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**Control of explosives facilities**



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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.<sup>1</sup> In recognition of these dual threats of explosion and diversion, the General Assembly requested the United Nations to develop **guidelines for adequate ammunition management**.<sup>2</sup> 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](http://www.un.org/disarmament/ammunition).

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<sup>1</sup> S/2008/258.

<sup>2</sup> 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

Explosives facilities, by their very nature, present special hazards and these hazards must be uppermost in the minds of those responsible for their administration and of those who work in them. This IATG module outlines the control regime that should be implemented in explosives facilities. It is strongly recommended that the information contained in this IATG module should be the minimum standard of national technical authority regulations.

## Control of explosive facilities

### 1 Scope

This IATG module introduces the principles and requirements for the routine control of activities within ammunition and explosive areas and facilities during the storage, handling, processing and internal transportation of ammunition and explosives.

### 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

For the purposes of this module the following terms and definitions, as well as the more comprehensive list given in IATG 01.40 *Glossary of terms, definitions and abbreviations*, shall apply.

The term 'national technical authority' refers to *the government department(s), organisation(s) or institution(s) charged with the regulation, management, co-ordination and operation of conventional ammunition stockpile management activities*.

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.

**'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.

**'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.

**'may' indicates permission:** It is used to indicate a course of action permissible within the limits of the document.

**'can' indicates possibility and capability:** It is used for statements of possibility and capability, whether material, physical or casual.

## 4 Personnel employed in explosives facilities (LEVEL 2)

### 4.1 Training and supervision

Before being employed in an explosives facility all personnel shall receive training, on a national technical authority approved syllabus, on explosives safety, fire prevention, firefighting and security. This training shall be repeated at regular intervals, as laid down by the national technical authority, for all staff members regardless of rank or position and shall be recorded.

In addition to the above, task-specific training shall be provided to personnel who operate specialized equipment (cranes, forklifts, truck drivers, etc.).

Personnel employed in an explosives facility shall work under strict supervision until they have acquired a working knowledge of all safety requirements. This applies to anyone training to be an explosives worker or an explosives area support worker.<sup>3</sup> Any training within an explosives area shall take place only when it cannot reasonably take place elsewhere. This training shall be the subject of a risk assessment. Such training may include, but not be limited to, training in the storage, handling, processing and inspection of explosives and explosives facilities.

Before entering an explosives area, a trainee shall receive appropriate instruction on explosives and explosives area safety. The number of trainees and other workers in the explosives area and their distribution shall be controlled to take account of individual and societal risks.

Supervisors shall not oversee any task involving the handling, processing, or storage of explosives until such time as they are considered by the head of the establishment to be thoroughly familiar with all the relevant regulations relating to the task.

## **4.2 Special conditions of employment (LEVEL 2)**

### **4.2.1 Disabled personnel**

Disabled personnel may be employed within an explosives facility and each case shall be considered on its merits. The head of the establishment shall be satisfied that the nature of the disability does not present an unacceptable risk. However, within these parameters, and where circumstances permit, disabled personnel may be employed.

A major consideration regarding the hiring of a disabled person to work in an explosives operation is their ability to evacuate, or to be evacuated, safely in the event of an explosive event or other serious situation, without putting others at risk.

### **4.2.2 Young people**

Good practice and experience has shown that persons under the age of 18 years, or persons over 18 years when there is reason to suspect that they are immature or irresponsible, should not be employed in, or permitted access to, any facility where explosives are stored or handled, except under appropriate supervision. A person under the age of 16 years should not be employed in any such facility.<sup>4</sup>

There may also be national legislation that applies to the hiring of persons under 18 years of age to perform hazardous operations.

### **4.2.3 Women**

Hiring managers and heads of establishment shall ensure that the selection or appointment of qualified women is not affected by conscious or unconscious gender biases.

## **4.3 Specific employment conditions (LEVEL 2)**

Individuals employed to work in an explosives area shall be responsible and of sound mind. The following shall not be employed to work in explosives areas:

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<sup>3</sup> See IATG 06.60 *Works services (construction and repair)*.

<sup>4</sup> In line with the principles contained within United Nations General Assembly Resolution 263 Session 54, *Optional Protocols to the Convention on the Rights of the Child on the involvement of children in armed conflict and on the sale of children, child prostitution and child pornography*. 25 May 2000.

- persons addicted to excessive consumption of alcoholic liquors or to controlled substances; and
- users of illegal substances.

## **5 Security<sup>5</sup>**

### **5.1 Patrolling and guarding (LEVEL 1)**

Explosives facilities should be patrolled in accordance with national technical authority regulations and the requirements of IATG 09.10 *Security principles and systems*. Each entrance to an explosives area, except when closed and secured, shall be guarded by sentries who shall:

- prohibit entry by unauthorised personnel and personnel disqualified by this module;
- scrutinise or, if suspicious, search all personnel and personal vehicles before admitting them;
- challenge personnel as to whether they possess controlled articles or contraband as defined below; and
- operate the control of entry system as described below.

### **5.2 Control of entry (LEVEL 1)**

No one shall be permitted to enter an explosives facility during normal working hours unless he or she produces a current official pass applicable to the area in question authorised by, or on behalf of, the head of the establishment, or has been specifically authorised to do so by the head of the establishment in person. During non-working hours, no one shall be permitted to enter an explosives facility unless he or she is specifically authorised to do so by, or on behalf of, the head of the establishment. Such entry into explosives facilities shall be via recognised entrances only. No person who shows signs of intoxication or drug abuse is to be allowed to enter an explosives facility.

The head of the establishment shall ensure there is in place a system for the mustering of all staff in the event of an incident in the explosive area. This system may take the form of a swipe card, numbered disc, etc. The custody, issue and return of discs or the control of swipe cards shall be strictly controlled and the building in which this function is carried out should be one that is unlikely to be destroyed or seriously damaged in the event of a fire or explosion. The use of barricades for protection should be considered. For small explosives facilities, for example a single potential explosion site (PES) or small group of PES, consideration should be given to the adoption of this or a suitable similar system such as a log book.

### **5.3 Contraband (LEVEL 1)**

The entry of certain items into explosives facilities is strictly controlled. These are known as controlled articles or contraband and are described below. Cases of doubt regarding the status of a particular item shall be referred to the head of the establishment and, if necessary, the national technical authority. Until the item is thus approved it should be considered as contraband.

#### **5.3.1. Example of a contraband notice**

An example of such a notice is at Annex C. It shall be prominently displayed at all of the entrances to all explosives facilities. This notice is to be produced locally to the required size as designated by the head of the establishment or national technical authority.

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<sup>5</sup> Also see IATG 09.10 *Security principles and systems*.

### 5.3.2. Smoking materials and designated smoking areas (LEVEL 1)

Smoking shall be strictly prohibited in an explosives area or PES except in places designated as smoking areas. These areas are known as designated smoking areas (DSA) and shall operate as required by the head of the establishment. All smoking and smoking related materials shall be declared at the control building. Means of ignition, including the removable portions of car lighters, shall be handed in. The owner may then take cigarettes or tobacco direct to the DSA. In order to avoid taking means of ignition into the area, a non-removable electric cigarette lighter may be fixed to the wall in the DSA.

Where such lighters are not provided, then the means of ignition shall be taken to and from the DSA in a locked red box observing the appropriate requirements detailed below. A separate red box shall be used to transport the smoking materials. The 'Red Box' containing smoking materials should always be locked and the key shall be in the physical possession of a designated person.

### 5.3.3. Firearms (LEVEL 1)

Firearms are prohibited within an explosives area or facility with the following exceptions:

- A) controlled weapons required in proof, test or trials facilities;
- B) firearms carried by authorised personnel on guard, defence and operational duties, or for authorised tactical exercises. Although these persons should normally patrol within a fenced boundary area;
- C) firearms held in authorised locations for rapid deployment of defence force personnel. The keys for these weapons shall be held under secure arrangements, separate from the explosives area keys; and
- D) firearms used for sports shooting or vermin control, in organised events that have been subjected to a formal risk assessment and which have been authorised by the head of the establishment.

### 5.3.4. Food and drink (LEVEL 1)

No alcoholic drinks shall be taken into an explosives area. Food and non-alcoholic drinks may be admitted subject to the prior approval of the head of the establishment. For reasons of hygiene and health, the consumption of food or drink is not permitted inside an ASA, and such items shall only be consumed in designated locations.

### 5.3.5. Battery powered devices (LEVEL 1)

Battery powered devices of any description, including mobile telephones and MP3 players, shall not be taken into an explosives facility unless specific authority has been obtained from the head of the establishment and the requirements of IATG 05.40 *Safety standards for electrical installations* have been met.

## 5.4 Searching of personnel (LEVEL 1)

Before entering an explosives facility all personnel shall search their pockets and bags and deposit outside the entrance any controlled articles that they have with them. A suitable, secure personal container should be provided for the reception of such articles. All persons employed in or visiting an explosives facility may, if they consent, be subjected to a thorough search at the entrance before entering and when leaving, or at any time whilst they are in the explosives area. The search is to be made in accordance with national technical authority regulations. Should they not consent then they should be prevented from entering or leaving until the head of establishment makes a decision on the appropriate next steps.

Personnel shall only be searched by personnel of the same gender and only in the presence of personnel of the same gender. Any body-search policy should be determined by the national technical authority. Searches shall be carried out at random intervals and a record maintained. Personnel unwilling to consent to search shall not be admitted to an explosives facility.

Visitors are also liable to be searched if this is considered desirable by access control personnel. Visitors shall only be searched by personnel of the same gender and only in the presence of personnel of the same gender. Visitors who do not submit to this liability are to be refused admittance. Before any visitor is searched, reference is to be made to the head of the establishment.

#### **5.4.1. Footwear**

Metal shod footwear is prohibited in a PES.

### **5.5 Magnetic therapy products (LEVEL 1)**

The wearing or carrying of magnetic therapy products such as bracelets, 'spot' magnets and joint bandages are expressly forbidden within an explosives area.

### **5.6 Spark, flame, or heat producing items (LEVEL 1)**

Spark, flame, or other heat producing items shall not be permitted inside an explosives facility unless required for a specific reason, such as a works service. Any item required shall be authorised using the permit to work system.<sup>6</sup>

### **5.7 Lighting of fires (LEVEL 1)**

The unauthorised lighting of fires in explosives facilities is strictly prohibited. Authority for the lighting of fires shall be given by the head of the establishment in special circumstances only. Such authority shall be subject to a formal risk assessment. When authority has been given for a fire to be lit only a means of ignition approved by the head of the establishment shall be used. The means of ignition are to be taken into the facility in a lockable red box by the person authorised to use them. The user is to keep the key to the box in his or her possession and is to allow no other person to have access to the means of ignition, and is to use them only for the purpose for which they have been authorised. Means of ignition are not to be left in the facility when unoccupied but are to be brought out by the authorised person.

Authorisation is to be given in writing by the head of the establishment and shall state the purpose for which the means of ignition are required.

The appropriate numbers/types of fire extinguishers shall be readily available and present.

The fire department should be present during the fire.

A safety monitor appointed by the head of establishment shall verify that the fire has been completely extinguished after its use. The safety monitor should normally be a member of the fire department.

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<sup>6</sup> See IATG 06.60 *Works services (construction and repair)*.

## 5.8 Vehicle tracker devices<sup>7</sup> (LEVEL 2)

Many vehicles are now fitted with anti-theft tracking devices or stolen vehicle recovery systems. The driver may not be aware of this; as such it must be assumed that all vehicles entering an ammunition storage area (ASA) have them fitted. It has been assessed that the probability of accidental initiation of electro-explosive devices (EED) is negated by maintaining a minimum distance of 5m between the vehicle and the exterior walls of any building containing explosives.

To ensure that the risk of the presence of tracker devices to unscreened or unshielded EEDs or guided weapons is as low as is reasonably practicable (ALARP) heads of establishment shall establish a control mechanism that routes any vehicle fitted with a tracker device in such a manner that it will not approach, or pass, within 25m of an ammunition process building (APB), explosive storehouse (ESH), building or area where affected EEDs or guided weapons are or may be present.

## 5.9 Other controlled items (LEVEL 1)

In normal circumstances, many other items are not permitted to enter explosives facilities. However, there are occasions when the following normally prohibited items may be authorised for entry into a facility by the head of the establishment. For example:

- cameras which are compliant with IATG 05.40 *Safety standards for electrical installations*;
- fuels, oils and lubricants not in sealed approved containers;
- lanterns, oil lamps and stoves; and
- unauthorised tools.

### 5.9.1. Vehicle radio key fobs (LEVEL 2)

These are battery powered devices to lock and unlock vehicles and should not be permitted inside PES. If the head of the establishment authorises their access, they may be permitted inside explosives areas where protected EIDs are present. Where exposed EIDs are present they shall not be permitted.

## 6 Estate management

Good estate management is important in promoting the maintenance, safety and serviceability of PES and their contents. In order to promote this, heads of establishment shall liaise with the responsible authorities to ensure all appropriate measures are put in place. Areas of responsibility are to be clearly defined.

### 6.1 Site plans (LEVEL 1)

The head of the establishment shall ensure that accurate, scaled site plans are drawn up. These plans shall be held at the facility control office and by the fire focal point. Each PES shall be uniquely numbered to ease identification.

### 6.2 Works services (LEVEL 2)

Works services in, on or in the vicinity of, a PES shall be carried out in accordance with IATG 06.60 *Works services (construction and repair)*.

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<sup>7</sup> See IATG 05.60 *Hazards of electromagnetic radiation*.

### **6.3 Release of surplus facilities for non-explosive use (LEVEL 2)**

The national regulations pertaining to explosives clearance and certification of surplus explosives facilities shall be followed. The regulations should ensure that all buildings and land are cleared and land released by national authorities in line and Certified as Free from Explosives (CFFE).<sup>8</sup>

### **6.4 Roads and drainage (LEVEL 2)**

Roads in and leading to explosive facilities should be maintained in a good state of repair. This will lessen the risk of accidents. Drain covers in road surfaces should be serviceable and correctly fitted. Traffic flow systems should be clearly marked. Good drainage of the land in explosives facilities is essential to the proper maintenance of roads, railways and buildings. All streams, ditches and culverts should be kept clear and free of obstruction.

### **6.5 Railway lines (LEVEL 2)**

The head of the establishment should ensure that there is no obstruction to the view of road users or locomotive drivers at junctions of roads and railway lines. Warning notices should be prominently displayed at the approaches to all such junctions and the normal road traffic rules should be observed. If rail lines run between a PES and its associated traverse their use should be confined to traffic serving that building.

### **6.6 Vermin control (LEVEL 1)**

Vermin are a source of damage to buildings and services. Rabbits and other burrowing animals such as termites can cause severe damage to barricades, undermine buildings and roads or damage ammunition and its associated packaging. Control measures should be taken to eliminate vermin and burrowing animals from explosives facilities. However national legislation may protect some of these creatures as they may be 'endangered or protected species' and the head of the establishment should take note of any such legislation when considering solutions.

Regular or periodical inspection should be carried out to ascertain any signs of attack or damage. The soil conditions at the facility will have an impact on the damage that vermin or pests can cause. Pesticides can be permanently imbedded before the construction of buildings or they can be temporarily deployed inside buildings to prevent damage to the buildings and their contents.

### **6.7 Vegetation and crops (LEVEL 1)**

This section describes the minimum recommended standards that should be implemented for the control of grass, trees and vegetation in and around explosives facilities. Grass, trees and vegetation shall be subject to control to ensure that they do not present a hazard to explosives in storage. Uncontrolled growth presents a major fire risk, particularly during dry weather conditions. Close liaison should be maintained between the facility and local firefighting services.

Other hazards will be dependent upon the topography and seasonal changes but include the undermining of foundations, the blockage of underground services by tree and shrub roots, blocking of drains by leaves and grass, and damage to buildings and facilities that could occur if trees fall on them. Trees and vegetation can also provide cover for intruders, particularly around perimeter fences.

Cut vegetation should be removed from the explosive facility on the day that it is cut, and cutting activities should be limited to ensure that the resulting waste vegetation may be removed from the explosive facility on the same day.

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<sup>8</sup> See IATG 06.50 *Special safety precautions (storage and operations)*, para 7.2.

### **6.7.1. Control measures and a three-area plan (LEVEL 1)**

Vegetation, undergrowth, dead leaves, and other growth creates a serious fire risk particularly during extended periods of dry weather. To reduce the risk of fire, a three-area plan should be implemented.

#### **6.7.1.1. Area 1**

In this area, no vegetation shall be permitted within 1m of a PES unless it is grass on earth covered buildings.

#### **6.7.1.2. Area 2**

Whenever possible, no vegetation over 50mm in height shall be allowed within a further 5m of a PES i.e. within 6m. No vegetation longer than 50mm on, or within 5m of, earth-covered buildings, or on barricades within 5m of a PES shall be allowed. This requirement allows emergency personnel to identify ejected unexploded articles in the event of an explosion. It also permits staff to easily identify damage to barricades caused by burrowing animals.

#### **6.7.1.3. Area 3**

Beyond the 6m boundary line the length of vegetation shall be in accordance with the site locally assessed risk (see below).

### **6.7.2. Site risk assessment (LEVEL 1)**

Local assessment of the risks facing the facility is the responsibility of the head of the establishment. A risk assessment team should be formed, and its membership should consist of specialists such as:

- A) the explosives safety representative;
- B) the fire focal point;<sup>9</sup>
- C) the security officer;
- D) estate management staff; and
- E) any other personnel considered necessary by the head of the establishment.

### **6.8 Control of trees and shrubs (LEVEL 1)**

Trees and shrubs may be permitted within explosives facilities provided that they do not provide a means by which a fire can bridge a firebreak as per the three-area plan. Conifers and spruce trees should not be closer than 30m to explosives facilities. Other types of trees should not be allowed closer than 15m. Trees should be regularly maintained by a competent person to ensure that they remain healthy. The proximity of trees to a PES should be controlled so that in the event of them being blown over they will not hazard the PES or its contents.

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<sup>9</sup> See IATG 02.50 *Fire safety*.

## 6.9 Cut vegetation (LEVEL 1)

Cut vegetation such as grass, branches and hay should be removed from the short grass areas around PES defined by the three-area plan immediately after cutting. If the cuttings are removed to a distance of not less than 50m from a PES, for example stacks of hay and cereal crops, they may be temporarily stacked to await their removal. Such removal should be completed within three days from the date of cutting. The head of the establishment is responsible for ensuring that any grass cutting or vegetation control contract tendered includes the requirement to remove all cuttings in accordance with this paragraph. Burning of cut vegetation shall not be permitted within an ammunition area, without the specific approval of the head of establishment.

## 6.10 Agriculture and agricultural chemicals (LEVEL 1)

Agricultural operations, excluding the grazing of livestock, may be permitted in explosives facilities subject to the following conditions. These conditions shall be formalised in a written contract between the head of the establishment and the operator carrying out the agricultural operations:

The number of exposed personnel shall be kept to the minimum required.

People and vehicles entering may be subject to search as previously described.

A) agricultural personnel involved in the agricultural operation shall be given the same protection as if they were contractors;<sup>10</sup>

B) any agricultural operation which is within the area encompassed by the inhabited building distance (IBD) shall not involve more days than would normally be required to maintain the area, e.g. grass cutting;

C) the crops grown shall not create a significant fire risk. The unit fire focal point shall advise if increased fire precautions are required, particularly increased fire breaks. These recommendations shall be implemented before agricultural operations commence; and

D) the contract with the operator shall include the stipulation that when agricultural operations cease, the ground is returned to short grass.

Only chemicals and fertilisers whose residue does not produce or cause a significant fire risk shall be used to control vegetation in explosives facilities. Any chemicals used shall be chlorate free.

## 6.11 Livestock (LEVEL 1)

The grazing of livestock within explosives facilities should not normally be permitted because of the amount of access time to the area normally required by the farmer or his or her employees and its consequential effect on the overall limits and exposure time in the facility. However, should the head of the establishment consider such grazing feasible, a risk assessment should be carried out and the results submitted to the national technical authority for consideration. This shall be done before any contractual obligation is undertaken. Even if the livestock is the property of the facility the same procedure shall be followed.

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<sup>10</sup> See IATG 06.60 *Works services (construction and repair)*.

## **7 Fire and first aid**

### **7.1 Fire (LEVEL 1)**

All personnel shall have a responsibility to do all in their power to prevent fires, report any occurrence of fire, to take immediate and appropriate firefighting measures to stop/control a fire before it impacts a PES and to co-operate in any larger firefighting effort. The head of the establishment shall be responsible for the production of fire orders, the establishment of fire prevention measures and a pre-fire plan. Detailed instructions for fire pre-planning and firefighting are given in IATG 02.50 *Fire safety*.

### **7.2 First aid equipment (LEVEL 1)**

First Aid equipment to a national technical authority approved scale shall be available at an accessible point in or at the entrance to all PES and in each process building. Details of first aid treatment for white phosphorous (WP) and other hazardous substances and the precautions to be taken when handling these substances are in IATG 06.50 *Special safety precautions (storage and operations)*.

## **8 Aircraft overflight (LEVEL 2)**

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

Conversely, explosives areas and facilities shall not be intentionally constructed in locations that would be over flown by existing or planned flight paths.

### **8.1 Helicopters (LEVEL 2)**

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

- A) a risk assessment has been conducted by the unit explosives safety representative that demonstrate that the risks are tolerable and ALARP;
- B) they are authorised beforehand by the head of the establishment;
- C) only passenger or non-explosive transfers are involved;
- D) no over-flight of PES is permitted;
- E) use is made of the safest ingress and egress routes, which shall be included in local flying and establishment orders; and
- F) no movement of explosives is undertaken during the over-flight.

## **9 Potential explosion sites (PES)**

### **9.1 Cleanliness (LEVEL 1)**

PES shall be kept thoroughly clean at all times. Non-static producing doormats may be provided at the entrance to the PES. The floor, workbenches and all platforms and fittings shall be kept free from dust and grit.

Oily rags, waste and other articles liable to spontaneous combustion shall be placed, immediately after use, together with any other refuse, into metal bins provided with lids situated outside the building. These bins shall be emptied at regular intervals and on no account are they to remain filled overnight. Any waste material which is, or is suspected of being, contaminated with explosives substances is to be treated as explosive and stored and disposed of accordingly.

## **9.2 Action on vacating a PES (LEVEL 1)**

### **9.2.1. Normal vacation**

When vacating a PES, all packages shall be closed and sealed if appropriate. All doors, windows and shutters shall be kept closed and secured except when they are open for work or ventilation. When the doors are open, a responsible person shall be left in charge of the building.

When a PES is vacated, the electrical supply shall be switched off at the building master switch. However, in buildings where a constant temperature or humidity is required, the power may be left on provided that the electrical equipment is thermostatically controlled.<sup>11</sup> Other than those provided for security features, all other power supplies are to be switched off.

### **9.2.2. Temporary breaks**

For temporary breaks during the working day, the following actions shall be carried out before leaving the PES:

- A) all entrances shall be cleared of any obstruction; and
- B) items on gravity rollers shall be secured against accidental movement.

Explosives may be left in process buildings and proof/test facilities if:

- C) they are safely secured or stowed away; and
- unless specifically stipulated as permissible on the explosives licence, no explosive filling is exposed.

## **9.3 Emergency evacuation**

All personnel employed in explosives facilities shall be made aware of the location of both the normal and emergency exits of the PES in which they work. Whenever a fire-fighting practice takes place, evacuation drills should also be carried out. In this case, the emergency exits as well as the normal exits shall be used. Emergency doors shall be clearly marked as such, both internally and externally.

The person in charge of the building shall record in the PES log book<sup>12</sup> the date of the practice and the time taken to clear the building. Comment should also be made on the adequacy, the number of exits and the use made of them. Recommendations for additional means of exit shall be made if they are considered necessary.

During these drills workers in process facilities should be encouraged to make use of all available exits and to ignore the normal rules for entering and leaving such buildings. However, care shall be taken that protective clothing and shoes are free from extraneous matter before personnel are permitted to re-enter the facility.

Ammunition packaging, mechanical handling equipment (MHE), gravity rollers and other equipment shall not be allowed to block fire lanes or flow lines, or impede emergency egress from the PES.

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<sup>11</sup> See IATG 05.40 *Safety standards for electrical installations*.

<sup>12</sup> See IATG 06.70 *Inspection of explosives facilities*.

## 9.4 Lightning (LEVEL 2)

Explosives sites shall have a clearly defined response to lightning hazards. All PES shall be vacated and secured during thunderstorms<sup>13</sup>.

Thunderstorms potentially contain a massive build-up of static electricity within the atmosphere and thus present a serious hazard to ammunition and explosive processing. In ammunition process buildings (APBs) work on EIDs and primary explosive is to cease immediately when there is a thunderstorm in the vicinity.<sup>14</sup> . Where it is safe to do so, ammunition and explosives being worked on are to be made safe and all ammunition and explosives are to be repackaged. The APB should then be evacuated and made secure until the thunderstorm has passed by.

A thunderstorm may be considered in the 'near vicinity' when the time between the lightning flash and the thunder report is approximately 25 seconds or less. The 25-second count will place the flash approximately 8 km from the observer.

## 9.5 Tools, materials, and equipment permitted in a PES (LEVEL 2)

No stores should be allowed in an explosives facility other than the explosives or non-explosives authorised for storage and any tools, equipment or other materials authorised from time to time in accordance with the relevant IATG. Explosives other than those authorised on the explosives licence shall not to be taken into a PES.

### 9.5.1. Articles in use list (AIU)

An AIU list of tools authorised for use by the authorised processing documentation shall be available in the process room or PES for each approved task. This list shall include brushes, dustpans and dusters etc for the cleaning of the PES.

### 9.5.2. Tools and equipment

Tools and other equipment of local manufacture should not be permitted unless their use is called for in an approved work instruction and their design is authorised. In cases where it is necessary to test a locally manufactured tool or other piece of equipment in an explosives facility, prior authority should be obtained from the national technical authority. Tools and equipment required for works services and repairs to PES shall be authorised for use as per IATG 06.60 *Works services (construction and repair)*, prior to their use in any PES.

## 10 Operations in PES

Some operations carried out in a PES are of negligible hazard and may be permitted in explosives storehouses. Operations involving direct work on explosive articles and any exposure of explosives substances shall be strictly prohibited in explosives storehouses. Apart from cleaning operations such as sweeping or dusting, the operations that may be permitted in explosives storehouses are as described in this section.

Other operations may be permitted where movement of the store to a process area creates a greater risk. In such instances the head of the establishment may authorise such work. Each case shall be the subject of a full risk assessment. All other exceptions shall be referred to the national technical authority. However, in general all other operations shall be carried out in Ammunition Process Buildings (APBs).

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<sup>13</sup> See IATG 05.40 *Safety standards for electrical installations, Section 8*

<sup>14</sup> It may be possible to get prior warning from the national meteorological office.

## 10.1 Explosive storehouses (ESH) and open bay storage (LEVEL 2)

The following operations may be permitted within an ESH or open storage bay:

- A) re-stencilling and re-labelling of packages and unboxed stores;
- B) the build-up and break down of weapon over-packs, ammunition containers and pallet configurations where the packages within are sealed or are unboxed stores;
- C) opening unit load containers to check humidity indicators;
- D) the maintenance and inspection of aircraft high explosive (HE) bombs as long as the operations are carried out in accordance with instructions issued by the national technical authority;
- E) the visual inspection of prepared for use aircraft weapons; and
- F) the checking of temperature and humidity indicators and approved data loggers as long as the check does not involve breaching containers or packages.

Low risk, short duration, tasks such as the repacking or visual inspection of a small quantity of ammunition may be permitted in the immediate vicinity of the parent licensed storage building at the discretion of the head of the establishment. In this case only one package (or two packages if fractioning ammunition for issue or storage) may be open at any one time. The doors to the parent building shall be closed.

## 10.2 Ready use ammunition (LEVEL 2)

In addition to the above activities, if the use of a process building is not reasonably practical, issues, receipts and visual inspection of ammunition may be conducted in a suitable area set aside for the purpose. This task shall be subject to a written risk assessment having been carried out by the facility explosives safety representative and should be authorised by the national technical authority. This activity shall be limited to stores of Hazard Division (HD) 1.3 and 1.4 only.

## 10.3 Captured enemy ammunition and foreign explosives (LEVEL 3)

Captured enemy and foreign explosives are subject to special regulations, as are improvised explosives recovered as part of Counter-Improvised Explosive Device (C-IED) operations. There may be little available technical information about the explosives and ordnance. It is therefore necessary to define procedures to be adopted to ensure explosives safety is not compromised. The procedures should be as follows:

- A) the head of the establishment shall request a copy of the explosive classification certificate from the national technical authority (if available) for the foreign explosive ordnance authorised for storage;
- B) written confirmation should be sought stating that the foreign explosive ordnance has been physically checked by a technical specialist acceptable to the national technical authority. This shall confirm that there are no other hazards from the ordnance other than the normal hazards associated with conventional explosives substances (e.g. the ammunition or explosive does not contain radioactive sources or chemical agents);
- C) a technical specialist acceptable to the national technical authority should certify that the foreign explosive ordnance or the improvised explosives are safe for storage. This certification should be repeated periodically at intervals as required by the national technical authority;
- D) the explosives facilities shall be inspected in accordance with the requirements of IATG 06.70 *Inspection of explosives facilities*;
- E) fire assets shall be manned and sited at a minimum of IBD from the PES whenever foreign explosive ordnance is being handled or processed;
- F) foreign explosive ordnance or improvised explosives shall not be stored or processed in any PES that contains national explosive assets;

- G) during handling and processing of foreign explosive ordnance or improvised explosives, all non-essential personnel shall be located outside the IBD from the PES; and
- H) during handling and processing of foreign explosive ordnance or improvised explosives, all activity shall be monitored by a competent person nominated by the unit explosives safety representative. This monitor retains the right to halt all activity if not absolutely convinced about safety. Prior to any handling or processing, the monitor shall be fully briefed on the activities that will take place.
- I) Ammunition purchased from a foreign country, which has been qualified by the mandatory tests and has been allocated a UN serial number and compatibility grouping after testing as per the UN regulations, shall be exempt from the above restrictions.<sup>15</sup>

## 10.4 Ammunition Process buildings (APBs) (LEVEL 3)

This section specifies the guidelines that should be applied to the running of ammunition process buildings (APB). These guidelines shall be applied in addition to those above.

### 10.4.1. Receipt and issue (R&I) bays

R&I bays are compartmented buildings where one or more compartments are authorised for receipts, issuing and fractioning of packages, and visual inspection of stocks. Only the compartments authorised on the explosives licence shall be used for these activities. R&I bays may also be located in storage areas.

### 10.4.2. Handling or testing of EID

If EIDs or stores containing EIDs are handled, maintained, assembled, tested or prepared for use, RADHAZ Category 1 safe distances shall be applied.<sup>16</sup> The earthing, conductive and anti-static and processing requirements given in IATG 05.40 *Safety standards in electrical installations* shall also be implemented.

## 11 Storage

### 11.1 Covered storage (LEVEL 2)

All explosives and associated non-explosives stores and dangerous goods should normally be stored under cover. Aircraft HE bombs and similar stores such as heavy artillery breech loading (BL) natures may be open stored in temperate climates. Aircraft HE bombs and other permitted items open-stored held in sub-tropical and tropical climates should be protected from the sun by a building or structure fitted with approved air conditioning.

NOTE 1 Open storage provides the least protection from subsequent propagation in the event of an accident or incident. Earth-covered magazines provide the highest level of protection from subsequent propagations.

Some explosive stores are more vulnerable to the elements and if covered storage is limited, the following provisions should be applied, and the following points considered when allocating covered storage:

- A) the prior authority of the national technical authority shall be obtained;
- B) the inherent liability of particular kinds of an explosive store to damage from exposure;
- C) the design of the ammunition packages to resist exposure and their condition;
- D) the type of storage required by regulation, i.e. magazine or ESH;

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<sup>15</sup> See IATG 01.50 *UN explosive hazard classification system and codes*.

<sup>16</sup> See IATG 05.60 *Hazards of electromagnetic radiation*.

- E) the prevailing climate;
- F) the need for the security of particular items, for example those items attractive to criminal and terrorist organisations (ACTO); and
- G) any special risks from exposure if the condition of the explosives is doubtful.

## 11.2 Open storage (LEVEL 2)

Where it is necessary to store explosives in the open, the stacks should be covered over with waterproof sheets, which are preferably fire resistant, or other suitable material. Care should be taken to use non-static producing covers, as significant static can be generated during the removal/movement of plastics-based covers.

The sheets should be supported in such a way as to allow a current of air to circulate over and around the stacks. When supports are not available, and the sheets are laid directly on the stacks, every opportunity shall be taken to air the stores by uncovering them periodically in good weather. As a minimum, the stores should be aired at least monthly and more frequently if the prevailing climatic conditions in theatre warrant it. Aircraft HE bombs and similar stores such as heavy artillery breech loading (BL) natures should also be subjected to this regime if possible.

## 11.3 Explosive items

Explosives shall be stored safely and securely in the special licensed facilities provided.<sup>17</sup> Where explosives storage facilities are not adequate or immediately available, the head of the establishment shall make temporary arrangements to minimise the risk to life and property in the event of an explosion or fire and to prevent deterioration of the explosive stores. Under normal circumstances, explosives storage facilities should not be used for the storage of other equipment, materiel or dangerous goods.

## 11.4 Non-explosive items

Drill and instructional stores or weapons may be empty or inert filled with a high explosive substitute (HES). These items shall not be stored with live stores to avoid inadvertent mixing in use. All drill, instructional and inert filled stores that have been converted from filled stores shall be subject to technical inspection before they are taken into use. Such stores shall conform to an approved design and prior authority for their conversion is to be obtained from the national technical authority. Drill and instructional stores or weapons should be clearly marked in a manner so as to preclude confusion with live stores.

Non-explosive components, which are related by function to explosives, such as fuze shear wires, may be stored in the same storehouse as their parent stores. The packages shall be sealed and identified and shall be stacked separately from the filled stores.

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<sup>17</sup> See IATG 05.20 *Types of buildings for explosives facilities*.

## **11.5 Dangerous goods and explosive stores filled with dangerous goods (LEVEL 3)**

Non-explosive dangerous goods should not be stored in a PES or explosives area because of the additional hazards introduced by their presence. However certain explosive natures or their components contain dangerous goods that are required to be stored because they are related by function to the explosives. Examples of these stores are aircraft flares and missile fuels. In such cases, it may be permitted to store these explosives related dangerous goods in a PES or explosives area so long as they comply with compatibility groups and mixing rules. Otherwise they shall be treated as HD 1.3 for quantity distance (QD) purposes. However, the items and their outer packages shall not be marked with HD 1.3 labels. Such storage should be specifically authorised by the national technical authority.

### **11.5.1. Items excluded from UN Class 1**

An item containing explosives may be considered by the national technical authority as presenting no significant hazard from explosion and may be excluded from UN Class 1 (for example some small pyrotechnics). In this situation, these items may be stored with the explosives items that they are related to but should be treated as HD 1.4S for storage purposes. However, the items and their packages shall not be marked with HD 1.4S labels.

## **11.6 Ammunition and ammunition packaging (LEVEL 2)**

### **11.6.1. Examination of stocks before entry into a PES**

Before being allowed into a PES all pallets, packages and unboxed munitions shall be examined for damage, signs of tampering with seals and so forth. Should such damage or signs of tampering be detected then the pallet, package or munition shall be segregated for detailed examination.

### **11.6.2. Serviceability of ammunition and its packaging**

All stocks of explosives and weapons should be maintained in a serviceable condition and markings on packages and unboxed stores should be legible. Unserviceable or suspect stocks shall be segregated. Defective packages should be repaired or replaced before storage is permitted. This work should be undertaken in an APB. Exceptionally, defective, or damaged packages may, after inspection by a competent person, be kept segregated until repaired.

If the seal of a package is broken or missing and the package concerned is not for immediate use, the inner packaging and contents should be examined by a competent person. If the examination is satisfactory the package should be correctly sealed before storage is permitted. This work should be carried out in an APB. The ammunition account should also be reconciled to ensure its accuracy and a local investigation should take place if any discrepancies arise.

## **11.7 Commercial explosives and fireworks (LEVEL 2)**

### **11.7.1. Commercial explosives**

Commercial explosives should be classified by the national technical authority in accordance with the UN 'Orange Book'<sup>18</sup> requirements prior to storage and are to be kept segregated. All commercial explosives usually have a much more limited safe storage life than military explosives. Storage records should indicate the shelf life of the item. On receipt the explosives should be inspected by a competent person. Explosives that are in poor condition or have been subject to local modification shall not be accepted for storage. This receipt inspection is to include checking for compliance with all national regulatory requirements and the packaging shall be in accordance with the UN Orange Book requirements.

### **11.7.2. Civilian fireworks**

The following guidelines cover the storage of fireworks and apply in all situations where fireworks of UN Class 1 are stored. The maximum time they may be stored in a PES containing ammunition or explosives should be 24 hours. Particular care shall be taken when handling fireworks due to the inherent weakness of the paper or cardboard cases and the high probability of spillage of the filling. Firework fillings are very sensitive to impact, friction, heat or sparks. Therefore, PES shall be carefully cleaned after fireworks have been stored there and before any other explosive is stored. This procedure should be the subject of a risk assessment. Storage in excess of 24 hours shall be approved by the national technical authority but is generally not recommended.

On their receipt and prior to their storage in a PES, the fireworks should be suitably over-packed to prevent the leakage of black powder or pyrotechnic composition.

## **11.8 Experimental explosives (LEVEL 3)**

If they have been classified and qualified by the national technical authority experimental explosives may be treated as normal explosives. However, they should be segregated from other natures within the storage facility.

If not classified or if their safety tests have not been accomplished, such materials shall be completely isolated from all explosives (see Clause 11.10 below). If it is determined that the material is unsafe or unstable, it shall be disposed of immediately using special procedures approved by the head of the establishment.

The owner or sponsor of the explosives shall provide disposal instructions before acceptance into storage. Contact shall be made with the owner or sponsor of the explosives at least every six months. To ensure they retain their identity at all times, the packages and contents should be marked with an identification symbol as required by the national technical authority. This symbology should ensure each item, if unused, is returned to its correct package. Additionally, the packages or stacks should be clearly marked with the sponsor details and any other information deemed necessary, e.g. points of contact.

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<sup>18</sup> See IATG 01.50 *UN explosive hazard classification system and codes*.

## 11.9 Special stores (LEVEL 3)

### 11.9.1. Gaseous tritium light source (GTLS)

Some weapon systems incorporate a GTLS within the integral sight. This presents a slight radiation hazard if broken in a confined space. These weapons should, as a minimum, be stored in buildings with ventilation openings. The building should also display the trefoil symbol in addition to the fire symbol and any supplementary symbol required by national technical authority regulations. The national technical authority regulations may also specify the maximum storage density in any single building. Finally, the PES should contain national technical authority approved instructions on the actions to be taken in the event of a breakage causing a tritium leak.

### 11.9.2. Depleted uranium (DU)

DU is mildly radioactive at a level that is low enough to permit handling and transportation with simple precautionary measures. DU has a chemical toxicity at the same level as other heavy metals such as lead, thus allowing handling and transportation in authorised packaging without abnormal risk. The mechanisms whereby radioactivity and toxicity might lead to harmful effects are:

- personnel being in close contact with DU over extended periods; and
- if DU is involved in a fire or explosion in which uranium oxides from the ammunition are dispersed and inhaled by personnel sited downwind from the event.

Advice on the storage of ammunition containing DU should be provided by the national technical authority. Handling and transportation of DU ammunition should be reduced to a minimum and no work or movement is to be carried out without prior reference to a national radiological protection supervisor. General regulations for the transportation of DU ammunition should be provided by the national technical authority and contingency planning for accidents and incidents should also be provided by the national technical authority.<sup>19</sup>

## 11.10 Isolation and segregation of stocks (LEVEL 3)

### 11.10.1. Fault and defect reporting

Explosives that are known or suspected of being inefficient, unsafe, whose condition is uncertain, or which cannot be conditioned by the facility's ammunition technical staff should be the subject of action in accordance with the instructions in IATG 01.70 *Bans and constraints*. Serious fault reporting action shall be carried out immediately.

### 11.10.2. Isolated storage

Isolated storage is the storage of explosives which are in an unsafe or possibly unsafe condition, in separate licensed accommodation away from all other explosives. The following explosives should always be isolated:

- A) repairable or unserviceable explosives that are, or are suspected of being, unsafe for use;
- B) salvaged stores recovered after an accident, explosion, fire or a trial;
- C) explosive items which have failed to function and are unsafe for use, but not unsafe for storage;
- D) explosives recovered during explosive ordnance disposal (EOD) operations, (including foreign ammunition or improvised explosives);

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<sup>19</sup> Useful technical information on DU may be found in Technical Note for Mine Action (TNMA) 09.30/02 Version 3. 1 February 2015.

- E) experimental explosives that may be unsafe or unstable; and
- F) any ammunition or explosives on the instruction of the national technical authority or an ammunition technical officer (ATO) or other certified competent person.

### **11.10.3. Segregated storage**

Segregated storage is the storage of explosives whose compatibility groups, whilst not requiring separate storage, do not permit mixed storage. The requirement for segregated storage may be met by any means which is effective in the prevention of propagation between the different groups, for example by a separate compartment, an internal traverse or barrier or by physical distance. The normal mixing of compatibility groups is permitted for explosives requiring segregated storage. The following stores should always be segregated:

- A) stores known to be, or suspected of being, faulty but which are not unsafe;
- B) experimental explosives;
- C) commercial explosives;
- D) shelf life expired ammunition;
- E) banned ammunition which is safe to store; and
- F) enemy explosives.

### **11.10.4. Isolated storage requirements – QD and CG**

A PES that is to be used for the storage of explosives requiring isolated storage should be sited in such a location so as to afford all exposed sites (ES) the QD protection given by the tables in IATG 02.20 *Quantity and separation distances*. The use of reduced QDs shall not be permitted. Explosives requiring isolated storage should not normally be mixed by compatibility group. However, small quantities of less than 10 kg net explosive quantity (NEQ) of any compatibility group requiring isolated storage may be stored in the same PES under the following conditions:

- A) explosives of each compatibility group shall be effectively segregated from explosives of any other compatibility group by walls of autoclaved aerated concrete blocks;
- B) no explosives of HD 1.1 shall be stored; and
- C) the stores are not EOD recoveries. The actions required for the storage of EOD recoveries are at Annex D.

### **11.10.5. Disposal of isolated explosives**

Explosives that require isolated storage should be addressed or disposed of as soon as practicable. Heads of establishment should ensure that items are stored in isolation for only the minimum practicable time and long-term isolated storage of explosives shall require justification. Failure to provide adequate justification may be viewed as a serious safety breach. In the event that disposal is not the corrective means to be used, a constraint shall not be removed from suspect stores until clearance for storage or issue is authorised by the national technical authority after repair or modification.

## **11.11 Rail and vehicle transit and staging facilities (LEVEL 2)**

### **11.11.1. Rail yards**

Platforms of a suitable height should be provided in transit facilities so that handling and load transfer between vehicles can be conducted in a safe and efficient manner. Heavy stores should be handled by means of mechanical handling and this shall be compatible with the building and vehicles used.<sup>20</sup>

The explosives license limits for a transit facility should be clearly displayed and complied with. If necessary, a train should be divided into suitable units at a marshalling yard where the required QDs and protection are available before moving into the transit facility. A transit shed should be emptied of explosives daily.

Dangerous goods, other than those related by function to the explosives present, shall not be handled at a transit shed if explosives are also being handled.

### **11.11.2. Vehicles**

Platforms of a suitable height should be provided in transit facilities so that handling and load transfer between vehicles can be conducted in a safe and efficient manner. Heavy stores should be handled by means of mechanical handling equipment and this should be compatible with the building and vehicles used.<sup>21</sup> If necessary, a vehicle convoy should be divided into suitable units at a marshalling yard where the required QDs and protection are available.

Any area authorised as a staging facility, irrespective of its location, should be clearly marked on the ground. The area should be large enough to accommodate the anticipated traffic flow and number of vehicles expected. There should be a gap of at least 6m around each vehicle to provide fire-fighting access.

Written or electronic records of the usage of a staging facility sited externally to the main explosives facility should be kept in a locally produced log. The record should detail the number and types of vehicles, the HD and NEQ carried and the dates and duration that the facility is occupied. The facility explosives safety representative should review this log at monthly intervals to ensure that the usage of the staging facility does not exceed the explosives licence criteria. If the usage has breached the criteria, advice shall be sought from the national technical authority.

### **11.11.3. Security**

The principles of Clause 5 of this IATG module equally apply to these facilities and shall be applied to the same level.

## **11.12 Storage conditions (LEVEL 3)**

### **11.12.1. Chemical stability**

In general, explosives become less sensitive as the temperature drops. However, very low temperatures may have an adverse effect upon their safety or function when they are subsequently used. Cracking and fragmentation of the explosives can occur which can affect their operation. In propellants, cracking can lead to increased burning rates and, in the extreme, detonation.

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<sup>20</sup> See IATG 05.50 *Vehicles and mechanical handling equipment (MHE) in explosives facilities*.

<sup>21</sup> Ibid.

Nitro-glycerine freezes below 13°C and may crystallize out. Should this happen, an increase in temperature may cause the leaching of nitro-glycerine. High temperatures may cause exudation, expansion, or increased decomposition rates. Above 32°C decomposition increases rapidly and prolonged exposure to temperatures above 15°C will affect the storage life of nitrate ester-based propellants.

To prevent these effects temperature limitations should be applied to the storage and transportation of certain types of explosives substances and articles and these should be promulgated by policy documents issued by the national technical authority. The purpose of this Clause is not to substitute these policy documents but to amplify the general guidance on temperature limitations for explosives and the mechanisms for measuring and controlling storage temperature. Thus, the most suitable storage accommodation available should be used in order that temperature susceptible explosives are maintained in a serviceable condition for the longest possible period.

Isolated periods of exposure to extremes of temperature may not cause any immediate deterioration but the effects are cumulative. Therefore, the extent of such periods of exposure should be recorded and notified to the national technical authority.

#### **11.12.2. Temperature restrictions**

The following restrictions should be considered when making major alterations to existing storehouses and when constructing new storehouses. They should be viewed as the ideal and a benchmark against which current capabilities are measured:

- Temperature limits. When an ammunition or explosive item has more than one class of temperature restriction it shall be viewed as being in the class with the maximum restriction;
- Minimum temperature. To prevent exudation of nitro-glycerine, nitrate ester-based propellants and articles containing such propellants should not be kept in storehouses for a continuous period of more than one month if the temperature in any part of the building is liable to remain below 5°C. If the stipulated minimum temperature conditions cannot be sustained, artificial heating to an approved standard should be installed; and
- Maximum temperature. The efficiency, storage life and safety of some explosives, particularly propellants, are adversely affected by storage at abnormally high temperatures. They are not to be kept in storehouses where the temperature can be expected to rise above the limits shown in the national technical authority policy documents. The use of adequate ventilation, approved air conditioning, or insulation should be considered in order to keep temperatures in storehouses within approved limits. The ammunition and explosives listed below are to be stored in the coolest accommodation possible:
  - ammunition containing amatol or TNT;
  - incendiary ammunition;
  - propelling charges or ammunition containing propellants; and
  - ammunition containing WP or lachrymatory (tear producing) compositions.

#### **11.12.3. Movement**

Temperature limitations are equally important during transportation, especially where explosives are to be moved by sea. The accompanying documentation should be annotated with any temperature limitations for the ammunition being moved.

#### 11.12.4. Temperature recording

Where stipulated in the technical publication for the ammunition, explosive or weapon maximum and minimum temperature thermometers or approved temperature data loggers should be installed in the buildings where temperature susceptible explosives and articles are stored, handled or processed and the readings recorded. Approved temperature data loggers may also be placed inside individual explosives packages.<sup>22</sup>

#### 11.13 Ventilation and relative humidity (RH)

Although proper ventilation is vital in a PES, indiscriminate admission of air into the PES may do more harm than good. Proper sealing and protective coating of the ammunition and explosives and their associated packaging will offset some of the effects of moisture-laden air. The higher the temperature of the air, the more moisture it requires to become saturated. On a warm day, the air is drier and better for ventilation than on a cold day. The reverse is also true. Therefore, when the RH is high PES should not be opened for ventilation without first ascertaining that the conditions are suitable.

The ventilation of a closed PES in which the internal temperature is lower than that of the incoming air may result in condensation forming on the internal walls and the explosives and associated packages. With a free flow of air, this condensation normally evaporates during the period of ventilation but when the airflow is restricted, as may occur where the PES is surrounded by barricades or situated in a deep hollow, the rate of evaporation may be slow. Several ventilation periods may be necessary before the condensation finally disappears.

In humid conditions, normal ventilation may not be sufficient to keep condensation at an acceptable level and air-drying or air conditioning apparatus to an approved standard may need to be installed. In temperate climates PES ventilators should normally remain open and only be temporarily closed as an immediate precaution against the entry of rain or fog. Ventilation by opening the doors and windows is not to be carried out unless condensation or excessive heat causes a problem.

Annex E provides further details on ventilation equipment and procedures.

## 12 Issuing of ammunition

### 12.1 Stock turnover (LEVEL 2)

As discussed in the previous section, explosives deteriorate with age, lose their effectiveness and reliability and, in extreme cases, become more dangerous to handle and store. Poor storage conditions and temperature extremes speed this process up. Ammunition is an extremely expensive asset and, therefore, to prevent unnecessary wastage from the causes stated above, regular turnover of stocks is essential. As a general principle, the oldest stock should be issued first. However, if units are serving overseas, to avoid the necessity of replacing at short intervals stocks that have become unserviceable through deterioration by age, issues to overseas units may be made from the newest stock.

When new stock arrives for storage it may be necessary to make physical changes to the ammunition stacks by ensuring that the oldest ammunition is the most accessible, as it will usually be issued first. This may mean moving the older ammunition to the top of the stacks, with newer ammunition below. This also has the advantage of avoiding excessive pressure or loading on the lower boxes during prolonged storage.

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<sup>22</sup> See IATG 05.40 *Safety standards for electrical installations*.

## **12.2 Prevention of deterioration of explosives (LEVEL 2)**

The operational life of many explosives commences when the packaging is first opened. The safe life of explosives commences on the day of manufacture of the explosives fill. The national technical authority or the manufacturer of the store shall be responsible for promulgating safety and operational life information in the technical publications. Effective systems shall be in place to ensure that explosives are managed and inspected in accordance with the technical publication relevant to the item concerned.

## **13 Underground storage (LEVEL 2)**

### **13.1 General**

The guidelines contained in these paragraphs refer to the administration and operation of underground storage areas and are designed to be supplemental to other storage guidelines in this IATG module. These guidelines should also be observed where applicable.

### **13.2 Stacking**

Stacking in underground storage should follow above-ground rules. Stacks should be kept clear of access routes. Stacks should be regularly monitored for signs of deterioration. Deterioration in the bottom tiers may lead to the collapse of a stack with consequent damage to the contents or may cause a fire or other event. Stack heights should be such to preclude such an event. Stacking heights and methods should be in accordance with approved procedures and to heights authorised by the national technical authority following stacking trials.

### **13.3 Repair and maintenance**

Repair and maintenance of underground facilities shall be in accordance with the general instructions in IATG 06.60 *Works services (construction and repair)*.

### **13.4 Records**

All records of stocks held in an underground storage area and their location, with records of the temperature and humidity readings, roof or wall defects, examinations made, maintenance work done and so forth should be kept outside the underground site in a place not likely to be involved or destroyed in a major fire or explosion.

### **13.5 Prohibited storage**

The following explosives should not be stored in underground sites:

- A) captured enemy stocks;
- B) items returned by units that are awaiting inspection;
- C) items in, or suspected to be in, doubtful or unsafe condition; and
- D) items not classified by the national technical authority or not of an approved pattern.

### **13.6 Limitations in storage**

The following explosives natures should only be permitted in single chamber storage sites with complete segregation by nature:

- A) those with incendiary or smoke effects belonging to compatibility group H and some of compatibility group G, due to the loss of visibility when smoke is trapped underground;
- B) those in compatibility group J due to the risk of an explosive atmosphere posed by any leak;

- C) those in compatibility group K due to the difficulty in decontamination; and
- D) materials in compatibility group L shall be isolated by specific type.

### **13.7 Mechanical handling equipment (MHE)**

Specific guidelines for MHE use in underground storage sites are provided by IATG 05.50 *Vehicles and mechanical handling equipment (MHE) in explosives facilities*. It should be noted that there may be an increased hazard in an underground site caused by the accumulation of exhaust fumes.

### **13.8 Humidity**

High humidity is often found in underground sites and it has an adverse effect on many materials. Humidity shall be controlled by ventilation or approved air conditioning. Where temperature control is not a prime consideration, an approved de-humidifying system may be used which limits RH to 75%.

### **13.9 Non-Explosive Dangerous Goods**

Non-explosive dangerous goods shall not be stored in underground explosives facilities.

## Annex A (normative) References

The following normative documents contain provisions, which, through reference in this text, constitute provisions of this module. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this module 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:

- IATG 01.40 *Glossary of terms, definitions and abbreviations*. UNODA;
- IATG 01.50 *UN explosive hazard classification system and codes*. UNODA;
- IATG 01.70 *Bans and constraints*. UNODA.;
- IATG 02.20 *Quantity and separation distances*. UNODA;
- IATG 02.50 *Fire safety*. UNODA;
- IATG 05.20 *Types of buildings for explosives facilities*. UNODA;
- IATG 05.40 *Safety standards for electrical installations*. UNODA;
- IATG 05.50 *Vehicles and mechanical handling equipment (MHE) in explosives facilities*. UNODA;
- IATG 05.60 *Hazards of electromagnetic radiation*. UNODA;
- IATG 06.50 *Special safety precautions (storage and operations)*. UNODA;
- IATG 06.60 *Works services (construction and repair)*. UNODA;
- IATG 06.70 *Inspection of explosives facilities*. UNODA; and
- IATG 09.10 *Security principles and systems*. UNODA.

The latest version/edition of these references should be used. The UN Office for Disarmament Affairs (UNODA) holds copies of all references<sup>23</sup> used in this guideline and these can be found at: [www.un.org/disarmament/un-safeguard/references](http://www.un.org/disarmament/un-safeguard/references). A register of the latest version/edition of the International Ammunition Technical Guidelines is maintained by UNODA, and can be read on the IATG website: [www.un.org/disarmament/ammunition](http://www.un.org/disarmament/ammunition). National authorities, employers and other interested bodies and organisations should obtain copies before commencing conventional ammunition stockpile management programmes.

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<sup>23</sup> 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 guideline:

- *Handbook of Best Practices on Conventional Ammunition*, Chapter 5. Decision 6/08. OSCE. 2008. [www.osce.org/fsc/33371](http://www.osce.org/fsc/33371).

The latest version/edition of these references should be used. The UN Office for Disarmament Affairs (UNODA) holds copies of all references<sup>24</sup> used in this guideline and these can be found at: [www.un.org/disarmament/un-safeguard/references](http://www.un.org/disarmament/un-safeguard/references). A register of the latest version/edition of the International Ammunition Technical Guidelines is maintained by UNODA, and can be read on the IATG website: [www.un.org/disarmament/ammunition](http://www.un.org/disarmament/ammunition). National authorities, employers and other interested bodies and organisations should obtain copies before commencing conventional ammunition stockpile management programmes.

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<sup>24</sup> Where copyright permits.

## Annex C (informative) Suggested contraband notice (LEVEL 1)

This is an [*insert appropriate type (e.g. ammunition storage)*] establishment where military explosives are stored and processed. Stringent regulations for safety are necessary and staff and visitors shall be fully conversant with them. These rules are framed for the protection of the establishment and of all personnel on site and shall be observed at all times.

**Unless formally authorised in advance, the following items shall not be taken into an explosives area:**

- a. Matches or any other means of producing flame or high temperatures.
- b. Tobacco in any form, including snuff.
- c. Any articles used in connection with smoking.
- d. Radio transmitters or receivers, including mobile phones and car key fobs.
- e. Tools and other equipment.
- f. Any battery or mains operated item.
- g. Unauthorised explosives.
- h. Dangerous or flammable substances.
- i. Cameras.
- j. Firearms.
- k. Drugs and Medicines.
- l. Metal shod footwear.
- m. Magnetic Therapy Products.
- n. Commercial vehicles unless specifically authorised.
- p. Nothing should be carried by the individuals inside explosives facility except a handkerchief and writing materials. All personal belongings should be left at the gate, secured in the locker provided.

**Food and Drink.** Food and drink shall be declared on entry and shall only be consumed at authorised locations. Food and drink shall not be consumed inside any explosives building.

**Liability to Search.** Persons are admitted into an explosives area only on the understanding that they and their vehicle are liable to search, by a person so authorised, at any time. Refusal to submit to search will preclude entry to the explosives area.

**Additional Measures.** Additional stringent control measures may be put in operation at any time.

## **Annex D**

### **(informative)**

### **EOD recoveries – storage and transport (LEVEL 3)**

#### **D.1 Introduction**

This annex details the suggested guidelines for the storage and transport of explosive ordnance disposal (EOD) arisings. Included in these guidelines are collections from civilian agencies, individuals and amnesties and all planned area explosive ordnance clearances (EOC). EOD arisings from criminal and terrorist activities are included but are subject to separate current legal forensic procedures.

#### **D.2 Exclusions**

The following arisings are excluded:

- life expired or surplus items, in their authorised packaging, which are subject to formal demilitarisation and disposal; and
- disposals of logistic stock holdings that become unserviceable and in their authorised packaging, except where subject to EOD action.

Any EOD action carried out prior to a move of explosive ordnance (EO) to short term licensed storage is also excluded.

#### **D.3 Legal Position**

International legislation covering the classification, labelling, packaging, storage and transport of explosives is drawn up to cover new or serviceable explosives in their authorised packaging. It was never designed to cover EOD operations or EOD arisings. National technical authorities should consider exempting EOD operations in its national regulatory framework for ammunition and explosive storage and transport as each EOD incident is different. However, the national technical authority shall then ensure that its EOD organisations have systems in place, which are equally as good.

##### **D.3.1 Competent person**

Certain procedures require the approval of a competent person. In respect of EOD arisings, a competent person shall be nominated by the holding or consigning organisation. It would be logical that the holder of this post would be competent by virtue of the successful completion of accredited EOD courses or the award of a trade qualification.

#### **D.4 Terminology**

The operational phase of any EOD operation commences at the point to which EOD resources deploy. In simplistic terms, the operator will destroy in-situ or move for disposal any EO found. The operator applies his or her specialist technical knowledge to carry out an assessment to determine whether the item is safe to move. The completion of the risk assessment for transportation and possible concentration centrally of EOD arisings for later disposal lies with the operator at the time of the EOD operation. The operator may move the EO to:

- a more appropriate location for immediate disposal; or
- when the volume or location of EOD arisings prevents immediate disposal, and the operator considers the item safe to transport, a segregated licensed storage location for later disposal.

## **D.5 EOD operator action**

The recovery phase of any EOD operation entails the move of EOD arisings from the discovered location to a segregated licensed store. A safety assessment covering the possible movement of hazardous substances may require completion. All EOD arisings to be moved shall be segregated, packed and marked as the operator deems appropriate for this operational move. The items should be packed in packaging appropriate to the EO nature and which affords sufficient environmental and physical protection.

The planning phase of planned EOD operations such as area clearances should include the procedures for the disposal of items found. Where EO is not destroyed in-situ during that working week the EO shall be moved to short term licensed storage.

## **D.6 EOD storage**

Recovered EOD arisings held in segregated licensed storage locations shall not be regarded as being in an operational situation. The storage and transportation of these holdings from this point should comply with the IATG guidelines in order to control these operations with regard to the safety of life and property.

## **D.7 Classification of EOD arisings for storage and transport**

All EOD arisings should be identified and classified items for storage and the final move from storage to disposal. Problems areas that will be encountered are:

- the validity of classification tests originally carried out on the store/package when pristine may not reflect the current status;
- where packaging exists, unserviceable items may have deteriorated or be damaged and cannot be properly classified;
- some items may be identifiable only by generic type, purpose, estimated net explosive quantity (NEQ), fuzing and other hazards; and
- other items may not be identifiable other than possibly being EO.

### **D.7.1 Disposal classifications**

The following system is regarded as best practice but its use should require approval by the national technical authority. Where the EOD operator or EOD Unit can positively identify the EOD arisings, a disposal classification (DC) from the list at Appendix 1 may be awarded. If generic identification is not possible, the item shall be grouped as DC of 1.1F.

### **D.7.2 Specific situations**

There may be specific situations, such as large scale EOC or large finds, which cannot be dealt with by DC procedures. On these occasions, the operationally responsible unit is to contact the national technical authority for instruction. The national technical authority may grant a temporary classification.<sup>25</sup> Before classification is awarded the national technical authority may wish to examine in detail the planning procedure from reconnaissance and identification through scale of disposal to final disposal arrangements.

## **D.8 EOD arisings – documentation and records**

EOD arisings shall be accounted for and registers of holdings kept. This is an auditable document and should show the item history from recovery to disposal. Accounting management is to be in

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<sup>25</sup> See IATG 01.50 *UN explosive hazard classification system and codes*.

accordance with written approved procedures. Once packed, the package should be marked with a unique identifier relating to the contents registered in the accounting system. System records should be kept as a register to record every item identified, transported, stored and disposed of. For recording purposes, closed records should be maintained for a minimum of five years.

## **D.9 Packaging**

The competent person should be responsible for ensuring that only appropriate containers and restraints are used for storage. If available, the correct ammunition container assembly (ACA) and inner packaging fitments should be utilised. If not available, then only suitable, serviceable ammunition containers should be used. When the correct or original packaging is not available, the container contents should be secured against movement by use of expanded foam or other inert packing medium. The package net mass limit for contents, specified in the UN package certification mark for the outer container used shall not be exceeded and each package should be sealed with ammunition seals. Internal separation of stores will be the norm, for which material may be procured locally. To assist with the monitoring of NEQs against explosive limits, recovered items should be segregated and grouped into correctly marked containers if possible.

### **D.9.1 Package markings for EOD arisings**

No UN package certification mark should be applied to the outer container. However, all containers should have the following basic markings applied both in storage and for the subsequent movement to the point of disposal:

- a generic description, or the letters FFE<sup>26</sup> if inert;
- the correct hazard classification code (HCC) and subsidiary risk labels are to be affixed;
- the UN serial number;
- the package all up weight (AUW) in kg;
- the EOD organisation accounting reference of the item or items contained within; and
- the estimated NEQ in kg.

Markings should be clear and legible and marked onto the container directly or by secure printed adhesive label.

## **D.10 Ammunition natures recovered**

### **D.10.1 HE**

Any high explosive items should be further divided into Hazard Divisions (HD) 1.1, 1.2, fuzed and unfuzed EO and stored in accordance with the explosives license.

### **D.10.2 Small arms ammunition (SAA)**

All SAA should be held segregated by weight and packaged by type dependent upon lead content. Pin-fire ammunition and SAA of 0.50 in calibre and above shall be stored separately. SAA is to be sorted as follows:

- SAA with lead content;
- SAA without lead content including powder cartridges; or
- shot gun (all shot types).

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<sup>26</sup> Free From Explosive.

### D.10.3 Pyrotechnics

Recovered pyrotechnics should be packaged generically by type. Any safety mechanism such as lanyards or pins are to be correctly fitted and, if necessary, secured by the application of suitable adhesive tape. Fireworks shall be packed in such a way as to preclude the escape of loose powder or filling from the container. Pyrotechnics should be grouped for storage and subsequent disposal as follows:

- 1.2G: rockets, rockets hand fired and line throwing apparatus;
- 1.3G: distress flares and hand flares;
- 1.4G: distress flares and hand flares; and
- 1.4G: smoke natures.

### D.10.4 Anti-riot and chemical training items

Only lachrymatory and anti-riot (AR) control agents may be held and these are to be identified as those with or without explosive components. Where possible, CS<sup>27</sup> natures should be packed or retained in their designed packaging. Non-explosive natures should be packed separately and marked accordingly. All natures must be packed in grey ammunition containers complete with subsidiary risk labels. Any munitions containing chemical agents (Compatibility Group (CG) 'K') should be dealt with as described below.

### D.10.5 White phosphorus (WP)

If WP munitions have to be recovered, the guidelines in IATG 08.10 *Transport of ammunition* shall be applied.

### D.10.6 Inert items

Non-explosive and inert items should be boxed and certified free from explosives (CFFE). Where a box is utilised for packing for final disposal, the accounting reference of the items contained should be shown on the exterior. Items too large to be boxed should be packed separately in cage or post pallets and an FFE certificate attached to each item or to the caged pallet in a prominent position. If any doubt exists that an item of EO is FFE, it must be treated as an explosive article and stored accordingly.

### D.10.7 Licensing

The location, quantity and method of storing EOD arisings shall be formally endorsed by the national technical authority and specified on the explosives licences for the PES.

### D.10.8 Standards of storage

EOD arisings should be stored by disposal classification in dedicated segregated licensed storage not holding other explosives or non-explosive stores. Isolated storage should be used if available. While storage outside is not recommended, the relevant open stack site guidelines should apply.

### D.10.9 Safety certificates

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<sup>27</sup> 2-chlorobenzalmalononitrile (also called o-Chlorobenzylidene Malononitrile) (chemical formula: C<sub>10</sub>H<sub>5</sub>ClN<sub>2</sub>)

EOD units without their own licensed storage should arrange for storage with another facility. The EOD operator shall certify that the items are safe for segregated or isolated storage as appropriate. A copy of this certificate shall be placed on the item or stack.

#### **D.10.10 Time constraints**

EOD arisings, except forensic evidence holdings, should be stored for no longer than 60 days before being consigned and moved for final disposal. At the final disposal site, to allow flexibility in large-scale disposal programmes, the EOD arisings may be stored for a further 60 days from the date of delivery before being destroyed.

#### **D.10.11 Transportation of EOD arisings**

Transportation of EOD arisings shall be as per IATG 08.10 *Transport of ammunition*.

#### **D.10.12 EOD chemical ammunition arisings**

Chemical EOD arisings of compatibility group K shall be treated separately. Instructions for anti-riot natures and chemical training items are not subject to this instruction. Chemical EOD arisings shall be stored in segregated storage. Packaging of recovered chemical munitions is the responsibility of the recovering unit in accordance with their national procedures. Marking of packages should be as per this IATG. The munitions shall be moved to the national disposal facility as per national instructions.

**Appendix 1 to Annex D**  
(informative)  
**UXO recoveries – classification list (LEVEL 3)**

Explosive Substance or Ammunition Type	Hazard Classification Code	UN Serial Number
<b>Ammunition, Smoke, White Phosphorus</b> ( <i>water activated contrivances, with burster, expelling charge or propelling charge</i> )	1.2L	0248
<b>Ammunition, Smoke, White Phosphorus</b> ( <i>with burster, expelling charge or propelling charge</i> )	1.2H	0245
	1.3H	0246
<b>Ammunition, Toxic</b> ( <i>with burster, expelling charge or propelling charge</i> )	1.2K	0020
	1.3K	0021
<b>Ammunition, Toxic</b> ( <i>water activated contrivances, with burster, expelling charge or propelling charge</i> )	1.2L	0248
	1.3L	0249
<b>Articles, Explosive, NOS</b>	1.1C	0462
	1.1D	0463
	1.1E	0464
	1.1F	0465
	1.1L	0354
	1.2C	0466
	1.2D	0467
	1.2E	0468
	1.2F	0469
	1.2L	0355
	1.3C	0470
	1.3L	0356
	1.4B	0350
	1.4C	0351
	1.4D	0352
	1.4E	0471
	1.4F	0472
1.4G	0353	
1.4S	0349	
<b>Components, Explosive Train, NOS</b>	1.1B	0461
	1.2B	0382
	1.3B	0383
	1.DS	0384

**Table D.1: List of Hazard Classification Codes for UXO recoveries**

NOTE 2 Although the compatibility group is irrelevant as the HD is the most important characteristic the combination of HD and CG is essential because a complete classification and UN serial number can be allocated.

NOTE 3 NOS = not otherwise specified. This allows the allocation of a UN number to unknown articles but that are in the expert judgement of the EOD operator most closely linked to the particular disposal classification selected.

## **Annex E** (informative) **Ventilation – equipment and procedures (LEVEL 3)**

### **E.1 Common thermometers**

One common thermometer (normal wet bulb thermometer) should be provided for each explosive storehouse (ESH) or group of ESH qualifying for ventilation. ESH similar in type and construction may be grouped for this purpose on the advice of the head of the establishment. Common thermometers should be installed in positions as follows where they are unaffected by draughts and can be read without being handled. The following criteria should apply:

- in a non-heated Class A ESH the thermometer may be placed on any inside wall;
- in a non-heated Class B ESH the thermometer should be placed on an inside wall, the exterior of which is in contact with the earth traverse or native rock or soil; and
- in a heated ESH, the thermometer should be installed remote from main heating sources and not more than one metre above floor level.

### **E.2 Wet and dry bulb thermometers**

#### **E.2.1 Location and set up**

Every ammunition storage facility should be provided with at least one wet and dry bulb thermometer, the use of which is to be controlled by the head of the establishment. Atmospheric conditions, especially in relation to the amount of water vapour in the atmosphere, can vary between locations in close proximity, especially where there are steep hills. This effect may be intensified when prevailing winds blow off the sea or across desert country.

In areas where it is considered possible that topographical and climatic factors may give rise to such local variations, additional wet and dry bulb thermometers should be installed at suitable points to establish if this is the case. Should the variations warrant the additional use of wet and dry bulb thermometers they are to be installed permanently.

Each wet and dry bulb thermometer should be installed out of doors in a permanent correctly designed screen. The screen should provide protection from direct or reflected sunlight, rain, draughts and wind. The position of the thermometer should be such that it can be read without being handled.

The wet bulb should be well supplied with water and the muslin covering and strand of wick kept clean, thoroughly wet and in good condition at all times. The muslin should cover the bulb completely and no reading is to be taken without ensuring that it is thoroughly wet. Distilled water should be used whenever possible. Should this be impracticable then rainwater, filtered if necessary, may be used instead. Tap water or sea water shall not be used. Only the supplied water container should be used, and containers are to be emptied and rinsed out, with distilled or rainwater, at least once a month to prevent the accumulation of impurities. The muslin or wick should be replaced every fortnight or as soon as it shows any sign of becoming dirty or unserviceable.

#### **E.2.2 Accuracy**

All approved thermometers should be manufactured to agreed international best practice specifications, which call for a high degree of accuracy. It is important that all thermometers in use remain accurate. Wet and dry bulb thermometers should give identical readings when both bulbs are dry. Common thermometers should be compared with a wet and dry bulb thermometer. Where appreciable variations are noted, arrangements should be made with local meteorological authorities

for the thermometers to be tested and a correction factor then applied. When this is impracticable the thermometer should be replaced. Spare receptacles containing water shall not be stored in the screen with the thermometer because this may increase the humidity of the surrounding air and lead to incorrect results.

### **E.3 Reading of thermometers**

No reading should be taken for at least an hour after cleaning or adjusting a thermometer. Observers should read thermometers so that their line of sight is at right angles to the scale.

In order to avoid heating effects from the warmth of their breath or bodies or from torches they should not approach the thermometer too closely. They should avoid breathing on the wet bulb because this may cause a slight variation in local humidity in addition to the possible heating error. Readings shall not be taken when the water of the wet and dry thermometer is frozen.

### **E.4 Care of thermometers**

After installation, thermometers should only be handled when it is necessary to clean the scale, rewet the muslin on the wet bulb, or to clean or refit the water container of the wet and dry bulb thermometer. These operations should be performed with the least possible disturbance of the instrument.

### **E.5 Ventilation of ESH**

When ventilation procedures are applicable to particular ESH or ammunition stocks, the ESH should be opened for ventilation purposes when directed by the head of the establishment or an authorised representative. The actual times at which the thermometers should be read and ESH opened will depend on local conditions and the head of the establishment should issue orders to suit local circumstances.

Local instructions should be issued as to the use of this equipment because so many types are available on the market that it is impossible to provide guidelines on all types available.

ESH should be closed as soon as favourable conditions cease to apply unless this is impracticable due to work continuing. Ventilation shafts and all other openings should be closed as well as doors and windows.

