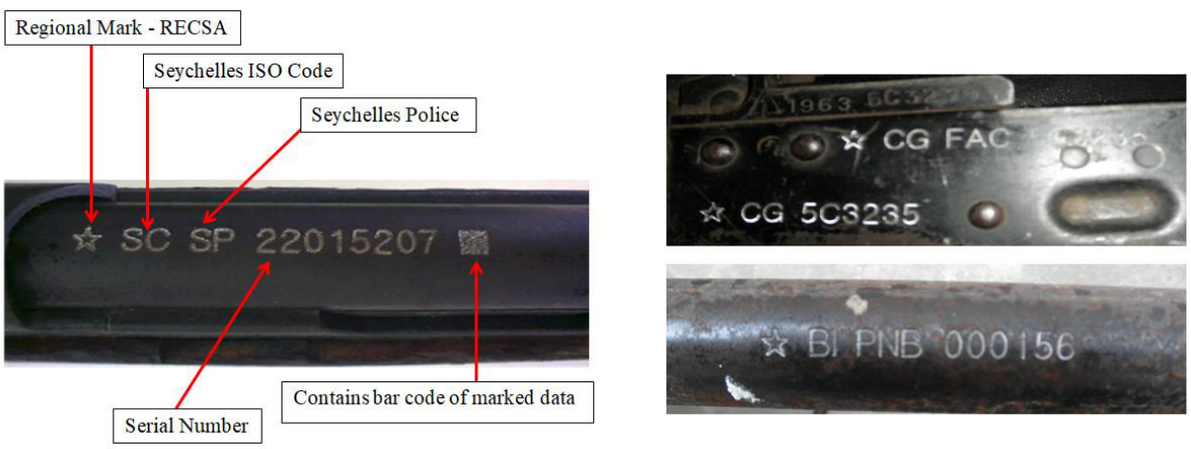
Record keeping is the process of documenting and storage of information whether manually or electronically. Record keeping is an essential prerequisite for limiting the illicit proliferation of SALW. A robust record keeping system provides the necessary means to trace firearms and investigate the illicit trade. Therefore, the marking of SALW is a necessary component of the record keeping as it links a specific SALW to a unique record of that item. Properly kept records assist in answering questions related to *history, production, ownership, distribution and transfers*. It is highly recommended that records on SALW are *automated, centralized, validated*

and accessible. Automation of SALW records enables users to retrieve information in a timely and reliable manner and also to fulfill obligations related to the periods of maintaining such records. (For more information, refer to ISACS 05.30 and Art 7 of the Nairobi Protocol).

18.6 Legal Framework of Marking Firearms in the RECSA Region

The legal framework for arms making under the Nairobi Protocol is provided for under Article 7. States Parties undertake to mark each small arm and light weapon with a unique mark. The Unique mark is: ISO country code and serial number. The photo below is for the firearms belonging to Seychelles Police.

Diagram 53: Illustration of RECSA Region Markings



The table below shows the ISO codes for RECSA Member States

S/n	Member State	ISO Code
1.	Burundi	BI
2.	Central Africa Republic	CF
3.	Republic of Congo	CG
4.	DRC	CD
5.	Djibouti	DJ
6.	Eritrea	ER
7.	Ethiopia	ET
8.	Kenya	KE
9.	Rwanda	RW

10.	Somalia	SO
11.	Sudan	SD
12.	South Sudan	SS
13.	Seychelles	SC
14.	Tanzania	TZ
15.	Uganda	UG

18.7 Marking Administrative Structure

This is an inter-agency team set up to guide the marking exercise in the country and they perform the following roles:

i. Planning marking programs
ii. Assessing existing resources & marking capacity
iii. Stocktaking of existing firearms
iv. Ensuring sustainability of marking & record keeping programs
v. Promotion of team work among armed agencies
vi. Regular reporting to Government
vii. Production of marking schedules and resource mobilization

Marking of firearms therefore requires comprehensive planning including stock taking and forecasting of necessary resources and capacity must precede any marking and record keeping initiative. *Marking, record keeping and establishing procedures for tracing SALW are three mutually dependent elements* and should be treated as such for effective results. Marking and record keeping exercises are a responsibility of respective national governments and as such they must commit funds to these noble issues. It is imperative to establish administrative marking structures to guide national marking exercises and piloting on geographical areas.

CHAPTER NINETEEN

19.0 STOCKPILE ELIMINATION

19.1 Introduction

This topic is intended to enable readers and practitioners to understand the importance of destruction of surplus ammunition and firearms, know the general factors to be considered for elimination of Ammunition and firearms and know the different methods/techniques of stockpile elimination.

Stockpile elimination is the process of final conversion of weapons, ammunition and explosives into an inert state so that they can no longer function. In the context, therefore, stockpile elimination refers to the act of destroying munitions or otherwise neutralizing their military potential. This process must be conducted in a *safe, cost effective, practical and environmentally responsible manner*.

The major reasons for stockpile elimination are:

a) Technical reasons (obsolete and or unable to repair)
b) Excess stocks/surplus
c) National counter proliferation efforts.

19.2 Common Terms Used in Stockpile Elimination

a. **Demilitarization.** This refers to the complete range of processes that render weapons, ammunition and explosives unfit for their originally intended purpose. Demilitarization not only involves the final destruction process but also includes all of the other transport, storage, accounting and pre-processing operations that are equally as critical to achieving the final result.
b. **Destruction.** This refers to the process of final conversion of weapons, ammunition and explosives into an inert state so that it can no longer function as designed.
c. **Disposal.** This refers to the removal of ammunition and explosives from a stockpile by the utilization of a variety of methods that may not necessarily involve destruction.

19.3 Framework for Stockpile Elimination

a) **Anti-Personnel Landmine Ban Convention (Ottawa Convention 1997)** – requires each SP to undertake to destroy or ensure the destruction of all stockpiled anti-personnel mines it owns or possesses, or that are under its jurisdiction or control.

b) **Convention on Cluster Munitions (Dublin 2008) -** requires that SPs shall destroy or ensure the destruction of all cluster munitions.

c) **UN Firearms Protocol (2005) requires** that SPs that have ratified the treaty shall adopt, within their domestic legal systems, such measures as may be necessary to prevent illicitly manufactured and trafficked firearms, parts and components and ammunition from falling into the hands of unauthorized persons by seizing and destroying such firearms, their parts and components and ammunition.

19.4 International Instruments (Environmental)

Ammunition and explosives are considered to be hazardous or industrial waste and as such fall under the remit of international treaties that have been signed and ratified:

a. The London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 29 December 1972;

b. The 1996 Protocol to the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (Amended 2006); and

c. The Convention for the Protection of the Marine Environment of the North-East Atlantic, 1998, also known as the OSPAR Convention. Ammunition and explosives shall therefore not be dumped at sea.

19.5 Disposal Options

There are six traditional methods for disposing of surplus and or obsolete weapons and Ammunition as per the table below:

Method	Explanation	Advantages	Disadvantages
Sale or Gift	Ammunition is either sold or gifted to another	Cheap for the donor country.	▪ Old Ammunition is unattractive to reputable end-users (state actors). ▪ Ammunition may not be

Method	Explanation	Advantages	Disadvantages
	country.		legal to move in accordance with international instruments and manufacturers' authorization. ▪ Transfers the eventual destruction problem to another location.
Consumed in training	Live firing is significantly increased during training of security forces.	▪ Makes cost effective use of the ammunition. ▪ Improved training standards in security forces.	▪ -Additional wear takes place on gun barrels, which will not last long enough to destroy significant stockpiles. Hence additional costs in barrel replacements. ▪ Could negate confidence and security measures between neighboring States. ▪ Only limited stocks could realistically be destroyed this way ▪ Larger caliber ammunition will require large training areas, which are often unavailable. ▪ Disposal of fuzzed Ammunition may lead to a higher incidence of "blinds", resulting in an increase in the need for Explosive Ordnance Disposal (EOD) action on ranges.
Deep Sea Dumping	The dumping of ammunition in deep water at sea in coastal or international waters.	Cost effective. Relatively quick.	▪ Banned by international treaty. ▪ Long-term environmental impact of decaying ammunition on seabed. ▪ Previous shallow water dumping has led to pollution and dangerous munitions

Method	Explanation	Advantages	Disadvantages
			being washed ashore.
Disposal by Landfill	The shallow or deep burial of ammunition and explosives.	Cost effective. Relatively quick.	▪ Long-term environmental impact of decaying ▪ There may be long term risks of spontaneous explosion due to degradation of safety mechanisms and chemical deterioration of the propellant and explosive content. ▪ Restricts future use of land for development.
Destruction / Demilitarization	The physical destruction of ammunition, or the use of industrial processes to demilitarize ammunition and recover raw materials for reuse and recycling.	▪ Proven technologies exist. ▪ Guarantees destruction or demilitarization. ▪ Can make effective use of recovery, reuse and recycling of components and materials.	▪ Can be expensive.

19.6 Factors to Consider in Stockpile Disposal

There are a wide range of factors that will determine the overall ammunition demilitarization or destruction plan as outlined below:

a) **National legislation -** National environmental legislation shall dictate the emission levels to be met which will in turn dictate the type of technology required to meet these emission levels.

b) **Knowledge of Ammunition design -** The stability in storage and degradation or deterioration rates of the explosive content should influence the degree of urgency for disposal, type of transport that can safely be used and destruction/demilitarization methodology.

c) **Quantity for disposal.** The most influential factor is likely to be economies of scale, in that the more ammunition that is requiring demilitarization or destruction, the larger the economies of scale and, therefore, the wider range of available technology at an affordable price.

d) **Safety**. Lack of resources, time pressure and other constraints must never imply that safety would not have the highest priority in any destruction operation. The presence of explosive ordnance and the use of industrial equipment in many cases would call for extra vigilance.

e) **Security.** Every effort should be taken to ensure the physical security of ammunition during storage, transportation and processing in accordance with the requirements of IATG 08.10.

f) **Logistic factors.** The demilitarization or destruction of ammunition stockpiles is primarily a logistics problem. The technology exists to destroy the vast majority of ammunition types, yet, the major phases of the demilitarization/destruction cycle involve logistics. The demilitarization or destruction methodology should be dependent on logistic factors such as: the availability of suitably qualified and trained manpower, location and type of ranges and demolition grounds, distance from storage to demilitarization facilities, the availability of transport, and the availability of water supply, power etc.

g) **Transport of Ammunition -** Ammunition should be transported in accordance with the requirements of IATG 08.10.

h) **Transparency and accounting -** The transparency of the demilitarization or destruction programme is an important security and confidence building measure especially for firearms arising out of civilian disarmament programmes. International organizations, national ambassadors, media and nongovernmental organizations (NGO) should be invited to witness the destruction process.

19.7 Priority for Demilitarization or Destruction

The demilitarization and destruction of surplus ammunition stockpiles in countries that do not currently adopt a 'whole life management' approach to stockpile management does not often follow logical destruction priorities. Small arms and ammunition often has priority as donors have budgets to support the demilitarization or destruction of these particular natures. The hazards that the nature of certain ammunition present to local communities and the associated

large costs of destruction mean that States shall determine demilitarization or destruction priorities as indicated in the table below:

Priority	Ammunition	Remarks
Priority 1	Ammunition that poses the greatest risks to the civilian community in terms of explosive safety	• This will usually be specific types of Ammunition stored in a stockpile very close to the civilian settlement. • This ammunition can be identified by surveillance (chemical analysis and visual inspection) and proof (performance) as part of ongoing stockpile management processes.
	Ammunition that is attractive to Criminal and Terrorist Organizations (ACTO).	• Detonators, Shoulder Launched Anti-tank Rockets • Man Portable Air Defence Systems (MANPADS), Bulk Explosives etc.
Priority 2	Ammunition that must be destroyed in order to meet treaty obligations	• Anti-Personnel Mines and Cluster Munitions.
	Small Arms Ammunition.	• <20mm calibre. • Classed as Priority 2 as an Armed Violence Prevention (AVP) matter. The proliferation of this ammunition is particularly undesirable.
Priority 3	Ammunition that needs to be destroyed to release storage space.	• Usually as part of security sector reform and downsizing of armed forces.
	Remaining ammunition types.	• May be done in order of ease of destruction.

19.8 Destruction Categories

There are two SALW-related categories to consider when selecting a destruction method (weapons and Ammunition):

a) Weapons are essentially inert objects and can be destroyed using normal industrial processes for the material involved. Workers will not need to be skilled in a particular trade and can be trained to accomplish destruction in a short time.

b) Ammunition and explosives contain energetic material and require specialized equipment or a secluded and protected area. The workers require extensive training and must be properly skilled to perform their duties.

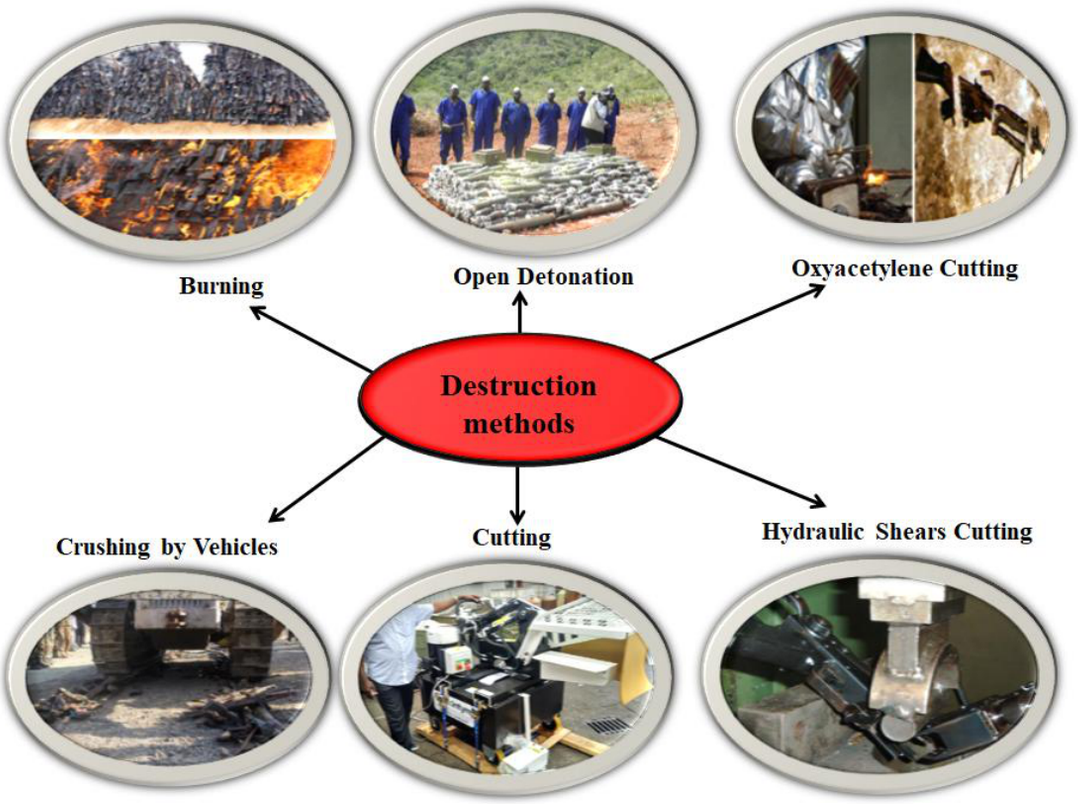
19.9 Methods of Destruction

There are various destruction techniques for SALW as highlighted below:

a) Smelting and recycling (the use of industrial steel smelting facilities to melt down complete processed weapons).
b) Band saw (the use of industrial band saws to cut SALW into unusable pieces).
c) Burning (the destruction of SALW by open burning using fuel substances).
d) Cementing (cast weapons into cement blocks).
e) Crushing by Armored Fighting Vehicles (AFVs) – (the use of AFVs to run over and crush the SALW.
f) Cutting (either by oxyacetylene, ox gasoline or Plasma cutting) – the use of high temperature technology to render the SALW inoperable.
g) Cutting by hydraulic shears – the use of hydraulic crushing and cutting systems
h) Deep sea dumping – the dumping at sea in deep ocean trenches.
i) Detonation – the destruction of SALW by detonation using high explosives.
j) Shredding – the use of industrial metal shredding technology

For more details on advantages and disadvantages of the above methods, please refer to Chapter 1 of the Best Practice Guideline for the Implementation of the Nairobi Protocol.

Diagram 54: Different methods of demolition/destruction



19.10 Destruction of Ammunition

There are various methods for destroying Ammunitions as outlined below:

a. **Firing**: This method is best suited for small quantities of similar SAA types. It is advantageous because it leaves only empty cases to dispose off. However, the method could cause confusion or distress in a post-conflict environment and it is not suited for large quantities.

b. **Burning using an improvised incinerator:** This method is also best suited for small to medium quantities of mixed SAA types, damaged,

old or poorly maintained SAA stocks and loose SAA rounds. It is not suitable for large quantities of SAA still in factory packaging.

Advantages

a) Requires very little equipment
b) Does not require much manual effort
c) If properly conducted is 100 per cent effective
d) Mobile

Disadvantages

a) Requires a long cooling-down period before verification of total destruction can take place.
b) Produces a dense cloud of smoke

19.11 Destruction of Rockets, Missiles, Shells, Mortars and Grenades

The quantity and the condition of the ammunition surrendered will be major factors in determining exactly how and when they are going to be destroyed. Destruction by detonation offers the most complete solution to munitions in a post-conflict environment, but it must be very carefully coordinated to ensure that it is achieved in the safest, most efficient and sensitive way possible.

a. Open Detonation

This form of destruction by detonation is the most common and the easiest to arrange. As the name implies, the munitions to be destroyed are placed in an open pit and demolition charges are added. The pit may be man-made or naturally occurring and is sometimes back-filled or tamped to arrest the flight of fragments and to cut down on noise.

b. Industrial Demilitarization (LEVELS 2 and 3)

Industrial demilitarization of ammunition combines the skills of mechanical, production, chemical and explosives engineering and is a highly specialist operation to plan. Appropriate technical advice should be taken before planning and developing such an activity. Industrial scale demilitarization has significant advantages:

a) Mechanical disassembly using machines, thereby increasing operational efficiency and also reducing risk to personnel;
b) Destruction (usually incineration) in environmentally controlled systems; and
c) The ability to operate 24 hours a day, up to 365 days a year.

Photo above of Ammunitions being subjected to liquid nitrogen, and after (becomes brittle)

Major disadvantages of industrial demilitarization are the high costs of design, project management, construction and commissioning among others.

Cryogenic Fracturing

This technique was developed for the demilitarization of chemical munitions. The ammunition is cooled down in a container filled with liquid nitrogen. Due to the low temperature the chemical warfare agent in the projectiles cannot evaporate so the metal fragments and the chemical agent are treated in a special furnace with exhaust cleaning.

19.12 Explosive Removal

Technology is often required to remove the explosive filling from the metal body of the ammunition after initial pre-processing. (Although explosive removal can be considered as a pre-processing operation, it is also a major industrial process in terms of improving the recycling and re-use of military explosives for commercial use.

The Table Summarizes the Technology Options for Explosive Removal

Technology	Remarks
Hot steam/water melt out **(LEVEL 2)**	• Hot water or steam is used to melt out TNT and TNT derivative (TNT/RDX) fillings, which melt at approximately 800C. • Conversely RDX melts at 2060C and therefore RDX filled munitions are not suitable for this technique. • The waste explosive is then often reprocessed and used in commercial blasting explosives. • Can also be used for white phosphorus ammunition if the process is all done under water. • The ammunition body will require further processing as a thin residue of explosive will remain.
Water jet washout **(LEVEL 3)**	• High pressure water is focused on the explosive, which is then washed out of the ammunition body using a rotating nozzle. • Suitable for RDX and PBX25 Ammunition. • Requires a waste water treatment facility to prevent ground water pollution.
Solvent washout **(LEVEL 3)**	• Uses a solvent that will easily dissolve the explosive, which is then extracted and reprocessed. (Methyl alcohol, methylene chloride, acetone or toluene are options). • Large quantities of solvent are required and it is not a cheap process. • It is best considered when high value explosive such as HMX needs recovering for re-use.

14.13 Post Project Review

It is important to undertake a post destruction review exercise to assess the successes and failures to inform future destruction exercises.

CHAPTER TWENTY
20.0 STOCKPILE INVENTORY MANAGEMENT

20.1 Introduction

This topic is intended to enable readers and practitioners know why we should undertake stockpile inventory and know how to organize and conduct an inventory.

The term inventory management refers to the system and processes that identify stockpile requirements, the condition of the stockpile, provide replenishment options and report actual and projected inventory status. It also covers procedures that are designed to record, numerically monitor, verify issue and receive stockpiles (IATG 03.10).

The safe, effective management of ammunition stockpiles and explosives is essential for safety, security and also for operational effectiveness. Ammunition production lead times and national security commitments mean that it must be procured in advance for it to be available for use. This comes at a cost meaning that the inventory management systems should not only be capable of accounting for ammunition only but should also be designed to ensure that the best value for money is achieved. Efficient logistic and operational processes improve stockpile security, optimize safety and also reduce illicit proliferation or theft hence identifying losses.

Inadequate ammunition stockpile management and storage conditions result in the deterioration of ammunition leading to unsafe environment for personnel and assets. In order to effectively manage ammunition stockpiles, there must be a base understanding of the principles of stockpile management.

20.2 Learning Objectives

The objectives of learning stockpile inventory management are as follows:

a) Understand reasons for inventory management.
b) Review types of inventories.
c) Review conduct of an inventory.
d) Review benefits of an inventory.

20.3 Reasons for Inventory Management

An inventory will be triggered by identification of a problem in the stockpile such as:

a) Surplus quantities
b) Deficiencies
c) Unknown quantities
d) Unknown locations

Inventory/stock taking is conducted for the reasons below:

a) Verify condition and quantities of ammunition in storage.
b) Identify obsolete/expired/damaged ammunition.
c) Detect missing/surplus ammunition.

20.4 Types of Inventory

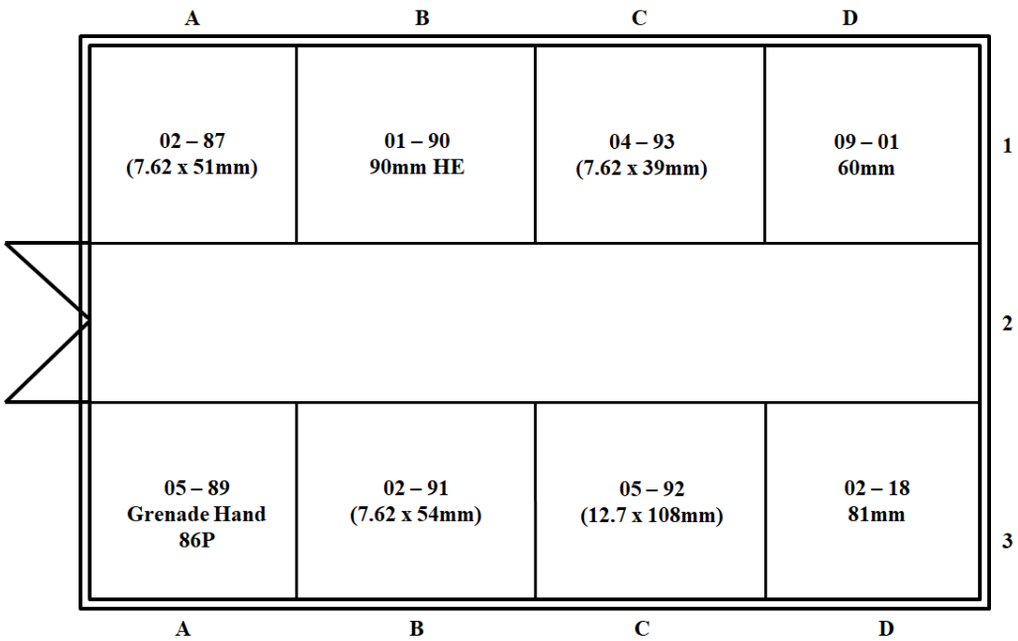
Inventory types include:

a) Cyclic.
b) Annual.
c) Spontaneous.

20.5 Conduct of an Inventory

This is usually conducted by a team which could be split into smaller groups. The team should not have prior knowledge of the quantities to be verified and also should not access the inventory system in existence. This is to ensure thoroughness and validity of the quantities during the conduct of the exercise. A quality control team is constituted to clear any anomalies should they arise at the end. The teams are guided by the storehouse map provided to execute the inventory.

Conducting the Inventory: Storehouse Map



Conducting the Inventory: Quality Control

Description	Year /Lot Number	Magazine	Team 1	Team 2	QC	Total Quantity
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Rounds 90mm HE	01 – 87	ESH 11	700	700	700	700
Rounds 105mm HE	08 – 89	ESH 5	1450	1400	1450	1450
Rounds 155mm HE	04 – 91	ESH 7	2000	2000	2000	2000
Bombs 120mm SMK WP	07 – 95	ESH 2	1500	1500	1500	1500
Rockets 57mm HE	10 – 01	ESH 9	800	800	800	800

Quality Check Team Reconciles the Figures of the Two Teams

20.6 Benefits of Undertaking Stockpile Inventories

In accordance with IATG 3.10, below are some of the benefits of undertaking stockpile inventories:

a) Safety in handling and transportation.

b) Performance and reliability.

c) Reduction in administrative costs.

d) Accuracy in Ammunition life – cycle planning.

e) Informed procurement planning.

CHAPTER TWENTY-ONE
16.0 MAN PORTABLE AIR DEFENSE SYSTEMS THREAT

21.1 Introduction

This topic is intended to enable readers and practitioners know what a MANPAD is, the history of MANPADs, be able to identify MANPADs and its components, know the threat of MANPADs and how to mitigate the threat.

Man Portable Air Defense Systems (MANPADS) are surface-to-air missile systems designed to be operated by either a single individual or a crew depending on the generation. Although there appears to be a decline of number of MANPADS, this does not necessarily imply a reduction in the MANPADS threat.

It should be noted that the threat of MANPADS today referred to here is expressly to MANPADS in the hands of non-state groups. And it is no surprise that MANPADS have become linked with terrorism which is the biggest threat to our society today. *The impact of a single successful MANPADS attack holds global implications*. They are easy to use, readily available on the black market, pose an imminent and acute threat to military aircraft and civilian airliners.

While addressing the Asia-Pacific Economic Cooperation Forum, former US Secretary of State Colin Powell warned that "*no threat is more serious to aviation*" than man-portable air defense systems (MANPADS). *Worst case scenario is terrorists attacking a modern civilian airliner*. There are hundreds of opportunities every day for a MANPADS attack.

MANPADS are easily portable (can be easily disassembled/assembled) and easy to conceal therefore posing a significant threat. A MANPADS attack could kill hundreds of people and cause substantial economic losses.

21.2 MANPADS Stockpile Estimates

The US Government estimates that approximately 500,000 – 750,000 MANPADS remain in stockpiles around the world, although it is difficult to estimate the number of operable systems.

21.3 History of MANPADS

The first recorded use of a MANPAD was around 500 BC.They were man portable, optical tracking, “fire and forget” kinetic energy operated. They were easily spoofed when target made severe course corrections. Funding and research problems hampered further development of MANPADS until the 1940’s. Borrowing from the concept of the simple and effective anti-tank *Panzerfaust*, an unguided multi-barreled 20mm rocket launcher, the *Fliegerfaust,* was developed by Germany in 1944. The weapon never reached mass production due to the end *of World War II*.

21.4 Types of MANPADS

MANPADS are easily differneted based on their generation (time and period of manufucture).

a) 1st Generation MANPADS

These were first deployed in the early 1960’s.They include among others Russian SA-7, Chinese HN-5 and U.S. Redeye.

Main Characteristics

a) They homed on heat source to get their targets.
b) They can be spoofed by flares fitted on aircrafts as a defence mechanism or the sun rays during the day.
c) They are currently obsolete.

b) 2nd Generation MANPADS

These were first deployed in the field in late 1970’s.They include Russian SA-14/16, Chinese FN-6 and U.S. Stinger.

c) 3rd Generation MANPADS

They were first deployed in the 1980’s. They include Russian SA-18 Grouse (Igla), French Mistral and U.S. Stinger B.

Main Characteristics

- All aspects of attack capability were considered.ie the use of (Infra-Red IR and Ultra-Violet rays UV)
- They could recognize and reject dispensed flares

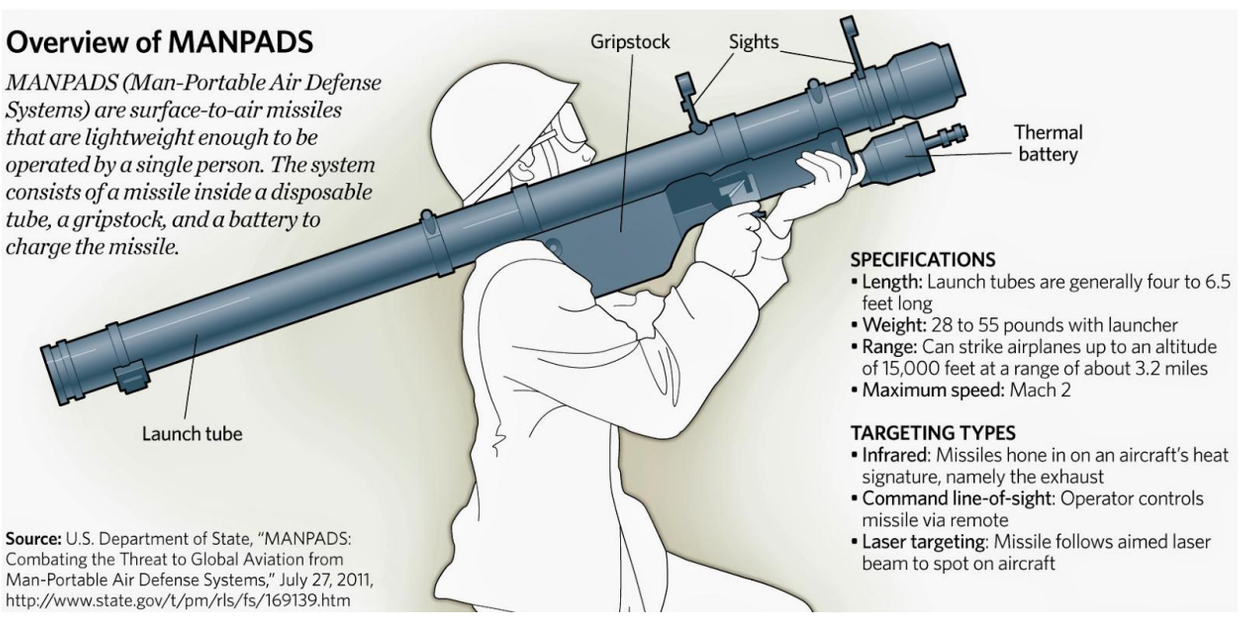
d) 4th Generation MANPADS

- These were first fielded in the 1990's. They include US Stinger- RMP, Russian SA-24 Grinch (Igla), French Mistral 2, South Korea KP-SAM Shin-Gung.
- All aspects of attack capability were considered.ie the use of (focal-plane array FPA guidance systems).
- They also have advanced sensor systems to permit engagement at greater ranges.

21.5 Components of a Typical MANPADS

The components of a typical MANPADS include launch tube, grip stock, sights and thermol battery as illustrated in the photo below.

Diagram 55: Parts of a MANPAD



There is a Thermal Battery is located towards the front of the system and this provides power to run the targeting system and also to activate the missile. There is also the arming and firing

mechanism, known as the gripstock. The IR seeker is the component that actually locates and tracks the target (located on the warhead). The warhead, typically less than 2kg of high-explosive, houses the flight motor and the eject motor.

21.6 Proliferation of MANPADS

The US Government estimates that approximately 500,000 – 750,000 MANPADS remain in stockpiles around the world, although it is difficult to estimate the number of operable systems.

MANPADS are attractive to terrorists and insurgents because they are:

a) **Lethal***:* Insurgent groups seek MANPADS because they are effective against attack helicopters and other aircraft that are used in counter-insurgency operations.
b) **Highly Portable and Concealable** - MANPADS are about 5 feet long and weigh approximately 30 to 40 pounds.They easily fit into the back of a truck or in a small boats.
c) **Inexpensive** - Early model MANPADS can be acquired on the black market for several thousand dollars. In exceptional circumstances, that price can drop to as low as a few hundred dollars.
d) **Easy to Operate** – with little training MANPADS are simple to operate (online videos are available). All the user has to do is visually acquire the target, and activate the automatic target lock and launch system by pulling the trigger**.**

21.7 Notable MANPADS Attacks

Since 1973, around 50 MANPADS attacks against civilian aircraft have occurred, mostly in Africa and Asia and resulted in almost 1,000 civilian deaths. A study projected that the direct costs of such an attack would approach $1 billion. The indirect economic costs, according to the study, would soar much higher. For example, if all U.S. airports stopped operating for one week after an attack, losses could climb past $3 billion. (Source: http://www.armscontrol.org/factsheets/manpads). The first recorded case of an attempted MANPADS attack against a civilian airplane was in Italy in 1973, orchestrated by the **Black September Palestinian Group.** The attack was foiled by the Italian security services before launch.

The first successful MANPADS attack against a civilian aircraft occurred in Sept. 3, 1978, when rebels of the Zimbabwe Peoples Revolution Army shot down Air Rhodesia Flight #825.
The MANPADS attack with arguably the most severe consequences was the 1994 downing of a plane carrying the presidents of Rwanda and Burundi. That attack initiated a war that killed more than 800,000 Rwandese.

Below is a list of notable MANPADS attacks:

i. **March 12, 1975:** A Douglas C-54D-5-DC passenger airliner, operated by Air Vietnam, crashed into Vietnamese territory after being hit by a MANPADS. All six crew members and 20 passengers were killed in the crash.
ii. **September 3, 1978:** An Air Rhodesia Vickers 782D Viscount Passenger airliner crash landed after being hit by a MANPADS fired by forces from the Zimbabwe Peoples Revolution Army. Four crew members and 34 of the 56 passengers were killed in the crash.
iii. **December 19, 1988:** Two Douglas DC-7 spray aircraft en-route from Senegal to Morocco, chartered by the U.S. Agency for International Development to eradicate locusts, were struck by MANPADS fired by POLISARIO militants in the Western Sahara. One DC-7 crashed killing all 5 crew members. The other DC-7 landed safely in Morocco.
iv. **September 22, 1993:** A Tupolev 154B aircraft operated by Trans air Georgia was shot down by Abkhazian separatist forces, crashed onto the runway and caught fire, killing 108.
v. **April 6, 1994:** A Dassault Mystère-Falcon 50 executive jet carrying the Presidents of Rwanda and Burundi and its French flight crew was shot down over Kigali, killing all aboard and sparking massive ethnic violence and regional conflict.
vi. **October 10, 1998:** A Boeing 727-30 Lignes Aeriennes Congolaises airliner was downed over the Democratic Republic of the Congo jungle by Tutsi militia, killing 41.
vii. **December 26, 1998:** A United Nations-chartered Lockheed C-130 Hercules transport was shot down over Angola by UNITA forces, killing 14.
viii. **January 2, 1999:** A United Nations Lockheed L-100-30 Hercules transport was shot down by UNITA forces in Angola, killing 9.
ix. **November 28, 2002:** Terrorists fired two MANPADS at an Arkia Airlines Boeing 757 -3E7 with 271 passengers and crew as it took off from Mombasa, Kenya. Both missiles missed.

x. **November 22, 2003:** A DHL Airbus A300B4-203F cargo jet transporting mail in Iraq was struck and damaged by a MANPADS. Though hit in the left fuel tank, the plane was able to return to the Baghdad airport and land safely.

xi. **March 23, 2007:** A Transaviaexport Ilyushin 76TD cargo plane was shot down over Mogadishu, Somalia, killing the entire crew of 11.

21.8 Mitigating the Threat of Manpads

The Three Pillars:

Options for addressing the MANPADS threat can be divided into three general categories: *susceptibility reduction, vulnerability reduction, and non-proliferation*.

a) **Susceptibility reduction** involves measures designed to prevent MANPADS from hitting an aircraft. Measures under this include improved airport perimeter security (patrolling the areas around airports could help to detect and deter MANPADS attacks). Technical countermeasures would cover a variety of protective systems designed to detect and foil MANPADS attacks against an aircraft.

b) **Vulnerability reduction** focuses on improving aircraft survivability in the event of a MANPADS hit. Vulnerability reduction involves designing or modifying the aircraft to increase the chance of survival in the event of a successful MANPADS hit, and is accomplished through: redundancy and separation of flight controls and hydraulic systems, improved fire and explosion suppression systems, installation of fuel shut-off valves or self-sealing fuel lines, hardening of vital areas that are vulnerable to external (MANPADS) threats.

c) **Non-proliferation** is aimed at preventing the acquisition and use of MANPADS by problematic end-users (e.g. criminal and terrorist organizations). Evolution in MANPADS technologies is making these weapons more lethal and better able to overcome the countermeasures identified above. To ensure that protective systems installed on aircraft today are not rendered obsolete by terrorist acquisition of next generation MANPADS tomorrow, the international community must act decisively to improve stockpile security and strengthen export controls in countries that import and manufacture MANPADs. For more information on MANPADS stockpile management, refer to: IATG 3.30.

The Wassenaar Arrangement's (WA) Elements for Export Controls of MANPADS - The agreement discourages MANPADS transfers to end-users other than states, and to governments that are unwilling or unable to protect against theft, loss, misuse, or diversion of the MANPADS themselves or related technical information. It also identifies several safeguards that importing governments should implement, *including storing the firing mechanism and the missile in separate locations, taking monthly inventories* of imported MANPADs, and re-exporting imported systems only after receiving prior consent from the exporting government.

The measures in each category are not mutually exclusive, and none alone will eliminate the threat posed by MANPADS to civilian aircraft. However, a coordinated strategy that incorporates measures from all three categories can reduce the likelihood of a successful attack.

21.9 How to Identify and Rate Possible Launch Sites (PLS)

It is important to note that the potentially affected zones around airports, subject to a MANPADS attack, are areas about 25 miles in either direction from a runway and about 6 miles wide and to an altitude of 12,000 feet (4000 meters). These areas should be monitored and consideration may include but not limited to:

i. Near departure corridors of Aircrafts
ii. Free or un controlled spaces or buildings close to airport (within 6.4 km)
iii. Anywhere within clear line of site
iv. Situations of extended target (Aircraft) exposure

Mitigation for Possible Launch Sites

The following measures should be put in place

i. Develop a Contingency Plan to cover the worst case scenario
ii. Level of action based on the current threat
iii. Establish effective inter-agency communication
iv. Carryout MANPADS awareness training for security personnel and civilians
v. There should be increased random patrols of high risk areas
vi. Re-assess and review of the action plans frequently

21.10 MANPADS Storage

The following should be considered in storage of MANPADS

a) Secure storehouses (preferably on secure military bases with suitable fences, with guards and alarms/dogs etc)
b) Prioritizing of funds/assets in order to achieve above
c) Missiles and grip-stocks should be stored separately
d) Components should only be brought together and assembled;
    i. In event of hostilities
    ii. Imminent hostilities.
    iii. For scheduled training or Batch testing.
    iv. When deployed as part of rapid reaction defence.

21.11 Disposal of MANPADS

There are several reasons for disposing MANPADS as listed below. For more information refet to Reference: IATG 10.10.

Reasons for Disposal of a MANPAD

a) Surplus military stocks
b) Technical reasons: either they are unserviceable, beyond repair
c) Law enforcement confiscations (captured weapons)
d) Conflict termination (civilian turn-ins)
e) National policy to conter-proliferation of MANPADS

Summary

i. The risk of MANPADS cannot be eliminated; it must be managed!
ii. Non-proliferation, counter-terrorism and aviation security jointly constitute the most effective means of countering the MANPADS threat.
iii. International, regional and national cooperation is vital in mitigating MANPADS threats.

CHAPTER TWENTY-TWO

22.0 IMPROVISED EXPLOSIVE DEVICE (IED) AWARENESS

22.1 Introduction

This topic is intended to enable readers and practitioners understand what an IED is, its components, types and effects of IEDs and counter IED principles with the objective of raising awareness on the same.

Raising public awareness involves creating a specific messaging campaign about a particular issue. It is an important part of developing community support for desired changes. In the case of IEDs, every poorly managed ammunition stockpile could lead to proliferation of ammunition and explosives into the hands of non-state actors and therefore directly or indirectly fuel criminal and terrorist activities through the provision of military materials for making the IEDs. This sub-section is intended to raise awareness to PSSM practitioners to mitigate the risks associated with poorly managed ammunition stockpiles.

22.2 Definition of IED

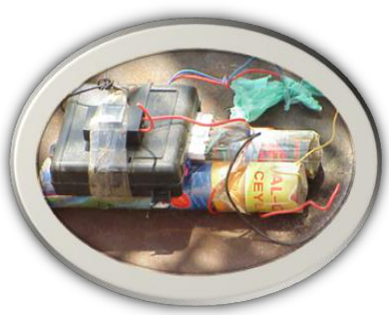
An IED is a device fabricated in an improvised manner, incorporating destructive, lethal, noxious, pyrotechnic, or incendiary chemicals and designed to destroy, incapacitate, harass or distract. It may incorporate military stores (conventional ammunition), but is normally devised using non-military components such as commercial explosives or home-made explosives (HME).

22.3 IED Components

IEDs are constructed with five basic components and may or may not include enhancements: The five *components* are:

Main charge (explosive)

1. Initiator (detonator)
2. Power source (battery)
3. Switch (activator)
4. Container or casing (body)



An example of an IED in a plastic Container

Main charge (explosive) –The main charge can be either from military explosives, commercial explosives or Home Made Explosives (HME).

Initiator (detonator) – The initiator can either be the electric or non-electric blasting cap.

Power Source (battery) – The common IED power sources encountered include household batteries or battery packs, vehicle batteries.

Switch (activator) – There are three methods of functioning IEDs. These are; time, command and victim activated.

Containers or Casings (body)– Anything can be used as a case or container as long as it holds the main charge. Military ordnance in the past was the most common casing encountered, however, common domestic households and industrial items and materials are becoming more and more prevalent. Casing material is limited only by what is available to the IED maker.

Enhancements- They include among others; fuel (powdered metals, gas) and fragmentation (nails, scrap metals).

22.4 Types of IEDs

a) Time
b) Command
c) Victim operated (VO)

Time – Time IEDs are designed to function after a preset delay, allowing the insurgents to make their escape or to target forces known to follow set patterns. There are various types including: burning fuse, mechanical timers, electronic time clocks and homemade timer circuits.

Command – Command IEDs use a direct link between the firing point and the explosive device (Line of Sight) and allow the insurgent to choose the precise moment of initiation. They are often used against targets that have previously set patterns, but are also used against targets of opportunity. The most common types include Command Wire (CW-IED) and Radio Controlled (RC-IED).

a) **Command Wire IEDs** – Require insurgents to position a trigger man in relative proximity to the main charge. *Be on the lookout for potential trigger men and other suspicious activity.* A common enemy Tactics, Techniques and Procedures (TTP) is for insurgents to place a secondary IED near the primary device, buried under the command wire. Tracing out the command wire may lead you into the kill zone of the secondary device. **REMEMBER**:

    i. DO NOT TRACE command wires – Leave it to specifically trained personnel, proficient in the proper TTPs to do so.
    ii. DO NOT CUT command wire – Collapsing circuits may be incorporated, resulting in detonation of the IED.
    iii. DO NOT PULL command wire – Pull/Trip type initiators may be incorporated, resulting in detonation of the IED.

b) **Radio Controlled IEDs** – Radio controlled devices are common switch mechanisms used to initiate IEDs. They provide increased stand off for the triggerman as well as allow accurate initiation timing.

Some of the most commonly used RC devices are: Two-way radios/Personal mobile radios, Long range cordless telephones, Mobile/cell telephones, Cordless telephones, Wireless doorbells, Keyless entry systems, Car alarms and Radio controlled toys.

Victim Operated IEDs – VOIEDs are emplaced so that the victim will carry out some form of action that will cause it to function. The various methods of initiation include: Pull/Trip, Pressure, Pressure release, Movement sensitive, Light sensitive and Range of electronic switches which include Passive and Active Infra-Red (PIR and AIR).

22.5 Counter IED Principles

a) **Maintain an Offensive Mindset** –Every leader must be prepared to rapidly develop the situation in order to remain on top of the situation.

b) **Stay Observant** – Most IEDs found before detonation have been located by the naked eye. Every security personnel should continuously scan their assigned sector in search of IED indicators.

c) **Develop and Maintain Situational Awareness** – Forces are to develop and maintain a heightened state of situational awareness (SA) while on patrol. Good SA is key to seeing, understanding and then acting on pre-attack indicators to deny the enemy the advantage of surprise.

d) **Avoid Setting Patterns** – Vary your operational patterns frequently and limit your predictability.

e) **360 Degree Security** – Vigilant360 degree security must be maintained at all times whether mounted or dismounted. Train to look at the terrain from the enemy's perspective.

f) **Maintain Standoff** – When practicable, keep a safe distance, and whenever possible maintain frontal and overhead protection from locations most likely to conceal an IED e.g. road shoulders or roadways, medians, intersections, static vehicles along the route, road culverts, etc. Keep all the civilian traffic a safe distance away from the patrol.

g) **Maintain Tactical Dispersion** – Maintain tactical intervals especially during movement as this reduces the likelihood of multiple vehicles getting damaged from an IED attack.

h) **Utilize Blast/Fragmentation Protection** – Armored vehicles provide a measure of protective capability against IED blast. However, avoid becoming too tied to armor at the expense of dismounting when appropriate.

i) **Utilize Technology** – Know the capability and limitations of your crew system, their impact on other electronic systems, and tactical employment techniques (jammers).

22.6 Potential IED Indicators:

The following are the notable IED indicators that all personnel on patrol should look for:

a) ***Change in Pattern of Life*** – Be alert to fewer people/ vehicles and absence of children playing in normally busy areas.

b) ***Colour –*** Notice clues unwittingly provided by the enemy such as exposed DETCORD or other parts of the IED. Look for freshly disturbed earth or concrete that does not match the surrounding areas.

c) ***Markers –*** Watch for indicators by the side of the road such as tyres, rock piles, ribbon or tape that may identify an IED location, or serve as an aiming reference.

d) ***Shapes*** – Take note of object outlines that seem out of place for the environment that you are in.

e) ***Graffiti*** – Be aware of symbols or writings on buildings and walls that might serve as a warning to locals. (Interpreters usually needed).

f) ***Signs*** – Pay attention to newly erected placards and signs that seem out of place or might serve as warning to locals and messages to insurgents.

22.7 Personnel must also be alert to

a) Vehicles following or preceding your convoy for a long distance and then pulling off the side of the road.

b) Dead animals along the roadways.

c) Freshly dug holes or pavements patching on or along the road that may serve as possible IED emplacement sites.

d) New dirt, rock or gravel piles.

e) Obstacles and craters in the roadway used to channel the envoy.

f) Personnel on/under overpasses.

g) Signal with flares or city lights (switched off/on) as convoy approaches.
h) People videotaping ordinary activities or military movements.
i) Wires laid out in plain sight.
j) Rags or plastic bags, paper hanging on trees.

22.8 IED Emplacement

IEDs are emplaced by the enemy to exploit your vulnerabilities and they are likely to be emplaced in the following areas/items:

a) Intersections
b) Roundabouts
c) Choke points
d) Sites with good observation points
e) Sites that have been successful before (previous IED strike areas)
f) Within, next to, or under any type of material or packaging
g) Concealed in cars, trucks, motor cycles, dead animals, human or carts.
h) Elevated in /on tree, walls, light posts, road signs, guard rails, overpasses and bridge spans.
i) In the median, the shoulder, or buried under the surface of any sealed or unsealed load.
j) As secondary or tertiary IEDs near the primary IED or in the vicinity of Point of Origin (POO) sites. These are often designed to target Quick Reaction Forces (QRFs), first responders, cordons, check points and Incident Control Point (ICPs).
k) In a daisy point-chained configuration-meaning there may be multiple explosive charges connected together to create an explosive chain-reaction if one is detonated or if the initiation system is tempered with.

17.9 Effects of IEDs

IEDs can cause devastating effects on lives and property. Below is a photograph illustrating the effects of IEDs on vehicles and personnel.

17.10 Counter IED Efforts

Defeat the network of the terrorists through:

a) Awareness creation

b) Seeking assistance from Explosive Ordnance Disposal (EOD) experts.

c) Finding materials caches

d) Stopping movement of materials by laying snap check points.

e) Surveillance on possible IED sites

f) Deny the terrorist the ability to emplace IED's through patrols

Never touch or pickup an IED, call EOD expert!

CHAPTER TWENTY-THREE

23.0 EMERGENCY PLANNING AND RESPONSE

23.1 Introduction

This topic is intended to enable readers and practitioners to understand emergency management concepts, know the characteristics of an explosive event and identify explosive incident management actions.

Emergency planning is the process of preparing systematically for future contingencies, including major incidents and disasters. The plan is usually a document, shared between participants and stakeholders that specifies tasks and responsibilities adopted in the multi-agency response to the emergency. It is a blueprint for managing events and, as such, should be responsive to management needs. It should specify the lineaments of *action, collaboration, command, and communication* during a civil contingency such as a disaster or a major event. Precisely, it is the framework for emergency response.

This section focuses on Unplanned Explosions at Munition Sites (UEMS). The idea behind this section is not to make the PSSM practitioners experts in emergency planning or response but rather to familiarize them with the concepts and to make them more aware.

This section provides an overview of emergency preparedness for explosive incidents, including unintended events and terrorist attacks. Upon reading this section, you will be able to:

a) Define emergency management,
b) Define the four phases of emergency management and describe activities associated with each phase,
c) Describe the organization of emergency management at the local, national and headquarter levels.

Various bodies or agencies are responsible for meeting various assistance needs. The National level or headquarters should be responsible for satisfying certain assistance needs, while others are the responsibility of the individual.

During a major UEMS, assistance needs will arise. These may include;

a) Evacuation of casualties
b) Medical personnel,
c) Provision of reliable information on the current situation and information that people need to deal with the situation as fast as possible.

Assistance needs can generally be categorized into the following domains:

a) Need to protect and save lives
b) Need to protect and save property
c) Need to protect environment
d) Need to provide people with support so that they can move on in life
e) Need to provide support for restoration of living conditions

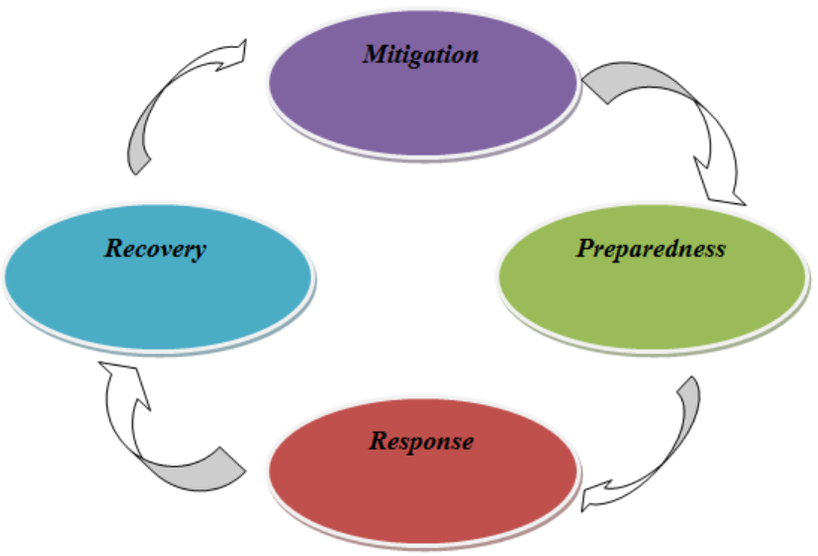
23.2 Examples of UEMS

a) The 2007 Maputo arms depot explosion where 83 people were killed and hundreds more injured in a series of explosions.
b) On 4 March 2012, a series of blasts occurred at an army ammunitions dump in Brazzaville, the capital of the Republic of Congo. During the incident, at least 250 people were killed by the explosions. Total injuries exceeded 2300, more than 13800 people were left homeless. Fires spread through the city burning homes and businesses.

Photo by BBC. The aftermath of the explosion of an ammunition dump in Congo Brazzaville

23.4 Four Phases of Emergency Management

Emergency management comprises of four phases namely: *mitigation, preparedness, response, and recovery* as illustrated below.



(i) Mitigation

This phase includes any activities that prevent an emergency, reduce the likelihood of occurrence, or reduce the damaging effects of unavoidable hazards. Mitigation activities should be considered long before an emergency. For example, to protect yourself and ammunitions from the costly burden of rebuilding after an explosion, a systematic Physical Security and Stockpile Management should be put in place. For example, proper dispersion of magazines, adhering to Quantity Distances, Compatibility, Traverses and Barricades, installation of fire alarms and heat sensors, fire extinguishers, among others. These actions reduce the danger and damaging effects of fire.

(ii) Preparedness

There are interventions put in place to prepare for disasters. For example, preparedness in cases of storing explosives may include assessing possible routes for evacuation as well as evacuation

areas, ensuring safe distances between explosive storage sites and ensuring that explosives are handled by experts among others.

(iii) Response

This deals with managing the disaster after it has occurred. Questions asked, among others, include; What are the things that we can do and how will they occur? Who will be in charge? How will they manage the site? What kind of site will it be? Where should it be located? How should they stage or how should they plan the different levels of response to handle the evacuation?

The response phase includes mobilization of the identified emergency staff, including the first responders, to an internal or external event which could have an impact on the Ammunition facility operations. Response procedures are pre-determined by the state and are detailed in disaster plans during the preparedness phase.

(iv) Recovery

After an emergency and once the immediate danger is over, your continued safety and well-being will depend on your ability to cope with rearranging your life and environment. During recovery, you should also consider things to do that will lessen (mitigate) the effects of future disasters. This period is marked by rebuilding and recovery of physical, social and psychological status prior to the occurrence of the incident.

In reality, the phases are not normally clearly demarcated. They can combine and overlap with each other. This is often the case in diffuse situations and undefined threats, such as toxic or radioactive emissions. It can be difficult for an individual to decide when or even if a threat situation actually exists.

Emergency Response Plan (ERP)

Below are the issues to be considered when developing and emergency response plan. Remember, the ERP is about *Protective actions for life safety*.

a) Review performance objectives.
b) Review hazard or threat scenarios identified during the risk assessment.

c) Assess the availability and capabilities of resources for incident stabilization including people, systems and equipment available within your facility and from external sources.
d) Collaborate with emergency services (e.g., fire, Police, ATOs EOD experts, and emerg ency medical services) to determine their response time to your facility, knowledge of your facility and its hazards and their capability to stabilize an emergency at your facility.
e) Determine if there are any regulations pertaining to emergency planning at your facility, address applicable regulations in the plan.
f) Develop protective actions for life safety (evacuation, shelter, shelter-in-place, lockdown).
g) Develop hazard threat-specific emergency procedures.
h) Coordinate emergency planning with public emergency services to stabilize incidents involving the hazards at your facility.
i) Train personnel so they can fulfill their roles and responsibilities.
j) Facilitate exercises to practice your plan.

23.3 Emergency Planning and Preparation at the National Level

Inter-agency coordination is the most crucial element in emergency planning at the national level. In the case of an UEMS, the ministry responsible for the stockpiles (defense) will take the lead of coordination assisted by the ministry of interior (Police). The *establishment of a chain of command and reporting channels* are also important factors to consider in managing the emergency incident.

23.4 Incident Command Post (ICP*)*

Typically, when a large scale emergency incident occurs, a command post is established. The command post provides a mechanism for emergency responders and management to converge to effectively coordinate and discus the ongoing response efforts during an incident. The emergency command post becomes the "home base" or epicenter for directing coordinated response operations.

There should be numerous pre-planned command post location options identified. The command site for a specific incident, for instance, ammunition explosion in a depot should be chosen based

on the location developing circumstances, safety, and the accessibility of a reliable communication system.

The incident commander's responsibility is overall management of the incident. On most incidents the command activity is carried out by the *overall commander*. The commander determines the incident objectives and strategies, sets immediate priorities, establishes an appropriate organization, authorizes an incident action plan, coordinates all activities for all command and general staff, ensures safety, coordinates with key people and officials, authorizes release of information to the news media and the public and performs other key duties.

23.5 Emergency Responders

The actions taken by first responders, especially when explosives are involved in fire, are absolutely critical to the safety of the public and the emergency responders. Emergency responders MUST be aware of their roles, responsibilities and concept of operations. They must be properly trained and equipped, and MUST maintain communication channels open with the Incident Command Post. For more details to assist in keeping the personnel and public safe in case of an emergency, refer to the Emergency Response Guide Book (ERG) 2016.

23.6 Explosive Incident Management

Explosive incident scenes are chaotic, stressful environments, especially those related to terrorism add increased levels of fear and potential injuries to both civilians and health care providers. Initially, only partial information will be available. This may include the fact that there has been an explosion, the general vicinity of the incident, and perhaps an estimate of the damage and extent of injuries at the scene.

Once an explosive incident has occurred, there is need to examine the immediate actions that need to be taken at the site of the incident. (see picture on the right). The following actions are crucial:

a) First, execute previously prepared response plans.
b) Mobilize all first responders and their equipment.

c) Recall all other personnel that can assist. If a particular specialty is not required, such as a decontamination unit, they can be released later. It is easier to call up all possible assets you might need at the outset than try to find personnel with a specific skill set later in the crisis.
d) Establish the Command Post.
e) Determine the situation so that the incident can be effectively resolved. (Based on initial reports the only thing that can be relied on is that something bad has happened.)
f) Firefighting: *Let it burn; only fight fires to save lives*, and then only for as long as absolutely necessary.
g) Expert Entry: Explosions and fire in ordnance create uniquely dangerous chemical residues and unstable munitions. Only qualified personnel should make the initial entry to avoid follow-on accidents or injuries.
h) Manage media activities - provide accurate information to avoid panic.

First responders must be situational aware and continually perform scene assessment to ensure their own safety and to report information to the incident command post.
Security teams should remove all curious bystanders from within the perimeter, all non-credential persons including volunteers who want assist, should be kept outside of the incident command location, triage locations and ambulance staging areas.

When an explosive device is suspected to have triggered the explosion at the facility, appropriate specialists, such as bomb squad should be involved. An extra care in planning and subsequent training must be taken when staging for response to a potential terrorist, because standardized locations for collection points may make these areas easy to anticipate and target by the terrorists.

Many terrorists have learned to exploit what is known as the "*second-hit principle"* or a "primary or diversion attack" which involves attracting first responders by initial blast and then injuring or incapacitating them with a subsequent attack. Therefore, the incident commander must assume the worst case scenario until it can be eliminated, maintain a reserve because crises may arise in other locations and resources will be needed to deal with them as well.

Resources MUST be committed to *medical, fire and rescue, transportation, law Enforcement, military assets, aviation assets, Explosive Ordnance Disposal and engineers or Construction Assets*.

23.7 Causes of Explosions at Munitions' Sites

According to Small Arms Survey (2014), behind each UEMS event is a weakness in the stockpile's management system that created the conditions and hence, permitting the event to occur. It is this structural weakness, combined with an initial trigger (such as a lightning strike, fire, etc.) that causes most UEMS. The trigger itself usually should not be enough, in and of itself, to cause a larger site explosion. The root causes that permit UEMS to occur are classified into five broad categories:

a) Lack of surveillance leading to ammunition deterioration;
b) Inappropriate storage systems and infrastructure
c) Handling errors and inappropriate working practices;
d) Failure to take into account external, environmental influences and events; and
e) Poor security.

23.8 Effects of UEMS Explosions

UEMS explosions have far-wide effects as outlined and as evidenced in the photo below:

a) Loss of lives and property
b) Injuries
c) Loss of stockpiles
d) Political effects
e) Religious effects
f) Environmental effects
g) May result into IDPs
h) Socio-economic effects

Diagram 56: Effects of UEMS

Emergency management therefore is a process to reduce loss of life and property and to protect assets from all types of hazards through a comprehensive, *risk-based, emergency management program of mitigation, preparedness, response and recovery . An Emergency Plan documents the* elements of the process. Any emergency management initiative must start with an inventory of risks and an assessment of the exposure from these risks with the desired outcome of creating a workable emergency management program. Infrastructure issues will likely be seen as presenting the most risk. The key steps in emergency management are context, Hazard, Risk and Vulnerability Analysis (HRVA), mitigation, preparedness, response, and recovery. The risks posed by explosives are high and need to be managed. Effective risk control measures are few and heavy emphasis is placed on the administrative procedural controls.

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