



Best Practice Guide on Procedures for Management of Stockpiles of Conventional Ammunition

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I. Introduction

This guide provides recommended best practices that will facilitate and enhance proper management of national stockpiles of conventional ammunition, explosive material and detonating devices. It contains information useful for those individuals currently working in ammunition storage locations and those managers involved in the chain of command over these facilities that are working to establish national policy and procedures. These practices will help participating States both use their resources more efficiently and diminish the risk of dangerous situations involving theft, loss, or accident.

Poor management can create situations in which unserviceable ammunition deteriorates and creates an unsafe environment for users or the local population. Conversely, the optimal management of national stockpiles of conventional ammunition and explosives enhances military, paramilitary, internal security forces, and police force readiness and is essential to responsive and effective forces. Proper management also aids in securing a stockpile, providing a means to diminish and deter theft and to quickly identify loss. A clear understanding of what is contained in the stockpile is essential for its optimal management.

II. Scope and methodology

This guide provides the basic practices that ammunition and explosives storage facilities can employ, while keeping in mind the cardinal principle of, “To protect the general public and environment, it will be the general principle to expose the minimum amount of ammunition and explosives for the minimum amount of time.” Where these practices cannot all be implemented, participating States should implement those practices for which they have the capability, and work on implementing further practices with the aim of creating a comprehensive stockpile management program.

This guide covers the same materials as covered by the OSCE Document on Stockpiles of Conventional Ammunition (OSCE Stockpiles Document)¹. While the

principles identified in this guide apply to all national stockpiles of conventional ammunition, explosive material and detonating devices, they are relayed largely with military stockpiles in mind. The OSCE Stockpiles Document includes “conventional ammunition, explosive material and detonating devices of land-, air- and sea-based weapon systems. Ammunition used for weapons of mass destruction (nuclear, chemical and biological) is excluded.”²

The areas covered in this guide are taken from Section IV of the OSCE Stockpiles Document on Stockpile Management and Security. It recommends the following indicators for use in assessing the current state of the stockpile and where improvements need to be made.

1 FSC.DOC/1/03, 19 November 2003.

2 OSCE Stockpiles Document, Section II, paragraph 16.

This guide expands upon the indicators listed below:

- (i) Safety and Storage: Robustness and capacity of stockpile buildings,
- (ii) Quality: Condition of conventional ammunition, explosive material and detonating devices,
- (iii) Accountability: Ammunition stock control function policies and procedures,
- (iv) Reporting: Procedures for the immediate reporting and recovery of any loss,
- (v) Training: The training of staff in effective stockpile management and security procedures,

- (vi) Management Controls: The system implemented and executed to ensure the ammunition stockpile management process is established and working as intended³.

The guide will first provide general information for management personnel working to establish policies and procedures regarding ammunition stockpile management on the local and national levels. Recommended technical practices are then provided for those individuals working directly in an ammunition stockpile facility.

III. General policies and procedures

A. Accountability: Receipt, storage, inventory, and materiel release, procedures

Management Responsibilities: Inventory management and accounting control procedures should be implemented at all levels of responsibility for stockpile facilities and there should be an organized system of reporting and communication between these levels. In order to complete regular reporting to higher levels of command, Facility Managers must have a firm grasp of their inventory and procedures and be able to provide higher levels of commands with information necessary for auditing control and for projecting future usage and supply needs. Conducting periodic inspections of facilities not only encourages communication among various levels of organization, but also holds Facility Managers accountable for their reporting. Communication and reporting will help ensure that all facilities are adequately stocked and that the necessary auditing is taking place.

Records and Reporting: It is important to note that a lifetime approach should be taken in inventory management, i.e., control and adequate records must be maintained from the moment facilities take control of stock, through the various movements of the stock, until the stock is expended or destroyed. It is particularly important to identify those munitions deemed as excess, obsolete and unserviceable/unrepairable so that they can be demilitarized or destroyed as soon as possible, or set aside for training if the quality permits. Ensuring this type of inventory management will minimize safety and security risks.

On a monthly or quarterly basis, local distribution points should report to their regional distribution point or their national distribution point (depending on the organization of the national system). Reports should contain information on current inventory and distributions for the preceding time period, including destinations for these distributions. This information should be

3 OSCE Stockpiles Document, Section IV, paragraph 21.

used to identify any inventory losses from accident or theft and to identify areas of insufficient inventory. This information should also be used to conduct periodic cost-benefit reviews to ensure that resources are being used in the most efficient manner.

Ideally, a computerized and networked inventory program should be developed to meet the inventory needs of the national system. This way, regional distribution facilities and/or the central distribution facility will have the ability to produce reports on the distribution activities of the various programs and also on the current inventory status of the facilities. In addition to enhanced reporting, a computerized system would also greatly facilitate inventory management and auditing, as information would be more easily accessible and recoverable. If it is not possible for a computerized system to be developed, organized paper inventory systems can also be very effective, although they are more labor intensive and time-consuming.

Physical Inventory: Each facility should also endeavor to take a full physical inventory of their stock annually. The term “physical inventory” means that operators will count the stock by hand or through automation (where applicable in automated inventory systems) to verify the current inventory. A physical inventory is a large resource commitment but it is the best way to truly verify the current inventory levels and ensure that present planning assumptions regarding ammunition and explosives stockpiles are correct. This is also a way to uncover any old reporting errors, which may have been skewing the numbers for subsequent reports. Self-contained weapons and items considered susceptible to theft (i.e. plastic explosives, detonators, High Explosive Hand Grenades, mines with fuzes, shoulder fired rockets) should be accounted for on a quarterly basis.

Maintaining these reports and any other necessary records will greatly facilitate the management of stockpiles while also enabling periodic auditing as well. As record keeping is such an important component in managing stockpiles of ammunition and explosives, it will be addressed in a best practice guide covering marking, registration and accounting of ammunition stockpiles.

B. Reporting: Procedures for immediate reporting and recovery of any loss or incidents

A key internal management control is accounting for events involving loss, accidents, damage, or destruction of ammunition and/or explosives. Facilities should aim to report any theft or other loss of ammunition or explosives immediately after the event or discovery of the loss, but in any event no later than 72 hours after the event or discovery of the loss, to the appropriate levels of command. As soon as the loss is discovered, the supervisor of the facility should be notified. The sooner an investigation can begin after a theft or loss, the greater the chance of recovering the material or determining the individual responsible. All of the circumstances surrounding the loss should be examined, including the transportation of the stock if it is recently arrived. After the loss is discovered, the appropriate corrections to the facility records should be made, with a notation on the lost inventory.

In order to limit variables surrounding an inventory loss, any inventory transported from another facility should travel under sealed container and the driver of the truck should not be allowed to leave until it is verified that the seal is intact and the number matches the shipment paperwork.

C. Training: Training of staff in effective stockpile management and security procedures

Facility Personnel Training: Individuals involved in the day-to-day management and operations of various ammunition and explosives stockpile facilities should be trained in the procedures and regulations governing the functioning of these facilities. Staff should receive standardized appropriate training in safe handling of these materials and what should be done in the case of an emergency situation when there are accidents or problems with the explosive material. There should be internal training on any national regulations and local requirements regarding the stockpile management of ammunition and explosives, organization and operations of the facility, requisite record keeping and reporting and any computerized inventory programs if they are used. Facility Managers are responsible for ensuring that their personnel are trained and also for maintaining that level of training. A recommended approach would be to institute a periodic cycle of training, with appropriate certification and re-certification or testing integrated into the cycle.

Training Curriculum: A curriculum for training facility personnel should be established on the national level and it should be reviewed, evaluated and updated at least annually to ensure the adequacy of the training being conducted. Managers at all levels within the national system should ensure that training requirements are being met and that the training is being properly documented. A “train-the-trainers” course, using curriculum established on the national level, would be useful as it would enable managers to be trained and then return to their facilities to train the rest of their staff on the facility procedures. Safety procedures could also be included in this training curriculum but it is recommended that a separate curriculum be established for training on

safety issues. This would ensure that personnel at these facilities are adequately trained to handle the material. Train-the-trainer courses would also promote communication within the national system to ensure that practices are meeting the needs of the facilities and the end-users. This would also facilitate an exchange of ideas on training where participants could learn from other participants on practices and ideas which have worked well in other facilities.

D. Controls: Supervisory Considerations

Responsibilities through the Chain of Command: “Responsibility” is the obligation of an individual to ensure that Government property and funds entrusted to his or her possession, command or supervision are properly used and cared for, and that proper custody and safekeeping are provided. Those individuals in supervisory roles in ammunition and explosives stockpile facilities have the responsibility to ensure that auditing takes place and that resources are being used in the best way possible. There should be a chain of command that should be followed and each level should have the responsibility for the facility and the property which they oversee. Final distribution points should be held accountable by regional distribution points or by the national distribution point (depending on the organization of the national system). If they exist, regional distribution points should be held accountable by the national distribution point. The national distribution point should be held accountable by a final committee or office at the national level which has been given oversight authority over the entire stockpile management process. “Being held accountable” means that each level of command audits the level beneath them to ensure that all of the property delivered to them is accounted for. Each storage organization performing the ammunition stock control function should implement

and execute a quality control program. This program will periodically sample receipts, ammunition transfer records, and materiel release orders, at a minimum to ensure that stored assets are being properly accounted for in terms of condition code, location, quantity, and ownership.

Inventory Accountability: Personal inspection of facilities and records is a vital part in holding Facility Managers accountable for their actions along with facility employees. As there are tremendously high quantities of ammunition, it may not be possible to ensure 100% accountability. Facilities should still be mandated that they reach as high a level of accountability as possible. Where any variation from 100% is identified, the discrepancy must be immediately reported and investigated, the reasons for it ascertained, and any necessary remedial action taken to prevent a recurrence.

Continuity of Personnel: Ensuring the accountability of ammunition and explosives facilities is an essential responsibility of those supervisors involved in the ammunition stockpile management system. It is also essential for supervisors to focus on other areas affecting the day-to-day functioning of a facility. One of the most critical elements in maintaining a well-organized, accountable system is the personnel whose job it is to support the facilities. Every effort should be made to ensure that reliable personnel are hired and that they obtain further training and education so that they can remain current in the latest methods and practices used in the management of ammunition and explosives. Personnel should be encouraged to continue to develop expertise and knowledge in their occupational specialty which can, in turn, encourage the longevity of employment. The maintenance of knowledgeable personnel in key positions for the long term is essential to ensuring that the stockpiles are being properly and safely managed. Maintenance of

personnel is the specific and ongoing responsibility of Facility Managers and those at higher levels of command within the system.

Prioritization: Supervisors must also pay great attention to their available resources and be able to prioritize their use in ways that will be of greatest use to the facility. Different participating States have different resources and there may be different resources available for various facilities. Those in management positions must be able to assess the needs of the facilities and prioritize the use of their resources. A necessary component of this assessment would be establishing the requirements of the facility (e.g., Which components are the facility supporting? What are the training needs? What are the wartime needs?) Resources can then be prioritized to ensure fulfillment of these requirements. Explosive safety & security should be the highest priority, be it securing the facility, ensuring that unstable ammunition and/or explosives are safely disposed of, or ensuring that a safe combination of ammunition and explosives are being stored together.

Surveillance: An important way to assess these facilities and ensure readily accessible information for prioritizing resources is for Facility Managers to ensure that there is continuous ammunition surveillance in their facility. This surveillance includes: 1) quality assurance and logistics functions related to the inspection, testing, and classification of ammunition and explosives; 2) functions that affect explosives safety during handling, storage, transportation, maintenance, use, and disposal of ammunition and explosives; 3) core functions of inspecting and determining the reliability of the stockpile, inspecting and monitoring ammunition/explosives operations for compliance with regulatory explosives safety requirements, and protecting the public and government assets from unnecessary expo-

asures to explosives hazards. Continuous ammunition surveillance managed and/or conducted by the facility manager is key to identifying safety risks and ensuring the accountability of the facility while also facilitating resource prioritization.

Planning: The long-term planning at the facility level and at the national level will help in ensuring a productive use of resources and will facilitate resource prioritization. Being able to anticipate long-term needs will enable Participating States and facilities to plan and allocate their resources in a way that will best benefit their facilities. Some long-term needs to anticipate could include updating any technology such as computers used in inventory processes; replacing any degraded shelving; or performing a physical inventory. Anticipating these needs will allow resources to be allocated in such a way that they will not have to be re-allocated at the last minute at the expense of other essential components of a facility such as personnel or security measures.

Accountability of Managers and Personnel: Facility Managers have the responsibility for managing the resources at their disposal with the end-goal of effectively managing a stockpile of ammunition and explosives. These resources include both available finances and personnel. Facility Managers must hold their personnel accountable for their activities and use of resources in a facility. Furthermore, Facility Managers must also be held accountable for the responsibility entrusted to them. Handling ammunition and explosives is a serious responsibility and all levels of management should emphasize the seriousness of this task by ensuring accountability at all levels. This is done by checking reports, periodic inspections, and ensuring punitive actions are taken if illegal actions are taking place.

IV. Technical practices for stockpile facilities

A. Safety and Storage: Robustness and capacity of stockpile facilities

Facility Capacity: In order to organize and maintain an ammunition stockpile properly, the storage facility must be able to safely store and physically contain the various classes of ammunition and explosives and also have sufficient capacity to perform the necessary activities of a stockpile storage facility. National facilities supplying smaller, local facilities must have the capacity to handle large amounts of ammunition and have the ability to facilitate the staging and shipping of that ammunition.




Smaller, local stockpile facilities must have the capacity to receive shipments of ammunition and provide adequate storage and security. In addition, the buildings must have the capacity to organize its stockpiles. Facilities must be large enough to facilitate the organization of various types of ammunition so that they are kept separate and not mixed with other incompatible stock. Because of the chemical characteristics of different types of ammunition and explosives, storing improper categories of these materials together can significantly increase either an accident's probability or, for a given quantity, the magnitude of an explosive incident's effects. Ammunition and




explosives categories and compatibility will be further discussed in a later section (see Section III.D).

Storage facilities should be constructed, designed and maintained to provide the greatest possible degree of protection to the public and the environment, as well as to prevent the spread of fire or explosion to other buildings in the facility. Regular trimming of vegetation will enhance security as well as safety.

Facility Markings: Stockpile facilities should be marked with the appropriate signs to indicate the appropriate fire hazard symbol for that facility. Facilities should use

the United Nations Organization (UNO) Hazard Classification System, which designates nine hazard classes. Class 1 is applicable to ammunition and explosives and is divided into the following subcategories to indicate the level of fire hazard in the facility. The six fire divisions are indicated by four distinctive symbols in order to be recognized by the firefighting personnel approaching the fire scene. A fire division number is shown on each symbol. Because of similar firefighting hazards, the Fire Division 1 fire symbol and number are also used for Fire Division 5 and the Fire Division 2 fire symbol and number are also used for Fire Division 6:

Category and Description	Example of what would be in category	Symbol used for each category
1.1- Mass Detonation (a mass explosion is one which affects almost the entire load instantaneously)	Artillery High Explosive Projectiles, e.g.: - Dynamite - Anti-tank Mines - 155mm Projectiles - Detonating Cords - Fragmentation Grenades - Most guided missiles and launchers	
1.2- Detonation with Fragments (have a projection hazard but not expected to mass detonate)	High Explosive Mortar Ammunition, e.g.: - 120mm, 60mm, 81mm cartridges - Some Guided Missiles and Launchers	
1.3- Mass Fire (have a fire hazard and either a minor blast hazard or minor projection hazard or both- no mass explosion hazard)	Propellants, e.g.: - 155mm Propellant Charge - Surface Trip Flares - Ground Illumination Signal	

1.4- Moderate Fire (present only a small hazard in the event of ignition or initiation- no projection of appreciable fragments are expected)	Small Arms Ammunition, e.g.: - 9mm, 5.56mm, .50cal, 7.62mm cartridges	
1.5 – Mass Explosion Hazard (are so insensitive that there is very little probability of initiation or transition from burning to detonation under normal condition)	Commercial Blasting Agents, e.g.: - ammonium nitrate fuel oil (ANFO) and ammonium nitrate emulsions	
1.6 – Explosion (articles that contain only extremely insensitive detonating substances and limited to the explosion of a single article)	Nonmass Explosion, e.g.: - extremely insensitive detonating substances (EIDS)	

B. Facility Standard Operating Procedures⁴

The SOP is a written directive that provides detailed procedures prescribing all safety requirements for the facility. This document should be based on national regulations if they exist. Otherwise, SOPs should be based on the circumstances, needs and responsibilities of the facility. An SOP should be developed prior to starting any operation involving ammunition or explosives. Inside the facility, the Standard Operating Procedures (SOP) for the facility should be posted in conspicuous locations. The Document should include:

- (i) Minimum training requirements for explosives operators or munitions handlers,
- (ii) Emergency notification procedures for accidents

or incidents resulting in personnel injury or damage to ammunition stock,

- (iii) Responsibilities and duties of personnel authorized entry into the facility,
- (iv) Non-emergency explosive ordnance disposal,
- (v) Fire safety, including lightning protection,
- (vi) Drawings, specifications, gauge schedules, tools, apparatus, and restriction lists,
- (vii) Static electricity grounding (earthing) requirements,
- (viii) Maximum and/or minimum humidities,
- (ix) Clothing and foot-wear requirements,
- (x) The maximum number of personnel to be in the workshop or laboratory at any one time,
- (xi) The maximum quantity of explosive items per-

⁴ Standard Operating Procedures that have been expanded to address local facility operations and conditions are often referred to as 'Standing Orders'. For purposes of this handbook, no distinction is made between the two types of documents.

mitted in the building and/or to be worked on at any one time,

- (xii) Any additional safety precautions necessary for the ammunition being worked on, such as the provision of evacuation routes and assembly points.

The Facility Manager has the approval authority for all SOPs and any future changes to the document. All personnel working in the facility should be required to read the SOP and sign as having understood the content of the SOP. Any questions on the meaning of the SOP should be asked prior to the employee signing the SOP. In addition to an SOP being posted, signs should be posted inside the facility indicating the safety precautions and regulations for the specific material stored in the facility. Emergency evacuation plans should be practiced periodically. The SOP should clearly describe each part of the operation, so that no doubt or flexibility is left in the manner in which the specific operation is to be conducted. The SOP should also include a complete listing of the tools and equipment approved for the completion of the specific task.

National regulations should determine the maximum number of personnel permitted to be present in the facility. Until national regulations are established, the Facility Manager should determine the appropriate number of personnel for the facility. This number should be kept to the minimum required to properly perform the work safely and efficiently. A sign stating the maximum/minimum number of personnel allowed in a facility containing ammunition and explosives should be posted in a conspicuous location. This number should include supervisors as well as the number of visitors permitted.

C. Quality: Condition of conventional ammunition, explosive material and detonating devices

Observation: A process for overall management of the quality of the ammunition and explosives must be established within the national system. Quality must be monitored upon initial receipt, while in storage and transport, during interim storage in other locations, during use by national authorities, during maintenance and finally during demilitarization. Continually observing and maintaining records on the condition of ammunition, explosive material, and detonating devices will aid both in ensuring safety for the facility and the surrounding areas and in increasing the cost-effectiveness of the stockpile facility. By constantly examining the condition of the ammunition, Participating States can identify deteriorated or unsafe ammunition and remove it from the stockpile. If ammunition stockpiles are managed properly, older ammunition can be used prior to the newer stocks, ensuring that the older ammunition does not deteriorate and require disposal. Ammunition which has already degraded past a useable stage should not be used and should be destroyed. Ammunition that is considered unsafe for storage should be moved to an Isolation Storage Area while awaiting disposal actions.

Actions to improve the condition of stockpiled ammunition: Facilities can work on de-rusting, cleaning, painting, and repackaging of material to upgrade stocks and correct nonfunctional defects of the ammunition and explosives. These activities could come as a result of regular surveillance inspections by facility personnel or from management decisions. These duties should be performed multiple times a year to keep the stockpiled material in an optimal state. Applying good supply techniques such as “first in-first out” will reduce the need for maintenance and rework caused by deterioration. Improving the condition of these stocks will also improve the security of the

entire stockpile by ensuring that stock is not degraded to a point that it becomes unstable and poses a threat to the facility and surrounding areas. The ammunition required for immediate peacetime needs or for primary war reserve⁵ requirements should receive the priority attention for cleaning, painting, repackaging, etc. Ammunition required for peacetime needs during the first year or for the second level of war reserve requirements should receive the next level of priority.

Storage Techniques: Proper storage techniques can help maintain or improve the condition of ammunition and explosives within a facility. Ammunition and explosives should be separated in stacks by nature, type, and lot number and they should always be stored inside their shipping containers. These containers should be stacked to maintain an orderly arrangement that will facilitate the safe and effective handling of ammunition. The bottom layer of a stack of ammunition and/or explosives should be raised off the floor by suitable means, preferably metal or wood, to provide ventilation and to protect the material from water and dampness. Wooden pallets are suitable means to raise the stacks when they are received as part of the packaged unit. Unobstructed aisles should be maintained between stacks to ensure that the ammunition and explosives can be inspected, inventoried, and removed as necessary. These aisles should be at least eighteen inches (46 centimeters) wide so that individual containers or stacks are accessible for inspection. It is recommended that a clearance of at least two feet (61 centimeters) be maintained from the front wall of the facility along with a space of at least six inches (15 centimeters) from stacks to the sides, rear, and ceiling of

the facility. Ammunition stacks should be placed at least one meter from doorways to provide protection from direct sunlight, rain, etc. when doors are open. If pallets are unbanded, stack heights should not exceed two meters or one pallet.

D. Supply Management: Organization of Stockpiles

Ammunition and Explosives Compatibility: Quantities of conventional ammunition can be in the hundreds of thousands in a single stockpile. Furthermore, there are different types of ammunition, different calibers, different manufacturers and different ages, all with varying degrees of volatility. The combination of these factors makes the strict organization of a stockpile essential in ensuring safety and the effective use of materials. In order to facilitate the organization of ammunition and explosives and to ensure that they are safely housed in a facility, they are assigned to specific groupings. These “ammunition compatibility groups” are assigned to ammunition in order to reduce the probability of an accident or, for a given quantity, the magnitude of the effects of such an accident. Refer to Annex A for the Compatibility Group Assignments and Storage Facilities Compatibility Chart that details which groups can be safely stored together.

Net Explosive Quantity (NEQ): A factor that is affected by the organization of stockpiles is the NEQ⁶. The NEQ is the weight in kilograms (pounds) of the explosive content of an individual round of ammunition. The NEQ must be calculated to determine the safe distance ammunition may be stored from inhabited buildings, public

⁵ The term “war reserve” can be defined as follows: “Stocks of materiel amassed in peacetime to meet the increase in military requirements consequent upon an outbreak of war. War reserves are intended to provide the interim support essential to sustain operations until re-supply can be effected.”

⁶ “Net Explosive Quantity” (NEQ) is a term used by many States, where the quantity of explosives is identified in kilograms (kg). Other States may use “Net Explosive Weight” (NEW), where the quantity of explosives is identified in pounds (lbs).

traffic routes, ammunition operating buildings, and other storage sites. The NEQ for each item of ammunition in the stockpile must be identified and published by the appropriate authority. When ammunition and explosives of more than one Hazard Division are stored in a single site, the required Quantity-Distances or permissible NEQ should be calculated using the following rules:

- a) When Hazard Divisions 1.1 and 1.2 are located in the same site, determine the distances for the total quantity considered first as 1.1 and then as 1.2. The required distance is the greater of the two. When the 1.1 requirements are controlling and the HE equivalence of the 1.2 is known the HE equivalent weight of the 1.2 items may be added to the total explosive weight of 1.1 items to determine the NEQ for 1.1 distance determination; otherwise, the total explosive weight of the 1.2 items (including the net propellant weight) is to be added to the total explosive weight of the 1.1 items to determine the NEQ for 1.1 distance determination.
- b) When Hazard Divisions 1.1 and 1.3 are located in the same site, determine the distances for the total quantity as 1.1. However, when the HE equivalence of the 1.3 is known, the HE equivalent weight of the 1.3 items may be added to the total explosive weight of 1.1 items to determine the NEQ for 1.1 distance determinations; otherwise the total net propellant weight of the 1.3 items is to be added to the total explosive weight of the 1.1 items to determine the NEQ for 1.1 distance determinations.
- c) When Hazard Divisions 1.2 and 1.3 are located in the same site, determine the required distance for each separately. The two quantities do not need to be added together for Q-D purposes. The required distance is the greater of the two.
- d) When Hazard Divisions 1.1, 1.2, and 1.3 are located in the same site, determine the distances for the total quantity considered first as 1.1, next as 1.2, and finally as 1.3. The required distance is the greatest of the three. As permitted by paragraphs C9.2.1.3. and C9.2.1.4., above, HE equivalent weights for 1.2 and 1.3 items may be used in NEQ determinations for Q-D purposes; otherwise the rules for adding total explosive (and/or propellant) weight of 1.2 and 1.3 items is to be added to the explosive weight of the 1.1 items (when controlling) to determine the NEQ for 1.1 distance requirements.
- e) Explosives designated as Hazard Division 1.5 for transportation are considered to be Hazard Division 1.1 for Q-D purposes (storage).
- f) When Hazard Division 1.6 is located with Hazard Division 1.1 or 1.5, Hazard Division 1.6 is considered Hazard Division 1.1 for Q-D purposes. When Hazard Division 1.6 is located with Hazard Division 1.2, Hazard Division 1.6 is considered Hazard Division 1.2 for Q-D purposes.
- g) When Hazard Division 1.6 is located with Hazard Division 1.3, then add the explosives weight of the Hazard Division 1.6 to the weight of Hazard Division 1.3 and determine the distances for the total quantity considered first as Hazard Division 1.3 (if demonstrated by testing or analogy; otherwise, treat as Hazard Division 1.1) and second as Hazard Division 1.6. The required distance is the greater distance of the two.
- h) The Q-Ds for Hazard Division 1.1, 1.2, 1.3, 1.5 or 1.6 individually or in combination are not affected by the presence of Hazard Division 1.4.i). If approved buffer

configurations are provided, the NEQ for Q-D purposes is the explosives weight of the largest stack plus the explosives weight of the buffer material.

The NEQ is also involved in another equation, the Explosive Safety Quantity Distance (ESQD). This equation provides the acceptable levels of protection (distance) based on the type and quantity of explosives, the type of structure they are stored in and the relationship to the exposed sites, (e.g., inhabited buildings, public transportation routes, and different ammunition storage facilities). The equation used to determine the ESQD is $D = XQ^{1/3}$, where D = Distance (m), X = Safety factor (the X variable⁷ is a constant and represents the degree of damage that is acceptable. Typical constants range from 1.25 to 50; the lower the factor, the greater the damage that is accepted), Q = NEQ (kilograms). A full and complete explanation of ESQD calculations is beyond the scope of this document. However, there are several national and other documents, which can further explain the ESQD implementation. Annex D contains contact information for regional organizations and other OSCE participating States' practices in this area.

Maintaining Organization in a Facility: Ammunition should be organized in such a way that promotes the timely receipt, storage, and issue of stock and also promotes the accuracy within ammunition location records. A way of promoting this organization is by utilizing an "ammunition locator record" which provides a record of each lot of ammunition and identifies the site location in which it is stored. Included in the locator record could be a "planograph"⁸ which is a diagram reflecting all of the items stored in the facility, grid locations of the items, and occupied and vacant storage space within an

ammunition storage structure or site. A "grid location" is a specific area within the confines or boundaries of an ammunition storage structure or site, which relates the location of the stocks in the facility to the floor plan/layout/or planograph of the location. The organization of a stockpile should facilitate the objectives of seeking to 1) accelerate the selection of stock for issue or shipment to facilities; 2) expedite the movement of received stock to its proper location in the facility; 3) achieve maximum use of storage space; 4) provide rapid response to inquiries for location information; and 5) maintain high accuracy standards for ammunition locator records.

Once a diagram of the facility has been completed which facilitates the objectives of an organized stockpile, any changes to the diagram should be highly regulated and documented if location changes are necessary.

Stocks within the individual grid locations should also be highly organized and separated according to lot number and condition. It is important to separate stocks by lot number and condition largely for quality control reasons. Often ammunition or explosives from a certain lot are sent to multiple regional distribution facilities. If a particular lot of ammunition is found to be unstable or dangerous, then the inventory from this lot would be re-called (i.e. it would be returned to the proper authorities for safe disposal). It is essential that facilities be able to immediately identify lots in question so that the risk to those in the facility or surrounding areas is minimized. Higher cost ammunition such as rockets and guided missiles may be assigned individual serial numbers. The serial numbers should also be carefully kept and the location of these items should also be designated on the planograph.

⁷ Some countries denote this factor with a 'K'.

⁸ Refer to Annex B for a sample planograph.

To keep stocks organized within grid locations, forms can be attached to each lot in a grid location which would be used to track additions or removals from that lot⁹. If multiple lots are stored in one grid location, then there should be a separate form for each lot. If storage locations cause the deterioration of these forms (due to climactic conditions or the presence of rodents or insects, etc.) they should be placed in plastic envelopes or suitable substitutes to prevent deterioration of the forms. When the last of the lot of ammunition is removed from the facility, the form should be maintained for at least two years in case there are any questions or issues with that stock.

Clearly identified physical security procedures are also a valuable way to maintain the organization of a stockpile. Less complex measures, such as controlling who has keys to the facility and sign-in/ check-out lists are cost-effective measures to enhance loss-prevention efforts in a facility. Other measures such as increased lighting and fencing around the facility, increased security staff, and an intrusion detection system can provide invaluable protection for an ammunition stockpile facility.

V. Additional information

Participating States looking for more specific information on stockpile management can refer to the regulations in place of other OSCE participating States. Regional organizations such as NATO have also produced regulations on ammunition and explosives topics which have been agreed to by all NATO members, with

many Partnership for Peace and Mediterranean Dialogue countries participating in their development. Annex D contains contact information for regional organizations and other OSCE members' practices in this area.

⁹ Refer to Annex C for a sample form.

Annex A

Ammunition and Explosives Compatibility Groups and Compatibility Chart

Aboveground Storage of Explosive Substances Rules for Mixing of Compatibility Groups.

Compatibility Group	A	C	D	G	L	S
A	X					
C		X ¹⁾	X ¹⁾	³⁾		X
D		X ¹⁾	X ¹⁾	³⁾		X
G		³⁾	³⁾	X		X
L					²⁾	
S		X	X	X		X

LEGEND: X = Mixing permitted

NOTES:

- 1) Mixing permitted provided substances have all passed UN Test Series 3. Storage of substances of any Compatibility Groups C, D or G which have failed UN Test Series 3 will require special consideration by the National Competent Authority.
- 2) Compatibility Group L substances must always be stored separately from all substances of other compatibility groups as well from all other substances of Compatibility Group L.
- 3) The mixing of Compatibility Group G substances with other compatibility groups is at the discretion of the National Competent Authority.

Aboveground Storage of Explosive Articles - Rules for Mixing of Compatibility Groups.

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

LEGEND: X= Mixing permitted

NOTES

- 1) Compatibility Group B fuzes may be stored with the articles to which they will be assembled, but the NEQ must be aggregated and treated as Compatibility Group F.
- 2) Storage in the same building is permitted if effectively segregated to prevent propagation.
- 3) Compatibility Group L articles must always be stored separately from all articles of other compatibility groups as well as from all other articles of different types of Compatibility Group L.
- 4) Mixing of articles of Compatibility Group G with articles of other compatibility groups is at the discretion of the National Competent Authority.
- 5) Articles of Compatibility Group N should not in general be stored with articles in other compatibility groups except S. However, if such articles are stored with articles of Compatibility Group C, D and E, the articles of Compatibility Group N should be considered as having the characteristics of Compatibility Group D and the compatibility groups mixing rules apply accordingly.
- 6) It is allowed to mix 1.6N munitions. The Compatibility Group of the mixed set remains N if the munitions belong to the same family or if it has been demonstrated that, in case of a detonation of one munition, there is no

instant transmission to the munitions of another family (the families are then called „compatible“). If it is not the case the whole set of munitions should be considered as having the characteristics of Compatibility Group D.

- 7) A mixed set of munitions 1.6N and 1.4S may be considered as having the characteristics of Compatibility Group N.

1.2.3.3. *Mixed Storage - Special Circumstances*

- a) There may be special circumstances where the above mixing rules may be modified by the National Competent Authority subject to adequate technical justification based on tests where these are considered to be appropriate.
- b) Very small quantity HD 1.1 and large quantity Hazard Division 1.2.1/1.2.2.
It should be possible to arrange storage in such a manner that the mixture will behave as 1.2.1/1.2.2.
- c) Mixing of Hazard Division 1.1, Hazard Division 1.2.1/1.2.2 and Hazard Division 1.3
The quantity distance to be applied in these unusual circumstances is that which is the greatest when considering the aggregate NEQ as Hazard Division 1.1, Hazard Division 1.2.1, Hazard Division 1.2.2 or Hazard Division 1.3.
- d) With the exception of substances in Compatibility Group A, which should not be mixed with other compatibility groups, the mixing of substances and articles is permitted as shown in Tables 5 and 6.

Compatibility Group Assignments

Group A: Primary explosive substance. Examples are lead azide, lead styphnate, mercury fulminate, tetracene, dry RDX, and dry PETN. Group A materials are prohibited aboard combatant ships.

Group B: Articles containing a primary explosive substance and not containing two or more effective protective features. Some articles, such as detonators for blasting, detonator assemblies for blasting and primers, cap-type, are included, even though they do not contain primary explosives. Examples are detonators, blasting caps, small arms primers, and fuzes without two or more safety features.

Group C: Propellant explosive substance or other deflagrating explosive substance or article containing such explosive substance. Examples are single-, double-,

triple-based, and composite propellants, rocket motors (solid propellant), and ammunition with inert projectile.

Group D: Secondary detonating explosive substance or black powder or articles containing a secondary detonating explosive substance, in each case without means of initiation and without a propelling charge, or article containing a primary explosive substance and containing two or more effective protective features. Examples are bulk TNT, Composition B, wet RDX, bombs, projectiles, warheads, or fuzes with two or more safety features.

Group E: Article containing a secondary detonating explosive substance, without means of initiation, with a propelling charge (other than one containing flammable liquid or gel or hypergolic liquid). Examples are artillery ammunition, rockets, or guided missiles.

Group F: Articles containing a secondary detonating explosive substance with its own means of initiation, with a propelling charge (other than one containing flammable liquid or gel or hypergolic liquid) or without a propelling charge. An example is a grenade.

Group G: Pyrotechnic substance or article containing a pyrotechnic substance, or article containing both an explosive substance and an illuminating, incendiary, tear-producing or smoke-producing substance (other than a water-activated article or one containing white phosphorous (WP), phosphide or flammable liquid or gel or hypergolic liquid). Examples are flares, signals, incendiary or illuminating ammunition, and other smoke and tear producing devices.

Group H: Ammunition containing both explosives and WP or other pyrophoric material. Ammunition in this group contains fillers which are spontaneously flammable when exposed to the atmosphere. Examples are WP, plasticized white phosphorus (PWP), or other ammunition containing pyrophoric material.

Group J: Ammunition containing both explosives and flammable liquids or gels. Ammunition in this group contains flammable liquids or gels other than those which are spontaneously flammable when exposed to water or the atmosphere. Examples include liquid- or gel-filled incendiary ammunition.

Group K: Articles containing both an explosive substance and a toxic chemical agent. Articles in this group contain chemicals specifically designated for incapacitating effects more severe than lachrymation. Examples are artillery or mortar ammunition, fuzed or unfuzed, grenades, and rockets or bombs filled with a lethal or incapacitating chemical agent.¹⁰

Group L: Explosive substance or article containing an explosive substance and presenting a special risk needing isolation of each type. Examples are prepackaged hypergolic liquid-fueled rocket engines, TPA (thickened TEA), and damaged or suspect ammunition of any group.

Group N: Hazard Division 1.6 ammunition containing only extremely insensitive detonating substance (EIDS). Examples are bombs and warheads. If dissimilar Group N munitions, such as Mk 82 and Mk 84 Bombs, are mixed together and have not been tested to assure non-propagation; the mixed munitions are considered to be Hazard Division 1.2, Compatibility Group D for purposes of transportation and storage.

Group S: Substance or article so packed or designed that any hazardous effects arising from accidental functioning are confined within the package. That is unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder or prohibit firefighting or other emergency response efforts in the immediate vicinity of the package. Examples are explosive switches or valves.

Items that should be stored separately from other items of ammunition:

- Detonators and blasting caps (separated from Compatibility Groups C, D, E, and F by a dividing wall capable of preventing sympathetic detonation of other items,
- White Phosphorous (storage site equipped with appropriate equipment required to take Immediate Actions in case of leakage)

¹⁰ All OSCE participating States have ratified the Chemical Weapons Convention.

- Damaged ammunition (if considered unsafe for storage, damaged munitions should be destroyed at the earliest convenience),
- Ammunition in an unknown condition (should be stored at such distance that detonation of this ammunition will not jeopardize the national stocks),
- Ammunition which has deteriorated and become hazardous (should be stored in Isolation and destroyed at the earliest convenience),
- Pyrotechnics and propellants.

Annex B

Sample planograph that identifies the location of inventory in an ammunition and explosives storage facility.

Strathmore Facility

Planograph- Site Number 107010

Latitude Grid = 02 Feet

Longitude Grid = 05 Feet

Date: 12/04/05

	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	
A	I												I	A
A	I												I	A
B	I	(BCAB)I		(BCCD)I									I	B
B	I	I		I									I	B
C	I	I		I									I	C
C	I	I		I									I	C
D	I							(DEAH)I					I	D
D	I							I					I	D
E	I							I					I	E
E	I							I					I	E
F	I													F
F	I													F
G	I													G
G	I													G
H	I			(HJAD)I								(HJ)M)I		H
H	I			I								I		H
J	I			I								I I		J
J	I			I								I I		J
K	I												I	K
K	I												I	K
L	I												I	L
L	I												I	L
M	I							(MNAH)I					I	M
M	I							I					I	M
N	I							I					I	N
N	I							I					I	N
	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	

Grid	Serial/Lot Number	Quantity	Stock Number
BCAB	HAQ-3162-7BY	89	15406544050PD62
BCCD	HAQ-3148-2AY	48	15406544089PD62
DEAH	VRD-9873-4AH	45	15402246597AH74
HJAD	RTS-542-3GV	67	15405265014HY54
HJJM	RSV-432-4RD	59	15402546540HP74
MNAH	HYO-740-6ST	121	15409701657YO12

Explanation of Sample Planograph:

This is a sample planograph for an imaginary facility. Participating States and/or facilities can adjust the planograph and the included information to best fit their needs. The goal is to provide a map of the facility and ensure that, 1) there is an awareness of all stock in the facility, and 2) that there is control over that stock and its movements.

Strathmore Facility: Name of the facility

Planograph-Site Number 107010: Facility identification number (sometimes facilities are assigned identification numbers along with names)

Latitude Grid: Length of the grid containing the ammunition/explosives

Longitude Grid: Width of the grid containing the ammunition/explosives

Date: Date the planograph was printed from the system or date it was created

BCAB, BCCD, DEAH, etc.: Names for grid locations. First two letters indicate the vertical length of the grid. Last two letters indicate the horizontal width of the grid. These grid locations indicate that a specific type and lot of ammunition are stored in these locations.

I: These markings indicate the front and back of the building. The lack of these markings through grids FF, GG, and HH on the right hand side indicate the entrance to the facility.

- These markings also indicate the end of a specific location of ammunition, e.g. for grid location name DEAH, the I's indicate that this certain type of ammunition ends at grid HH.

Grid location names can then be matched up with the specific type of ammunition stored in that location, as is done at the bottom of the planograph. Participating States should include whatever information necessary for the identification of the ammunition.

Annex C

Sample Form for Tracking Additions or Removals from a Lot in a Grid Location

Lot Data Card						
Internal Control Number (if applicable):		Description of Lot:				
Lot Number:		Site Location:			Grid Location:	
Date	Document Number (of paperwork used to track internal sup- ply move- ments)	Received From or Is- sued To	+ Or -	Quantity Re- ceived (+) Or Issued (-)	Balance	Signature

Annex D

Regional Organizations

North Atlantic Treaty Organization (NATO)
 Military Agency for Standardization (MAS)
 B - 1110 Brussels
 Tel: 707.55.76
 Fax: 707.57.18
 Email: mas@hq.nato.int

NATO AC/326 Ammunition Safety Group
 Mortier, Mrs. Marie Claire, Secretary
 Armaments Directorate
 Defense Investment Division
 Room J 344
 NATO Headquarters
 B - 1110 Brussels
 Tel: +32-2-707.3942
 Fax: +32-2-707.4103
 Email: mc.mortier@hq.nato.int

South Eastern European Clearinghouse for the Control
of Small Arms and Light Weapons (SEESAC)

Team Leader,

SEESAC,

UNDP Belgrade,

Janka Veselinovica,

11000 Belgrade,

Serbia

Tel: (+381)(11)244.29.02

Fax: (+381)(11)245.43.51

Email: rmads@undp.org.yu

Tel : ++45 31541313

Fax : ++45 32968055

AIR FORCE

Flyvematerielkommandoen

Postboks 130

DK - 3500 Vaerlose

Tel : ++45 44682255

Fax : ++45 44662533

Participating States

Belgium

a. Military ammunition and explosives:

Logistiek Steuncomplex NOORD-SIPEG

Fort Colonel IMF Brosius

B - 2070 Zwijndrecht

Tel: 03/253 7248

Fax: 03/253 7269

b. Civil ammunition and explosives

MINISERE DES AFFAIRES ECONOMIQUES

Administration des Mines

Service des Explosifs

Rue J.H. De Mot 28-30

B - 1040 Bruxelles 4

b. Civil ammunition and explosives

Justitsministeriet

Civillkontoret

Slotholmsgade 10

DK - 1216 Kobenhavn K

DK - 1216 Kobenhavn K

Tel : ++45 33923340

Fax : ++45 33933510

Netherlands

Military Committee on Dangerous Goods

DMKL/Bevod/Milan

PO Box 90822

2509 LV The Hague

Netherlands

Tel: --31 70 316 5090

Fax: --31 70 316 5091

Denmark

a. Military ammunition and explosives ARMY

Haerens Materielkommando

Arsenalvej 55

DK - 9800 Hjørring

Tel : ++45 98901322

Fax : ++45 98900623

NAVY

Sovaernets Materielkommando Holmen

DK - 1433 Kobenhavn K

Norway

a. For military ammunition and explosives

1) Haerens forsyningskommandos

ammunisjonskontroll

Postboks 24,

N-2831 RAUFOSS

Norway

Tel: ++47 61 19 1230

2) Sjøforsvarets forsyningskomando

Postboks 3,
N-5078 HAAKONSVERN
Norway
Tel: ++47 55 50 2000

3) Luftforsvarets forsyningskommando

Postboks 10,
N-2007 KJELLER
Norway
Tel: ++47 63 80 8000

b. For civilian explosives and articles containing
explosive substances:

DIREKTORATET FOR BRANN OG
EXPLOSIONSVER
Postboks 355, Sentrum
N-3101 TONSBORG
Norway
Tel: ++47 33 39 8800

Turkey

a. For military ammunition and explosives:

Ministry of Defense
ANKARA

b. For non-military explosives:

Ministry of Internal Affairs
ANKARA

United Kingdom

Explosives Storage and Transport Committee (ESTC)
Room 755, St Giles Court
1-13 St Giles High Street
London WC2H 8LD
(civil net) Tel: ++44 171 305 7109/7006
Fax: ++44 171 305 6022
(mil net) Tel: LHQ 57109/57006
Fax: LHQ 56022

United States

a. Military ammunition and explosives

Chairman DoD Explosives Safety Board
Room 856C, Hoffman Building I
2461 Eisenhower Avenue
Alexandria, VA 22331-0600
USA
Tel: ++1-703-325-8624 (DSN 221-8624)
Fax: ++1-703-325-6227

b. Non-military explosives

Associate Administrator for Hazardous Materials
Safety
Material Transportation Bureau
RSPA/DOT
400 7th Street, SW
Washington, D.C. 20590
USA
Tel: ++1-202-366-0656
Fax : ++1-202-366-3753