Field storage
Warning

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Foreword

Ageing, unstable and excess ammunition stockpiles pose the dual hazards of illicit proliferation and accidental explosion, which have caused destabilization and humanitarian disaster in all regions of the world.

Crucial for adequate stockpile management is the identification of surpluses – that is, the portion of weapons and ammunition that does not constitute an operational need. When surpluses are not recognized, the entirety of the stockpile may continue to be seen as of operational value. Although not used, weapons and ammunition surpluses thus continue to fill warehouses and can thus pose a significant risk to safety and security.

Defective stockpile management has been assessed as the norm rather than the exception in many countries. Often it is not only surplus stocks that should be the focus of attention, but the lack of appropriate policy for stockpile management. Governments remain unaware of surpluses; their national stockpiles remain a risk to public safety; and diversion from warehouses feed into crime and armed violence.

In 2011, the United Nations developed the International Ammunition Technical Guidelines (IATG) to ensure that the United Nations as a whole consistently delivers high-quality advice and support in ammunition management. Many stakeholders, including international organizations, non-governmental entities and national authorities, use these guidelines.

The IATG, along with other conventional ammunition issues, are managed through the United Nations SaferGuard programme.

Taking into account the diversity in capacity of States, three levels of ascending comprehensiveness are offered in the IATG, referred to as “risk-reduction process levels” (RRPLs). These are indicated within each IATG as either LEVEL 1 (basic), LEVEL 2 (intermediate) or LEVEL 3 (advanced).

The aim of implementing partners should be to maintain stockpile management processes at RRPL 1 as a minimum. This will often reduce risk significantly. Ongoing and gradual improvements could then be made to the stockpile management infrastructure and processes as staff development improves and further resources become available. These additional actions would equate to RRPLs 2 and 3.

The RRPLs are determined by calculating a weighted score of questions about a particular ammunition stockpile. A checklist is available at: https://www.un.org/disarmament/un-saferguard/risk-reduction-process-levels/.

The IATG are reviewed on a regular basis to reflect developing ammunition stockpile management norms and practices, and to incorporate changes due to changing international regulations and requirements. The IATG are also available in multiple languages.

The latest version of each guideline, together with practical IATG implementation support tools, can be found at https://www.un.org/disarmament/un-saferguard/.
Introduction

While the ideal and most efficient method of storing ammunition is in purpose built ammunition depots to ensure explosive safety, conventional ammunition can be stored safely, effectively and efficiently, in the short term, under field conditions for operational purposes. There are, however, disadvantages to field storage in that the service life of ammunition is very likely to be significantly reduced. There will also be security issues to be addressed, as the ground area is necessarily larger than that used for permanent ammunition storage facilities.

Ammunition that is stored under field storage conditions for prolonged periods of time should be subjected to an effective technical surveillance and in-service proof programme, which will be dependent on the time period for which field storage is utilized.\(^1\) This is the only way to ensure that the ammunition does not deteriorate to a condition that compromises performance or safety in storage.

Ammunition shall only be stored under field conditions during periods of military operations or in the event of a high national security threat. It should not normally remain under field storage conditions for more than one year, before being moved into temporary or permanent storage facilities.

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\(^1\) See IATG 07.20:2015[E] Surveillance and proof.
Field storage

1 Scope

This IATG introduces and explains the requirements for the safe, effective and efficient storage of conventional ammunition under field (operational) conditions. It does not cover other additional tactical requirements of field storage that are also required to support the protection of ammunition stocks and the resupply of military operations.

For the purposes of this IATG field storage shall cover the storage requirements when ammunition is deployed from ammunition depots to support military operations (usually abroad).

2 Normative references

The following referenced documents are indispensable for the application 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 list of normative references is given in Annex A. Normative references are important documents to which reference is made in this guide and which form part of the provisions of this guide.

A further list of informative references is given at Annex B in the form of a bibliography, which lists additional documents that contain other useful information on field, and temporary storage of conventional ammunition.

3 Terms and definitions

For the purposes of this guide the following terms and definitions, as well as the more comprehensive list given in IATG 01.40:2015[E] Terms, definitions and abbreviations, shall apply.

The term 'hazard' refers to a potential source of harm.

The term 'exposed site' refers to a magazine, cell, stack, truck or trailer loaded with ammunition, explosives workshop, inhabited building, assembly place or public traffic route, which is exposed to the effects of an explosion (or fire) at the potential explosion site under consideration.

The term 'potential explosion site' refers to the location of a quantity of explosives that will create a blast, fragment, thermal or debris hazard in the event of an accidental explosion of its content.

The term 'risk' refers to a combination of the probability of occurrence of harm and the severity of that harm.

The term 'risk analysis' refers to the systematic use of available information to identify hazards and to estimate the risk.

The term 'risk reduction' refers to actions taken to lessen the probability, negative consequences or both, associated with a particular risk.

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.

4 Background

The storage of ammunition and explosives under field storage conditions is quite common, particularly during deployed operations. Longer-term storage of ammunition under temporary storage conditions as a technique for daily storage of a stockpile is less desirable, but safety can still be assured (see IATG 04.20:2015 Temporary storage). The impact of field storage on the in-service life of the ammunition is less certain, as protection from climatic conditions and diurnal cycling is less effective under field conditions.

The quantity of ammunition and explosives held in any operational field storage area shall be limited to the minimum consistent with safe and efficient operations. No ammunition should be held that does not support the mission. The NEQ per storage site should be kept as low as practically possible, consistent with the mission and the available QDs.

Unless specifically stated within this IATG the requirements of all other IATG shall be observed in order to retain the most stringent safety standards and preservation of assets during field storage conditions.

There is less flexibility in the safety distances that shall be implemented during the field storage of ammunition as such areas are normally planned and operated by general logistic personnel with limited access to ammunition specialists. This is because they are designed for the short-term storage of ammunition during operations. The tolerable risk is therefore accepted as being higher than the tolerable risk that would be accepted for longer-term permanent or temporary storage during peace.

Ammunition should not normally be stored under field conditions for more than one year, after such time it should be transferred to temporary or permanent storage facilities.

5 Risk acceptance (LEVEL 1)

Field storage on deployed operations may require a balance to be struck between safety and operational requirements. Where safety is to be compromised it shall be subject to a formal risk assessment (in accordance with the principles contained within IATG 02.10:2015[E] Introduction to risk management principles and processes), and the Force Commander shall be informed of the risk, particularly if it involves an increased risk to the general public.

All reductions in safety standards should be made with the authority of the respective technical authority but only after considered judgement on the balance of risk between reducing the safety of people and assets and the need to increase the practical efficiency of operations.

If a Commander makes a decision, against ammunition technical advice, that negatively impacts on explosive safety on the grounds that it is an operational imperative, and if assets to improve explosive safety are unavailable, then that Commander shall formally accept the risk, and that risk

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2 The exposure of ammunition and explosives to the temperature changes induced by day, night and change of season.
acceptance shall be appropriately recorded. The ammunition technical advisor shall immediately refer such a situation back to the conventional ammunition stockpile management organisation. The explosives limits licences in use during such a situation should be annotated that a command decision has been made to apply reduced quantity and separation distances.

Safety rules and procedures shall not be ignored during war or war-like operations.

6 Field storage (LEVEL 1)

6.1 General

Ammunition shall be deemed to be under field storage conditions when it has been out-loaded from peacetime ammunition depots to support military operations (usually abroad). It shall be considered to be a short-term tactical measure, and such field conditions should only be permitted during the period of active military operations. Once such operations have concluded the ammunition should either be returned to peacetime ammunition depots, or the ammunition should be stored in accordance with the more stringent temporary storage requirements contained within IATG 04.20:2015[E] Temporary storage.

6.2 Field Storage Area components

A Field Storage Area (FSA) is the term used for an area used for the storage of ammunition and explosive conditions up to a maximum gross weight of 5000 tonnes. A number of FSA should be required for large stockpiles of ammunition.

6.2.1. Stack

A stack of ammunition is approximately 1 tonne gross weight, which occupies 1 cubic metre. It should be considered to be similar to the Unit of Space (UOS) concept often used in depot storage.

6.2.2. Field Stack Module (FSM)

A Field Stack Module (FSM) shall consist of up to 10 stacks, (i.e. a maximum of 10 tonnes gross weight of ammunition). This equates to a maximum credible explosive event (MCE) of 10 tonnes or less for a FSM. One ISO container would equate to an FSM.

6.2.3. Field Storage Site (FSS)

A Field Storage Site (FSS) consists of a number of Field Stack Modules. The number of FSM within a Field Storage Site should be dependent on the net explosive quantity (NEQ) of the ammunition and explosives expressed as a percentage of the gross weight, but shall not exceed 20.

An FSS may be considered to be a single PES for outside quantity distance (OQD) purposes.

6.2.4. Field Storage Area (FSA)

A Field Storage Area (FSA) should consist of a group of FSS. The number of FSS being determined by; 1) the quantity and type of ammunition required for operations; 2) the need for at least two point dispersion to protect stocks; and 3) the need to store incompatible munitions separately.

\(^3\) All Up Weight including packaging.
6.3 Location of Field Storage Areas

There are a range of factors that should be considered when selecting a location for a Field Storage Area. These are shown in Table 1.

<table>
<thead>
<tr>
<th>Critical Factors</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td>• No underground hazards, such as oil or gas tanks and pipelines.</td>
</tr>
<tr>
<td></td>
<td>• Firm ground capable of taking heavy vehicles (of up to 14 tonnes) even during inclement weather.</td>
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<tr>
<td></td>
<td>• Ideally, the ground should be dry, well drained, pervious to water and fairly level.</td>
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<td></td>
<td>• Natural traverses formed by hills are desirable to reduce the size of the area required and also the risk to neighbouring areas.</td>
</tr>
<tr>
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<td>• Large quarries or farm complexes normally make suitable Field Storage Areas.</td>
</tr>
<tr>
<td>Dispersion</td>
<td>• Adequate space must be allowed for dispersion of the stock and separation between the different Field Storage Sites.</td>
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<td></td>
<td>• Specific explosives natures should be split between at least two locations to prevent all the stock of a specific nature being lost in a single accident.</td>
</tr>
<tr>
<td>Expansion</td>
<td>• Extra space must be planned to allow for expansion in case of a requirement to hold increased levels of stock.</td>
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<tr>
<td></td>
<td>• Such extra space can alternatively be used should a part of the area in use become unsuitable as a result of inclement weather or the cutting up of tracks by heavily laden vehicles.</td>
</tr>
<tr>
<td>Communications</td>
<td>• Field Storage Areas must be readily accessible to major roads or railways, yet far enough away that they do not present an explosive hazard.</td>
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<tr>
<td></td>
<td>• Good minor roads are required on the approaches to, and in, the area.</td>
</tr>
<tr>
<td>Natural Fire Protection</td>
<td>• Natural firebreaks to prevent the spread of fire from one Field Storage Site to another are advantageous.</td>
</tr>
<tr>
<td></td>
<td>• Similarly, roads can be used as effective firebreaks.</td>
</tr>
<tr>
<td>Security</td>
<td>• Field Storage Areas are necessarily large and security will be a concern.</td>
</tr>
<tr>
<td></td>
<td>• Access can be temporarily denied by the use of armed guards and guard dogs.</td>
</tr>
<tr>
<td>Isolation</td>
<td>• A Field Storage Area should not be located adjacent or close to other main storage areas, airfields or hospitals.</td>
</tr>
<tr>
<td></td>
<td>• They should also be located well away from any large radio transmitters.</td>
</tr>
<tr>
<td>Improvement</td>
<td>• The selected site should be capable of improvement if it is to become a temporary storage area, or even have permanent storage infrastructure developed on it in the future.</td>
</tr>
</tbody>
</table>

Table 1: Field Storage Area location criteria

6.4 Implementation of field storage (LEVEL 1)

None of the normal hazards associated with the storage of ammunition and explosives are reduced just because it is being stored under field conditions. Ammunition depots provide infrastructure designed to protect ammunition from deterioration and external events; this protection is much reduced under field storage conditions and hence the potential for accidents and explosive deterioration is increased. The guidance given in this Clause should be specifically followed in order to reduce risk as far as possible.

6.4.1 Stack (LEVEL 1)

Ammunition should be stored wherever possible in its original service packaging. Loose ammunition should be stored on dunnage (timber or brick) and raised at least 0.1m above the ground to allow for air circulation. Each layer should be reversed to improve the stability of the stack. Chocks should also be nailed to the stacks to prevent them collapsing.

Ammunition should be orientated so that their markings can be easily read. Dirty ammunition should be cleaned before stacking to ensure visibility of markings.
Ammunition of the same type, lot and/or batch number should be stored in the same stack. Mixed stacks should be discouraged.

6.4.2. Field Stack Module (LEVEL 1)

An FSM consists of up to 10 stacks. Sufficient space should be allowed between each stack to allow for access by individuals or rough terrain forklift truck, and ideally the field stack module should cover an area of ground of at least 7m x 3m.

![Figure 1: Field Stack Module](image)

Ideally there should be a distance of 25m between each FSM to reduce the risks of propagation, act as a firebreak and to allow for vehicular access. It is accepted, however, that this will significantly increase the area of the field storage site and thus make security more difficult. Therefore the minimum distance between FSM shall be 2m, although 5m is preferable.

6.4.3. Field Storage Site (LEVEL 1)

An FSS should normally cover a minimum length of track or road of 50m, assuming FSM are stored each side of the road.

![Figure 2: Field Storage Site](image)

The number of FSS within a Field Storage Area should be determined by:

a) the land area available to achieve effective separation and quantity distances (see Clause 7.4.2);
b) the necessity for two point dispersion within the Field Storage Area; and

c) the requirements to store incompatible groups separately (see Clause 7.1).

6.4.4. Field Storage Area (LEVEL 1)

An FSA should contain between 600 to 5000 tonnes gross weight of ammunition. Within the FSA there will be a number of FSS, with the number of FSS being dependent on the type of ammunition being stored. There will therefore be a 25 FSS within an FSA if they are all of the 200 tonne type. More realistically an FSA will contain more FSS due to the requirements in Clause 6.4.3.

The distance between FSS within an FSA shall be determined by the separation and quantity distances at Clause 7.4.1.

The safe separation distance between an FSA and local civilian communities shall be determined by the separation and quantity distances at Clause 7.4.2.

Figure 3: Field Storage Area

An FSA may require a range of supporting facilities and activities to ensure its efficient operation. These should include:
Facility or Activity | Requirements
---|---
Administrative Area | • This should be co-located with the Site Access Control.
• An appropriate Outside Quantity Distance (OQD) between the administrative area and the nearest field storage sites should be implemented to ensure the reduction of risk to site workers.
• The administrative area should have line communications to the civilian exchange.

Demolition Ground | • A small demolition area should be identified that can be used for the destruction of unsafe ammunition that presents an immediate risk of detonation or deflagration.

Returned Ammunition Group (RAG) | • At least one FSS should be kept empty and used for the storage of ammunition returned from units.
• This ammunition will require technical inspection before it can be re-issued.

Site Access Control | • Access to the FSA, or individual FSS should only be permitted for authorised personnel.
• A strict system of access control should be implemented.
• The access control system shall ensure that smoking materials, matches, lighters, mobile telephones etc are not permitted within the field storage area.

Traffic Circuits | • Traffic circuits within the FSA should be signposted and made one way wherever possible.
• A sketch map of the FSA should be made available to drivers of ammunition vehicles.

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<tr>
<td></td>
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</tbody>
</table>

Table 2: Field Storage Area facilities and activities

6.5 Ammunition processing

6.5.1. Ammunition inspection, repair and maintenance

Routine ammunition inspection, repair and maintenance operations would not normally take place during field storage conditions.

7 Explosive safety

7.1 Mixing rules (LEVEL 2)

Ideally each Field Storage Site should consist of ammunition belonging to a single Compatibility Group (CG). Each Field Stack Module shall consist of ammunition belonging to a single CG. Should CGs have to be mixed then the rules at Table 3 shall apply.

<table>
<thead>
<tr>
<th>Compatibility Group</th>
<th>A</th>
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4 See IATG 01.50:2015[E] UN Explosive Classification System and Codes.
Table 3: Compatibility Group mixing rules

<table>
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<th>Compatibility Group</th>
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<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>(4)</td>
<td>NO</td>
</tr>
<tr>
<td>N</td>
<td>NO</td>
<td>NO</td>
<td>(5)</td>
<td>(5)</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>(7)</td>
<td>(6)</td>
</tr>
<tr>
<td>S</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>(6)</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>

NOTE 1  Compatibility Group B fuzes may be stored with the articles to which they belong, but the NEQ shall be aggregated and treated as Compatibility Group F. Compatibility Group B ammunition (other than fuzes) shall be stored in a separate site.

NOTE 2  Storage in same area permitted if effectively segregated to prevent propagation.

NOTE 3  Providing Compatibility Group G is still in its authorised outer packaging and at discretion of national authority.

NOTE 4  Articles of Compatibility Group N should not be stored with other Compatibility Groups except S. However if such articles are stored with articles of Compatibility Groups C, D and E, the articles of Compatibility Group N should be considered as having the characteristics of Compatibility Group D and the Compatibility group mixing rules apply accordingly.

NOTE 5  Articles of Compatibility Group N should not be stored separately from other articles of other compatibility groups as well as from other articles of different types of Compatibility Group L.

NOTE 6  A mixed set of munitions of HD 1.6N and HD 1.6S may be considered as having the characteristics of Compatibility Group N.

NOTE 7  Compatibility Group F is to be stored separately, except that F may be stored with Hazard Division (HD) 1.4 of any Compatibility Group.

7.2  Ammunition requiring separate storage (LEVEL 1)

In addition to the mixing rules (Clause 7.1) certain types of conventional ammunition should always be stored in separate Field Storage Sites, (or under specific conditions), from other types of ammunition:

a)  white phosphorous (WP). The Field Storage Site for this ammunition should be very near to a source of water, or a water container large enough to fully accept the largest ammunition container should be on the site. The WP ammunition should be stored in an upright position with the base nearest the ground;

b)  missiles in a propulsive state. These should be stored in a barricaded Field Storage Site with the warheads pointing away from other ammunition stocks. If barricading is not available, then they should be stored at a Field Storage Site near the external perimeter of the Field Storage Area, even if this complicates security requirements;

c)  damaged ammunition. (If considered unsafe for storage, damaged munitions should be destroyed at the earliest convenience);

d)  ammunition in an unknown condition or of unknown origin. (This shall be stored at such a distance that detonation of this ammunition will not jeopardize other stocks);

e)  ammunition awaiting destruction or demilitarization;

f)  ammunition that is constrained or banned for use; and

g)  ammunition which has deteriorated and become hazardous. (This shall be stored in isolation and destroyed at the earliest convenience).

5 Barricades should be constructed in accordance with the guidance at Clause 7.5, IATG 04.20:2015 Temporary storage.
7.3 Aggregation rules (LEVEL 1)

Ideally each Field Storage Site should consist of ammunition belonging to a single Hazard Division (HD). Each Field Stack Module shall consist of ammunition belonging to a single HD. Should HDs have to be mixed then the rules at Table 4 shall apply.

<table>
<thead>
<tr>
<th>Serial</th>
<th>Hazard Divisions in FSS</th>
<th>Storage Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>YES NO NO</td>
<td>• Use HD 1.1 Quantity Distance.</td>
</tr>
<tr>
<td>2</td>
<td>YES YES NO</td>
<td>• Aggregate the HD 1.1 and 1.2 NEQ.</td>
</tr>
<tr>
<td>3</td>
<td>YES YES YES</td>
<td>• Aggregate the HD 1.1, 1.2 and 1.3 NEQ.</td>
</tr>
<tr>
<td>4</td>
<td>YES NO YES</td>
<td>• Aggregate the HD 1.1 and 1.3 NEQ.</td>
</tr>
<tr>
<td>5</td>
<td>NO YES NO</td>
<td>• Use HD 1.1 Quantity Distance for the aggregated NEQ total.</td>
</tr>
<tr>
<td>6</td>
<td>NO YES YES</td>
<td>• Aggregate the HD 1.1 and 1.3 NEQ.</td>
</tr>
<tr>
<td>7</td>
<td>NO NO YES</td>
<td>• Use HD 1.1 Quantity Distance.</td>
</tr>
</tbody>
</table>

Table 4: Aggregation rules

7.4 Quantity and Separation Distances (LEVEL 1)

Ammunition in field storage is particularly vulnerable to fire. Inadequate separation from site to site may cause large losses through secondary effect such as explosions initiated by the fire. It is therefore important that consideration be given to applying adequate Quantity Distances (QDs) between sites and ensuring that natural traverses and overhead cover are used wherever possible.

The aim of the paragraphs below is to detail the minimum QDs required for the storage of ammunition in Field Storage Areas. In all cases, QDs are to be measured from the nearest point of the Potential Explosion Site (PES) to the nearest point of the Exposed Site (ES).

7.4.1 Inside Quantity Distances - between Field Storage Sites (LEVEL 1)

The Inside Quantity Distance (IQD) is the distance required to reduce the risk by propagation of one field storage site directly affecting another by blast, flame or by radiant heat. The IQD will also provide a lesser degree of protection from fragmentation, projected and lobbed ammunition (UXO).

Table 5 contains the minimum IQD that should be used between Field Storage Sites:

<table>
<thead>
<tr>
<th>Hazard Division</th>
<th>Factor</th>
<th>Minimum IQD for Hazard Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Normal</td>
<td>200m 100m 100m 100m</td>
</tr>
<tr>
<td>1.1</td>
<td>Barricaded</td>
<td>100m 100m 100m 100m</td>
</tr>
<tr>
<td>1.1</td>
<td>Vital Stocks</td>
<td>300m 100m 100m 100m</td>
</tr>
</tbody>
</table>

---

6 See IATG 01.50:2015[E] UN Explosive classification system and codes.
7 This includes individual storage locations within a Temporary Storage Area.
8 See IATG 02.20:2015[E] Quantity and separation distances for further information on this risk management concept.
<table>
<thead>
<tr>
<th>Hazard Division</th>
<th>Factor</th>
<th>Minimum IQD for Hazard Division</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1.1</td>
</tr>
<tr>
<td>1.2</td>
<td>Normal</td>
<td>100m</td>
</tr>
<tr>
<td>1.3</td>
<td>Normal</td>
<td>100m</td>
</tr>
<tr>
<td>1.3</td>
<td>Propellant Stocks</td>
<td>200m</td>
</tr>
<tr>
<td>1.4</td>
<td>Normal</td>
<td>100m</td>
</tr>
</tbody>
</table>

Table 5: Minimum IQD between Field Storage Sites

Ammunition of Hazard Division 1.4S may be stored in isolation without regard to safety distances.

The following ammunition should be stored at least 300m from serviceable ammunition that is available for issue:

a) recovered ammunition that has not been inspected;

b) unserviceable ammunition; and

c) ammunition awaiting destruction or demilitarization.

Storage areas that contain packaging materials should be at least 100m away from a Field Storage Site storing ammunition. This is a key fire prevention measure.

7.4.2. Outside Quantity Distances - Field Storage Areas (LEVEL 1)

The Outside Quantity Distance (OQD) is the distance required to reduce the risk by propagation of explosions within a field storage site or area directly affecting, by blast, flame or by radiant heat, areas to which the civilian population have regular and uncontrolled access (i.e. roads, houses, factories etc). The OQD will also provide a lesser level of protection from fragmentation, projected and lobbed ammunition (UXO), although a degree of risk will remain.

Table 6 contains the minimum OQD\(^9\) that should be used between Field Storage Areas and areas that the civilian population has uncontrolled access to:

<table>
<thead>
<tr>
<th>Exposed Site (ES)</th>
<th>Minimum OQD for FSA containing Hazard Division</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Major Roads or Railways</td>
<td>400m</td>
<td>400m</td>
</tr>
<tr>
<td>Inhabited Buildings</td>
<td>500m</td>
<td>500m</td>
</tr>
<tr>
<td>Vulnerable Buildings</td>
<td>1,000m</td>
<td>1,000m</td>
</tr>
</tbody>
</table>

Table 6: Minimum OQD for Field Storage Areas

\(^9\) AASPT-5, Edition 1, Version 2, *NATO Guidelines for the Storage, Maintenance and Transport of Ammunition on Deployed Missions or Operations* contains a system using Field Distances (FD) between a wider range of options than contained within this IATG, but limits the NEQ to 4,000kg. The AASPT-5 system is designed to deal with more operational issues, such as safe distances between ammunition stocks and armoured vehicles. This is beyond the scope of this IATG, which is designed for the safe storage of non-operational stocks, where distances have been derived from AASTP-1 (see Annex B).
8 Stock protection from environmental factors (LEVEL 1)

8.1 Degradation of explosives and the weather

The effects of weather, hot temperatures, direct solar radiation, daily temperature changes (diurnal cycling) and high humidity may rapidly degrade the performance and safety of explosives. Ammunition is designed for use under stated climatic conditions, and its service life will be significantly reduced if it is stored under climatic conditions that it was not designed for. In some cases the ammunition may rapidly become unserviceable and dangerous to use.¹⁰

Although it is safe to store ammunition under field conditions, if appropriate conditions are met, it is unusual as it usually significantly reduces the safe service life of the ammunition. The worst condition for storing explosives under field conditions is where there is a considerable temperature fluctuation from day to night, combined with high humidity.

IATG 07.20:2015[E] Surveillance and proof contains further technical information on the degradation of explosives due to climatic conditions and should be consulted prior to undertaking field storage of ammunition. As an example, this IATG will consider the impact of high temperature and direct solar radiation (also see Clause 9).

In the Middle East recorded temperatures have ranged from -1°C to +31°C in the winter months and from +22°C to +51°C in the summer months. This means that the ammunition was exposed to daily diurnal cycles of up to +31°C in the winter months and +29°C in the summer months. These are usually considered as extreme ranges for ammunition, and a reduction in service life shall be expected. Yet, these temperatures are ambient air temperatures and do not take into account the effects of direct solar radiation on ammunition or on packaged ammunition.

Tests have shown that, when fully exposed to the sun, the temperature on the external surface of the ammunition can be as much as 50°C higher than the ambient air temperature. This means that ammunition could theoretically reach external surface temperatures of 101°C in the Middle East. It should be noted that the melting point of TNT based explosives is approximately 80°C; the very real danger of using TNT filled ammunition at this temperature cannot be overstated.

8.2 Climatic protection options (LEVEL 1)

The options for the protection of ammunition stocks in Field Storage Areas from climatic conditions are limited unless covered infrastructure is available. Table 7 summarises the available options. The option selected should depend on what sort of protection is required.

<table>
<thead>
<tr>
<th>Option</th>
<th>Impact</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directly covered by tarpaulins (or equivalent) in contact with ammunition.</td>
<td>- Protects ammunition from rain and wind.</td>
<td>WARNING. This option should NOT be used in hot climates.</td>
</tr>
<tr>
<td></td>
<td>- The temperature at the external surfaces of ammunition temperature is up to 5°C greater than if left unprotected.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Condensation due to poor air ventilation may lead to moisture ingestion in very hot climates.</td>
<td></td>
</tr>
<tr>
<td>Shaded by camouflage nets or sheeting raised above the ammunition.</td>
<td>- Protects ammunition from radiant heat.</td>
<td>The nets or sheeting should be raised to at least 300 mm to 500mm above the surface of the ammunition or ammunition packaging.</td>
</tr>
<tr>
<td></td>
<td>- The ammunition is vulnerable to rain and wind, hence moisture ingestion is possible.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- In hot climates, the temperature at the external surfaces of the ammunition can be reduced by up to 23°C compared to unprotected ammunition.</td>
<td>Much preferred to direct coverage.</td>
</tr>
</tbody>
</table>

¹⁰ More technical detail on this issue may be found in IATG 07.20:2015[E] Surveillance and proof.
8.2.1. Priorities for covered storage (LEVEL 1)

When covered storage is not available for all the explosives in Field Storage Areas, priority should be given to the natures that are likely to deteriorate most rapidly. However, rigid adherence to fixed guidelines may not always be feasible. The priorities may have to be altered to take into account, for example, the packaging of individual natures. For instance, in extremely hot climates, shells containing WP, which are normally fairly robust, may have to be accorded a high priority for covered storage because circumstances do not allow them to be stored in an upright attitude.

Assuming a normal standard of packaging, with no other requirements, the following order of priority for covered storage should be applied:

a) water activated explosives;
b) guided weapons and torpedoes;
c) anti-tank, ranging and spotting ammunition;
d) propelling charges;
e) pyrotechnics;
f) mortar ammunition;
g) grenades and mines;
h) boxed shell;
i) small arms ammunition (SAA); and
j) loose shell.

9 Surveillance and in-service proof (LEVEL 2 and 3)

It is highly likely that the service life of ammunition is significantly reduced if it is kept under field storage conditions for prolonged periods of time. It should be subjected to an effective technical surveillance and in-service proof programme. This is the only way to ensure that the ammunition does not deteriorate to a condition that compromises performance or safety in storage.
An example of the impact that field storage conditions have on ammunition is the chemical deterioration of propellant. During prolonged periods of storage, the rate of chemical deterioration of propellant is approximately doubled for every 10°C rise in temperature above 30°C. Most propellants, dependent on design, have a shelf life of at least 15 to 40 years when stored at a constant 30°C and will last much longer in temperate climates. In high heat environments the stabiliser is depleted far quicker and the probability of spontaneous combustion due to autocatalytic ignition becomes much higher. There is evidence that suggests that the reduction in shelf life versus temperature is as shown in Table 8.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Projected Shelf Life (Years)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>15.0 20.0 30.0 40.0</td>
<td>• Initial In-Service Shelf Life.</td>
</tr>
<tr>
<td>30</td>
<td>15.0 20.0 30.0 40.0</td>
<td>• Significant degradation starts after 30°C.</td>
</tr>
<tr>
<td>40</td>
<td>7.5 10.0 15.0 20.0</td>
<td>•</td>
</tr>
<tr>
<td>50</td>
<td>3.75 5.0 7.5 10.0</td>
<td>•</td>
</tr>
<tr>
<td>60</td>
<td>1.83 2.5 3.75 5.0</td>
<td>•</td>
</tr>
<tr>
<td>70</td>
<td>0.92 1.25 1.83 2.5</td>
<td>• This propellant is now approaching a dangerous condition and should be destroyed as soon as possible.</td>
</tr>
<tr>
<td>80</td>
<td>0.46 0.62 0.92 1.25</td>
<td>•</td>
</tr>
<tr>
<td>90</td>
<td>0.23 0.31 0.46 0.62</td>
<td>•</td>
</tr>
</tbody>
</table>

Table 8: Propellant degradation due to high temperature

Clause 8.1 indicated that ammunition could theoretically reach external surface temperatures of 101°C in the Middle East, although internal temperatures would be substantially less. Propellant degradation and stabiliser depletion is not linear, and the decay rate reduces during the night when the ammunition cools. Yet it is clear that field storage conditions for propellant in these types of temperature extremes would not be a particularly sensible idea.

IATG 07.20:2015[E] Surveillance and proof contains further technical information on the degradation of explosives and should be consulted prior to undertaking field storage of ammunition.

Troop Contributing Nations (TCN) to UN peacekeeping operations shall certify that all ammunition deployed in support of national contingents is ‘safe to deploy’ and is subject to a surveillance and proof programme fully in compliance with the requirements of IATG 07.20 Surveillance and proof. Form IATG 04.10:2015[E] at Annex C shall be completed and distributed as indicated on the certificate.

Troop Contributing Nations (TCN) to multi-national operations should certify that all ammunition deployed in support of national contingents is ‘safe to deploy’ and is subject to a surveillance and proof programme fully in compliance with the requirements of IATG 07.20:2015[E] Surveillance and proof. A similar form to that of Form IATG 04.10:2015[E] at Annex C should be completed and distributed as required by the deployed force headquarters.

10 Fire precautions (LEVEL 1)

Ammunition that is being stored in Field Storage Areas is more vulnerable to fire than ammunition held in purpose built ammunition depots. Therefore, even more importance shall be paid to fire prevention and fire fighting measures.

The fire precautions, fire-fighting principles and procedures contained within IATG 02.50:2015[E] Fire safety shall be complied with as far as is reasonably practicable.
10.1.1. Fire precautions (supplementary to IATG 02.50:2015[E])

Firebreaks, 2m wide, shall be maintained around all open stacks. Additionally, all vegetation within 10m of ammunition stacks should be strictly controlled by cutting back.

10.1.2. Fire fighting (supplementary to IATG 02.50:2015[E])

The equipment recommendations in IATG 02.50:2015[E] Fire safety shall be supplemented by an adequate supply of fire-beaters, shovels, machetes etc in each Field Storage Site to deal with bush and scrub fires that are not normally encountered within an ammunition depot.

An Emergency Water Supply should be located at each Field Storage Site.

The appropriate Fire Division Signs and Supplementary Fire Signs shall be displayed on posts at the approaches to each Field Storage Site, although black and green tactical versions may be used if justified by the operational environment.

All fires in the vicinity of the ammunition should be fought until stacks of ammunition or explosives become involved in the fire or the fire is extinguished. If ammunition becomes involved in a fire, personnel shall be removed immediately from the site to safe locations/distances.

All personnel shall be made aware of the appropriate emergency withdrawal safe distance that they shall place between themselves and the ammunition should immediate fire-fighting prove to be ineffective at controlling the spread of the fire. This safe distance shall not be less than 750m.

Personnel whose duties require them to fight secondary fires shall not approach within 300 m of any fire involving ammunition and explosives other than Fire Division 4. They shall immediately withdraw to the designated safe distance, (at least 800m), when the fire fighting teams at the ammunition site withdraw.

After an ammunition fire has been extinguished, personnel shall wait at least six hours before entering the area to inspect the consequences of the fire.

11 Security (LEVEL 1)

The security of Field Storage Areas should be the responsibility of the unit operating that particular site. As FSAs are normally only used during military operations, their security becomes a normal military task based on available assets and operational requirements.
Annex A
(normative)

References

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of the guide. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of the guide are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO maintain registers of currently valid ISO or EN:

a) IATG 01.40:2015[E] Terms, glossary and definitions. UNODA. 2015;
b) IATG 01.50:2015[E] UN Explosive classification system and codes. UNODA. 2015;
c) IATG 02.20:2015[E] Quantity and separation distances. UNODA. 2015;
d) IATG 02.50:2015[E] Fire safety. UNODA. 2015:
f) IATG 05.30:2015[E] Barricades. UNODA. 2015;
g) IATG 05.40:2015[E] Safety standards for electrical installations. UNODA. 2015; and
h) IATG Series 07 Ammunition processing. UNODA. 2015.

The latest version/edition of these references should be used. The UN Office for Disarmament Affairs (UN ODA) holds copies of all references used in this guide. A register of the latest version/edition of the International Ammunition Technical Guidelines is maintained by UN ODA, and can be read on the IATG website: www.un.org/disarmament/un-safeguard/. National authorities, employers and other interested bodies and organisations should obtain copies before commencing conventional ammunition stockpile management programmes.

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11 Where copyright permits.
Annex B
(informative)
References

The following informative documents contain provisions which should also be consulted to provide further background information to the contents of this guide:


b) AASTP-5, Edition 1, Version 2, NATO Guidelines for the Storage, Maintenance and Transport of Ammunition on Deployed Missions or Operations. NATO. October 2012; and


The latest version/edition of these references should be used. The UN Office for Disarmament Affairs (UN ODA) holds copies of all references used in this guide. A register of the latest version/edition of the International Ammunition Technical Guidelines is maintained by UN ODA, and can be read on the IATG website: www.un.org/disarmament/un-safeguard/. National authorities, employers and other interested bodies and organisations should obtain copies before commencing conventional ammunition stockpile management programmes.

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12 Where copyright permits.
Annex C
(normative)
Proof and surveillance compliance form

### Proof and Surveillance Compliance Reporting Form

<table>
<thead>
<tr>
<th>Serial</th>
<th>Troop Contributing Nation Details</th>
<th>IATG Form 04.10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IATG Form 12.10C</td>
</tr>
<tr>
<td>1</td>
<td>Troop Contributing Nation Details</td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Nationality</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Major Units Deployed</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Minor Units Deployed</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Sub-Units Deployed</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>Associated Products</td>
<td></td>
</tr>
</tbody>
</table>

2 Ammunition Details

| 2.1    | Types and Calibre (List)          |
| 2.5    | Any Proof and Surveillance Concerns or Limitations in Use |

3 Certification

| 3.1    | This form certifies that the in-service proof and surveillance in accordance will ALL the requirements of IATG 07.20 Proof and surveillance has been carried out on all ammunition deployed in support of this operation. This form also certifies that the ammunition is 'safe to deploy and store' and that any concerns about its safety in storage or use have been identified in Box 2.5 above. |
| 3.2    | Certifying Individual             |
| 3.3    | Certifying Authority             |
| 3.4    | Signature                        |

4 Distribution

| 4.1    | Appropriate National Technical Authority |
| 4.2    | UN Department of Peacekeeping Operations |
| 4.3    | Force Commander UNIF---             |
Amendment record

Management of IATG amendments

The IATG guidelines are subject to formal review on a five-yearly basis, however this does not preclude amendments being made within these five-year periods for reasons of operational safety and efficiency or for editorial purposes.

As amendments are made to this IATG they will be given a number, and the date and general details of the amendment shown in the table below. The amendment will also be shown on the cover page of the IATG by the inclusion under the edition date of the phrase 'incorporating amendment number(s) 1 etc.'

As the formal reviews of each IATG are completed new editions may be issued. Amendments up to the date of the new edition will be incorporated into the new edition and the amendment record table cleared. Recording of amendments will then start again until a further review is carried out.

The most recently amended, and thus extant, IATG will be the versions that are posted on the UN SaferGuard IATG website at www.un.org/disarmament/un-saferguard/.

<table>
<thead>
<tr>
<th>Number</th>
<th>Date</th>
<th>Amendment Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>01 Feb 15</td>
<td>Release of Edition 2 of IATG.</td>
</tr>
</tbody>
</table>

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