Defence
Safety Authority

DSA 03.OME Part 2 (JSP 482) - Defence Code of Practice (DCOP) and Guidance Notes for In-Service and Operational Safety Management of OME

Defence OME Safety Regulator

DOSR

DSA VISION

Protecting Defence personnel and operational capability through effective and independent HS&EP regulation, assurance, enforcement and investigation.

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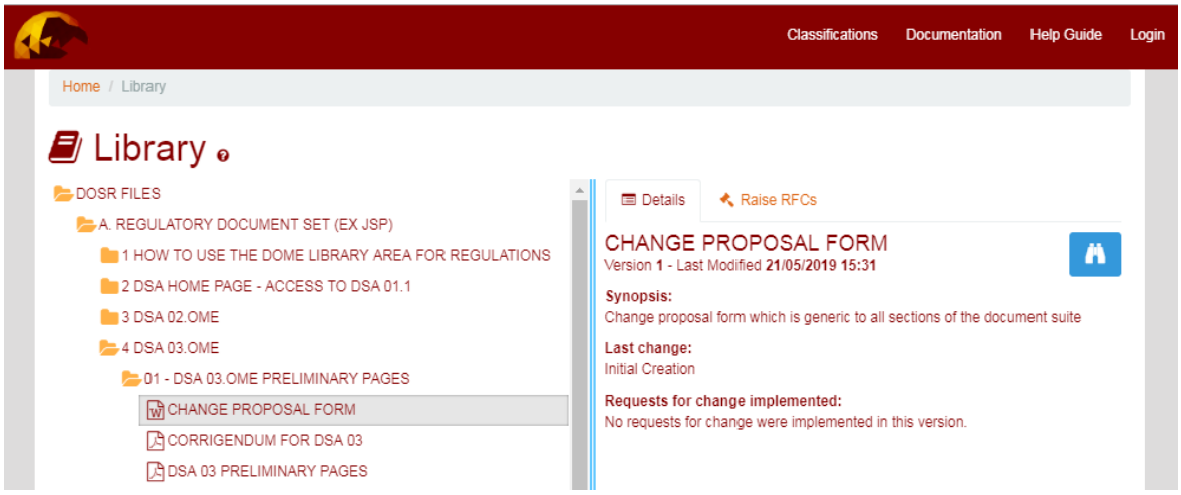

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CHAPTER 17

EXPLOSIVES FACILITIES – SAFETY PRECAUTIONS

CONTENTS

Annex

A Temperatures for Normal Storage in Magazines and Storehouses
B Breakdown and Disposal of Explosives
C Safety for Training, Demonstrations and Displays and use of Fireworks
D Treatment of Phosphorus Burns
E Toxic Hazards

1 SAFETY PRECAUTIONS

1.1 Introduction

1.1.1 The fact that explosives are inherently dangerous is self-evident. Over the years procedures have been devised to control the risks so that today the UK accident record shows explosives to be one of the safer industries. However constant vigilance is required if this good safety record is to be maintained.

1.2 Explosion and Fire Hazards

1.2.1 The most obvious hazard from explosives is an accidental explosion or deflagration. Explosives may function accidentally due to stimuli such as impact, friction, spark, heat, electrostatic discharge, RF induced current, reaction with another substance or inherent chemical instability. The inadvertent initiation of even small quantities of explosives can lead to death or serious injury and may, through subsequent events, lead to a major catastrophe.

2 HEATING EXPLOSIVES AND EXPLOSIVES BUILDINGS

2.1 Introduction

2.1.1 Heating explosives clearly carries with it an increased risk of accidental initiation and special precautions are therefore required.

2.2 Vapours and Sublimates

2.2.1 Special considerations are necessary when heating explosives that are liable to sublime or vaporise and subsequently solidify or condense on any cool surface. An example of an explosive that sublimes is TNT and one that condenses is Nitroglycerine, which is present in many gun propellants. In buildings or ovens where such materials are heated special precautions may be required such as the avoidance of electrical fittings. In extreme circumstances electric lights may need to be fitted outside the building and illuminate through glass panels.

2.3 Space Heating for Explosives Buildings

2.3.1 Steam (of a temperature not exceeding 120 degrees Celsius), hot water or electricity may be employed as the heating medium for space heaters in explosives buildings. There are special requirements for electrical space heaters and these are given in Chapter 8 paras 7.2. Explosives must not be stored, held or processed within 500 mm of any space heater or other hot surface except when deliberately heating explosives under controlled conditions as described in para 2.4 below. The temperature requirements for process buildings are given in Chapter 19 para 5.11. The minimum temperature of 13 degrees Celsius specified for process buildings will safeguard against the freezing of Nitroglycerine and also meet the requirements of the Workplace Health Safety and Welfare Regulations 1992. Propellants and explosives containing Nitrate Esters, such as Nitrocellulose or Nitroglycerine,

deteriorate more rapidly if kept at too high a temperature in storage and this can lead to auto ignition.

2.4 **Heating Explosives During Processes**

2.4.1 Equipment for heating explosives will incorporate features designed to avoid overheating. There are special requirements for electrical appliances used for heating explosives during processing and they are given earlier in this document. Whatever medium is used for heating or cooling explosives in processing it is essential to consider at the design stage how to control the temperature within safe limits. The provision of an independent overriding protection feature to cover failure of primary controls is normally essential.

2.5 **Conditioning Chambers**

2.5.1 Conditioning chambers with air re-circulating systems are not to be used for conditioning explosives which give rise to flammable vapours or explosives dust without the prior approval of CIE (MoD). Exceptionally, where there are overriding reasons for such systems to be employed, the design must allow for the easy breakdown of ducting for cleaning and the surface temperature of the heaters must be acceptably low. Conditioning chambers must be fitted with at least three independent thermostatic regulators; the first set to control the temperature, the second set at 5 degrees Celsius above the control temperature and the third, a tamperproof manual resetting thermostat, which will override all other controls and limit the temperature to a safe level, normally not exceeding 100 degrees Celsius. The final override should be positioned close to the chamber and be regularly checked for operation with the results recorded. It should have its own electrical contactor and be fitted with an indicator light to show when it is energised. To avoid an accumulation of flammable or noxious gases it is recommended that the atmosphere within the larger walk-in heated chambers should be changed at a rate indicated by the risk assessment but not less than one chamber volume per hour.

3 **SPECIFIC SAFETY CONSIDERATIONS**

3.1 **Electro Explosives Devices (EEDs)**

3.1.1 Relatively little power is required to function many EEDs. They are therefore susceptible to initiation by emissions from RF radiation, induced electromagnetic energy or electrostatic electricity.

3.1.2 RF radiation. This includes mobile telephones, radio and Radar transmissions. In transit EEDs are normally screened by their transit container to protect them from such emissions but once removed from their containers they may be vulnerable. The attachment of test cables to the EED will, by acting as an aerial, increase susceptibility to RF transmissions. To reduce the risk to an acceptable level a regime must be adopted which considers the sources of RF transmissions in the vicinity and devises an appropriate protection scheme. The starting point of such a regime will normally be the elimination or control of RF transmissions. Where RF transmissions cannot be effectively controlled to harmless levels, protection of the EED may be necessary. Such protection may include shorting plugs, screening the EED or an RF filter in any circuit that may act as an aerial.

3.1.3 Induced electromagnetic energy. This may be from testing of adjacent circuits in a weapon or from other electrical circuits in the vicinity.

3.1.4 Electrostatic electricity. The most likely source of electrostatic electricity is from the human body or when thunderstorms are in the vicinity. It should be noted that the conditions

associated with thunderstorms increase the possibility of generating electrostatic charges even when there is no direct lightning strike in the vicinity.

3.1.5 Additionally, packing material presenting an electrostatic discharge hazard used inappropriately in Temporary Packaging configurations can lead to an accidental initiation. “Bubble wrap” is an example of a material that has been used in error.

3.2 **Breakdown Operations**

3.2.1 It is much more hazardous to break down explosives items than to fill them. In filling and assembly components that contribute the greatest potential hazards are assembled to the main charge as late as possible, but in items for breakdown such components will be present when operations are begun. In many items where there is a requirement for breakdown, deterioration and corrosion will have occurred; this may have affected the explosives as well as the mechanical parts and will tend to make disassembly much more difficult and potentially more hazardous than assembly. Detailed advice regarding the breakdown of munitions is given in Annex B.

3.3 **Safety During Training, Demonstrations and Displays**

3.3.1 The safety precautions to be taken when using explosives for training are prescribed in the relevant user arm training manuals, see also Annex C.

4 **DANGEROUS CHEMICALS**

4.1 **Munitions Containing White Phosphorus, Red Phosphorus or Phosphides**

4.1.1 Stacking - ULCs, pallets and boxes containing white phosphorus or phosphide-filled munitions must be stacked as follows:

(1) Phosphide filled munitions are to be stacked not more than 1.5 m high, with a passage between each two rows so that any item or box which develops defects can easily be seen and quickly removed.

(2) White Phosphorus filled munitions are to be stacked in accordance with the requirements of this document.

4.1.2 White and Red Phosphorus Filled Munitions - White phosphorus, unless wet, ignites spontaneously in air. It can be extinguished by immersion in water but steps must be taken to prevent re-ignition. A suitable container of clean water, large enough to immerse a complete package or item, must be kept available at stacks, loading points, etc. for immersion of leaking stores if necessary prior to their disposal. Leaking munitions should only be handled by suitably trained personnel. White phosphorus filled munitions should be stored under the coolest conditions practicable and must not be exposed to sunlight either directly or through windows. Heating to temperatures above 40 degrees Celsius greatly increases the likelihood of leakage and hence of spontaneous ignition. Leakage of white phosphorus filled munitions is indicated by the characteristic smell of phosphorus and the presence of white fumes; leaking munitions must be isolated and kept under water until it can be destroyed. The exposed phosphorus must not be allowed to dry or it will again become liable to ignite spontaneously. First Aid Instructions and a contingency plan to deal with casualties from white phosphorus burns should be posted at buildings where white phosphorus munitions are stored (see Annex C for suggested First Aid Instructions). The contingency plan must, for instance, consider where water can be obtained to treat the casualty. A regular inspection regime must be instituted for the early detection of leakers in all storage buildings containing white phosphorus filled munitions. The frequency of the inspections will depend on the local conditions. In temperate climates, the packages / ULS

are to be inspected externally at intervals of not more than seven days and a record of these inspections is to be maintained. In the past the failure to detect a leaking item has lead to catastrophic fires. Munitions containing red phosphorus may generate phosphine gas during normal storage, which is toxic and flammable It is therefore necessary to ensure good ventilation.

4.1.3 Phosphide Filled Munitions - Phosphide munitions are activated by water. It must be stored under dry conditions and be protected from the ingress of moisture. Leakage of the filling, arising from fracture or slow corrosion of the case, may interact with water in any form and evolve toxic phosphine gas. If evolved in sufficient quantity, the phosphine will ignite and may cause a fire. Slower evolution of phosphine gas will be diluted by the air present such that the concentration in the atmosphere will not reach toxic proportions, unless it is in a confined space. A regular inspection regime must be instituted to aid the prompt detection of leakers. Munitions believed to be leaking should only be handled by suitably trained personnel. When a leaking store is found, it must be moved promptly to an isolated place in the open to await destruction. Suitable respirators should be made available on site for use in an emergency.

4.2 **Metal Powders, and Explosives Containing Them**

4.2.1 Many finely divided metal powders produce hydrogen on contact with water. Hydrogen is a gas that can form explosives mixtures with air. Therefore where these materials are stored precautions must be taken to ensure they do not become wetted. Steam or water space heating is not advisable in buildings where they are stored. Explosives that contain metal powders, such as Torpex, are to be kept dry. Tools and containers used to process them must be kept at room temperature to avoid condensation.

5 **HEALTH HAZARDS**

5.1 **Introduction**

5.1.1 In addition to the more obvious explosion hazard, many explosives present a health hazard (see Annex E). Absorption of toxic substances may be by inhalation, ingestion or absorption through skin and eyes. Organic nitro compounds such as TNT and Tetryl (also known as CE) are readily absorbed, either through the skin or by inhalation, into the bloodstream. They can cause severe toxic effects and dermatitis. Once sensitised a person may experience a reoccurrence of dermatitis after only a minor re-exposure. Some nitrate esters such as nitroglycerine are also readily absorbed through the same entry routes. They can cause severe headaches and more severe toxic effects in the short term and long tem exposure can cause heart failure. Nitramines such as RDX and HMX are generally less readily absorbed through the skin but can enter the body through ingestion or inhalation of the dust where they can prove fatal. Many pyrotechnic substances and associated chemicals present health hazards including both toxicity and dermatitis. A Taggant is now added to plastic explosives and this has an associated health hazard.

5.2 **Sources of Information**

5.2.1 The risk of harm with such substances varies with concentration, toxicity and duration of exposure. Suppliers of substances with associated health hazards are required by law to provide information regarding these hazards; for explosives this information is normally provided as a clause in the Explosives Hazard Data Sheet. Explosives Hazard Data Sheets or Safety Certificates are also available for many older explosives in the existing inventory. Safety Data Sheets for potentially hazardous substances supplied to the MOD are to be included inthe Hazardous Substances Information System (HSIS). Therefore, this database is a valuable source of information that should be consulted when preparing COSHH assessments.

5.2.2 The Health and Safety Executive publish a list (called EH40) of Occupational Exposure Limits (OELs) for chemicals including explosives, which gives guidance on permitted concentrations in air. Additional information can also be found in JSP 333 (Second Edition) the Services Textbook of Explosives in this document; this includes information on the toxicology of fumes from the functioning of explosives and propellants. Although not explosives in themselves white and red phosphorus and phosphides are used in some munitions. In addition to fire hazards they have toxic properties above. Occupational Health and Occupational Hygiene specialists will also give advice regarding the handling of such substances. This JSP is currently being updated by DOSG.

5.3 **Precautions**

5.3.1 A COSHH assessment must be carried out before any work is undertaken with explosives that have health hazards associated with them. It will identify the need for appropriate precautions. The Occupational Health Department or Medical Officer must be consulted regarding the need for pre-work screening and subsequent periodical checks before any work where exposure to toxic explosives and associated chemicals is undertaken. Natural air ventilation or forced local exhaust ventilation may need to be installed. Personal Protective Equipment in the form of respirators, gloves, barrier creams or special clothing may be required. Hand wash basins or showers may need to be installed. Food and drink must not be taken into areas where such materials are handled but it may be allowed within the explosives area in specially designated places. It is important that personnel who handle explosives should wash their hands before touching food.

5.4 **Tagged Plastic Explosives**

5.4.1 A Taggant is now added to plastic explosives in order to enable them to be easily detected by security equipment at airports etc. There is an exemption for explosives manufactured or imported into the UK prior to 31st July 1997 and held by the MoD. This exemption lasted for fifteen years until 31st July 2012. All exempted stocks must be used, or else disposed of, prior to this date.

5.4.2 The Taggant to be used within the UK is 2,3-Dimethyl-2,3-Dinitrobutane (DMNB) and it is to be present at a minimum concentration of 0.1% by mass. It is toxic and must be handled in accordance with the precautions detailed below:

(1) Packages containing such explosives must only be opened in a well-ventilated area as DMNB vapour may build up in boxes during storage (especially at high temperatures). If for any reason, there is a possibility of particulate explosives being dispersed in the air then a suitable particulate respirator must be worn.

(2) Nitrile gloves are to be worn when handling explosives. They should be disposed of once removed or in any case changed every two hours.

(3) If ingestion of the explosives occurs, or adverse reaction following exposure to the vapour, seek medical advice immediately. If contact with eyes, mouth or skin occurs, flush with copious amounts of clean water and seek medical advice immediately.

5.4.3 The following munitions currently contain the Taggant:

(1) Plastic Explosives

(2) Sheet Explosives

(3) Reactive Armours

(4) Linear Cutting Charges

(5) Command Detonated Munition M18A1 (Formerly Claymore Mine)

6 AREA MANAGEMENT PRECAUTIONS

6.1 Use of Tensile Steel Strapping

6.1.1 There is a risk of eye injuries during the application or removal of Tensile Steel Strapping (TSS) to ammunition containers and pallets, due to the lashing action of tape banding.

6.1.2 To comply with the Personal Protective Equipment at Work Regulations (PPE) 1992, personnel employed in the process of applying or removing TSS are to be provided with protective goggles.

6.1.3 To be effective, goggles are to be splinter proof and conform to EN 166B. Stocks of Goggles Industrial are to be provided and used as and when required.

6.1.4 Industrial gloves are also to be provided to protect the hands.

6.2 Permit to Work

6.2.1 No engineering work such as for alterations, repairs or maintenance nor any new installations or demolitions are to be carried out in an explosives area without a Permit to Work having been issued. This is to control the risks to maintenance workers and to ensure explosives facilities are fit for use after such maintenance work. The Permit to Work must be signed by a competent person, normally the officer in charge of the work in the explosives building or area. He signs to attest to the condition of the building about the absence of explosives. It will lay down any special conditions to be observed, such as the need for an explosives worker to supervise the work. Normally all explosives will be removed and the area or equipment to be repaired thoroughly cleaned in a similar manner to that required prior to the issue of a CFFE before any such work is carried out. However, the Head of Site may permit, by issue of a special authority, the partial clearance of explosives for minor tasks. The use of a flame or equipment that could generate a spark will require a “Fire Pass” to be issued by a competent person. This is to ensure control of all sources of ignition in the explosives area. When the engineering work has been completed a “Clearance Certificate” will be issued to the effect that the area is now in a satisfactory condition for work with explosives to recommence. This will normally be signed both by the supervisor who carried out the engineering work and the officer in charge of the building. The former signs to verify the safety of his repair and the latter with respect to matters such as cleanliness and fitness for use with explosives. It is usual for the clearance certification to be a part of the Permit to Work form.

6.3 Emergency Arrangements

6.3.1 Heads of Establishments where explosives are processed, handled or stored must ensure that adequate emergency arrangements are in place. These arrangements must be in accordance with the requirements of JSP 375. Emergency plans are to be prepared for any reasonably foreseeable contingency. Such contingencies include accidents resulting in property damage, fire, explosion, injury and fatality. Identification of contingencies will be aided by a comprehensive site wide risk assessment (JSP 375 Vol 2). Incidents, for which emergency plans are required, may be major incidents with effects throughout the site, and perhaps outside of it, or relatively minor local incidents. Where MACR applies to a site, any

emergency arrangements in place as a consequence of this will form a part of the emergency plans. MACR requires, amongst other things, liaison with off-site emergency services; where MACR does not apply it may still be necessary to consider liaison with off site emergency services. In addition to specifying emergency actions for the building where the primary incident occurs, emergency plans should specify actions for personnel in adjacent buildings; it may be safer for people to remain where they are. Personnel must be made familiar with the actions to be taken in emergency. Notices giving information regarding emergency action in the event of Fire, Evacuation and First Aid must be displayed at suitable locations throughout the site and these are to include all process buildings. Emergency instructions must include details on how to shut processes down safely, how to move to a safe place and arrangements for re-entering the explosives area after an emergency incident. Arrangements are to be made to ensure that any particularly vulnerable persons such as visitors or any disabled people are conducted to safety in an emergency. Fire and evacuation drills must be carried out for process buildings at least every 6 months. All available exits must be used during the evacuation drill. Records of the exercises must be maintained and where appropriate post exercise reports prepared.

6.3.2 A part of the emergency planning process is the consideration of the provision of a Fire Fighting Force and medical assistance. The latter may encompass first aid parties, nursing staff, qualified medical practitioners, ambulances, medical supplies and facilities. Because of the particular nature of injuries that result from accidents involving explosives these arrangements are normally to include the provision of medical personnel who are adequately trained to deal with such injuries. Exceptionally at small sites where less hazardous classes or small quantities of explosives are involved specially trained First Aiders (so called “Trauma” trained) may suffice. Special consideration must be given to those working with explosives in remote locations and plans must be made to provide medical assistance and evacuation to a hospital as quickly as possible. A part of the emergency planning process for sites with the potential for major explosives accidents will include buildings designated for use as temporary casualty clearing stations.

6.4 **Thunderstorms**

6.4.1 Procedures will be prepared in advance for the action to be taken on the approach of a thunderstorm. The Met Office can provide a dedicated service in some areas where a designated Met Office will use a manned Radar to give early warning of the approach of storms. This is based on risk levels and has, in the past, proved very reliable. Alternatives are the use of lightning warning indicators or simply using a local observer. Risk assessment will determine the appropriate system. Normal practice is to suspend any work and firing operations when a thunderstorm is expected imminently and this is essential where sensitive EEDs or primary explosives are involved. However, it may be considered impractical to stop work immediately and the situation should be made safe before cessation of work and evacuation of any building. Storehouses and Process Buildings are to be made secure after evacuation. Movements of explosives should cease as soon as possible, and they should be moved to the nearest appropriate explosives building for storage during the storm.

6.5 **Surveillance of Nitrate Esters**

6.5.1 It must be remembered that all Nitrate Ester based explosives are liable to deteriorate during storage and will eventually auto-ignite usually with disastrous consequences. The most common nitrate esters used are nitroglycerine and nitrocellulose and these are found in most propellants for all calibres of gun from small arms upwards and in some rocket propellants. Detailed advice is given in JSP 762.

6.6 **Firework Displays**

6.6.1 Firework displays are a very specialised branch of the explosives industry and are only to be undertaken by specifically trained staff who have attended the appropriate course run by a manufacturer, or an equivalent commercial training organisation, and are deemed to be Competent Display Operators (CDOs). CDOs are defined in the HSE Guide: “Working Together on Firework Displays”, which is a guide to safety for firework display organisers and operators available from HSE Books, 2006, HS(G) 123, (ISBN 9780717661961).

6.6.2 Full details of Fireworks displays and storage are given in Annex C.

6.8 **Safe for Transport and Handling**

6.8.1 The MOD requirements for the transportation of dangerous goods by road, rail and sea are outlined in the Dangerous Goods Manual (DGM), which includes the basic principle that explosives and packaging when consigned for transportation will withstand the stresses encountered during transport and the condition will not prejudice safety. Refer to the DGM.

6.8.2 The consignors of explosives for transport are required to assure that the consignment meets the requirements of the DGM Existing procedures are in place to ensure compliance with the DGMd other related legislation. Exceptionally, situations may occur where the condition of the explosive is unknown, possibly having deteriorated through age or storage conditions, or as a result of damage. In this case an assessment of the condition of the stores is to be made. This assessment is to take consideration of both the 'safe to store and transport life' of the item and the condition of any associated packaging. In addition, the physical condition of the munitions should be assessed if there is a technical requirement stipulated by the IPT munitions manager.

6.9 **Certificate of Safety**

6.9.1 Certification of safety is required to demonstrate that all explosive items are correctly packaged and marked, that the packages are undamaged and are safe for transport and handling. This is to accompany each consignment of explosives sent for disposal to any place or establishment, including other Munitions Depots/Centres. This certification is covered by existing movement/accounting documentation provided to and carried by, the Authorised Representative.

6.9.2 Munitions sent for disposal are to have sufficient remaining safe to store and transport life and be free from constraints directly affecting issue or movement. In addition, authorised, competent, DSDA staff should ensure that the munitions are packaged, marked and palletised correctly. If necessary, the appropriate IPT Munitions Manager will request specific pre-issue inspections. Automatic 100% or sample inspection is not required.

6.9.3 Where concerns exist about a lack of active management of munitions e.g. no obvious IPT ownership, legacy items, etc, DSDA should seek advice from the most appropriate PT or DOSG.

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CHAPTER 17

ANNEX A

TEMPERATURES FOR NORMAL STORAGE IN MAGAZINES AND STOREHOUSES

CONTENTS

1 TEMPERATURES

1.1 Introduction

1.1.1 Ideally all magazines and storehouses should be designed and equipped so that the inside temperature rarely falls below 5 degrees Celsius and rarely rises above 25 degrees Celsius. This is not a situation that would be likely to be attained without the installation of heating. But in practice there are many explosives that can be kept safely in buildings that are not equipped with space heating. However, some explosives should not be allowed to get too cold and some should not get too hot. Yet other explosives need to be protected from moisture. The following paragraphs cover those, which are particularly susceptible to deterioration at low and/or high temperatures and high humidity.

1.2 Low Temperature Limit

1.2.1 To reduce the possibility of exudation of nitroglycerine, and to avoid problems arising out of changes in physical properties, gun and rocket propellants containing nitroglycerine or other nitrate esters must not be stored in a building any part of which is liable to remain below 5 degrees Celsius for a continuous period exceeding one month.

1.2.2 Water wet explosives must not be stored in any place where the temperature is liable to fall below 0 degrees Celsius.

1.2.3 As far as possible the temperature in buildings containing cordite pastes, dynamite or blasting gelatine (unless of the low freezing variety) should be kept from falling below 15 degrees Celsius and under no circumstances should the temperature be allowed to fall below 13 degrees Celsius, the freezing point of nitroglycerine. If the latter situation arises out of a failure in the heating supply then these materials must not be moved or handled until they have thoroughly warmed up again.

1.2.4 If the temperature conditions required cannot be met, then space heating must be installed.

1.3 High Temperature Limit

1.3.1 Deterioration of explosives in terms of physical properties or performance and a reduction of the shelf life of propellants and other explosives containing nitrate esters will occur more rapidly with increasing temperature. It is recommended that wherever practicable the temperature in a storage building should not be allowed to exceed 30

degrees Celsius. The chemical stability of explosives in storage should be kept under surveillance in order to avoid problems associated with autoignition.

1.4 **Humidity Conditions and Air Flow**

1.4.1 Conditions of high humidity will produce deterioration in physical and ballistic properties of composite propellants. Certain double-based compositions (so called “composite modified” compositions) are also adversely affected by high humidity. Care should therefore be taken to afford all such propellants adequate protection against high humidity. Nearly all pyrotechnics deteriorate in conditions of high humidity to the detriment of their performance. Phosphide ammunition must be kept dry.

1.4.2 Packages should be so arranged as to allow a free passage of air around the stack and the stack is to be raised off the floor by the use of battens. The clearance between the stack and the wall is normally to be at least 0.5 metres.

CHAPTER 17

ANNEX B

BREAKDOWN AND DISPOSAL OF EXPLOSIVES

CONTENTS

1 GENERAL CONSIDERATIONS FOR BREAKDOWN OPERATIONS

1.1 Questioning the need for Breakdown

1.1.1 Ammunition will only be broken down if there is a definite advantage to be gained by so doing. However, there are instances where it is required to be broken down for disposal or for inspection and research purposes and the contents of this Annex will be applicable. If a safe system of working cannot be evolved the explosives will be destroyed by enclosed incineration or by detonation of the complete item.

1.2 Regular Inspection of Stocks Awaiting Operations

1.2.1 Explosives awaiting breakdown will be regularly inspected. Inspection with special reference to the onset and progress of corrosion will assist in ensuring that explosives items are broken down before they become dangerous.

1.3 Risk Assessment and Planning Breakdown Operations

1.3.1 Explosive items will not be broken down until the risks have been assessed, the operation has been planned and a layout and system of work, with appropriate safety measures, has been approved. The risk assessment will normally include a COSHH assessment and may include other subsidiary risk assessments. See Appendix 1 for a suggested protocol for breakdown operations involving foreign or unknown stores; the risk assessment for these will need to be reviewed and appropriately amended, as more information becomes available during the breakdown operation.

1.4 Plan of Operation

1.4.1 In preparing the plan of operation consideration should be given to the following stages:

1.4.2 Obtaining relevant data - Data such as that following should be obtained:

(1) Relevant drawings and specifications from the manufacturer.

(2) Relevant Explosives Hazard Data Sheets.

(3) Any safety information available from the manufacturer.

(4) The possibility of hazards arising from incompatibilities not present in the original item as manufactured should be provided for.

(5) History of the stores including such aspects as rough handling temperature cycling, sea water contamination.

(6) Information from DOSG, PTs and from relevant Service Manuals.

1.4.3 Radiographic examination - If insufficient information is available for the method of functioning of the round to be ascertained, a radiographic examination of the round or of selected rounds should be carried out (see also Appendix 1).

1.4.4 Breakdown under precautions - Where the risk assessment determines the need, it may be necessary to breakdown under precautions, for instance to check the condition of fuzes or fuzed ammunition (see also Appendix 1).

1.4.5 Preparation of a schedule of operations - This is particularly important where large-scale breakdown is being carried out.

1.4.6 Selection of site, process building, etc - Due regard should be given to Q-Ds and the strength of guards, shields, cubicles and other protective devices. These must all be type-tested, and suitably identified.

1.4.7 Preparation of Process building layout, etc - Plant should be sited according to the following principles:

(1) Breakdown operations considered to have an unacceptable hazard must be carried out by remote control.

(2) The supply of filled items to the breakdown process and the removal of the components after breakdown should be so arranged that there is no accumulation of exposed explosive compositions and filled components beyond the approved limits.

1.4.8 Preparation of working instructions - Preparation and approval of working instructions for operatives must be completed before the breakdown commences.

1.4.9 Training of operatives - The training of operatives in the operations they will carry out should include an explanation of the safety rules applicable to that work.

1.4.10 Accounting for arisings - In the interest of good management and the Control of Explosives Regulations it is necessary to institute a system of accounting for the arisings from explosives breakdown so that the likelihood of explosives or their components being overlooked, secreted or dumped is minimised.

1.5 **Machinery and Tools for Breakdown Operations**

1.5.1 The general principles outlined later in this document, with regard to the use, design and siting of machinery and tools will be followed. Consideration should be given to the design of machinery and tools so that they cannot be wrongly used. For example, the leverage which is possible with tools should be related to the amount of work, generation of heat by friction, etc. that the item can safely tolerate. Any tool which is hollow and which could conceivably be used to fit over the handle of another tool and so increase the leverage obtainable should either be excluded from the breakdown area or be modified to prevent its misuse. Adjustable tools should not be prescribed for breakdown operations.

1.6 **Permitted Tools Only to be Used**

1.6.1 The Use List should describe the number and type of tools permitted for the operation in sufficient detail to preclude any likelihood of doubt. The unauthorised entry into the breakdown area of any tool not on the Use List or modification of any machine or tool to alter its mode of operation must not take place. The marking, colour coding of tools or use of a tool board are examples of good practice and facilitate checking.

1.7 **Items not to be Heated**

1.7.1 Items containing explosives will not be heated to release the tightness of screw threads unless this operation has been authorised in the operating instructions. It is important to ascertain that such authorised heating will not cause migration of the filling into screw threads with subsequent increase in potential hazard during unscrewing operations. A trial designed to test this possibility should be carried out in advance and it should cover such ranges of temperature and time as may be used during normal working conditions. Unless a fail-safe system of automatic temperature control is used, there must be a very considerable margin of safety in the limits prescribed.

1.8 **Protecting Sensitive Components**

1.8.1 In breakdown operations, parts that are susceptible to initiation by light blows, friction etc. will be protected during handling operations and this protection will only be removed at the latest practical stage. An example of this is the use of clips to cover primers in cartridge cases.

1.9 **Treatment of Difficult Items**

1.9.1 Operatives engaged in the breakdown of explosive items will be given precise and detailed instructions as to what action to take if a situation arises which is not covered by the procedure laid down.

1.10 **Segregation of Difficult Items**

1.10.1 Provision will be made for the identification, collection and removal of all explosive items that cannot be broken down by the accepted procedure. They must be given special consideration as to their storage and subsequent disposal.

2 **BREAKDOWN OF FIXED AMMUNITION**

2.1 **Order of Removal of Components**

2.1.1 The order in which component parts of a complete round of gun ammunition undergoing breakdown should be removed will be decided after consideration of the nature and condition of the filling and in particular of the propellant in the cartridge. However, normally the first operation will be the separation of the projectile from the cartridge case. Components should usually be disassembled in order of decreasing sensitivity and for the projectile this will normally be as follows:

(1) Initiatory device,

(2) Gaines or exploders,

(3) Main filling.

2.1.2 It is sound practice to sub-divide the quantity of explosives at risk as soon as practicable. Separation of the projectile from the cartridge case is an example. Appendix 2 describes a typical operation.

3 **BREAKDOWN OF AIRCRAFT BOMBS**

3.1 **Preliminary Examination for Fuzes and Detonators**

3.1.1 Aircraft bombs will not be broken down until it has been confirmed that they do not contain detonators or fuzes.

3.2 **Breakdown to take Place Singly in Isolation**

3.2.1 Aircraft bombs will be broken down singly in isolation. The degree of isolation need be no more than is necessary to prevent propagation of explosion to other explosives stores and to arrest fragments. Details of the method of examination for the presence of detonators and fuzes and for the removal of exploder pellets are given in Appendix 3.

4 BREAKDOWN OF WHITE PHOSPHORUS FILLED AMMUNITION

4.1 Separation of Stages

4.1.1 White phosphorus-filled ammunition will be broken down in two locations that are well separated from one another, the explosive components present being removed in the explosives area and the phosphorus on an area of the site reserved for work of this nature.

4.2 Precautions Against Fire

4.2.1 During the removal of white phosphorus from ammunition special precautions will be taken against fire hazards. Experience has shown that occasionally ammunition containing explosives does find its way to the white phosphorus section of the breakdown operation. All explosives are strong oxidants and violent reactions can occur if they come into physical contact with phosphorus. It is only by 100 per cent examination for the absence of explosive before the removal of white phosphorus is begun that freedom from accidents due to the presence of explosive can be ensured.

5 BREAKDOWN OF ROCKET TAILS AND MOTORS

5.1 Protection of Igniter

5.1.1 The schedule of operation for the breakdown of rocket tails and motors will be designed with due regard to the avoidance of damage to the igniter and the protection of operatives against fire. It is particularly important to keep the igniters that have been removed from items away from the recovered propellant. This may be achieved by good layout and constant supervision.

6 GENERAL CONSIDERATIONS FOR DISPOSAL OF EXPLOSIVES

6.1 Available Methods of Disposal

6.1.1 Explosives will be disposed of by one of the following methods: Chemical means, burning or detonation. In deciding which method of destruction is appropriate consideration should be given to the nature and quantity of the explosive and also to the potential hazard associated with each method of destruction. The normal method of destroying small quantities of caps and detonators is by heating in a suitable furnace. The equipment used should be such that no fragment or self propelled item can cause injury either to the operator or to passers by. Any risk to hearing from excessive noise must be controlled as also should risks from toxic materials, for instance heavy metals such as lead or mercury. If detonators or caps are disposed of by blasting, a safe system of work must be established and adequate containment must be provided, e.g. a thick walled shell, to prevent the scattering of unexploded items or hazardous debris over a wide area. Any method of disposal adopted must be in accord with Statutory Requirements for the environmental risks.

6.2 Officer in Charge of Disposal of Explosives

6.2.1 A responsible officer (referred to hereunder as the Officer-in-Charge) will be appointed by the Head of the Site to be in charge of explosives destruction sites.

6.3 Safety Duties of Officer in Charge

6.3.1 By training, instruction, inspection and supervision the Officer-in-Charge of explosives destruction sites is to ensure that the destruction of explosives is carried out in a safe and efficient manner. He must also ensure that a Suitable Person remains on site during

explosives destruction, and for periods before and after which are adequate to ensure that the duties listed below can be performed.

6.4 **Safety Duties of the Suitable Person**

6.4.1 The Suitable Person appointed to remain on site is to:

(1) Ensure that only authorised persons are present on site;

(2) Check before work commences that the plant and premises, if any, are in safe working order;

(3) Ensure that before destruction operations begin warning signs and road blocks are posted to restrict entry into the area;

(4) Ensure that only authorised destruction is performed;

(5) Ensure that in the event of an accident or an unusual occurrence such steps are taken as are necessary to alleviate distress and to make the site safe and secure from unauthorised persons and report at once to the Officer-in-Charge;

(6) Have the site searched at the completion of operations and cleared up to ensure that it is left in a safe condition. A site is not in a safe condition until it presents no potential hazard to any person, authorised or unauthorised who may visit it.

6.5 **Planning Destruction Techniques**

6.5.1 No explosives destruction operations will be permitted until an approved technique has been developed which will include a misfire drill. A set of instructions for the safe conduct of operations will be drawn up (this is to be approved by an officer appointed by the Head of the Site) and operatives will be trained and practised in these methods of working, before they are employed to destroy items.

6.6 **Preservation of Identity**

6.6.1 Different types of explosives sent for destruction will be segregated and the identity of each type will be preserved until destruction has been completed. Explosives, which cannot be identified, should only be destroyed in accordance with a plan that has the approval of the Head of Site. The safety precautions for such an undertaking should be made appropriately stringent.

6.7 **Emergency Arrangements**

6.7.1 During explosives destruction operations, adequate facilities will be available to deal with fire and accidents. Personnel will be practised in emergency procedures. .

6.8 **Record Keeping**

6.8.1 A record will be kept of the quantities and nature of explosives destroyed. The records should include details of unusual incidents and of the action found appropriate in dealing with them.

6.9 **Segregation of Explosives Awaiting Destruction**

6.9.1 Explosives awaiting destruction will be segregated from other explosives items and will be sited in accordance with the limits approved by the appropriate IE.

6.10 **Periodic Examination of Explosives Awaiting Destruction**

6.10.1 A regular examination will be made of explosives awaiting destruction to ensure that deterioration does not become so excessive as to prevent their eventual safe disposal.

6.11 **Removal of Explosives by Steaming Out**

6.11.1 Steaming out will be carried out in a facility specially designed and provided for the purpose. Care will be exercised to avoid the mixing of incompatible explosives, and also the contamination of explosives with any harmful materials. In this respect the use of the same facility for steaming out explosives and items filled with inert ingredients should be avoided. Steaming out requires that special precautions be taken to prevent contamination of surrounding area and of aquifers in particular. Operatives are at particular risk from the toxic effects of TNT and great care must be taken when carrying out the COSHH assessment. Appropriate Personal Protective Equipment and medical surveillance will invariably be required.

7 **DESTRUCTION OF EXPLOSIVES BY CHEMICAL MEANS**

7.1 **Site to be Equipped for the Purpose**

7.1.1 Operations connected with the chemical destruction of explosives will take place in a building or at an open-air site designed and equipped for the purpose. The hazard data sheets for the explosive compositions must be consulted and any safety requirements applied to the process. Due regard will be taken of QD requirements for the quantities of explosives present during the process.

7.2 **Limitation of Quantity to be Destroyed**

7.2.1 Destruction of explosives by chemical means will normally be limited to small quantities. If it is decided to apply it to large quantities of explosives, authorisation from CIE (MoD) will be obtained in each case.

7.3 **Safeguards During Chemical Destruction**

7.3.1 The process and associated layout selected for the chemical destruction of explosives will include appropriate safeguards against explosion, fire and toxic hazards.

7.4 **Development of Techniques**

7.4.1 If an approved technique is not available small-scale trials will be carried out by selected authorised staff to develop a safe process of destruction.

7.5 **Competence of Person Conducting Destruction Operation**

7.5.1 The person in charge of operations connected with the chemical destruction of explosives must have sufficient knowledge of the process and be competent to know what action to take in an emergency.

7.6 **Prevention of Accumulation of Explosives**

7.6.1 No more material than that in process of being destroyed by chemical means will be permitted in the destruction building or place.

7.7 **Disposal of Effluent**

7.7.1 Provision will be made for the safe disposal of both gaseous and liquid effluent and if necessary for ventilation of the building during the chemical destruction of explosives.

8 **DESTRUCTION OF EXPLOSIVES BY BURNING**

8.1 **Location of Site**

8.1.1 The site selected for the open burning of explosives will be chosen with due regard to limits approved by the appropriate IE and types of explosives materials to be destroyed. Other factors to be considered are the area over which missiles and firebrands resulting from an inadvertent explosion might possibly be projected and that over which significant quantities of toxic fumes or smoke might be emitted.

8.2 **Protection of Operators**

8.2.1 Protection will be provided to operators on the assumption that explosives, which are capable of burning to detonation or explosion, may in fact do so. Hence operatives engaged in the burning of explosives must be protected against fire, blast and projections.

8.3 **Use of Properly Prepared Trays or Cages**

8.3.1 Where trays or cages are used for the destruction of explosives by burning, they are to be of an approved design and properly prepared. The selection of the type of cage to be used will be influenced by the quantity and nature of the explosives to be burnt. A prime consideration is the avoidance of premature ignitions, which have been the main cause of serious accidents in batch burning. Also to be considered is the minimisation of dangerous fragments should an explosion occur. In this respect thick cast iron trays are unsuitable.

8.4 **Removal of Wrappings before Burns**

8.4.1 Unless it has been definitely confirmed to be safe to burn explosives in their packages, these packages or wrappings will be removed before burning is begun. Wrappings will be destroyed at a different location. Those that have been removed from explosives should be regarded as if they were explosives and care should be taken to ensure that they do not become mixed with non-explosive material. Such contaminated wrappings should be destroyed with due regard to the explosive associated with them.

8.5 **Quantity and Condition of Explosives to be Burnt**

8.5.1 The total quantity of explosives present on the site will not exceed the limits approved by the IE. The quantity of explosive items or loose compositions to be burnt at one time on one hearth will be strictly controlled and laid down in the explosive licence for the facility. The sizes of individual pieces of explosives, and the depth of layers laid out for burning, will conform to the local standing instructions and the data contained in relevant explosives hazard data sheets.

8.6 **Segregation of Different Explosives**

8.6.1 On the burning ground different explosives will be kept apart and only one type will be burnt at a time, except where otherwise specifically authorised.

8.7 **Examination before Burning**

8.7.1 All explosives will be carefully examined before burning to ensure that nothing unacceptable is accidentally included. It is most important that detonators or other initiating material are not included with explosives.

8.8 **Residues of Aluminised Explosives**

8.8.1 The residue from aluminised explosives will be included with combustible material and burnt for a second time. The residues from the burning of aluminised explosives should be identified so that there is no confusion between those which have been burned once and those that have been burned more than once. These residues need to be thoroughly oxidised, and require at least two burnings followed by their being laid out in thin layers for weathering.

8.9 **Prevention of Premature Ignition**

8.9.1 Except in continuous operation under approved conditions, no explosives will be placed for burning where they can be ignited by a heated surface from a previous firing. When explosives are burned in batches the hearth is to be hosed down before the fire is prepared. At the completion of operations when the fire is out the hearth will be hosed down to ensure that it is adequately cooled before any materials are put on the bed for the next fire. For efficient operation in the batch burning of explosives several hearths should be available so that they can be used in rotation as a means of ensuring that the hearth will be cold before the next fire is prepared. The required time for a hearth to become cold after being used must be specified in the process instruction for burning explosives.

8.10 **Precautions Against Electrostatic Hazard**

8.10.1 In explosives burning operations, those known to have an electrostatic hazard will be protected against premature ignition caused by electrostatic discharge. It may not be possible to provide conducting conditions and alternative precautions, such as temporary protection e.g. clips on cartridge cases, may be used. Each material must be treated according to the circumstances and manner of the possible electrostatic build-up.

8.11 **Effect of Weather**

8.11.1 Before explosives are burnt, attention will be given to the direction and force of the wind, and other relevant weather conditions. Operations would normally be suspended during thunderstorms.

8.12 **Care of Fire in Tray and Cages**

8.12.1 A fire upon which explosives have been burnt will be watched until it is cold and may only then be raked out.

8.13 **Handling Incompletely Burned Explosives**

8.13.1 When the fire is out and the tray or cage is cold any incompletely burnt explosives will be removed only under clearly defined procedures for that particular explosive. The unburnt residue will be set aside and identified until burnt by an approved method at a subsequent firing. Earth and ash hearths should be raked over from time to time to uncover any explosives composition that may be present in the bed. Any burned debris or metal components that may be brought to light should be removed.

8.14 **Destruction of Non-Explosive Combustible Materials**

8.14.1 Non-explosive combustible materials that have not been in contact with explosives are to be burnt in such location, time and manner, as to preclude any danger of ignition of any explosive material whatever.

8.15 **Disposal of Phosphorus**

8.15.1 In no circumstances will explosives burning trays/cages be used for the disposal of red or white phosphorus. White phosphorus may only be disposed of by burning in a specially designated and fenced area. The area must be signed with warning notices indicating the possible presence of white phosphorus.

8.16 **Lighting Fires for Burning Explosives**

8.16.1 Remotely operated electrical methods of ignition will always be used for lighting fires upon which explosives are to be burnt unless another method is specifically authorised by the Head of Site.

8.17 **Continuous Burning Process**

8.17.1 When explosives are burnt in a continuous process or one in which mechanisation is employed, proper safeguards for the operatives should be applied to avoid the possibility of the explosives which they are required to feed to the burner being exposed to any source of ignition.

8.17.2 Procedures for burning are to be based on Risk Assessments specific to the facility and to the items being burned.

8.17.3 Special care is to be exercised in the examination of the residues from burning and Certification Free From Explosives is to be in accordance with this document.

8.17.4 Emission Controls are to be used to reduce the emission of particulates and gases to levels that comply with Environmental Legislation.

8.18 **Provision of Fire Fighting Facilities**

8.18.1 Fire-fighting facilities will be available to extinguish any uncontrolled fires occurring in the areas associated with the burning of explosives. All vegetation should be cut short to a distance of 20 metres from the perimeter of the tray/cage etc.

9 **DESTRUCTION OF EXPLOSIVES BY DETONATION**

9.1 **Selection of Site for Detonation**

9.1.1 If an approved cell, suitable for the quantity of explosives to be destroyed, is available it will be used. If a cell is not available, a site will be selected in a remote part of the site and precautions for the safeguarding of personnel and buildings both inside and outside the establishment from air blast, fragments and debris will be observed. The cell need not necessarily be other than an extempore shelter, e.g. sleepers and sandbags provided loose items cannot become projectiles and hazard the operatives. Where repeated demolition has to be carried out there may be advantages in using a cell rather than preparing each time a trench and appropriate sandbag protection.

9.2 **Means of Initiation**

9.2.1 Detonation will normally be initiated by electric means using detonators as appropriate. Permanently installed electric circuits energised by an approved firing box or other approved firing device should be used for demolition operations.

9.3 **Safety of Electrical Firing Systems**

9.3.1 Firing systems will be designed and used in a manner to minimise the possibility of inadvertent firing. Each circuit used for electrical firing will include a reliable and unique device for interrupting or rendering inoperative the circuit. The device will remain under the sole control of the person immediately responsible for the firing. Where a Shrike is to be used, in order to comply with the foregoing, it is held by the firing officer. It is important to ensure no one but the firing officer can initiate the firing circuit. This can be achieved by restricting access to all Shrikes and by posting personnel at the firing point to ensure only the authorised firing officer for the particular firing has access to the firing leads. Additional safety breaks may also be desirable for other operations involved in experimental firings in particular. To protect the operator from the effects of an accidental initiation, the electric puffer or detonator should be safely placed behind appropriate shielding (often a sandbag will suffice) whilst being connected to the firing leads. When this has been safely accomplished the detonator should then be inserted into the explosive charge or taped to the detonating cord where this is used. In some instances, this procedure may have to be modified.

9.4 **Avoidance of Premature Ignitions**

Premature ignition may arise from static electricity or induced electric current from radio frequency equipment or high-tension wires, etc. Circuits should be so installed as to minimise inductance or leakage from other electrical systems, such as might result from running other circuits parallel to and close to the firing leads. Care should be taken to ensure that the leads of the electric detonator are not waved through the air while they are being unwound and in this operation the detonator should not be held by hand. The leads of the electric puffer or detonator should, where possible, be twisted together so as to be non-inductive.

9.5 **Misfires or Partial Ignitions**

9.5.1 Instructions for all electrical firings of explosives in process of destruction will include drills to cover such eventualities as misfires or partial ignitions.

9.6 **Use of non-electrical Detonators and Burning Fuze**

9.6.1 When it is impracticable to use electric detonators for detonation, the operation will be carried out by means of a non-electric detonator with a burning fuze. Where safety fuze is used it must be of sufficient length to enable the person lighting it to get under cover before the explosion occurs. Before using the safety fuze it is important to test it so that its timing characteristics are known. The piece of fuze to be used must, in addition, be examined to ensure that it has no flaws in it. It should be noted that the burning rate may be substantially increased under some circumstances, e.g. underwater. Fuze instantaneous may need to be used under some circumstances and it is to be used in a similar manner to an electric detonator, that is to say with the firing officer getting under cover prior to ignition.

9.7 **Crimping Tools**

9.7.1 A sound junction between burning fuze and non-electric detonators, used in detonation operations, can be ensured by using an authorised crimping tool and ensuring that the fuze is seated home firmly. Undue force must not be used, neither should a grinding action be employed.

9.8 **Cessation of Detonation Operations during Thunderstorms**

9.8.1 During thunderstorms, neither destruction of explosives by detonation will be carried out nor will preparation for detonation be made if explosives are already present on the site.
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9.9 **Protection of Personnel**

9.9.1 The officer-in-charge of explosives demolition operations will ensure that all personnel in the danger area are under adequate cover before action is taken to destroy the explosives.

9.10 **Search After Detonation**

9.10.1 After each destruction of explosives by detonation a search will be made under the control of the officer in charge, for unexploded or other dangerous materials before the area is declared safe. The bed or bottom of the trench, if one is used, will be dug out carefully to ensure freedom from explosives.

9.11 **Cover**

9.11.1 In all demolition operations care will be taken to ensure that cover is provided at the site of the explosion so that missiles, if they arise, are arrested at source. Cover will also be provided for operators and others who may be in the vicinity sufficient to give full protection should the primary cover fail.

9.12 **Certification Free From Explosives**

9.12.1 Certifying arisings free from explosives is an important part of the disposal task.

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CHAPTER 17

ANNEX B

APPENDIX 1

BREAKDOWN OF UNKNOWN, UNFAMILIAR OR INADEQUATELY CHARACTERISED MUNITIONS OR OTHER ITEMS CONTAINING EXPLOSIVES

CONTENTS

1 BREAKDOWN OPERATION

1.1 Introduction

1.1.1 This Appendix addresses the breakdown or other invasive operations on unknown or unfamiliar munitions or explosive devices or on munitions which could also be in an uncertain safety condition following exposure to unusual storage conditions, to any physical abuse (e.g. involvement in an accident) or any other abnormal circumstance.

1.2 Exclusions

1.2.1 This Chapter does not cover munitions or devices identified as, or suspected to be, of a chemical, biological or nuclear nature. Dealing with such items requires special expertise and facilities.

1.3 Organisation

1.3.1 Because of the extremely hazardous nature of this category of breakdown operation, special attention is needed in organisation and control. The arrangements must include:

(1) The appointment of an officer-in-charge of the entire activity.

(2) Where the officer-in-charge delegates part of the activity, there must be a clear statement of the allocated task(s) and demarcation of responsibilities. Only one person must be responsible for each aspect of the work. There must be no overlap of responsibilities.

(3) Preparation of an initial breakdown Plan, by an appropriately competent person who has been certified as competent by a senior officer (normally a senior line manager).

(4) Peer review of the breakdown Plan.

(5) Circulation of the Plan to all persons involved in the work.

(6) Provision for revision of the Plan if additional information is received or as breakdown proceeds and generates new data. All revisions are to be peer reviewed and circulated, as for the initial Plan.

(7) The Plan to is include a Risk Assessment and all personnel to be informed of, and kept up-to-date on changes in, the perception of the risks to which they are exposed.

(8) Conformance of work to a recognised Qualify Management system.

(9) As breakdown proceeds all personnel to be informed of findings and any possible impact on their individual work plan.

(10) Circulation of the Plan and subsequent revisions to others who may have useful input, inviting comment.

(11) Definition of the competency required for each member of the breakdown team. Only those with the appropriate competence and experience, and who have been certified competent by an authorised line manager, will be selected.

(12) The Plan must include an instruction to stop work and seek further advice if at any time the risk(s) seem unacceptable to any individual, if detailed plans cannot be complied with or if there is any doubt about how to proceed safely.

1.4 **Breakdown Plan**

1.4.1 General guidance on the preparation of a Breakdown Plan is given below:

(1) Before devising any plan personnel must learn as much as possible about the munition from literature or other sources. Analogies may be drawn with similar weapons systems but beware; foreign manufacturers design safety standards may not be equivalent to those of the UK. There may be documentation available that covers such activities, particularly for UK or NATO stores, from sources such as DOSG.

(2) Produce an initial Breakdown Plan (to include a Risk Assessment) and keep it under constant review so that it can be modified as greater knowledge is gained about the weapon. This initial Risk Assessment will normally concentrate on the risk of explosion or actuation of any system containing energetic material, during handling and transport. However risks such as toxic properties of the explosives and manual handling risks must not be forgotten.

(3) Use non-intrusive techniques to learn about the construction of the munition e.g. X-Ray. If the Risk Assessment process identifies any reasonable concerns associated with the process, carry out any investigations “under precautions”; for example, remotely in a structure designed to contain the effects of any functioning of the weapon.

(4) Breakdown the munition in the least violent way possible making appropriate use of remote handling. Information from the processes described in sub-paras (1) to (3) above may be used to decide whether or not remote handling is essential (if it is practical to use it remote handling is normally preferable). Guidance about the disassembly procedure itself is given in this Appendix at paragraph 1.7. If it is subsequently necessary to sample or remove explosives fillings etc do so using as little energy as possible. Treat all explosives as if they are very sensitive to electrostatic and mechanical stimuli until positive evidence to the contrary has been

obtained; make no unsupported assumptions regarding safety characteristics of the explosives.

(5) Consideration must be given to the need for personal protective equipment. Such equipment includes: face visors, fire resistant clothing and respiratory protective equipment etc. Personal protective equipment used to protect against the effects of an accidental explosion must only be relied upon for protection where risks are very low; it is not to be used as a substitute for remote handling. The use of personal protective equipment must not be discounted simply because the quantity of explosives involved is very large. It is perfectly feasible for a partial explosion, in which only a small part of a larger charge reacts explosively, to occur in a secondary detonating explosive.

1.4.2 Potential hazards from weapons are to be identified in the Risk Assessment process prior to carrying out any movement, examination, breakdown or trials. The following have been identified as possible hazards associated with the breakdown of munitions (this list is not comprehensive):

(1) The functioning of the weapon explosively.

(2) The functioning of the weapon's propulsion system or other systems (including the warhead) giving rise to an energetic event other than an explosion.

(3) The functioning of the weapon mechanically e.g. Gyro motors staring up.

(4) Mechanical hazards e.g. release mechanisms.

(5) Electrical hazards e.g. high voltages.

1.4.3 Knowledge of the following will be helpful when carrying out the Risk Assessments and subsequent breakdown operations:

(1) Identification of fuzes, igniters, power supplies etc, of the item including their status.

(2) An understanding of the methods of manufacture and assembly of all the items that make up the whole store as far as is practical.

(3) Layout of the store including warhead, rocket motor, sensors etc.

(4) A history of the store to show any stressing or adverse storage or handling to which it may have been subjected.

1.4.4 If it is intended to carry out further work, which involves the handling of exposed explosives, sensitiveness testing of the explosives compositions will be carried out where it is practical to do so. Such testing could include Figure of Insensitiveness, Mallet and Rotary friction, Electric Spark tests, Temperature of Ignition; the decisions on which tests to perform must be logically argued as part of the Risk Assessment. If any long term storage is envisaged Vacuum Stability Testing or other stability testing, such as the Abel Heat Test or stabiliser content analysis (for nitrate esters) of explosive components is to be carried out as appropriate. It is desirable to involve Hazard Testing experts in the selection of any tests.

1.4.5 Components, containing energetic materials, must be removed promptly during the breakdown operation. The general principle is that at all times only the minimum quantity of explosives necessary to carry out the task in hand will be present. When formulating the breakdown plan consideration must be given to the safe storage and disposal of energetic components that have been removed from the munition.

1.5 **Risk Assessment**

1.5.1 In many respects the Risk Assessment process will be essentially as for breakdown of known stores. However, in the case of known stores a great deal will be known regarding the design of ammunition and the properties of the explosives therein. In breakdown of unknown devices, the objective may well be to find out this information. However the same principles still apply. Very great care and vigilance is required, and time should be taken to review the Risk Assessment as breakdown proceeds.

1.6 **Retained Inert Products of Breakdown**

1.6.1 It is likely that there will be a requirement to retain non-explosive items from a breakdown operation, for further evaluation, as samples or exhibits for presentations and possible consignment to a museum. It is important that such items are rendered explosive-free and certified as such. All items are to be marked or tagged with a unique number, also labelled as INERT or FREE FROM EXPLOSIVES, and a register of such items is to be maintained. For complex, or otherwise difficult, items consideration should be given to the need for a second CFFE operation by a different officer to verify the first.

1.7 **The Disassembly Procedure**

1.7.1 The actual sequence of events will vary from store to store. The aim must be to render the item harmless in a logical and safe way.

1.7.2 The first priority is to obtain maximum possible information on the construction of the item and the materials from which it has been made. If manufacturing details (drawings, specifications, etc.) are not available; then as a minimum, the item should be radiographed. The first radiograph should be examined and, based on that examination, further radiographs taken until the person responsible for disassembly is satisfied that there is a clear view as to how the disassembly is to be attempted.

1.7.3 If drawings and assembly details are available and if the store contains safety and arming (S&A) mechanisms, unless it can be clearly and unequivocally established, by visual inspection or by electrical or mechanical test, that all S&A mechanisms are in the SAFE condition, the store should be radiographed to positively determine the status of these units. If any are ARMED (or in a state other than SAFE) a decision must be made as to how to proceed safely. Only an expert who is familiar with S&A mechanisms can make this decision. It may be necessary to destroy the item in situ or to proceed using remote breakdown techniques.

1.7.4 The priority in the disassembly process must be to remove the most sensitive components first, subject to location and ease of access. These are fuzes, igniters and detonators and sources of energy associated with activation and initiation of components.

1.7.5 Each step must be carefully considered before it is taken and a risk assessment conducted and recorded. The direct and indirect consequences of each action must be clearly understood. After each step the actions taken will be recorded.

1.7.6 It may be necessary to remove power supplies early in the procedure if they become accessible before say, an electric igniter. Wherever possible, the greater hazards will be dealt with first. As the operation proceeds it may be necessary to stop and carry out further X-ray examination of individual items, as they become exposed or available (for instance a fuze once removed from its parent store).

1.7.7 Nothing must be done which impinges upon the integrity of fillings of sub-assemblies during the disassembly of a store into its major components.

1.7.8 No “hands on” procedure must be undertaken if the possibility of an injury occurring can reasonably be foreseen. If the probability of injury occurring can be reduced to an acceptable level by the use of remote techniques or other changes in practice, then the new procedure is to be recorded along with the new risk assessment. The work can then proceed.

1.7.9 The following procedures are relevant and typical of those used in exploitation activities:

(1) Removal of store from packing.

(2) Separation of major assemblies.

(3) Removal of warhead.

(4) Removal of propellant grains or charges.

(5) Removal or disconnection of power supplies.

(6) Removal of fuzes. *

(7) Removal of detonators and igniters. *

(8) Separation of boosters from fuzes.

(9) Removal of HE fillings.

(10) Shorting and screening electrical components.

NB. *Fuzes, detonators and igniters must be removed as soon as they become accessible.

1.7.10 During these processes it may be necessary to manufacture special tooling. If, due to practical reasons such as strength etc., these tools are manufactured from ferrous based material special attention shall be paid to increased risk of mechanical initiation of the explosive filling when conducting the risk assessment. This is of particular concern if the process also involves ferrous cased energetic material items. Where possible, non-ferrous tools are to be employed.

1.7.11 Suitable repackaging materials are to be prepared before disassembly. As the disassembly progresses all components containing energetic materials must be repackaged, adequately labelled and removed to a safe distance from the parent store, and thence to proper storage, before the next operation commences.

1.7.12 During the disassembly process notes shall be taken. These notes shall be sufficiently detailed to support the writing of a formal work instruction for the specific store. Information to be recorded shall include:

(1) An outline profile of the store showing the approximate location of all energetic components.

(2) An indication of the type and mass of each energetic composition.

(3) An outline of any electrical connections, colour codings etc.

(4) Special techniques developed during the disassembly process.

(5) Any unusual electrical/mechanical features that, if inadvertently activated, could significantly alter the Risk Assessment rating, e.g. spring-loaded fins/arming systems.

1.7.13 If it is possible that another store of the same type will require breakdown then, on completion of the disassembly, a written disassembly work instruction covering the processes employed, special equipment, tooling and process risk assessments is to be prepared.

1.7.14 A log must be kept of all arisings from the breakdown process containing energetic materials.

CHAPTER 17

ANNEX B

APPENDIX 2

A TYPICAL BREAKDOWN ROUTINE FOR FIXED AMMUNITION

CONTENTS

1 A TYPICAL BREAKDOWN ROUTINE FOR FIXED AMMUNITION

1.1 When planning the breakdown of fixed ammunition, the aim should be to separate the major components and to then remove components in the order of their sensitivity starting with the most sensitive.

1.2 Thus the first operation should generally be to separate the projectile from the cartridge case.

1.3 Then having segregated the projectile for later dis-assembly, remove the propellant charge and place into a suitable receptacle. In the case of single base propellants provision is to be made to guard against the generation of static and its potential discharge by earthing and the use of anti-static or full conducting conditions as necessary.

1.4 The cartridge primer is then removed using the appropriate tool and placed in a suitable container.

1.5 Any fuze should be removed as the first operation in the breakdown of a projectile; it should be suitably packed and segregated for later breakdown/disposal. Where there is any doubt as to the safety of manual removal of fuzes they should be removed by remote operation. Where practical fuze magazines are to be removed and suitably packaged for later disposal. Further breakdown of fuzes is only to be undertaken if essential for trials or test purposes and is to be carried out under strict control using approved tools and procedures.

1.6 Exploders and any other internal components are to be removed and separately packaged for later disposal.

1.7 Projectiles are to have the fuze well plugged with suitable paper and be taped closed, then suitably packaged for later disposal.

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CHAPTER 17

ANNEX B

APPENDIX 3

BREAKDOWN OF AIRCRAFT BOMBS

CONTENTS

Paragraph

1 BREAKDOWN OF AIRCRAFT BOMBS

1.1 The technique described applies to all bombs completed to specifications obtaining in this country which call for liners to the exploder cavity and sealing compositions to the filling:

1.2 The plug representing pistol or fuze will be unscrewed and the exploder cavity examined to ensure that there is no detonator therein.

1.3 Exploders are removed by means of lifting hooks or failing these by kitsticks. Any not removable by these methods are to be left and the bombs plugged for special disposal.

1.4 The exploder container and base plate will be removed by unscrewing the base plate; the component parts being separated later.

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CHAPTER 17

ANNEX C

SAFETY FOR TRAINING, DEMONSTRATIONS AND DISPLAYS AND USE OF FIREWORKS

CONTENTS

1 SAFETY FOR TRAINING, DEMONSTRATIONS AND DISPLAYS

1.1 Introduction

1.1.1 The following regulations govern the use by units of explosives on exercises, demonstrations, displays and also the employment of explosives to destroy blinds. They do not cover unit trials with experimental explosives *see* Appendix 1 where such trials are conducted under the direct supervision of the appropriate design authority, but they are to apply where experimental explosives is issued to units for trials which are not under such direct supervision.

1.2 Explosives for Drill or Display Purposes

1.2.1 Live explosives are *not* to be used for drill instructional purposes, nor as part of a static exhibition, lecture aid nor for the purpose of passive demonstration. Where the functioning of an explosives item is to be described it is to be done with the aid of diagrams, models or approved inert sectioned components. Items held by units as training aids to assist in their identification and functioning, are referred to in paras 1.8 below.

1.3 Use of Live Explosives at Tattoos and Demonstrations

1.3.1 To obviate the risk of accidents with explosives in the presence of the public, a Safety Officer is to be appointed for each event where live explosives are intended to be used.

1.3.2 The Safety Officer is to be responsible for ensuring that regulations laid down to protect the public are observed. He is to consult the Technical Explosives Authority (TEA) through the appropriate command headquarters in all instances where live explosives are intended to be used.

1.3.3 Safety distances and precautions for the natures of explosives most commonly used in tattoos and demonstrations are given in DSA03.OME (JSP 403) Vol 5. Where details are not quoted in the table, the TEA is to give guidance on the safety distances and the precautions to be observed.

1.3.4 The safety distances given in user arm training manuals apply generally when explosives are being fired by troops on the ranges or during exercises. It is emphasised that the distances quoted in these manuals do not necessarily meet the criteria for the absolute safety necessary at tattoos and demonstrations when the general public are present.

1.3.5 A safety case for the use of live explosives at Tattoos and Demonstrations is required, approved by the HoE. When required, guidance can be sought from the IE.

1.4 **Disposal of Blinds**

1.4.1 Blinds, by their very nature, are highly dangerous items. All blinds, except Guided Missile (GM) blinds, are to be located and destroyed in situ. When left undetected they are hazardous to anyone who finds them.

1.4.2 The methods for the destruction of blinds, together with the necessary equipment and explosives, are detailed either in the instructions for practice of the Arms concerned or in the user handbook for the explosives being used.

1.4.3 GM blinds may be in any of a variety of unsafe conditions for which disposal requires specialized knowledge and techniques. In addition, it is often necessary to recover components for defect investigations and the necessary render safe and recovery techniques are to be undertaken by the TEA and not by the unit. Where a TEA is not present at a firing resulting in a suspected blind missile, the local TEA is to be contacted as soon as possible.

1.4.4 All blinds are performance failures and are to be reported to the TEA in accordance with this document.

1.4.5 If for any reason destruction in situ is difficult or undesirable, a guard should be posted and the matter immediately reported to the nearest TEA.

1.4.6 Where a firing area is under the control of a permanent range officer, he and his staff are responsible for he destruction of blinds, in all other instances it is the responsibility of the Unit Weapon Training Officer.

1.4.7 Unit orders and instructions on the clearance of blinds are to be comprehensive. Training instructions issued by headquarters of commands and districts should include comprehensive instructions on the destruction of blinds and these instructions should be written by the Chief or Senior TEA.

1.4.8 Explosive training devices such as battle noise simulators etc which fail to function are to be treated as blinds.

1.4.9 During unit inspections, technical explosives staff are to check that units hold the correct demolition stores and demolition box and that the instructions used for the destruction of the various blinds with which they may have to deal, are up to date.

1.5 **Demolition Kit Boxed H83**

1.5.1 The Demolition Kit Boxed H83 is primarily for use by unit demolitions qualified personnel on ranges but may also be used by TEA and Joint Service Explosives Ordnance Disposal (JSEOD) Teams if required. The Box steel H83 is the approved container for the storage and transportation of the explosive natures which make up a Kit Boxed H83 and has the DOSR classification number P2639.

1.5.2 On initial configuration the Demolition Kit Boxed H83 will contain the items given in Table 1. Should there be a requirement for electric detonators, they will be issued separately.

TABLE 1 – EXPLOSIVE CONTENTS OF DEMOLITION KIT BOXED

ADAC	Nature	Maximum Quantity
	Charge Demolition PE	4
	Detonator Demolition Non-Electric	10
	Fuze Safety (Metric)	8 m
	Match Fuzee	2 Boxes
	Cord Detonating (Metric)	10 m

1.5.3 The Demolition Kit Boxed H83 is to be painted Signal Red and have the following markings stencilled in paint Marking Golden Yellow on the front face:

(1) DEMOLITION KIT BOXED H83 UN SER No. 0461.

(2) The BKI, i.e. UOT 09 98 000002 indicating:

(a) UOT. Configured in Otterburn Ammunition Compound.

(b) 09 98. Configured in September 1998.

(c) 000002. Demolition Box No. 2.

All Demolition Kit Boxed H83 are to be allocated a local BKI using the format at para 1.5.3(2)

1.5.4 A Hazard Classification Code (HCC) 1.1B hazard warning label is to be affixed to the box.

1.5.5 All explosives used for replenishment must be checked to ensure that it has a minimum of one-year shelf-life remaining, in order that there is no possibility of component parts becoming shelf-life expired during the one-year life of the configured box.

1.5.6 At the time of configuration, the BKI details of all the individual explosives items are to be noted and given to Communications Information System Support (CISS), Defence General Munitions Integrated Project Team (DGM IPT), to enable input onto the ASTRID system. This technical data will ensure visibility and tracking of components to enable control to be exercised in the event of bans, constraints or changes of shelf-life. The format given in Table 2 will ensure that the information is easily transferable.

TABLE 2 FORMAT FOR RECORDING BKI DETAILS

Dem Box BKI	ADAC PE BKI	Qty	ADAC Det Dem Non-Elec BKI	Qty	ADAC Fuze Safety BKI	Qty	ADAC Match Fuzee BKI	Qty	ADAC Cord Det BKI	Qty

1.5.7 Boxes will be issued under local arrangements and the transaction processed normally.

1.5.8 On return the boxes are to be receipted as Condition C3 RAG stocks and when inspected and replenished are to be brought back to account as Condition A1. The box is to have a new BKI with dates changed and will therefore have a new shelf-life of one year from this date. The box may now be returned to stock for re-issue as required.

1.5.9 At each configuration or replenishment the UIC of the Ammunition Technician or Examiner is to be marked on the box.

1.5.10 In the event of a box remaining unissued for a long period (in excess of one year) ASTRID will identify it as being shelf-life expired and downgrade to Condition B4. Upgrade to Condition A1 will be achieved by inspection and confirmation that all items are within their own shelf-lives, have at least one full year of life remaining and updating of the BKI of the Demolition Kit Boxed H83:

(1) Inspection to confirm all items are within their own shelf-lives.

(2) Ensuring all items have at least one full year of shelf-life remaining.

(3) Updating the BKI of the Demolition Kit Boxed H83.

1.6 **Use of Simulator Battle Noise L29A1**

1.6.1 The Simulator Battle Noise L29A1 have replaced the Thunderflash. They are powerful pyrotechnics designed to produce a flash and explosion. Serious injury and damage to equipment can be caused by their incorrect or deliberate misuse. Their limitations in use and safety precautions are detailed in the Joint Service Munitions Control Register (JSMCR).

2 **FIREWORKS**

2.1 **General**

2.1.1 Fireworks, depending on their category, can present a very significant hazard leading to serious injury if used incorrectly or mishandled by unqualified and inexperienced persons. The types of firework now available for sale to the public have been restricted because of the Legislation. Whilst the Armed Forces are disapplied from these regulations, it is Secretary of State for Defence policy that arrangements are to be put in place that are as least as good as those required by the legislation. As such, the purchase of Category 4 fireworks by the Armed Forces is not permitted except in the case of a firework display conducted and controlled solely by a recognised display company.

2.1.2 Fireworks for sale to the general public are classified in BS 7114 Part 1 1998 according to their intended use:

(1) Category 1. Fireworks suitable for use inside domestic buildings. These fireworks should not cause injury to people standing 1m or more away and should not cause damage to property. In the case of hand held fireworks, the person holding them should not be injured.

(2) Category 2. Fireworks suitable for outside use in relatively confined areas. These fireworks should not cause injury to people standing 5 m or more away. The fuse should enable the person lighting the firework to retire safely to a minimum distance of 5 m or more.

(3) Category 3. Fireworks suitable for outdoor use in large open areas. These fireworks should not cause injury to people standing 25 m or more away. People firing these fireworks are to wear suitable personal protection.

(4) Category 4 Fireworks. Category 4 Fireworks are generally the most powerful and hazardous of all categories and are not on sale to the general public. Displays are only to be conducted by a display company competent to handle this category.

2.2 **Displays**

2.2.1 HSE Guidance. HSE guidance on firework displays is contained in the HSE Guide entitled Working Together on Fireworks Displays, A guide to Safety for Fireworks Display organisers and operators, HSE Books, 2006, HS(G) 123, (ISBN 0 717661961). Whilst this remains a guide the safety principles and guidelines are to be followed.

2.2.2 Planning a Display. The first consideration should be to have the task carried out by either a professional display company which is a member of the British Pyrotechnists Association or the Explosives Industry Group of the Confederation of British Industry. These organisations employ Competent Display Operators (CDO) to set up and conduct the display.

2.2.3 In-House Managed Displays. No military person nor MOD employee, is to conduct a display unless he/she has attended the appropriate course run by a manufacturer or an equivalent commercial training organisation, and are deemed to be CDO within the meaning given in the HSE Guide referred to in Para 1.10.3. Evidence of training, qualification, experience and competence to carry out a proper Risk Assessment, are pre-requisites before conducting any such display. For the purposes of these regulations, this excludes Category 4 Fireworks. Commercially based training continues to have no statutory nor MOD approved standing currently but such training constitutes best practice.

2.2.4 Official and Private Displays. Displays published in the units' daily orders are official displays and persons nominated to initiate fireworks are deemed to be on duty. The Head of Establishment must ensure that appropriate insurance or indemnity arrangements are put in place so as to ensure that any claims for compensation which may arise out of firework displays do not fall to public funds.

2.2.5 If the display is not published on the units' daily orders it is deemed to be a private display and unit personnel are not engaged in official duty. In this case the MOD has no liability so personal and public liability must operate. Private functions held in messes or clubs require a CDO to initiate fireworks and these functions too, must also be covered by insurance. Firework displays in MOD quarters are regarded as private functions for which the MOD has no liability.

2.2.6 AT/ATO/(RN, RAF or Civilian Equivalent) Involvement. AT/ATO/(RN, RAF or Civilian Equivalent) are not qualified as CDO by virtue of their training. They are not to be involved in firework displays as part of or in the performance of their technical duties. They may, however, conduct displays strictly as CDO after receiving the appropriate training and with the sanction of the appropriate IE, so long as it is clearly understood that they do so outside the requirements of their trade and military responsibilities, and without obligation.

2.3 **Storage**

2.3.1 The following paragraphs provide regulations for the storage of fireworks and apply in all situations where fireworks, including those for theatrical effect, in UN Class 1, are stored.

2.3.2 Fireworks, for MOD purposes only may be stored for up to 24 hours in an otherwise empty compartment of a PES. If other explosives are stored in the same compartment of the PES, approval of the Technical Explosive Authority is required. Particular care is to be taken when handling fireworks due to the inherent weakness of the paper or cardboard cases and the high probability of spillage of the filling. Firework fillings are very sensitive to impact, friction, heat or sparks. Therefore, PES are, after a Risk Assessment, to be carefully cleaned after fireworks have been stored within, and before any other explosive is stored.

2.3.3 If fireworks are to be stored in PES for periods in excess of 24 hours, the Explosives Safety Representative is to apply to DOSR, through the appropriate IE, for formal classification in advance of the arrival of the fireworks on the unit. Receipt of formal DOSR classification is a pre-requisite for storage of fireworks for periods in excess of 24 hours. The DOSR classification process is likely to take in excess of 28 days. Early application is therefore imperative.

2.3.4 Generally, on receipt, and prior to storage in a PES for periods in excess of 24 hours, the fireworks are to be suitably over-packed in metal containers to prevent the leakage of black powder/pyrotechnic composition.

2.3.5 Fireworks may only be stored for up to a maximum of 3 months from receipt, after which time they must be destroyed.

2.3.6 Owing to the exceptional circumstances that prevail in Northern Ireland, provided that all firework containers are undamaged and totally enclose their contents, over-packing of fireworks being stored in the Ammunition Sub Depot Ballykinler under temporary DOSR classification is not required unless they need to be stored for longer than 12 months. Metal containers should be used for this whenever possible; however, where the size of the fireworks prevents this tri-wall containers can be used. Any firework containers showing damage must be immediately over-packed on receipt into storage.

CHAPTER 17

ANNEX C

APPENDIX 1

IDENTIFICATION OF EXPERIMENTAL EXPLOSIVES

CONTENTS

1 TRIALS AND EXPERIMENTAL EXPLOSIVES

1.1 Introduction

1.1.1 Explosives manufactured or specially procured for troop trials fall into two categories:

(1) Experimental Explosives. These are explosives specially made for experimental purposes.

(2) Trials Explosives. These are explosives in their finished state procured for the purpose of trials; they may come from outside agencies, including foreign manufacturers and governments and normally bear the markings appropriate to the country of origin or those used by the manufacturer.

1.2 Experimental Explosives

1.2.1 Experimental explosives are provided from experimental requisitions for evaluation purposes. They are then identified as follows:

(1) They are allotted an 'XL' and an 'E' model number e.g. XL 23E1.

(2) Containers and explosives are painted and stencilled in the normal basic colours appropriate to the explosives.

1.2.2 Container markings are augmented by the following details:

(1) Rectangular and similar containers have a 25 mm dark violet stripe marked centrally across the top, sides and ends.

(2) Cylindrical containers have two longitudinal dark violet stripes not exceeding 25 mm in width, marked from end to end along the body of the cylinder. They are placed diametrically opposite to each other.

(3) The letters EXPT may be marked on the containers.

Note: Circumferential bands are not used.

1.2.3 Explosives markings are augmented by the following details:

(1) Two dark violet stripes diametrically opposed are marked on the body.

(2) Cartridge cases are stamped on the base and may, in addition to the two longitudinal stripes, be marked with one dark violet stripe or bar across the base, the width of which does not exceed 13 mm.

(3) Small arms ammunition, percussion and electric tubes may be marked with a narrow dark violet band on the cartridge case. This colour is not applied to bullet tips or across the base of the case.

(4) Fuzes, primers, tracers and other small stores have the dark violet marking applied to be clearly visible after the component is assembled to another component. Additionally, nose fuzes fitted with a cover will also have the cover marked. Proximity fuzes are only marked on the metal flange of the back-end body where it protrudes from the shell. The protective nose cover of certain proximity fuzes may be painted dark violet overall indicating an operational variant.

(5) Experimental markings on explosives and containers are not to obscure or obliterate any other identification markings or colours.

(6) Requisition numbers and any other particulars required by the requisitioning authority may be found prominently marked in a contrasting colour.

Note: Internal components e.g. gaines, boosters, smoke containers *etc* are not marked as they are not visible after assembly.

1.3 **Trials Explosives**

1.3.1 Trials Explosives are provided as a result of anticipated requirements and may come from home or foreign manufacturers. They are provided as a result of trials requisitions for user assessment. They normally bear the markings appropriate to their country of origin or those used by their manufacturer.

CHAPTER 17

ANNEX C

APPENDIX 2

BATTLE NOISE SIMULATORS L29A1

CONTENTS

WARNING: INJURIES AND DAMAGE. INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN BE CAUSED BY THE MISUSE OF BATTLE NOISE SIMULATORS.

1 USERS ARE TO BE TRAINED IN THE USE OF BATTLE NOISE SIMULATORS IN ACCORDANCE WITH INFANTRY TRAINING PAMPHLET VOL III.

1.1 Introduction

1.1.1 The Battle Noise Simulators are designed to produce a flash and explosion and are for use by troops in the open. The use of the Battle Noise Simulators in confined spaces is forbidden. Their use in such places as rooms or weapon pits, dangerously increases the effects of the explosion.

1.2 Limitations – General

1.1.2 Directions for use are printed on the Battle Noise Simulators and these are to be strictly complied with in addition to the following:

(1) Users closer than 10 m must wear hearing protection. If the number of explosions is likely to exceed more than 100 in a 24hr period than safety distances should be increased to 20 m.

(2) The construction of the Simulators is not to be tampered with or modified.

(3) Simulators are not to be used in or near vehicles, equipment, inflammable stores, barns or other fire risks.

(4) When firing or throwing a series of Simulators the thrower is to count the explosions. All Blinds are to be located and destroyed in accordance with Infantry Training Vol IV Pam No. 21 (Army Code No. 71080).

(5) The unauthorised possession or retention of Simulators by individuals is forbidden.

(6) When Simulators are used in training or at Tattoos, displays or demonstrations etc, the following safety distances are to be observed from the point of burst:

(a) When the General Public is Present - 100 m. In cases where a safety distance of 100 m is not available the unit is to apply to the local Technical Explosives Authority for authority for the safety distance to be reduced.

(b) When the General Public is not present - 10 m. The distance is to be increased (as considered necessary by the officer in charge) if the ground is stony or if spent cartridge cases or other potential missiles are present.

(7) Simulators are not to be used as a Diver Recall Signal (DRS) during training, except when the diver's life is in immediate danger.

1.3 **Limitations - Simulator Battle Noise Electric L29A1**

1.3.1 The following limitations apply to Simulator Battle Noise Electric L29A1:

(1) Users are to observe normal precautions for Electro-Static Discharge before handling the Simulator. This may be achieved by placing the hands on the ground to discharge any static electricity.

(2) The Simulator is to be placed on the ground. It is not to be buried.

(3) Only one Simulator is to be attached to each firing cable.

(4) The Base Plug is to remain fitted until required for use.

(5) If the prepared Simulator is not used, the Base Plug must be replaced immediately.

CHAPTER 17

ANNEX D

TREATMENT OF PHOSPHORUS BURNS

CONTENTS

WARNING: SYSTEMIC POISONING. PREPARATIONS OTHER THAN WATER ARE NOT TO BE USED AS WHITE PHOSPHORUS IS SOLUBLE IN OIL OR GREASE AND MAY BE ABSORBED INTO THE SYSTEM RESULTING IN SYSTEMIC POISONING.

1 WHITE PHOSPHORUS

1.1 Responsibility

1.1.1 It is the responsibility of the OC Unit to ensure that all persons connected with the handling or storage of White Phosphorus (WP) ammunition are conversant with the method of rendering first aid to any person burnt or contaminated by WP.

1.1.2 A copy of para 1.2 of this Annex is to be displayed wherever WP ammunition is stored.

1.2 Treatment

1.2.1 The following first aid treatment is to be given in the event of any person being burnt or contaminated by WP:

1.2.2 Where practicable, immediately immerse the burn area in water, or alternatively, pour liberal quantities of water over the area. An attempt may be made to remove loose WP particles with forceps while under water, no attempt is to be made to dig out imbedded particles. Do not use the fingers to avoid burning.

1.2.3 Apply a large wet dressing and ensure that it is kept wet or burning will recommence.

1.2.4 In the event of WP being splashed into the eye of a person, copious quantities of water are to be used to wash the eye and a wet dressing, in the form of a pad, applied. This dressing is to be kept wet by pouring water on to it; it is not to be removed or allowed to dry, as in either instance, burning will recommence.

1.2.5 The contaminated person is to be taken to the nearest medical establishment for treatment as quickly as possible.

Note: The Medical Authorities have authorised only the treatment in this section. Copper Sulphate, in any form, and Hydrogen Peroxide are not to be included as part of first aid treatment for WP burns.

1.2.6 The requirements to provide a filled water container for each building or area in which explosives belonging to Compatibility Group H is stored and the requirements to provide clean water and gauze for first aid treatment, are detailed in this document.

2 RED PHOSPHORUS

WARNING: RED PHOSPHORUS BURNS. RED PHOSPHORUS (RP) UNLIKE WP IS NOT LIABLE TO SPONTANEOUS IGNITION. IT IS HOWEVER FRICTION SENSITIVE AND CAN RE-IGNITE. RP BURNS SHOULD BE TREATED IN THE SAME WAY AS WP BURNS.

2.1 General

2.1.1 Amorphous RP is the main ingredient of Grenades Smoke Discharger L8 and Grenade Smoke Screening L84. Any hazards are most likely to be from the smoke produced by the activated grenades but some hazard is posed by the substance itself. Actual contact is unlikely if the grenades are used properly.

2.2 Hazard

2.2.1 Although RP is not liable to spontaneous ignition there is a possibility of RP reverting to WP on combustion in an oxygen deprived environment.

2.2.2 All personnel are to be briefed on the hazards of both solid phosphorus and the smoke produced. Personnel should not enter the smoke cloud at training and should avoid contact with any unburnt solid particles.

2.2.3 Although the Service S6 Respirator provides full protection from the smoke hazard, personnel should not pass through the grenade target area as they could be contaminated with particles of RP.

2.2.4 Extinguished RP particles may re-ignite if, during the burning process, WP has been produced. Care should be taken to avoid friction when removing quenched RP particles as this may cause re-ignition.

2.3 Treatment

2.3.1 The first aid treatment for any person being burnt or contaminated by RP is the same as for WP burns.

CHAPTER 17

ANNEX E

TOXIC HAZARDS

CONTENTS

1 TOXIC HAZARDS

1.1 General

1.1.1 It has been established in recent years that toxic hazards can exist with certain types of explosives and associated packaging. It is important that all personnel concerned with the handling of affected items are fully acquainted with the relevant safety precautions to be observed.

2 WOODEN AMMUNITION BOXES AND SHIPPING PALLETS OF UNITED STATES ORIGIN

2.1 Introduction

2.1.1 Wooden ammunition boxes and shipping pallets of United States origin may have been manufactured from wood which has been impregnated with a 5% solution of Pentachlorophenal (PCP) as a preservative.

WARNING: TOXIC SUBSTANCE. PCP IS TOXIC AND ROUTES BY CONTACT, INHALATION AND INGESTION ARE TO BE AVOIDED. EYE OR SKIN IRRITATIONS SHOULD BE REFERRED TO A MEDICAL OFFICER IMMEDIATELY. PERSONNEL HANDLING PCP IMPREGNATED AMMUNITION PALLETS OR BOXES ARE TO WEAR PROTECTIVE EQUIPMENT.

2.1.2 Ammunition boxes and shipping pallets manufactured from PCP impregnated wood may be identified by their greenish tint appearance.

2.2 Safety Precautions

WARNING: TOXIC VAPOURS. HEATING OR BURNING OF PCP TREATED WOOD IN A CLOSED OR INADEQUATELY VENTILATED SPACE IS TO BE AVOIDED. BECAUSE OF THE POSSIBILITYOF CONTACT, INHALATION OR INGESTION OF PCP, PROTECTIVE EQUIPMENT IS TO BE WORN.

2.2.1 Heating or burning of PCP treated wood may cause the PCP to vapourize. Toxic fumes which may be inhaled or ingested are likely to build up if this is carried out in closed or inadequately ventilated locations.

WARNING: TOXIC SUBSTANCE. PCP IMPREGNATED WOOD DUST IS TOXIC ON CONTACT WITH THE SKIN AND MAY BE INHALED AND INGESTED. PROTECTIVE EQUIPMENT IS TO BE WORN.

2.2.2 Working the surface of PCP impregnated wood by sanding, sawing or similar processes may release toxic wood dust into the atmosphere which could be inhaled, ingested or contaminate the skin or clothing. Personnel are not to work the surface of any PCP impregnated wood.

2.2.3 Personnel handling PCP impregnated wooden ammunition boxes or pallets are to wear the protective equipment detailed as follows:

(1) Gloves industrial.

(2) Coveralls.

(3) Respirator, Half Mask, Light Fumes.

3 SPECIAL REQUIREMENTS FOR AMMUNITION CONTAINING RED PHOSPHORUS

3.1 Introduction

WARNING: TOXIC GAS. PHOSPHINE GAS IS TOXIC AND IF INHALED IN LARGE QUANTITIES OVER LONG PERIODS, CAN CAUSE INJURY. INHALATION IS TO BE AVOIDED.

3.1.1 An inherent property of ammunition containing Red Phosphorus is that it generates phosphine gas.

3.1.2 The Service items affected are detailed on the JSMCR:

3.2 Safety Precautions

WARNING: TOXIC GAS. ESHs CONTAINING RED PHOSPHORUS AMMUNITION THAT EMITS PHOSPHINE GAS ARE TO BE VENTILATED.

3.2.1 Explosives Storehouses (ESHs) containing the affected items are to be ventilated at regular intervals as decided by the Senior Technical Explosives Authority (TEA).

WARNING: TOXIC GAS. RED PHOSPHORUS AMMUNITION CONTAINERS ARE ONLY TO BE OPENED IN WELL VENTILATED AREAS.

3.2.2 When opening containers of the affected ammunition, the following safety precautions are to be observed:

(1) The Area must be well ventilated.

(2) The Containers are to be at arms length from the operator’s head.

4 RAPIER ROCKET MOTOR EFFLUX

4.1 Introduction

WARNING: TOXIC SUBSTANCE. EQUIPMENT SURFACES EXPOSED TO RAPIER ROCKET MOTOR EFFLUX WILL BE CONTAMINATED BY DEPOSITED LEAD. AVOID HAND TO MOUTH ACTIVITY, WASH HANDS.

4.1.1 The efflux from Surface to Air Guided Weapon (SAGW) Rapier rocket motors is contaminated with lead, and will leave lead deposits on Rapier equipment surfaces.

4.2 Safety Precautions

4.2.1 In order to avoid possible lead poisoning, after handling exposed surfaces of Rapier equipment, hand to mouth activity such as smoking or eating is to be delayed until hands have been washed.

4.2.2 Where practicable, gloves should be worn or the exposed surfaces of the Rapier equipment should be washed down before any activity commences which involves handling such areas.

5 GASEOUS TRITIUM LIGHT SOURCES

5.1 Introduction

WARNING: RADIOACTIVE GAS. BREAKAGE OF A TRILUX LAMP RESULTS IN THE RELEASE OF THE MILDLY RADIOACTIVE TRITIUM GAS. IN THE EVENT OF A BREAKAGE THE FOLLOWING PRECAUTIONS ARE TO BE TAKEN:

(1) DO NOT INHALE THE ESCAPING GAS AND EVACUATE THE IMMEDIATE AREA.

(2) IF BREAKAGE OCCURS INDOORS, DOORS AND WINDOWS ARE TO BE OPENED TO ALLOW THE GAS TO CLEAR.

(3) THE BROKEN PARTS ARE NOT TO BE HANDLED WITH BARE HANDS.

(4) ALL BREAKAGES ARE TO BE SEGREGATED AND REPORTED TO THE SATO/(RN, RAF or CIVILIAN EQUIVALENT) WHO WILL ADVISE DISPOSAL ACTION.

5.2 Safety Precautions

5.2.1 The breakage of a trilux lamp will result in the release of Tritium Gas. There is little danger from the gas if the breakage occurs outside, however, if it occurs inside:

(1) Do not inhale the gas and evacuate the immediate area.

(2) Doors and windows are to be opened to allow the gas to clear.

(3) Do not handle broken parts with bare hands.

5.2.2 Full instructions on breakages are contained in Instructions for Radiological Protection - JSP 392 Chapter 32.

6 INFRARED PAINT

6.1 Introduction

WARNING: INFRARED PAINT. INFRARED REFLECTING PAINT CONTAINS CHROMIUM OXIDE AND COBALT OXIDE WHICH ARE TOXIC. PROTECTIVE EQUIPMENT IS TO BE WORN.

6.1.1 Infrared Reflecting Paint used on Shipping and Storage Containers contains chromium oxide and cobalt oxide. Guided Missiles SA Javelin may be encountered in containers that have been sprayed with this paint.

6.2 Safety Precautions

6.2.1 The following precautions are to be taken:

(1) Spraying or dry sanding of containers is not to be carried out unless breathing apparatus is worn.

(2) For minor repairs, application by brush is recommended, in which case breathing apparatus is not required, however, dry sanding is to be avoided.

(3) Further information may be obtained from the local TEA.

7 TAGGED PLASTIC EXPLOSIVES

7.1 Introduction

WARNING: TOXIC SUBSTANCE. THE TAGGANT USED IS TOXIC AND ROUTES BY CONTACT, INHALATION AND INGESTION ARE TO BE AVOIDED. IF INGESTION OCCURS, OR ADVERSE REACTION FOLLOWING EXPOSURE TO VAPOUR, SEEK MEDICAL ADVICE IMMEDIATELY. IF CONTACT WITH EYES, MOUTH OR SKIN OCCURS, FLUSH WITH COPIOUS AMOUNTS OF CLEAN WATER AND SEEK MEDICAL ADVICE IMMEDIATELY.

7.1.1 Taggant is now added to plastic explosives in order to enable them to be easily detected by security equipment at airports etc. There is an exemption for explosives manufactured or imported into the UK prior to 31st July 1997 and held by the MoD. This exemption lasted for fifteen years until 31st July 2012. All exempted stocks must be used, or else disposed of, prior to this date. The following munitions currently contain the Taggant:

(1) Plastic Explosives

(2) Sheet Explosives

(3) Reactive Armours

(4) Linear Cutting Charges

(5) Claymore Mine (change to whatever current designation is)

7.2 Safety Precautions

WARNING: TOXIC SUBSTANCE. THE TAGGANT USED IS TOXIC AND ROUTES BY CONTACT, INHALATION AND INGESTION ARE TO BE AVOIDED. IF INGESTION OCCURS, OR ADVERSE REACTION FOLLOWING EXPOSURE TO VAPOUR, SEEK MEDICAL ADVICE IMMEDIATELY. IF CONTACT WITH EYES, MOUTH OR SKIN OCCURS, FLUSH WITH COPIOUS AMOUNTS OF CLEAN WATER AND SEEK MEDICAL ADVICE IMMEDIATELY.

7.2.1 The Taggant to be used within the UK is 2,3-Dimethyl-2,3-Dinitrobutane (DMNB) and it is to be present at a minimum concentration of 0.1% by mass. It is toxic and must be handled in accordance with the precautions detailed below:

(1) Packages containing such explosives must only be opened in a well-ventilated area as DMNB vapour may build up in boxes during storage (especially at high temperatures). If for any reason there is a possibility of particulate explosives being dispersed in the air then a suitable particulate respirator must be worn.

(2) Nitrile gloves are to be worn when handling explosives. They should be disposed of once removed or in any case changed every two hours.

(3) If ingestion of the explosives occurs, or adverse reaction following exposure to the vapour, seek medical advice immediately. If contact with eyes, mouth or skin occurs, flush with copious amounts of clean water and seek medical advice immediately.

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