**Ministry of Defence**
**Defence R&D Organisation**

# STEC PAMPHLET -4

# A MANUAL ONSAFE WORKING PRACTICES IN EXPLOSIVE AREAS

**2025**



Issued by

Storage & Transport of Explosives Committee
Centre for Fire, Explosive & Environment Safety (CFEES)
Brig. S. K. Mazumdar Marg, Delhi – 110054

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## PREFACE

The purpose of this pamphlet is to provide establishments, dealing with storage, transport and handling of explosives and ammunition, management and administrative guidance for the promotion of safe and efficient working operations in explosive areas. The prescriptions contained in this document are based on long years of Safety Audit experience gained through periodic inspections of major explosives and ammunition establishments under MIL, DPSUs DRDO and DGQA organizations.

The guidelines describe a list of useful considerations with particular emphasis on 'Dos' and 'Don'ts' to reduce/minimize the chances of mishaps/accidents. These may, therefore, serve as an effective aid to explosives safety managers, supervisors and workmen in performance of their duties.

It is hoped that users will find this revised STEC Pamphlet 2025 simpler, easier to understand and implement, thereby promoting the safe storage and transportation of military explosive. This publication supersedes STEC Pamphlet, 2017 on the subject.

## SECTION-1

## INTRODUCTION

### Scope

1. The purpose of this pamphlet is to provide establishments, dealing with storage, transport and handling of explosives and ammunition, management and administrative guidance for the promotion of safe and efficient working operations in explosive areas. The prescriptions contained in this document are based on long years of Safety Audit experience gained through periodic inspections of major explosives and ammunition establishments under MIL, DPSUs DRDO and DGQA organizations. The guidelines describe a list of useful considerations with particular emphasis on 'Dos' and 'Don'ts' to reduce/minimize the chances of mishaps/accidents. These may, therefore, serve as an effective aid to explosives safety managers, supervisors and workmen in performance of their duties.

## SECTION-II

## GENERAL SAFETY REQUIREMENTS

### Siting of Explosives Buildings

2. Ammunition/Explosives buildings are to be sited and constructed in accordance with STEC regulations on the subject. The occupied buildings with connected activities are designated as enclosed explosives area. The term Explosives would also include Ammunition hitherto in the succeeding paragraphs.

3. For planning cum siting of Explosives facilities for Ministry of Defence establishments and Defence Public Sector Undertakings, Centre for Fire, Explosive and Environment Safety (CFEES), Brig S K Mazumdar Road, Timarpur Dehli-110054 may be associated in the Boards constituted for the purpose by the user. The user establishment should accordingly fill in the particulars in a 'Format' (Annexure-I) and forward the same to CFEES prior to convening a Board. This will form the basis for the discussion in the meeting and the 'Format' would form part of the Board Proceedings. Instructions for filling the Proforma for 'siting of new explosive facilities' are given at Annexure II

### Responsibilities of the Head of the Establishment

4. The Head of the establishment of an explosives facility has primary responsibility for safe working and storage conditions within the facility. The following actions should normally be taken:

   a. Establish and enforce man limit for explosives facilities.

   b. Establish and enforce explosives limits for all magazines, transit sheds/areas, outside stacks or hardstands, workshops, laboratories and proof areas.

   c. Ensure that Standard Operating Procedures (SOP) are prepared, displayed in buildings and enforced for all examination, repair, renovation, modification, disassembly, assembly, proof and disposal (by breakdown, burning or demolition) of ammunition and explosives.

   d. Review periodically working conditions within the explosives area.

   e. Prepare a complete layout/master plan, comprising of all the buildings within and outside the enclosed explosives area with circles of SIQD, PIQD and OQD clearly marked in, red, blue and yellow colors respectively.

   f. Implement an explosives/ ammunition safety programme with a system of accident, incident, defect and malfunction reports and investigations.

**Safety Responsibilities**

5. a. All personnel in the course of their duty who are required to handle ammunition or explosives should have a detailed knowledge of STEC regulations and orders or directives issued to reduce the inherent hazards associated with the work.

b. A high degree of care must be demanded of personnel who are in-charge of, or are handling explosives, where even a slight degree of negligence involves danger to life or damage to properties.

c. It is the responsibility of all personnel to maintain vigilance to improve and develop safe practices, methods and attitudes.

**Admission to Explosives Area**

6. a. No person shall enter an explosives area except by authorized entrance and only under authority of a pass.

b. Any person showing the least signs of intoxication or impairment from drugs shall not be admitted to explosives areas.

**Personnel Employed in Explosives Areas**

7. A person should not be employed in the explosives area unless the Head of the establishment is satisfied that the person is suitable for such employment.

**Prohibited and Restricted Articles**

8. a. No stores, other than explosives, which have been properly classified and authorized for storage therein, and such tools, appliances and materials as are authorized from time to time, are to be permitted into an explosives area.

b. In particular, admission of the following is to be prohibited or strictly controlled:

i. Oil or gas filled lighting, heating or burning appliances and all flame, spark or fire producing appliances.

ii. Matches, cigarettes and other portable means of producing spark or flame.

iii. Radio transmitters and receivers.

iv. Tobacco in any form and any article used for the purpose of smoking or carrying tobacco.

v. Beers, wines and alcoholic liquor.

vi. Motor spirit, flammable oils and solvents not contained in the fuel tank of a vehicle or in a sealed container.

vii. Fire arms.

viii. Cameras.

ix. Drugs and medicines,

x. Food and drinks unless for sale or consumption in official canteens or refreshment areas.

xi. Battery operated equipment e.g. hearing aids, calculators.

**Smoking**

9. a. Smoking inside explosives areas is strictly forbidden except in authorize smoking gareas.

b. Prominent signs should be displayed at each exit from the smoking area with the wording "NO SMOKING BEYOND THIS POINT". A sign with the wording "WARNING - NO LIVE AMMUNITION OR EXPLOSIVES ARE PERMITTED IN THIS AREA" should be placed on or near the doors leading into the smoking area.

**Employee Working Alone**

10. No one person should be permitted to work alone (where another person cannot provide immediate assistance in case of an accident) in explosives workshop or laboratory operations which involve the assembly or breakdown of ammunition or the exposure to explosive fillings, or in any other operation which involves the opening of packages and the exposure to loose ammunition.

**Photography**

11. Photographs taken within the explosives area should be restricted to those required for official purposes. Where explosives are exposed, electro-explosive devices (EED) are involved or explosive or flammable gases may be present, the use of cameras with electrically operated equipment should be avoided unless specially approved for the purpose.

**Portable Hand Lights**

12. Approved type of portable hand lights may be used within the explosives area provided they are of a design that meets electrical requirements for the particular building/area in which they are to be used.

**Wearing of Rings and Other Jewellery**

13. It is a good safety practice to discourage the wearing of rings and other jewelry by personnel employed in explosives process buildings.

**Battery Operated Devices**

14. a. Battery operated devices may be used in locations within the explosives area at the discretion of the Head of the establishment.

b. Only "intrinsically safe" devices should be used in those areas where EED, explosive dust or other conditions which may give rise to an explosion are present. To be "intrinsically safe", the device should be incapable of producing sufficient energy to initiate an explosion.

**Thunderstorms**

15. a. At the discretion of the Head of the establishment, work involving explosives and in buildings containing explosives should cease during thunderstorms and personnel evacuated to a suitable location at an appropriate distance from Potential Explosion Sites.

b. Truckloads of explosives should be moved under shelter. Loads which must be left in the open should be covered with tarpaulins.

**Private Motor Vehicles**

16. Private vehicles shall not be permitted in the explosives area.

**Limit Boards**

17. Each Explosive building/location shall be provided with a Limit Board of size (90cm x 60 cm) at the entrance of the building showing therein the following:

a. OPERATION: STORAGE/PROCESS
b. DETAILS OF THE OPERATION
c. QUANTITY OF EXPLOSIVES
HELD ..…Kg
AUTHORISED ……Kg
HD ……
COMPATIBILITY GROUP ……
d. MAN LIMIT ……..
e. FIRE SYMBOL ……..
f. LIGHTNING PROTECTION
Tested on …….
Next test due on …….

## SECTION – III

## ARRANGEMENT OF AMMUNITION AND EXPLOSIVES IN A BUILDING OR STACK

### Ammunition and Explosive Storage – General

18. Ammunition and explosives should be stored only in locations designated for that purpose. The types and quantities of explosives / ammunition which may be stored in these locations must be in accordance with the prescribed quantity-distance requirements.

### Explosives Storage

19 a. Explosives magazines and store houses are intended for the storage of ammunition and explosives including explosive components and should not be used for the storage of non -explosive stores.

b. Explosive items and their related non-explosive components may be stored together in the same building, for example, aircraft bombs and their tail units.

c. Dummy and other inert ammunition should not be stored in the same building with their live counterparts. Inert ammunition should normally be stored in non-explosive storehouses.

d. Ammunition and explosives packages and containers should be properly marked, in good condition and free from loose dirt, grit or other contamination before being stored in magazines. Any broken or damaged packages or containers should be repacked before being accepted into a magazine, unless the damage is slight and does not adversely affect the protective qualities of the package. Repacking should not be carried out in the explosive building.

### Ammunition Stacking

20. a. Ammunition and explosives should be stored in stable stacks in explosive buildings in an approved manner which precludes toppling or collapse of the stacks, or the crushing or deforming of the containers in the lower tiers.

b. Dunnage should be used to secure the stacks. They also protect the ammunition boxes from dampness, termite infestation and allow proper aeration of the packages to ensure long storage life. The minimum height of the dunnage shall be 10 cm. For normal conditions, a 10 cm x 10 cm dunnage in hard wood or concrete is recommended.

c. Fiber Reinforced Glass (FRG) laminated dunnage as per specification (Refer Annexure III) can also be used as an alternative to wood.

d. When a specific method of stacking a particular item is not prescribed, explosives and ammunition should be stacked in accordance with the following guidelines.

i. Ammunition and explosives should be stored in their approved containers and should be separated in stacks by nature, type, and lot number. All containers should be closed and sealed by suitable means.

ii. Sufficient space should be left between ammunition stacks and the floor, ceiling and walls of the magazine to permit air circulation. Additional space by way of a lobby may be provided for inspection purposes. The minimum clearances to be observed are as follows:

- 0.6 m between walls and stack. If the floor area of storehouse is less than 40 sq m, clearance may be reduced to 0.3m.

- Width of the gangways between the main stacks shall be 1.2 m

- Clearance around the pillars shall be 0.5m.

- Clearance between sub stacks shall be 0.2m.

- Clearance between ceiling and top of the stack shall be 0.6m.

iii. Ammunition stacks should be placed at least 1 m from doorways to provide protection from direct sunlight, rain, etc. when doors are open.

iv. The stacking height or ammunition/explosive packages should not normally exceed 3.5m.

v. Light cased phosphorus filled ammunition should be in double rows to permit rapid identification and removal of leaking packages. Stack height should not exceed 2m or one pallet. Pallets should be arranged in single lines with sufficient room between each line to permit the removal of any container showing signs of leakage. Suitable tools to cut strapping should be readily available in the building.

vi. Gun cotton (wet) packed and detonator boxes should not be stacked beyond 2m.

vii. Partly filled boxes should have a fraction tag attached, or be otherwise marked, and the box placed conspicuously on the stack. There should be only one fraction box per lot.

viii. Ammunition stacks should be placed at an appropriate distance from heating devices.

e. Records of storage arrangements should be maintained to aid in space control and to ensure that the authorized explosives limits are not exceeded.

**Ventilation**

21. Magazines should be kept as dry and temperate as possible. To assist in the reduction of condensation, magazines should be provided with adequate number of ventilators. The ventilators should be designed to prevent the insertion into the magazine of any extraneous object.

**Temperature**

22. a. Temperature control is important in magazines used for storage of those types of ammunition which are adversely affected by extremes of temperature.

b. Magazine temperature records should be maintained when:

i. Such records are useful for the selection of lots for proof or test.

ii. Ammunition in the magazine has published temperature limitations which are liable to be exceeded under prevailing climatic conditions.

**Authorized Stores and Equipment**

23. Only stores, tools and equipments authorized and required for use should be permitted in magazines. A list of stores, tools and equipment approved for use should be displayed in the building. In particular, empty pallets and dunnage should not be allowed to accumulate in magazines containing ammunition.

**Aisles and Safety Exits**

24. Aisles and escape ways in magazines containing ammunition should not be blocked or obstructed. When work is being conducted doors shall be unlatched or open. All doors should be opening outward.

**Isolation Storehouses**

25. a. Condemned or unserviceable ammunition presenting more than a normal storage hazard should be removed to an isolation storehouse pending disposal.

b. Ammunition and explosives of different compatibility groups may be mixed in isolation storehouses. Such mixing should only be permitted when it is unavoidable and does not significantly increase either the probability or severity of an accident. Some control when storing condemned or unserviceable ammunition is necessary.

**Transit Storage**

26. A transit storage is defined as a building used for:

    a. The receipt of small consignments which may be mixed prior to being placed in permanent storage.

    b. The assembly of small issues which may be mixed prior to dispatch.

27. a. In buildings used as transit stores, ammunition and explosives of differentcompatibility groups may be mixed in the same way as is permitted for the appropriate mode of transport.

    b. If it is necessary to open packages, for acceptance, receipt or issueinspections or for identification, verification of quantity, repack or other process, this should be done in an adjacent building or separate compartment of the same building.Only one package should be present in this building or compartment at any time. Remarking of the outer packages and sorting of packages may be carried out in the main transit building. Irrespective of the quantities of each hazard division present at any time, the overall explosive limit applied to the building should be that for the hazard division, which permits the least Net Explosives Quantity for the available quantity distance.

## SECTION-IV

## HANDLING, MAINTENANCE AND DISPOSAL OF AMMUNITION AND EXPLOSIVE

### A. HANDLING

### Cleanliness of Building

28. The cleanliness of all magazines and other buildings containing explosives should be maintained at high standard. The following precautions shall be taken:

a. Dangerously combustible materials, such as paper, oily rags, cotton waste, paints, solvents, volatile liquids, and painting clothes required for use in an explosives storehouse or explosives workshop should be removed to a safe storage place when not actually in use.

b. Particular care should be exercised to avoid the presence of steel wool, sand, gravel, or any other abrasive substance upon the floors, tables or other working place where explosives are being handled.

c. Explosive dusts or vapours should not be allowed to accumulate inside or outside a building.

d. Electrical fixtures and motors should be kept free from dust. Well glass of FLP fittings found to contain dead insects, etc, should be immediately attended to by providing new gasket.

e. Special precautions should be observed when packages containing explosives liable to initiation by spark or friction are stored and are not in dust tight containers.

### Handling Equipment

29. Handling equipment should be in accordance with approved specifications, used in accordance with the manufacturer's instructions and maintained and inspected in accordance with the manufacturer's recommended maintenance schedules. Relevant STEC standards should be consulted.

### Parking of Vehicles, Railcars and Barges

30. Vehicles, railcars and barges should be parked in the vicinity of magazines and workshops only for the period of time required for loading or unloading; at all other times designated holding or marshaling areas should be used for parking purposes. When such vehicles/vessels are moving through explosives areas, appropriate routes should be used to minimize the risk of an explosion and propagation between Potential Explosion Sites.
Ammunition Returned From Bases or Units

31. a. All ammunition received from user units should be given an inspection to ensure that it is suitable for storage and subsequent re-issue

b. All empty ammunition containers, packaging materials, empty cartridge cases and empty ammunition components etc., received from user units should be given a 100% inspection and certified free from explosives before being declared as scrap.

## B. MAINTENANCE

### General

32. This section contains special requirements for the repair, modification, inspection and proof of ammunition and explosives buildings. These activities should only be conducted in the locations designated.

### Workshop, Process Buildings and Laboratory working Conditions

33. a. clean conditions must prevail when explosive contents are exposed.

b. Each work area should be thoroughly cleaned daily and each time work is changed from one nature of explosives to another.

c. Before any article is taken into explosives building operating under clean condition, it should be examined externally and any grit or objectionable substance removed.

d. Work benches on which explosives are likely to be exposed should be so situated that nothing can accidentally fall on the explosives; this is particularly important when dealing with detonators or other sensitive material.

e. Work should be arranged so that explosives are never exposed to direct sunlight.

f. Explosives not being worked upon should be kept covered.

g. In explosives process buildings, oils, spirits, paints etc. should be in sound containers which in turn should be kept in a metal tray the size of which should be adequate to contain spilling. The quantity should be kept to a minimum and during non-working hours should be kept in a metal locker outside the building or special fireproof room approved for this purpose. These lockers should be included in the daily security check.

h. Appropriate protective shielding should be erected around assembly or disassembly apparatus, as required, to protect operators against flash and splinters in case of accident. Protective shields should be proof-tested prior to initial use and only used for purposes for which they have been proof-tested.

i. When movement of unpacked ammunition is necessary, care must be taken to ensure that it is securely held and is protected against damage and dislodgment.

j. Ammunition containing EED should not be removed from its package for longer than is essential, so as to minimize the time during which it may be susceptible to electro-magnetic pick-up. Whenever it is necessary to remove ammunition of this kind from its package, the safe distances from RF-sources specified in regulations should be fully observed.

k. Grenades and other similar small stores, which are potentially dangerous when fitted with initiators, should be dealt within a room provided with a disposal chute or equivalent facility.

l. Workshops or parts of workshops used for paint or rust removal should not be considered as clean areas while being so employed. They should be thoroughly scrubbed and cleaned before being included in the clean area.

m. Paint or rust removal and painting operations should not be conducted in the same processing room.

n. Ovens for drying non-explosive components should not be located in clean areas or explosives workshops.

o. Non-ferrous metal receptacles should be appropriately located at workplaces when there is a possibility of loose explosives or propellants being scattered on floors or work benches.

**Standing Operating Procedures (SOP)**

34. a An SOP should prescribe step by step procedures to control operations and the precautions to be taken in the course of workshop and laboratory operations. They should be available in the building for the operation in progress.

b. An SOP should be approved by the Head of the establishment and include, as applicable:

i. Drawings, specifications, gauge schedules, tools, apparatus, and restriction lists.

ii. Static electricity grounding (earthing) requirements.

iii. Maximum and/or minimum humidities.

iv. Clothing and foot-wear requirements.

v. The maximum number of personnel to be in the workshop or laboratory at any one time.

vi. The maximum quantity of explosive items permitted in the building and/or to be worked at any one time.

vii. Any additional safety precautions necessary for the ammunition being worked on.

**Man and Explosive Limits**

35. a. To reduce the risk of injury to personnel and damage to property, the number of personnel employed and the quantity of ammunition within an explosives building should be kept to the minimum required to maintain the operation. Dividing the overall quantity into separate bays or rooms, with substantial internal walls or barricades, will reduce the risk of explosives propagation and probably reduce the effects of an explosive accident. A man limit is to be assessed for each building, room or area in accordance with the following principles:

i. The number of persons employed should be the minimum compatible with the highest standards of safety, quantity and an even flow of work.

ii. The man limit should include all persons employed on the movement of the ammunition or other tasks in the immediate vicinity.

iii. The limit should be related to the size of the building and number of exits. Irrespective of other considerations, each person is to have ample working space and suitable evacuation routes.

iv. The limit may include up to two supervisors or inspectors even though their presence is not continuous.

b. Working explosive limit for each building, room or area should be assessed in accordance with the following principles:

i. It should not exceed the quantity permitted by available quantity distances.

ii. The limit should represent the minimum number of containers or rounds required to maintain an even and continuous flow of work.

iii. The working limit should include all ammunition held within the building and the immediate vicinity. It should also include ammunition that has been processed or waiting to be processed, whether on vehicles or on the ground.

iv. The possibility of reducing the hazard presented both inside and outside the building by the use of adequate internal traverses should be considered.

**Clean Working Area**

36. a. Clean conditions may be described as a set of precautions that are taken in explosives laboratories, workshops, proof areas, and certain magazines, to prevent the introduction of, or the contact of explosives with, extraneous matter such as ferrous metals, aluminum or aluminium alloys or grit which might cause an explosion through friction or spark.

b. Working areas that are required to be maintained under clean conditions should be provided with a changing lobby. The lobby should be divided by a barrier to indicate the clean area.

**Clothing for Clean Conditions**

37. Clothing used for wear in explosives workshops or laboratories maintained under clean conditions should be specified and will normally include items such as spark-proof conductive footwear, flame proofed socks or fire retardant overalls and suitable head covering.

**Inspection and Testing of Electrical Installations**

38. The frequency of testing and inspection of all electrical installations like protected fittings, lightning protective systems, conducting / anti-static floors shall be carried out as per relevant STEC schedules on the subject and records maintained in a register for scrutiny by the inspecting authorities.

**Static Electricity Precautions**

39. a. Process buildings should be provided with conductive or anti-static flooring, where ever required. Conductive flooring is designed to provide a path of conductivity for the free movement of electrostatic charges, thereby preventing a charge accumulation.

b. Anti-static flooring differs from conductive flooring in that it offers greater resistance to the passage of electrical current.

c. Grounding (earthing) points should be available for equipment, tools and ammunition in explosives workshops, to prevent a difference of electrical potential between operators and the material that they must handle.

d. Conductive flooring and grounding (earthing) systems should be tested for continuity in accordance with STEC standards.

e. The epoxy based floorings may be used in process buildings where the explosives are not exposed and do not give rise to flammable vapors or explosives dust e.g. Missile

integration, Missile check-out facility, Missile Maintenance and Preparation Unit. Epoxy based floorings should not be used in explosive process buildings (e.g. filling, mixing, pressing, grinding etc.) where the explosives are exposed and likely to give rise to flammable vapours or explosives dust.

f. Personnel working in explosives workshops should wear conductive footwear or copper chain, when conductive flooring is present. Such safety devices should be tested frequently.

**Electrical Extensions**

40. When not specifically prohibited and when it is necessary to use extension lights during the handling, loading, or unloading of explosives or ammunition in magazines or other buildings or on board vessels, lighters, railroad cars, trucks, or other vehicles, portable electric extension lights may be used provided, they comply with the standards in such locations.

**Painting Operations**

41. a. Painting and stenciling operations should only be conducted in well ventilated rooms or outdoors.

b. Spray painting operations, when conducted indoors, should be done in spray painting booths, except for minor touch-up or stenciling using low pressure spray markers or aerosol containers.

c. Operators and helpers should wear protective masks while spray painting is in progress, unless the spray booths are properly exhausted so as to preclude exposure of personnel to toxic atmosphere.

**Heat Sealing Equipment**

42. a. The use of heat sealing equipment for packaging of ammunition in polyethylene is permitted under the following conditions:

i. The ammunition is suited to heat sealing.

ii. The heat sealing apparatus is approved.

iii. It is used in accordance with the manufacture's instructions.

iv. It is properly maintained and inspected for serviceability and cleanliness before initial use and at the beginning of each shift, and should be checked for cleanliness (absence of any spillage) before each operation.

b. Approved type of heat sealing equipment shall be used. However, heat sealing equipment must not be permitted in a room maintained under clean conditions.

c. Items to be heat sealed should be in serviceable condition and free of defects.

d. Detonators and heat sensitive items such as propellant or explosives samples should be suitably packaged before heat sealing.

**Tools**

43. a. Only non-sparking tools should be used in direct contact with exposed explosives or in rooms maintained under clean conditions.

b. Special or locally designed tools and equipment should not be used in ammunition operations nor should modifications or alterations to approved tools or equipment be made without prior approval.

c. Tools and appliances designed and provided for particular explosives operations should not be used for other purposes without prior approval.

d. Only those tools authorized for use by the applicable SOP for the operation being performed should be permitted in the room or area.

**Closedown of Explosives Workshops/Process Building**

44. a. When an explosives building is vacated, all electrical installations and powered equipment other than essential services should be switched off or disconnected. At the end of each working day the building should be secured.

b. Ammunition remaining in the building should be subject to the following:

i. During temporary breaks within the course of a working day, the ammunition may be left in position, provided it is safely stored, and the explosive is not exposed.

ii. At the end of each working day ammunition may be left in the work area provided it is packed, (except for ammunition which is not normally stored in packages) and placed on the floor. Items should be grounded (earthed) as applicable.

## C. DISPOSAL OF AMMUNITION

### General

45. a. These recommendations establish measures and procedures for minimizing the risks in disposal of unwanted ammunition and explosives. They do not deal with the details of normal operational measures required for the safe conduct of destruction processes.

b. Ammunition and explosives will be disposed of by detonation or burning, only in locations designated for the purpose. Disposal must not be accomplished by burying or by dumping in waste places, pits, wells, marshes and inland waterways.

### Site Selection

46. a. Sites selected for the disposal of ammunition and explosives should be located at the maximum practicable distance from all magazines, workshops, administrative facilities, inhabited buildings, and public traffic routes. If disposal is by burning and involves only non-mass detonating ammunition and explosives, the distance should be not less than the applicable inhabited building distance for quantity and type of material involved. If disposal is by detonation, or if Hazard Division 1.1, is being burned, the minimum distance as laid down in relevant regulations should be observed.

b. For establishments unable to provide the minimum safety distances required above, disposal areas may be authorized subject to restrictions concerning the quantity of ammunition and explosives and the use of procedures and techniques that will limit to an acceptable level projections, thermal radiation, and blast overpressures.

c. An ideal disposal area is one with deep soil, free from loose rocks, where trenches and pits can be dug easily and in which the risk of fire is negligible. In selecting a permanent disposal area, the following should be avoided:

(a) Locations upwind (for prevailing wind situations) from exposures that are vulnerable to accentuated thermal and blast effects.

(b) Locations near high energy electromagnetic transmitters.

i. Locations along established air traffic routes.

ii. Areas with high water table, shallow sub-surface rock strata, and saturated clay soil.

**Explosive Limits**

47. Explosives limits for disposal areas vary because of local conditions. In establishing explosives limits for individual disposal operations, the maximum quantity to be destroyed at any one time should be determined carefully by a qualified trained officer.

**Supervision**

48. Constant supervision should be maintained by supervisory staff and all personnel should be safety conscious. Each operator should be fully acquainted with any hazard associated with the ammunition on which he is required to work. Before commencing an operation each operator should be familiarized with the particular task that he will perform.

**Accident Involving Ammunition**

49. a. In the event of an accident or incident involving ammunition, all operations shall cease immediately and the situation shall be reported to the Head of the establishment. Nothing shall be disturbed, except in the interest of safety or as may be necessary to give assistance to injured persons. Precautions should be taken to prevent unauthorized personnel from entering the area.

b. In all major explosive accidents in all the establishments covered under STEC, CFEES shall be a member for accident investigation. The decision whether to be a part of investigation team when the accident does not involve storage, transport or processing of explosive, will be taken by CFEES.

d. It is the responsibility of the Head of the establishments under all organizations of the Ministry of Defence to ensure that all accidents involving ammunition and explosives in their units are reported in accordance with the procedure given at Annexure IV. He shall apprise of this requirement to the Chairman of the Board of Enquiry and prepare a report on major accidents involving serious injuries/fatalities to personnel and damage to buildings/equipments exceeding 20 lakhs and forward the same to Centre for Fire, Explosive and Environment Safety, Brig S. K.Mazumdar Road, Timarpur, Delhi-110054.

**Monitoring of unserviceable/ rejected ammunition**

50.A large quantity of unserviceable/rejected ammunition are stored in various MoD establishments which could have been avoided due to timely disposal of the same. It is the responsibility of Head of the Establishment under all organization of MoD to constitute a mechanism in place to maintain a data base of all such ammunition for its effective monitoring and disposal in a time bound manner. All MoD establishment (OFB, DGQA, DRDO, Army, Navy, Air Force and PSU) involved in manufacture of explosive and ammunition shall forward the details of UNSV/ Rejected/ Dangerous for retention ammunition twice in a year (i.e. as on 1st Jan and 1st Jul every year) as per format given in Annexure-VI,to CFEES to monitor the progress of disposal during the Annual Safety

Audit. The action taken by various MoD establishment for disposal will be reviewed at every SAR Panel meeting and put up to STEC for issuing of advisory as deemed fit.

**Summary**

51.a. To carry out safety audit in comprehensive manner and to insure the coverage of all safety issues during audit a comprehensive check list for safety audit inspection by CFEES is given in annexure V.

b. To summarise, it is pertinent to point out that safety guidelines enumerated in this publication are by no means exhaustive. For details on specific aspects of safety, the Users are advised to refer to the relevant STEC standards mentioned at Annexure III.

**Annexure I**

## PROFORMA FOR SITING OF NEW EXPLOSIVE FACILITIES

(Use separate form for each building)

| | | |
|---|---|---|
| 1. | Name of Factory/ Estt/ Unit | |
| 2. | Section/ Division/ Command | |
| 3. | Proposed Bldg No.<br>(Type with dimensions)<br>(Magazine/ ESH/Igloo /Bunker/ Process etc) | |
| 4. | Whether Storage Building or process Bldg (In case of process Bldg, give a brief description of the proposed activities) | |
| 5. | Whether the bldg is proposed to be traversed?<br>If so, type of traverse (i.e. NAT, VIFT, Bunker, Blast wall etc.) | |

6. **SIQD/PIQD** required from the proposed building to the surrounding buildings (refer QD tables of STEC Pamphlet No.1)

| (a) | (b) | (c) | (d) | | (e) | (f) | Remarks |
|---|---|---|---|---|---|---|---|
| Proposed building No. | Gross Tonnage and NEC of proposed building (MT) | Hazard Division | QD required to the surrounding buildings (m) | | Surrounding buildings/ utilities with building No. | Distance available from proposed building (m) | |
| | | | SIQD | PIQD | | | |
| | | | | | | | |

7. **SIQD/PIQD** required from the surrounding buildings to the proposed building:-

| (a) | (b) | (c) | (d) | | (e) | (f) |
|---|---|---|---|---|---|---|
| Bldg No. & Type | Gross Tonnage & NEC authorized (MT) | Hazard Division | QDs required to the proposed building(m) | | QDs available to proposed building(m) | Remarks |
| | | | SIQD | PIQD | | |
| | | | | | | |

8. **OQD** required from the proposed building

| Proposed buildings No. | Utilities requiring OQD | OQD required from proposed bldg (m) | OQD available(m) | Remarks (if any) |
|---|---|---|---|---|
| | a. Dwelling houses | | | |
| | b. Public traffic route | | | |
| | c. Airport | | | |
| | c. HT lines | | | |
| | d. LT lines | | | |
| | f. Main Fire Station | | | |
| | g. Main Gen Stn | | | |
| | h .Mobile Towers | | | |
| | i. Over Head Water Tank | | | |
| | j. Assembly Places | | | |
| | Any other utilities as given in STEC Pamphlet No. 1 | | | |

9. **Building construction details (Refer STEC Pamphlet No. 3):**

| | | |
|---|---|---|
| (a) | Material of Construction of walls and thickness | : |
| (b) | Material of construction of roof and thickness | : |
| (c) | Material of partition walls and their thickness (if required) | : |
| (d) | Material of construction of floor | : |
| (e) | Material of construction of Doors/ Windows/ ventilators with proposed sizes | : |
| (f) | Window panes: Ordinary/ Toughened/ Shatter proof | : |
| (g) | Details of construction of Traverse (If applicable) | : |
| (h) | Dimension of the loading platform & the gradient/ size of ramp and stairs for movement of FLT, if required | : |
| (i) | Any special design features proposed | : |

10. **Location of the proposed building (Enclosed Scale Site Plan):**

11. **Electrical Installation, Lightning Protection, Air conditioning & humidity control and Measures required to preventing Static charge:**

| | | |
|---|---|---|
| (a) | Type of electrical equipment/ fittings proposed | : |
| (b) | Whether lightening protection required | : |
| (c) | Whether Air conditioning and humidity control required; if so enclose the proforma as given in Annx-I of STEC-8 | : |
| (d) | Measures required preventing static charge accumulation and dissipation. If so, give details | : |

(Signature of the Head of Estt/ CO Unit)

Recommendation of CFEES:

Signature of Rep. CFEES, Delhi.

**Annexure II**

## Instructions for filling Proforma for 'Siting of New Explosive Facilities'

1. Self Explanatory.

2. Self Explanatory.

3. Type of proposed building i.e. Process/ Magazine or ESH/ Igloo/ Bunker etc. Dimensions (LXBXH) to be given in meters with proposed capacity of shed in Gross tonnage and NEC (MT).

4. Self Explanatory

5. Ref STEC Pamphlet No.3 for type of traverse and their layout as per user's requirement.

6. Refer STEC Pamphlet No.1 QD tables for various Hazard Divisions and section IX of STEC Pamphlet No.1 for utilities requiring SIQD/PIQD to fill up various Columns. `Distance available ` column to be correctly filled up after physically measuring the distances from proposed bldg. to all surrounding buildings using GPS/ Measuring Tape.

7. Give details of authorized explosives (Gross tonnage and NEC) with Hazard division of all Explosive store houses in the vicinity of the proposed bldg with SIQD/ PIQD worked out correspondingly from the QD table STEC Pamphlet No.1. Remember, whenever PES changes to ES & vice versa; the QD changes as QD is a function of NEC.

8. Refer STEC Pamphlet No.1 for respective OQD's for the utilities mentioned.

9. Refer STEC Pamphlet No.3 for the details of construction materials & other dimensions of the buildings. Height of loading platform should correspond to the tail height of the vehicles for ease of loading/unloading. Distance of proposed building from traverse should be decided by user keeping in view the vehicles' width/ turning radius etc

10. Enclose site plan drawn to scale showing proposed building and all surrounding utilities with proper legends and QD circles (at least up to the OQD of proposed building).

11. For electrical installation details refer STEC Pamphlet No.7, for lightening protection requirement refer STEC Pamphlet No.17, for Air Conditioning and humidity control requirement refer STEC Pamphlet No.8 and for Measures required preventing static charge accumulation and dissipation refer STEC Pamphlet No.7.

NOTES:-

1. Proforma for siting of new explosive building should be separate for each new building.

2. Enclose a scaled site plan of the area where the proposed buildings are to be sited giving complete details of surrounding buildings and facilities up to OQD. QD circles are to be clearly marked on the site plan. (For marking QD Circles, take radius corresponding to the QD required from the proposed bldg and draw a circle with proposed bldg as the centre. Use different color codes for different QD circles depicting SIQD, PIQD and OQD).

3. Ensure no bldg/utilities upto OQD is omitted when preparing scaled site plan. For this, a detailed recce of the area up to OQD is recommended. Location of Airport, HT/LT lines, mobile towers etc.should also be ascertained from appropriate authorities before forwarding the Proforma and Site plan to CFEES.

4. Blow up of Google Map of the area may also be enclosed with the Proforma /site plan for better Assimilation of site.

5. In case a fresh land is planned to be acquired for siting of new storage buildings , it is recommended that land up to OQD should be acquired to avoid any legal dispute at a later stage (STEC Pamphlet No.1 Para 62 refers).

**Annexure III**

## Specification for Fiber Reinforced Glass (FRG) Laminated Dunnage

| | | |
|---|---|---|
| Size | : | 100 mm x 100 mm x 3000 mm |
| Material | : | Fiber Reinforced Glass as per following technical details<br>a. FRG made of chopped strands material of Density 450 gm / $m^3$conforming to IS Code 11551 – 1996<br>b. Iso-phtalic grade unsaturated Polyester Resin conforming to IS Code 6746 – 1994<br>c. Thickness of Laminated Layers 5.0 (– 0 + 1 mm)<br>d. Not to be reinforced with Ferrous & Non-ferrous materials<br>e. To be reinforced with inter-cellular FRG Ribs<br>f. The FRG laminate should be compatible with Ammunition for anti-static charge |
| Finish | : | Surfaces to be of smooth finish in desired colour |
| Working Load | : | 2 MT (DL) |
| Ultimate Load | : | 4.5 MT |
| Inspection | : | a) Dimension check as per drawing<br>b) Load Test – Dunnage should be tested for 4.5 MT on plain surface at which it should not break. The deflection should disappear on unloading<br>c) Rigidity / Drop test – Dunnage will be dropped from a height of one meter and it should not break |

**Annexure IV**

## REPORTS ON ACCIDENTAL EXPLOSIONS

### Information Required

In order that reports on damage resulting from accidental explosions be of value and useful to the Centre for Fire, Environment and Explosive Safety (CFEES) in verifying the validity of the safety principles, the accident reports should include the following and a copy of the same invariably sent to CFEES.

1. a. Name of the Establishment
   b. Building No.
   c. Operations Carried out
   d. Authorized Explosive Limit
   e. Man Limit
   f. Date and Local time

2. Name and quantity of ammunition or explosives in the store or building where the accident occurred.
3. Net Explosives Quantity and name of filling and number of filled items involved in the accident.
4. Method of packing of ammunition or explosives where the initial accident occurred and material of packages.
5. Separation distances between the items in the packages.
6. Method of storing the ammunition or explosives where the initial accident occurred.
7. Information as above for neighboring utilities stating whether such neighboring buildings/stacks were set off or otherwise affected. Give details on number of persons killed or injured as well as damage to buildings, whether complete destruction (more than 75%), damage beyond economical repair (50 to 75%), repairable damage (1 to 49%), locations and dimensions of craters, etc.
8. The thickness of walls and roofs if ammunition or explosives were stored/processed in buildings and whether there were windows through which fragment or debris got into the buildings.
9. Distance between buildings or stacks if buildings were not used.
10. The influence of traverses upon the protection of neighboring buildings and stacks.
11. Fire-fighting measures (attempts to fight fire).
12. The time between the first and last propagation from stack to stack.
13. The general effect on inhabited buildings in the vicinity and their inhabitants.
14. A map indicating the size and distribution of fragments and debris.

15. A brief summary of the likely causes of accident. When appropriate, describe the influence of factors like environmental and meteorological such cover, wind direction and velocity, temperature, relative humidity, electromagnetic radiations, topography, such as hills, forests, etc. contributing to the mishap. Appropriate cost of damage should also be included together with effects on production, operation, mission or other activity.

**Annexure - V**

## SAFETY AUDIT INSPECTION - CHECK LIST

### 1. PRE-AUDIT CHECKS

| (a) | **Safety Awareness Programme** | **Observations** | **Remarks** |
|---|---|---|---|
| | Training/lecture, consultancies in identification and evaluation of risk levels. | Yes/No | |
| | Observation of Safety day/weekday-by lab as well as Div./Groups | Yes/No | |
| (b) | **Safety Management** | | |
| | Existence of safety policy and conducting of safety meetings and implementation of follow up actions. | Yes/No | |
| | Operation explosives building without deviation. | Yes/No | |
| | Effort for vacation of deviation, if any. | Yes/No | |
| | Fire drill (by working personnel in presence of Fire men / supervisor) frequency. | Yes/No | |
| | Emergency plan. | Yes/No | |
| | No. of accident/incident occurred in a year and remedial action taken. | Yes/No | |
| | Preparation of GSD and updating Maintenance of log books. | Yes/No | |
| | Maintenance/ certification/ calibration (periodically) of equipment. | Yes/No | |

2. **SAFETY AUDIT INSPECTION OF PROCESS/STORAGE BUILDINGS DURING AUDIT.**

| | **Safety Parameters** | **Observations** | **Remarks** |
|---|---|---|---|
| (a) | **Checking of Fixed Installations**. | | |
| | Electrical Fitments. | | |
| | Display boards, Fire symbol and limit boards etc. | | |
| | Status of material handling equipment. | | |
| | Check whether the building number has been displayed in conspicuous position. | | |
| | Check the display of Fire Classification Board at a prominent position and verify its correctness. | | |
| | Check whether lightning protection has been provided. If so, when was it's resistance to the earth measured and verify whether the records are being maintained. | | |
| | If the building is traversed, check the condition of transverse, growth of trees, grass, shrubs etc. thereon. Verify if the toe wall has been provided and the space between the traverse and the building wall is of concrete. | | |
| | If the building is untraversed, the growth of grass, trees, shrubs etc. In the vicinity should be checked. Also ensure that a firebreak has been provided around the building. | | |
| | Check if the explosives limit board has been displayed. Verify if the details regarding authorized explosives limit & man limit with hazard division of explosives have been displayed. | | |
| | Check if the personal tester or electrostatic discharge handles/ knobs have been provided. If so, verify that they are in working order & also a record of resistance is being maintained. | | |
| | Check the condition of building to ensure that clean area conditions are being maintained. Verify there are no pits/ cracks and no seepage inside. | | |
| | Check if the doors are opening outside and wire net has been provided to the ventilators. | | |
| | Check the condition of lighting fittings and whether they are as per the operation being carried out in the building. Ensure that the wiring is though conduits & switches are located outside if inside, these should be of protected type. | | |

| | | | |
|---|---|---|---|
| | Check if the first aid fire-fighting equipment has been provided or not. Check if these are being maintained properly and also adequately. | | |
| | Check if the fire hydrants have been provided and there is proper approach to the same. Ensure that fire hydrant is approachable i.e. approach road is of concrete. | | |
| | **Safety Parameters** | **Observations** | **Remarks** |
| | Check if the static water tank has been provided and sufficient water is available. | | |
| | Check if the electrical earthing pits have been provided. They should be easily approachable and readily identifiable. | | |
| (a) | **Process Pre-Checks** | | |
| | Task & Safety briefing of personnel before operation. | | |
| | Check whether the GSD/ SI has been displayed in the building & whether it is the approved one and is matching with the work being carried out. | | |
| (b) | **Audit of Process/ Storage Buildings** | | |
| | Adherence to safety practices, regulation/ acts. Use of safety gadgets and safety gear by personnel. | | |
| | Housekeeping. | | |
| | Observation of explosives limit | | |
| | Observation of man limit | | |
| | Status of Labyrinth. | | |
| | Checking of compatibility group. | | |
| | If it is storage building, check if stacking is proper, dunnage is provided and bin cards are being displayed. | | |
| | Check that there are no overhead electric line upto a distance of 15m from the building & no overhead telephone connections are provided to the building. | | |
| | Check approved type of ventilator provided in storage/ process building. | | |
| | Check Fire Hydrant serviceability, adequate pressure/ flow | | |
| | Check condition of SWT | | |
| | Check condition of demolition/ burning ground | | |

**Annexure - VI**

## MONITORING OF UNSERVICABLE/REJECTED AMMUNITION

| S. No | Building No. | Nomenclature of Ammunition | Tonnage | | Condition and cause of down gradation | Date since down graded | Action taken | | Balance quantity | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Gross | NEC | | | Disposal method | Quantity disposed | Gross | NEC | |
| | | | | | | | | | | | |

**Annexure - VII**

## LIST OF STEC PUBLICATIONS

| Sr. NO. | Title | Number |
|---|---|---|
| 1. | Quantity Distance Regulations for Military Explosives / Ammunition | STEC – 1 |
| 2. | Classified List of Military Explosives | STEC – 2 |
| 3. | Construction of Buildings and Traverses for Military Explosives | STEC – 3 |
| 4. | A Manual on Safe Working Practices in Explosive Areas | STEC - 4 |
| 5. | Quantity Distance Regulations for Liquid Propellants | STEC – 5 |
| 6. | Regulations on Fighting Fires in Government Explosive Establishments | STEC - 6 |
| 7. | Safety for Electrical Installations and Apparatus for Buildings and Areas containing Military Explosives | STEC – 7 |
| 8. | Regulations on Air Conditioning and Humidity Control in Explosive Areas | STEC – 8 |
| 9. | Rules for Conveyance of Military Explosives by Rail | STEC – 9 |
| 10. | Regulations for the Conveyance of Military Explosives and Ammunition by Road | STEC – 10 |
| 11. | Regulations for Conveyance of Military Explosives by Service Aircraft | STEC – 11 |
| 12. | Safety Conditions for use of Vehicles and Mechanical Handling Equipment in Explosive Areas | STEC – 12 |
| 13. | Withdrawn | |
| 14. | Instructions on Processing / Obtaining Deviation | STEC – 14 |

| | | |
|---|---|---|
| | Sanction | |
| 15. | Guidelines on Provision of Fire Protection and Fire Fighting Arrangements in Explosive Establishments | STEC – 15 |
| 16. | Hazard for Electromagnetic Radiation to Ammunition Containing Electro Explosive Devices | STEC – 16 |
| 17. | Protection of Explosive Buildings against Lightning | STEC – 17 |
| 18. | Disposal of Waste Explosives and Ammunition by | STEC – 18 |
| 19. | Regulations on Packaging of Military Explosives | STEC – 19 |
| 20. | Regulations on the use of Freight Containers for Transportation of Military Explosives | STEC – 20 |
| 21. | Design and Construction Manual for Blast Resistant Structures using Laced Reinforced Concrete (LRC Igloos) | STEC – 21 |
| 22. | Specification of Fire Damper for Air Conditioning Ducts in Explosive Buildings | STEC – 22 |
| 23. | Hazards from Non – Ionising Radiation & Safe Working Practices | STEC - 23 |
| 24. | Safety Guidelines on “Breakdown of Ammunition” | STEC – 24 |
| 25. | Regulations for the Storage of Explosives in Field and Ammunition on Open Plinths. | STEC – 25 |