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AMMUNITION TECHNICAL
GUIDELINES

IATG
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**Guide to the International Ammunition
Technical Guidelines (IATG)**

Warning

The International Ammunition Technical Guidelines (IATG) are subject to regular review and revision. This document is current with effect from the date shown on the cover page. To verify its status, users should consult www.un.org/disarmament/ammunition

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Foreword

Ageing, unstable and excess conventional ammunition stockpiles pose the dual risks of **accidental explosions at munition sites** and **diversion to illicit markets**.

The humanitarian impact of ammunition-storage-area explosions, particularly in populated areas, has resulted in death, injury, environmental damage, displacement and disruption of livelihoods in over 100 countries. Accidental ammunition warehouse detonations count among the heaviest explosions ever recorded.

Diversion from ammunition stockpiles has fuelled armed conflict, terrorism, organized crime and violence, and contributes to the manufacture of improvised explosive devices. Much of the ammunition circulating among armed non-State actors has been illicitly diverted from government forces.¹ In recognition of these dual threats of explosion and diversion, the General Assembly requested the United Nations to develop **guidelines for adequate ammunition management**.² Finalized in 2011, the International Ammunition Technical Guidelines (IATG) provide voluntary, practical, modular guidance to support national authorities (and other stakeholders) in safely and securely managing conventional ammunition stockpiles. The UN SaferGuard Programme was simultaneously established as the corresponding knowledge-management platform to oversee and disseminate the IATG.

The IATG also ensure that the United Nations entities consistently deliver high-quality advice and support – from mine action to counter terrorism, from child protection to disarmament, from crime reduction to development.

The IATG consist of 12 volumes that provide practical guidance for ‘through-life management’ approach to ammunition management. The IATG can be applied at the guidelines’ **basic, intermediate, or advanced levels**, making the IATG relevant for all situations by taking into account the diversity in capacities and resources available. Interested States and other stakeholders can **utilize the IATG for the development of national standards and standing operating procedures**.

The IATG are reviewed and updated at a minimum every five years, to reflect evolving ammunition stockpile-management norms and practices, and to incorporate changes due to changing international regulations and requirements. The review is undertaken by the UN SaferGuard Technical Review Board composed of national technical experts with the support of a corresponding Strategic Coordination Group comprised of expert organizations applying the IATG in practice.

The latest version of each IATG module can be found at www.un.org/disarmament/ammunition.

¹ S/2008/258.

² See also the urgent need to address poorly maintained stockpiles as formulated by the United Nations Secretary-General in his Agenda for Disarmament, *Securing Our Common Future* (2018).

Introduction

This IATG module details the general, and, in some cases, recommended mandatory requirements, for the design of buildings that are to contain explosives for either storage or processing. Most potential explosion sites (PES) are a *de facto* potential hazard to personnel, other explosives facilities, and other buildings that are in the vicinity. Correct building design, construction and siting is essential in order to make effective use of the quantity distances (QDs) calculated.⁴

This IATG module will describe the potential consequences of explosive events that may occur and the subsequent effects on the building containing the explosives and other nearby buildings. It will also describe how correct building design will mitigate these effects and it provides descriptions and schematics of some typical ammunition storage buildings.

Guide to the International Ammunition Technical Guidelines

1 Scope

This IATG module defines the role of the IATG, their structure, and establishes the guiding principles for their proper use, if appropriate, by national authorities, international organisations and organisations involved with the planning and implementation of conventional ammunition stockpile management processes.

2 Normative references

A list of normative references is given in Annex A. These documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

A further list of informative references is given in Annex B in the form of a bibliography, which lists documents that contain additional information related to the contents of this IATG module.

3 Terms and definitions

The IATG mainly follow³ the ISO layout and process and can be defined as: *'a documented agreement containing technical specifications or other criteria to be used consistently as guidelines, or definitions of characteristics to ensure that conventional ammunition stockpile management processes are safe, effective efficient and fit for their purpose'*.

For the purposes of this module the terms and definitions given in IATG 01.40 *Glossary of terms, definitions and abbreviations* shall apply.

In all modules of the International Ammunition Technical Guidelines, the words 'shall', 'should', 'may' and 'can' are used to express provisions in accordance with their usage in ISO standards.

- a) **'shall' indicates a requirement:** It is used to indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.
- b) **'should' indicates a recommendation:** It is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form, 'should not') a certain possibility or course of action is deprecated but not prohibited.
- c) **'may' indicates permission:** It is used to indicate a course of action permissible within the limits of the document.
- d) **'can' indicates possibility and capability:** It is used for statements of possibility and capability, whether material, physical or casual.

³ The main variation from the ISO required contents is that terms, definitions and abbreviations are not included in the Annexes of each individual IATG module as this would make them unwieldy and unnecessarily repetitive for field use. All terms, definitions and abbreviations are contained in IATG 01.40 *Glossary of terms, definitions and abbreviations*.

4 Conventional ammunition stockpile management

The term 'stockpile management' refers to those procedures and activities regarding the safe and secure accounting, storage, transportation, handling, and disposal of conventional ammunition. The objectives of conventional ammunition stockpile management are to reduce and mitigate the risk to personnel and communities from unplanned explosive events and the risk of diversion to illicit markets as well as to ensure optimum usage of scarce resources.

Conventional ammunition stockpile management comprises six complementary groups of activities:

- a) ammunition storage.
- b) ammunition processing,⁴ maintenance and repair.
- c) ammunition accounting.
- d) ammunition demilitarization or destruction.
- e) security of ammunition stockpiles, and
- f) transport of ammunition.

A number of other enabling activities are required to support these six components of stockpile management, including: risk assessment and planning, allocation of resources, information management, human skills development and management training, quality management, and the selection and use of effective, appropriate, and safe equipment.

5 Purpose of ammunition technical guidelines

The IATG are designed to assist States to establish national standards and national standing operating procedures (SOPs) by establishing a frame of reference, which can be used, or adapted for use, as a national standard.

In certain situations, and at certain times, it may be necessary and appropriate for the UN, or some other recognised international body,⁵ to assume some or all of the responsibilities, and fulfil some or all of the functions, of a national authority. In such cases, the UN will work towards the IATG as the de-facto national standard.

The IATG are not themselves SOPs. They do not define the detailed way in which conventional stockpile management requirements are to be achieved by States, which should be covered in national and local SOPs, rules, instructions, and codes of practice.

The IATG have been developed to improve safety, security, and efficiency and efficacy in conventional ammunition stockpile management by providing guidance, by establishing principles and, in some cases, by referring to other related international requirements and specifications.⁶ They provide a frame of reference, which encourages national authorities responsible for conventional ammunition stockpile management to achieve and demonstrate effective levels of safety and security. They provide a common language, are based on sound, and accepted, explosive science, recommend an integrated risk and quality management system, and allow for a progressive, integrated improvement in safety and security in line with available resources.

The IATG have been developed to assist national authorities in the development of national conventional ammunition stockpile management processes and procedures. They have no legal

⁴ Including Inspection, Surveillance and Proof.

⁵ During, for example, peace operations in areas of conflict where there is no effective governance.

⁶ In this case, international requirements and specifications refer to those treaties, international laws and conventions, international agreements, international ISO standards etc. that have already been agreed to by participating nations.

standing except where they have been adopted by a national authority as national standards, or where one or more IATG modules are specified in a contract or some other legal instrument, (such as a Memorandum of Understanding or a Letter of Agreement).

6 Guiding principles

The preparation and application of the IATG are shaped by four guiding principles:

- a) the right of national governments to apply national standards to their national stockpiles.
- 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, and
- d) the need to maintain consistency and compliance with other international norms, conventions, and agreements.

6.1 National responsibilities and obligations

The primary responsibility for conventional ammunition stockpile management shall rest with the Government of the State holding the ammunition. This responsibility should normally be vested in an authority, which is charged with the regulation, management, and coordination of conventional ammunition stockpile management. The national authority shall be responsible for establishing the national and local conditions that enable the effective management of conventional ammunition. It is ultimately responsible for all phases and all facets of the stockpile management processes within its national boundaries, including the development of national standards, SOPs, and instructions.

Troop/Police Contributing Countries (T/PCCs) should develop SOPs, alongside their national stockpile management regulations, for the sound management of the ammunition stockpiles available within their national contingents deployed around the globe. These SOPs necessitate inclusion of, within the national SOPs, the UN safety requirements, and local conditions of the host countries.

6.2 Explosives safety

An accumulation of conventional ammunition presents inherent hazards to local communities in the form of a risk of explosive events in the ammunition storage areas. Ammunition storage area explosions are widespread and increasingly common; more than 623 incidents have been recorded in at least 106 countries and territories between 1979 and December 2019.⁷ Often these events result in a large number of casualties, widespread destruction of infrastructure, and the disruption of the livelihood of entire communities.⁸

In order to address these risks in an efficient and effective manner, the IATG contain an integrated risk management process designed to progressively reduce and mitigate risk as more resources become available.

⁷ Small Arms Survey Unexpected Explosions at Munition Sites (UEMS) database. www.smallarmssurvey.org/weapons-and-markets/stockpiles/unplanned-explosions-at-munitions-sites.html

⁸ An average of more than 737 casualties per year have been recorded during 1979-2019. Source Ibid.

6.3 Capacity-building

In countries with limited national capacity to effectively, efficiently, and safely, manage conventional ammunition stockpiles, the development of national capacity is key to long-term stockpile safety and security. Capacity development is the process by which individuals, institutions, and societies (individually and collectively) perform functions, solve problems, and set and achieve objectives.⁹

At the national level capacity is characterised by a State's ability and willingness to develop and articulate stockpile management policy and practice. It is also about a State's ability to plan, coordinate, manage and sustain a safe, secure, effective, and efficient conventional ammunition stockpile management programme. This includes the technical capability to develop, maintain and apply appropriate national standards for conventional ammunition stockpile management.

Developing States, that may have limited financial and technical resources, may not be able to initially achieve a minimum standard of safe, efficient and effective ammunition stockpile management.¹⁰ The UN may take initiatives to mobilise resources to support such States.

6.4 Other international guidelines, regulations and guides

The IATG are written to be consistent with other international guidelines, and to comply with international regulations, conventions, and treaties. Precedent and norms for workplace and site safety, as well as environmental protection, already exist at the international level. The main 'top level' ones are:

- a) Relevant International Labour Organization (ILO) instruments for safety in the workplace.
- b) the International Organization for Standardization (ISO) providing guidance on risk management (ISO Guide 51).
- c) the application of quality management systems (ISO 9001:2015 series), and
- d) environmental management systems (ISO 14001:2015).

Other international protocols and norms describe procedures for the classification and transport of conventional ammunition; these also have application to conventional ammunition stockpile management and are referred to as normative references in the appropriate IATG module.

The IATG have been developed from a wide range of source material by other international organisations, regional organisations, national governments, and individuals. This material has been key to the development of the IATG and acknowledgement for direct use has been attributed within the IATG. Other information has been used as the basis for content within the IATG. A bibliography of the most used sources is at Annex C, and these organisations are thanked for their contributions through the public availability of their documentation.

⁹ UNDP Definition at www.undp.org/content/dam/aplaws/publication/en/publications/capacity-development/capacity-development-a-undp-primer/CDG_PrimerReport_final_web.pdf.

¹⁰ Level 1. See IATG 01.20 *Index of risk reduction process levels*.

6.5 Risk reduction process levels (RRPL)

Within the IATG modules 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) (IATG 01.20 *Index of risk reduction process levels*). These are indicated within each IATG module as either **LEVEL 1**, **LEVEL 2** or **LEVEL 3** dependent on risk reduction or mitigation achieved by each task or activity. The basic aim of a conventional ammunition stockpile management organisation should be to make sure that stockpile management processes are maintained at RRPL 1 as a minimum, which will reduce or mitigate risk significantly. Ongoing and gradual improvements should then be made to the stockpile management infrastructure and processes as staff development improves and further resources become available.

7 Framework of IATG

The IATG are divided into generic areas of conventional ammunition stockpile management, which are then further divided into individual modules that address specific activities within that area:

Series	Generic area
01	Introduction and Principles of Ammunition Management
02	Risk Management
03	Ammunition Accounting
04	Explosives Facilities (Storage) (Temporary Conditions)
05	Explosives Facilities (Storage) (Infrastructure and Equipment)
06	Explosives Facilities (Storage) (Operations)
07	Ammunition Surveillance
08	Transport of Ammunition
09	Security of Ammunition
10	Ammunition Demilitarization and Destruction
11	Ammunition Accidents, Reporting and Investigation
12	Small Unit Ammunition Storage

Table 1: Generic areas of IATG

The detailed framework of the IATG is shown at Annex D.

Individual IATG modules will, where appropriate, be divided into levels of ascending comprehensiveness. The first level will include guidelines that present the most expedient ways to apply the basic principles of safe and secure ammunition management. Subsequent levels will detail progressive measures that should be taken to improve stockpile management in the area in question and thereby progressively reduce or mitigate the risk.

Each level will feature, where appropriate, statistics that indicate the degree of risk reduction or mitigation likely to be achieved by following the IATG. Technical drawings and diagrams will be used to support the IATG, where applicable. A qualitative or quantitative risk assessment (QRA) methodology is integrated into the IATG, wherever possible, to estimate the level of risk reduction and/or mitigation that might be achieved through adherence to the IATG.

8 International Organization for Standardization

ISO is an independent, non-governmental international organisation with a membership of over 160 national standards bodies. Its work results in voluntary standards and guides which have been adopted by many countries as part of their regulatory framework. ISO deals with the full spectrum of human activities and some of the tasks and processes that contribute to the stockpile management of conventional ammunition have a relevant standard. A list of ISO standards and guides is given in the ISO catalogue at www.iso.org/standards-catalogue/browse-by-ics.html.

ISO has an international reputation for integrity and neutrality, and it enjoys a special working relationship with international organisations including the United Nations, and with regional organisations including the European Union. The IATG have been developed to be compatible with ISO standards and guides. Adopting the ISO format and language provides some significant advantages including consistency of layout, use of internationally recognised terminology, and a greater acceptance by international, national and regional organisations which are accustomed to the ISO series of standards and guides.

The adoption of the ISO format and language also brings the IATG in line with other complementary standards and guidance, including:

- a) International Disarmament, Demobilisation and Reintegration Standards (IDDRS), (www.unddr.org/iddrs).
- b) International Mine Action Standards (IMAS), (www.mineactionstandards.org), and
- c) Modular Small-arms-control Implementation Compendium (MOSAIC) (www.un.org/disarmament/mosaic).

9 Quality and risk management

The IATG have been developed in line with the recommendations and processes contained within the ISO quality management systems (ISO 9001:2008¹¹) and the ISO risk management system (ISO Guide 51¹²). Elements of these systems are contained within the majority of the IATG modules, thereby making the IATG themselves an integrated risk and quality management system. There is still a requirement, however, for national authorities to develop their own specific individual risk and quality management systems for the stockpile management of conventional ammunition.

A guide to the use of risk management in the IATG is contained at IATG 02.10 *Introduction to risk management principles*.

10 Legal requirements

The IATG have no legal standing except where they have been adopted by a national authority as national standards, or where one or more of the IATG modules is specified in a contract or some other legal instrument, (such as a Memorandum of Understanding or a Letter of Agreement). The wording of each contract or agreement should clarify the application of the IATG to each proposed project, and should reflect the national and local circumstances; i.e. the local situation, the authority of government, political will, and the resources available.

¹¹ ISO 9001:2015(E) *Quality management systems – requirements*. ISO. 2015.

¹² ISO Guide 51:2014 *Safety aspects – Guidelines for their inclusion in standards*. ISO. 2014.

11 Continual review of IATG

The IATG are subject to a formal review on a five-yearly basis. This is to ensure that the IATG are still relevant, accurate, achievable, and appropriate. This does not preclude essential amendments being made within that period for reasons of operational safety or efficiency.

Annex A

(normative)

References

- a) IATG 01.40 *Glossary of terms, definitions and abbreviations*. UNODA;
- b) ISO Guide 51 *Safety aspects – Guidelines for their inclusion in standards*. ISO. 2014;
- c) ISO 9001 *Quality management systems – Requirements*. ISO. 2015;¹³ and
- d) ISO 14001 *Environmental management systems – Guidelines*. ISO. 2015.¹⁴

Annex B (informative) Source bibliography

The following informative documents contain primary and secondary source material that was used in the development of the IATG:

- A Destruction Handbook – small arms, light weapons, ammunition and explosives. UN Department for Disarmament Affairs (UNDDA). 2001;
- AAP-06 (Edition 2019), *NATO Glossary of Terms and Definitions*. NATO Standardization Office (NSO) ;
- AOP-38 *Glossary of Terms and Definitions concerning the Safety and Suitability for Service of Munitions, Explosives and Related Products*. (5th Edition). NATO Standardization Office (NSO). June 2009;
- AOP-48 (Edition 2). *Explosives - Nitrocellulose Based Propellants, Stability Test Procedures and Requirements Using Stabilizer Depletion*; NATO Standardization Office (NSO). October 2008;
- AOP-62 (Edition A, Version 1). *In-Service Surveillance of Munitions General Guidance*. NATO Standardization Office (NSO). February 2017.
- AOP-63 (Edition A, Version 1). *In-Service Surveillance of Munitions Sampling and Test Procedures*. NATO Standardization Office (NSO). February 2017.
- AOP-64 (Edition A, Version 1). *In-Service Surveillance of Munitions Condition Monitoring of Energetic Materials*. NATO Standardization Office (NSO). February 2017.
- AOP-4518 (Edition A Version 1). *Safe Disposal of Munitions, Design Principles and Requirements, and Safety Assessments*. NATO Standardization Office (NSO). May 2018;
- AASTP-1, Edition B, Version 1, *NATO Guidelines for the Storage of Military Ammunition and Explosives*. NATO Standardization Office (NSO). December 2015.
- AASTP-3, Edition 1, Change 3, *Manual of NATO Safety Principles for the Hazard Classification of Military Ammunition and Explosives*. NATO Standardization Office (NSO). August 2009;
- AASTP-4, Edition 1, Change 4, *Explosives Safety Risk Analysis*. NATO Standardization Office (NSO). September 2016. (Note: Part 2 has restricted distribution);
- AASTP-5, Edition 1, Version 3, *NATO Guidelines for the Storage, Maintenance and Transport of Ammunition on Deployed Missions or Operations*. NATO Standardization Office (NSO). June 2016;
- *The Arms Trade Treaty*, 2013.
- *Assessing people against the Explosive Substances and Articles National Occupational Standards*. Denise Clarke, HSQ Ltd, in SAFEX Newsletter 50, 3rd Quarter, 2014;
- *Best Practice Guidelines for the Implementation of the Nairobi Declaration and the Nairobi Protocol on Small Arms and Light Weapons*. RECSA. Approved 20 – 21 June 2005;

- BS 1722-10:2006, *Fences. Specification for anti-intruder fences in chain link and welded mesh*. BSI. UK. November 2006;
- BS 4449:2005 + Amendment 2 2009 *Specification for carbon steel bars for the reinforcement of concrete*. BSI. UK;
- *Central African Convention for the Control of Small Arms and Light Weapons, their Ammunition, and all Parts and Components that can be used for their Manufacture, Repair and Assembly* (Kinshasa Convention). 2017;
- Test and Evaluation Protocol 09.30, *Explosive Ordnance Disposal (EOD) Competency Standards*, October 2014
- *Conflict Specific Capital: The Role of Weapons Acquisition in Civil War* Nicholas Marsh, *International Studies Perspectives*, Vol.8, 2007;
- *Convention for International Carriage by Rail (COTIF)*. 09 May 1980. Modified by the Vilnius Protocol of 03 June 1999;
- *Convention for the Protection of the Marine Environment of the North-East Atlantic*, 1998;¹⁵
- *Convention on International Civil Aviation, Annex 18. The Safe Transport of Dangerous Goods by Air*. (Fourth Edition). ICAO. 17 November 2011;
- *Convention on Small Arms, Light Weapons, Their Ammunition and Other Related Materials*. ECOWAS. 2006;
- *Conventional Ammunition in Surplus – A Reference Guide*. Small Arms Survey. ISBN 2-8288-0092X. January 2008;
- EN 12320:2012 *Building hardware – Padlocks and padlock fittings – Requirements and test methods*. BSI. UK;
- *ESA NOS KR1 Research, Design and Development (Key Role 1)*. UK Standards Setting Body (SSB) for Explosives, Munitions and Search Occupations. February 2006;
- *European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR 2019)*, ECE/TRANS/275 (Vol 1 and II), November 2018;
- European Union Council Directive 2000/76/EC *The incineration of waste*, 04 December 2000, amended by Regulation (EC) No 1137/2008 of 11 December 2008.
- European Union Council Directive 2008/98/EC *Waste*, 19 November 2008;
- *Explosion Hazards and Evaluation*. W E Baker et al. Elsevier. (ISBN 0 444 42094 0). Amsterdam. 1983;
- *Following the lethal trail: identifying the source of illicit ammunition*. (In *Targeting Ammunition: a Primer*, p 207 - 227). H Anders. Small Arms Survey. 2006;
- *Guns, Planes and Ships: Identification and Disruption of Clandestine Arms Deliveries*. Griffiths H and Wilkinson A E A. (ISBN 978 66 7728 069 7). SEESAC. August 2007;

¹⁵ Also known as the *OSPAR Convention*.

- *Handbook of Best Practices on Conventional Ammunition*. Decision 6/08. OSCE. 2008;
- *IATA Dangerous Goods Regulations (DGR)* (61st Edition). 2019;
- *ICAO Technical Instructions for the Safe Movement of Dangerous Goods by Air*. (Doc 9284);
- *Inter-American Convention Against the Illicit Manufacturing of and Trafficking in Firearms, Ammunition, Explosives and Other Related Materials (CIFTA)*. OAS. 1997;
- *International Convention for the Safety of Life at Sea, (SOLAS), Chapter VII – Carriage of Dangerous Goods*. IMO. 1974;
- *International Maritime Dangerous Goods (IMDG) Code*. (Amendment 37-14). IMO. 2014;
- *International Mine Action Standards (IMAS)*. UNMAS. 2009;
- *Modular Small-arms-control Implementation Compendium (MOSAIC)*. CASA.;
- *Introduction to Explosive Substances and Articles National Occupational Standards*. Denise Clarke, HSQ Ltd, in SAFEX Newsletter 44, 1st Quarter, 2013;
- *ISO Guide 51:2014 Safety aspects – Guidelines for their inclusion in standards*. ISO. 2014;
- *ISO 2859 Series[E] Sampling procedures for inspection by attributes*. ISO;
- *ISO 3766:2003[E] Construction drawings - Simplified representation of concrete reinforcement*. ISO. 2003;
- *ISO 3951 Series[E] Sampling procedures for inspection by variables*. ISO;
- *ISO 4220:1983(E) Determination of a gaseous acid air pollution index -- Titrimetric method with indicator or potentiometric end-point detection n*. ISO. 1983;
- *ISO 8422:2006[E] Sequential sampling plans for inspection by attributes*. ISO. 2006;
- *ISO 8423:2008[E] Sequential sampling plans for inspection by variables for percent nonconforming (known standard deviation)*. ISO. 2008;
- *ISO/TR 8550 Series[E] Guide for the selection of an acceptance sampling system, scheme or plan for inspection of discrete items in lots*. ISO;
- *ISO 9001:2015(E) Quality management systems – requirements*. ISO. 2015;
- *ISO 9612:2009 Acoustics - Determination of occupational noise exposure – Engineering method*. ISO. 2009;
- *ISO/TR 10017:2003[E] Guidance on statistical techniques for ISO 9001:2000*. ISO. 2003;
- *ISO 11453:1996[E] Statistical interpretation of data - Tests and confidence intervals relating to proportions*. ISO. 2006;
- *ISO 13448 Series[E] Acceptance sampling procedures based on the allocation-of-priorities principle (APP)*. ISO;
- *ISO 14001:2015(E) Environmental management systems – Guidelines*. ISO. 2015;

- ISO 14004 *Environmental management systems - General guidelines on principles, systems and support techniques*. ISO. 2016
- ISO 14560:2004[E] *Assessment and acceptance sampling procedures for inspection by attributes in number of nonconforming items per million items*. ISO. 2004;
- ISO 15630-1[E] *Steel rod test methods*. ISO;
- ISO 16269 Series[E] *Statistical interpretation of data*. ISO;
- ISO 18414:2006[E] *Accept-zero sampling schemes by attributes for the control of outgoing quality*. ISO. 2006;
- ISO/TR 18532:2009[E] *A Guide to the application of statistical methods to quality and standardization*. ISO. 2009;
- ISO 21247:2005[E] *Quality plans for product acceptance - Combined accept-zero and control procedures*. ISO 2005;
- ISO 22965:2007 Series *Concrete*. ISO 2007;
- DSA03.OME part 2 provides for the safe storage and processing of Ordnance, Munitions and Explosives (OME). UK MOD. November 2020:
- *London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*, 29 December 1972;
- *London Protocol to the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*, 1996, (Amended 2006);
- Loss Prevention Standard (LPS) 1175 *Specification for testing and classifying the burglary resistance of building components, strong-points and security enclosures*. Issue 6. Building Research Establishment (BRE) Global. UK. 24 May 2007;
- *Model Regulations for the Control of the International Movement of Firearms, Their Parts and Components and Ammunition – Updated*. Organisation of American States (OAS). 2006;
- *Nairobi Protocol for the Prevention, Control and Reduction of Small Arms and Light Weapons in the Great Lakes Region and the Horn of Africa*, 2004
- National Occupational Standards for Explosives. UK Commission for Employment and Skills (UK CES)¹⁶;
- *OSCE Document on Stockpiles of Conventional Ammunition*. OSCE. 2003;
- *Protocol against the Illicit Manufacturing and Trafficking in Firearms, Their Parts and Components and Ammunition, supplementing the United Nations Convention against Transnational Organized Crime (Firearms Protocol)*. 2005;
- *Programme of Action to Prevent, Combat and Eradicate the Illicit Trade in Small Arms and Light Weapons in All its Aspects*. 2001;

¹⁶ Enter the search term 'Explosives' in this website nos.ukces.org.uk/Pages/Search.aspx to obtain all relevant NOS on the explosives sector. The full list is at Annex K.

- *Protocol on Explosives Remnants of War to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which may be deemed to be Excessively Injurious or to have Indiscriminate Effects*, 2003;
- *Protocol on the Control of Firearms, Ammunition and Other Related Material in the Southern African Development Community Region (SADC Protocol)*. 2001;
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- *Revealing Provenance: Weapons Tracing During and After Conflict*. (In Small Arms Survey 2009: Shadows of War, p107 - 133). J Bevan. Small Arms Survey. 2009;
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- *United Nations Recommendations on the Transport of Dangerous Goods Model Regulations*, (Twenty-first revised edition), ST/SG/AC.10/1/Rev.21, New York and Geneva, United Nations, 2019;
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- DoD 6055.09-M Volumes 1- 8, *Ammunition and Explosives Safety Standards*. (Incorporating Change 1 (12 March 2012)). US Department of Defense. 29 February 2008;
- *Usage Manual for Missile and Artillery Armaments, Part 1, Use of Missile and Artillery Armaments by Troops*,¹⁷ Chapter 4. USSR¹⁸ MOD. 1989;
- *Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies*. 1996;
- *Wassenaar Arrangement on Exports Controls for Conventional Arms and Dual-Use Goods and Technologies Best Practices for Effective Enforcement of Export Controls*. 2000; and
- *Wassenaar Agreement End-User Assurances Commonly Used Consolidated Indicative List*. 2005 (updated).

¹⁷ Appendix 1 to Order of the Chief Commander of the Ground Forces No 5 1988.

¹⁸ Now Russian Federation.

Annex C (normative) Framework of the IATG

The IATG are divided into thematic volumes using the ISO layout system. Each volume will address a broad area of stockpile management activity, which will be further divided into modules that address specific activities within that field.

Volume		Module		Contents
#	Area	#	Title	
01	Introduction and Principles of Ammunition Management	01.10	Guide to the International Ammunition Technical Guidelines (IATG)	<ul style="list-style-type: none"> ▪ Purpose ▪ Guiding Principles ▪ Framework ▪ Legal Status
		01.20	Index of Risk Reduction Process Levels within IATG	<ul style="list-style-type: none"> ▪ Risk reduction process levels in one document
		01.30	Policy Development and Advice	<ul style="list-style-type: none"> ▪ Strategic Requirements ▪ Functional Areas of Stockpile Management ▪ Identification of Surplus Stocks
		01.35	Organisational capabilities	Functional Roles Capability enabling lines
		01.40	Glossary of Terms, Definitions and Abbreviations	
		01.50	UN Explosive Hazard Classification System and Codes	<ul style="list-style-type: none"> ▪ Hazard Divisions (HD) ▪ Compatibility Groups (CG) ▪ Hazard Classification Codes (HCC) ▪ Mixing of Compatibility Groups ▪ Types of Tests for UN Hazard Classification
		01.60	Ammunition Faults and Performance Failures	<ul style="list-style-type: none"> ▪ Purpose and rationale ▪ Benefits ▪ Faults ▪ Performance Failures – Immediate Actions ▪ Performance Failures – Investigator's Actions

Volume		Module		Contents
#	Area	#	Title	
		01.70	Bans and Constraints	<ul style="list-style-type: none"> ▪ Purpose ▪ Definitions ▪ Responsibilities
		01.80	Formulae for Ammunition Management	<ul style="list-style-type: none"> ▪ Gurney Equations ▪ Kingary and Bulmash ▪ Hopkinson/Crans Scaling Law ▪ QD Formulae
		01.90	Ammunition Management Personnel Competences	<ul style="list-style-type: none"> ▪ Competency requirements
02	Risk Management	02.10	Introduction to Risk Management Principles and Processes	<ul style="list-style-type: none"> ▪ Components of risk management ▪ The risk management process
		02.20	Quantity and Separation Distances	<ul style="list-style-type: none"> ▪ Introduction to QD System ▪ Hazards to Personnel ▪ QD for Above Ground Storage ▪ QD for Underground Storage ▪ QD for Transit Areas ▪ QD for Ports ▪ QD to Hazardous (non-explosive) Facilities ▪ Authorised Quantities of Explosives (Non-ASA Storage)
		02.30	Licensing of Explosive Facilities	<ul style="list-style-type: none"> ▪ Licensing Systems
		02.40	Safeguarding of Explosive Facilities	<ul style="list-style-type: none"> ▪ Safeguarding Systems ▪ Mapping ▪ Directional Weapon Maps ▪ Maintenance of Safeguarded Areas
		02.50	Fire Safety	<ul style="list-style-type: none"> ▪ General Responsibilities ▪ Planning ▪ Fire Alarm Systems ▪ Fire Breaks and Vegetation ▪ Water Supplies ▪ Fire Fighting Equipment ▪ Evacuation Distances ▪ Principles of Fire Fighting

Volume		Module		Contents
#	Area	#	Title	
03	Ammunition Accounting	03.10	Inventory Management	<ul style="list-style-type: none"> ▪ Lotting and Batching ▪ Accounting Requirements ▪ Accounting Systems
		03.20	Lotting and Batching	<ul style="list-style-type: none"> ▪ Lotting and Batching Requirements ▪ Batch Key Identities
05	Explosives Facilities (Storage) (Infrastructure and Equipment)	05.10	Planning and Siting of Explosives Facilities	<ul style="list-style-type: none"> ▪ General Considerations ▪ Systems Approach ▪ Siting Boards ▪ Siting Board Requirements ▪ Siting Considerations
		05.20	Types of Buildings for Explosives Facilities	<ul style="list-style-type: none"> ▪ Introduction ▪ Consequences of an Explosives Accident ▪ Protection against Propagation ▪ Building Damage Levels ▪ Types of Buildings ▪ Design Fundamentals
		05.30	Barricades	<ul style="list-style-type: none"> ▪ Functions ▪ Types of Barricade ▪ Position of a Barricade ▪ Geometry of a Barricade ▪ Barricade Materials
		05.40	Safety Standards for Electrical Installations	<ul style="list-style-type: none"> ▪ Categorisation Systems ▪ Electrical Supply and Safety ▪ Electrostatic Safety ▪ Lightning Protection
		05.50	Vehicles and Mechanical Handling Equipment (MHE) in Explosives Facilities	<ul style="list-style-type: none"> ▪ Authority to Enter the ESA ▪ Category and Zoning of PES ▪ Compatibility of Vehicles/MHE and Working Environment ▪ Design Specifications and Construction Requirements of Vehicles/MHE ▪ Operating Limitations

Volume		Module		Contents
#	Area	#	Title	
		05.60	Radio Frequency Hazards	<ul style="list-style-type: none"> ▪ Introduction and Principles ▪ Exposure Levels ▪ Susceptibility Factors ▪ Separation Distances ▪ Safe Distances
06	Explosive Facilities (Storage) (Operations)	06.10	Control of Explosive Facilities	<ul style="list-style-type: none"> ▪ Introduction ▪ Operational Procedures ▪ Controlled Articles and Contraband ▪ Estate Management ▪ Over-flight Restrictions ▪ Isolation and Segregation of Stocks ▪ Maintenance of Operational Capability ▪ Chemical Stability and Temperature Limitations ▪ Protection from Moisture and Ventilation
		06.20	Storage Space Requirements	<ul style="list-style-type: none"> ▪ Calculation of Storage Space and Requirements
		06.30	Storage and Handling	<ul style="list-style-type: none"> ▪ General Handling Advice ▪ Stacking of Ammunition ▪ Use of Racking ▪ Stack Tally Cards ▪ Use of Lifting Gear and Slings ▪ Storage Temperatures
		06.40	Explosives Packaging and Marking	<ul style="list-style-type: none"> ▪ International Marking of Packaging Requirements ▪ Palletisation ▪ Sealing of Packaging
		06.50	Specific Safety Precautions	<ul style="list-style-type: none"> ▪ Breakdown Operations ▪ Certification of Free From Explosive (FFE) ▪ Dangerous Chemicals and Phosphorous Ammunition ▪ Permits to Work ▪ Changing Environmental Conditions ▪ Health Hazards ▪ Surveillance of Nitrate Esters

Volume		Module		Contents
#	Area	#	Title	
		06.60	Works Services (Construction and Repair)	<ul style="list-style-type: none"> ▪ Introduction ▪ Permits to Work ▪ Impact on Explosives Limit Licences (ELL) ▪ Explosives Safety Brief ▪ Control of Equipment
		06.70	Inspection of Explosives Facilities	<ul style="list-style-type: none"> ▪ Purpose ▪ Types of Inspection ▪ Scope of Inspections ▪ Inspection Criteria
07	Ammunition Surveillance	07.10	Surveillance and in-service proof	<ul style="list-style-type: none"> ▪ Purpose ▪ Definitions ▪ In-Service Proof ▪ Chemical Stability ▪ In-Service Stability Surveillance Systems
		07.20	Inspection of Ammunition	<ul style="list-style-type: none"> ▪ Purpose ▪ Types of Inspection ▪ Inspection Criteria
		07.30	Ammunition processing operations - Safety and, risk reduction and mitigation	<ul style="list-style-type: none"> ▪ Introduction ▪ Man Limits ▪ Safe Systems of Work ▪ PPE ▪ Control of Equipment ▪ Cleanliness of Process Building ▪ Supervision and Competency

Volume		Module		Contents
#	Area	#	Title	
08	Transport of Ammunition	08.10	Transport of Ammunition	<ul style="list-style-type: none"> ▪ Refer to United Nations Recommendations on the Transport of Dangerous Goods Model Regulations (Fifteenth revised edition). ▪ Refer to European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR). ▪ Refer to International Ordinance on the Transport of Dangerous Goods by Rail (RID), (Appendix I to the International Agreement on Rail Freight Transport). ▪ Refer to IATA Dangerous Goods Regulations (DGR) (51st Edition). ▪ Refer to Convention on International Civil Aviation, Annex 18, The Safe Transport of Dangerous Goods by Air. (Ninth Edition). (Doc 7300/9). IACO. 2006. ▪ Refer to IACO Technical Instructions for the Safe Movement of Dangerous Goods by Air. (Doc 9284). ▪ Refer to International Maritime Dangerous Goods (IMDG) Code. (Amendment 34-08). IMO. 2008. ▪ Refer to International Convention for the Safety of Life at Sea (SOLAS), Chapter VII - Carriage of dangerous goods. 1974. (Entered into force on 25 May 1980. IMO).
09	Security of Ammunition	09.10	Security Principles and Systems	<ul style="list-style-type: none"> ▪ Introduction ▪ Principles ▪ Access Controls ▪ Control of keys ▪ Patrolling ▪ Perimeter Security ▪ ACTO Explosives
10	Ammunition Demilitarization and Destruction	10.10	Demilitarization and Destruction of Conventional Ammunition	<ul style="list-style-type: none"> ▪ Open Burning and Detonation (From IMAS 11.20) ▪ Industrial Demilitarization (From MOSAIC 05.51:2010(E))

Volume		Module		Contents
#	Area	#	Title	
11	Ammunition Accidents, Reporting and Investigation	11.10	Ammunition accidents and incidents: unit reporting and technical investigation methodology	<ul style="list-style-type: none"> ▪ Purpose ▪ Competencies ▪ General Approach ▪ Assistance from Other Agencies ▪ Jurisdiction ▪ Initial Response ▪ Initial Investigation ▪ Preservation of Evidence ▪ Witnesses ▪ Technical Investigation ▪ Classification of Accidents ▪ Ammunition Details ▪ Drills and Procedures ▪ Inspection Points ▪ Qualifications, Authorization and Orders ▪ Skills and Experience ▪ Circumstances and Conditions ▪ Trials Accidents
		11.20	EOD Clearance of Ammunition Storage Area Explosions.	<ul style="list-style-type: none"> ▪
12	Ammunition Operational Support	12.10	Ammunition on Multi-National Operations	<ul style="list-style-type: none"> ▪ Ammunition technical support to force generation and technical survey. ▪ Applicable IATG.
		12.20	Small Unit Ammunition Storage	<ul style="list-style-type: none"> ▪ Explosive Limits and Licences ▪ References to IATG Clauses

To assist in the application of the IATG, key IATG implementation support tools are available for immediate use by ammunition experts to improve ammunition safety at www.un.org/disarmament/unsafeguard :

Risk Management tools:

[Create an Explosives Limit Licence](https://www.un.org/disarmament/unsafeguard/explosives-limit-license/)¹⁹

[Explosion Consequence Analysis \(ECA\)](https://www.un.org/disarmament/unsafeguard/explosion-consequence-analysis/)²⁰

[Risk Reduction Process Levels](https://www.un.org/disarmament/unsafeguard/risk-reduction-process-levels/)²¹

[Quantity-Distance Map](https://www.un.org/disarmament/unsafeguard/map/)²²

¹⁹ <https://www.un.org/disarmament/unsafeguard/explosives-limit-license/>

²⁰ <https://www.un.org/disarmament/unsafeguard/explosion-consequence-analysis/>

²¹ <https://www.un.org/disarmament/unsafeguard/risk-reduction-process-levels/>

²² <https://www.un.org/disarmament/unsafeguard/map/>

Technical Calculators:

[Kingery-Bulmash Blast Parameter Calculator](#)²³

[Gurney Equations for Fragment Velocity](#)²⁴

[Hopkinson-Cranz Scaling Law](#)²⁵

[Noise Prediction Calculator](#)²⁶

[Detonation Pressure Calculation](#)²⁷

[Explosion Danger Area Calculator](#)²⁸

[Vertical Danger Area Calculator](#)²⁹

²³ www.un.org/disarmament/un-saferguard/kingery-bulmash/

²⁴ www.un.org/disarmament/un-saferguard/gurney/

²⁵ www.un.org/disarmament/un-saferguard/hopkinson-cranz/

²⁶ www.un.org/disarmament/un-saferguard/noise-prediction/

²⁷ www.un.org/disarmament/un-saferguard/detonation-pressure/

²⁸ www.un.org/disarmament/un-saferguard/explosion-danger-area/

²⁹ www.un.org/disarmament/un-saferguard/vertical-danger-area/

