

CHAPTER 19**EXPLOSIVES PROCESSING****CONTENTS**

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1 PROCESSING

1.1 Introduction

1.1.1 In the context of this chapter all references to explosives are deemed to include ammunition and munitions.

1.2 Processing- Definition

1.2.1 Generally tasks involving only the marking of boxes or of articles, which are usually stored unpackaged, are not considered to be processing. Neither is the assembly and disassembly of approved Unit Loads and pallets of explosives items. Hence where the risks associated with such work would be increased by moving the explosives to a processing facility, such activities may be conducted inside explosives storehouses or at licensed sites. However such activities must be the subject of a risk assessment and where the risks are acceptable they may be permitted with the consent of the IE.

1.2.2 Any task involving the manufacture, assembly, repair, testing, modification, or disassembly of explosives carries with it an increased risk of accidental initiation. It is therefore regarded as explosives processing and is to be carried out in a facility suitable for the explosives process activity and normally in isolation from the storage of bulk stocks of explosives. Such tasks include any operation where the integrity of the primary package is breached and the explosive item is exposed. See also Chapter 12, paras 5.19. Many activities, such as the of loading of explosive armament stores on to an aircraft or the loading of munitions into armoured fighting vehicles, are not covered by this chapter as the policy, regulations and responsibilities for these activities are promulgated elsewhere. Each situation must be considered on its merits and the appropriate IE can advise if required. Never the less the underlying principles of this Chapter will apply and risk assessment will determine the need for any particular precautions, such as the need to carry out operations in isolation or the taking of anti-static precautions.

1.2.3 Although testing is generally viewed as processing, there is an increasing use of electronic devices for collecting data on the munitions inventory and often these are used inside storehouses. The use of these devices raises safety issues in relation to the devices themselves, the procedures and instruments necessary for

reading and downloading of the information and the location and numbers of personnel involved in the data gathering function (see Annex A).

2 ASSESSING THE RISKS

2.1 Risk Assessment

2.1.1 A risk assessment is to be carried out prior to commencing any explosives processing activity. Consideration of the nature of the explosives will determine the most suitable processing techniques. To aid the risk assessment, as a minimum, information regarding the following hazardous properties of the explosives must be available to those carrying out such risk assessments: Sensitiveness data (from Explosives Hazard Data Sheets), information regarding chemical stability, data on the behaviour of the explosives when initiated in an accident (including HCC where appropriate) and health hazards. However for the manufacture of new experimental explosives compositions this will clearly not be the case and the procedure given in paragraph 4.6 below must be followed. Where one has been produced, the Safety Case for a weapon or munition will be central to any risk assessment. The starting point for any such risk assessment will be the consideration of the use of remote processing or testing (see paragraph 5.2). If this is not considered necessary, or reasonably practicable, consideration must then be given to minimising and controlling the risks in other ways. In many instances the process will be an adaptation of established, existing practices and procedures. However vigilance will be required to ensure that significant differences are not unwittingly introduced or that a previously existing risk assessment with intrinsic flaws is not adopted.

2.1.2 The risk assessment process should direct the selection of appropriate process facilities and tools etc. For example the likely presence of explosives dust or a flammable atmosphere will determine the choice of electrical category of the process building used. The sensitiveness data from the Explosives Hazard Data Sheet will determine the need for precautions against static electricity, the use of non-sparking tools or the avoidance of impact or friction. This part of the risk assessment may be aided by using standard processing conditions for grouped categories of explosives providing the risk assessor understands that the basis for this grouping is the sensitiveness data for the explosives. Detailed advice regarding the construction of equipment for processing and testing of explosives is given at Annex B.

2.1.3 An assessment of the likely reaction of the explosives item being processed, in an unplanned event, should be undertaken. The ESTC classification awarded to the packaged item is no longer applicable, where the item has been removed from that package, as the reaction may be different.

2.2 Recording Risk Assessment

2.2.1 The significant findings of the risk assessment must be recorded. Often the record will be embodied in several documents. These may include the following: the explosives licence, the ESTC Quantified Risk Assessment for the site, a generic risk assessment, a task specific risk assessment, a Weapon Safety Case and an Approval to Process. Risk assessments are to be regularly reviewed; generally this takes the form of an annual review. They must also be reviewed when any changes are made to the process or to the design/build standard of the munition. The risk assessment must also be reviewed after a long period of time has elapsed since processing was last carried out; circumstances may have changed.

2.3 COSHH Assessments Associated with Explosives

2.3.1 In addition to the more usual COSHH Assessments associated with explosives processing e.g. for solvents, it is important to remember that many

explosives and propellants themselves present a risk to health. Where any health hazards associated with a particular explosive have been identified, a Control of Substances Hazardous to Health (COSHH) Assessment will also be required relating to the hazard from the explosives. Where explosives with associated health hazards are handled as bulk substances personal cleanliness is important and, dependant on the level of exposure, consideration should be given to the provision of suitable washing facilities and showers. For further guidance see Chapter 17, paras 5.

3 SAFE SYSTEMS OF WORK

3.1 Introduction

3.1.1 Safe processing of explosives will be achieved through the implementation of Safe Systems of Work (SSOW). The form that these will take will be guided by risk assessment and will comprise, amongst other things, elements as for the headings of the following paragraphs. These may be summarised as follows: (a) competent staff, (b) adequate supervision, (c) suitable written work instructions, (d) appropriate work equipment and (e) adequate work facilities. For these to be effective management systems must be in place to ensure configuration control (see paragraphs 4.9 and 4.10 below) for example to ensure that the correct version of work instructions is used to process the particular variant of a complex weapon. This will be aided by the adoption of recognised Quality Control Systems.

3.1.2 There are occasions when commercial companies are required to carry out work on munitions in MoD establishments. Under these circumstances the Head of Establishment (HoE) is to ensure that these companies implement a SSOW. This equally applies to MoD staff employed at sites not under the control of their HoE.

4 CONTROLLING THE RISKS- MANAGEMENT ARRANGEMENTS

4.1 Explosives and Man Limits

4.1.1 A key element in minimising risks is achieved by keeping the number of personnel and the quantity of explosives present in a processing facility to the absolute minimum necessary to safely and efficiently carry out the operation. The guiding principle must be that if a task can be carried out in isolation it should be. Where high throughput operations, such as the make up or dismantling of munitions, require production line type procedures for them to be carried out efficiently, due consideration must be given to the risks involved. This can only be justified where the risks are very low because, by the very nature of the process, the probability of initiation is very low and also that to do otherwise would result in an overall increase of the risks. See also paragraph 4.8 below. The thought processes, outlined in the preceding sentences, will identify the man and explosives limits appropriate to the task. These are to be displayed in the process facility during work and the explosives limits are never to be exceeded. Personnel working with explosives should not normally work alone. Where this is deemed to be necessary it is essential that arrangements are made to ensure regular contact and that aid is available in the event of a mishap.

4.2 Determination of Man Limits

4.2.1 The man limits do not include transitory supervisory staff or authorised occasional visitors. However, sound safety practice requires that the number of visitors to an explosives facility should be kept to the minimum. This requirement is tempered by the need to allow access to senior managers, auditors and others who may enhance the safety of activities overall. All personnel who are permanently located at a process facility, and are at direct risk in the event of an accidental explosion, must be considered as a part of the man limit. It is usual to quote the

limits as “maximum” and “normal”. Maximum includes regular transitory visitors such as those delivering or removing explosives.

4.3 Explosives Stock Control in Processing Areas

4.3.1 The total explosives content of all explosives items present at a process facility will be taken into consideration when calculating the quantity of explosives held in relation to the authorised explosives limit of the facility. This includes explosives awaiting processing or return to storage whether in transit bays or in trucks. To ensure that the explosives limits are not exceeded an effective stock recording system must be adopted.

4.4 Limitation of Explosives

4.4.1 In addition to any limitation imposed by the explosives licence, the quantity of explosives present in a process building is to be kept to the minimum quantity consistent with a sensible working regime for the processing task in hand. This is in order to minimise the severity of any consequences arising from an accidental fire or initiation. The total quantity of explosives in a process building, including that in transit areas, should not exceed that necessary for a day’s working. Similarly it is good practice to keep the quantity of exposed explosives to the minimum. Whenever possible, only one box or container of explosives should be open at any one time and all explosives, not being worked on, should be suitably covered to minimise the risk of initiation by spark.

4.4.2 Mitigation measures should be employed to reduce, as far as is reasonably practicable, the possibility of propagation between explosives present in the processing area.

4.5 Overnight Storage of Explosives in Process Buildings

4.5.1 Where it is necessary to do so for the efficient operation of a process, explosives may be kept in an explosives process building overnight providing that the building is secure to the standards required by JSP 440.

4.6 Unauthorised Use of Ammunition

4.6.1 Units or individuals are not to:

- (1) Carry out experiments involving the alteration of charges of Service propellants or of bursting charges.
- (2) Use non-Service ammunition of any type, unless the ammunition has been obtained through official channels for a specific use.
- (3) Use ammunition for purposes other than those for which it is authorised.
- (4) Use ammunition in other than the manner prescribed in the Ministry of Defence (MOD) publications.
- (5) Make use of an explosive device that is only authorised for other specialised units.
- (6) Manufacture or use Home Made Explosives (HME) unless specifically authorised by the IEs.
- (7) Manufacture or use simulated IEDs without authority or technical supervision. IED Training Aids are only to be manufactured, or held, by those units that have a specific role for IEDD training, such as the ASofA, DEODS & OPTAG. Units involved in IEDD, such as 11 EOD Regt RLC, RN, RE and RAF IEDD teams are also permitted to manufacture and possess IED Training Aids. The explosive components of simulated IEDS are restricted to recognised and authorised electric EOD simulators and Igniters Safety Fuze Electric (ISFE).

4.7 Home Made Explosives and New Experimental Explosives

4.7.1 The manufacture of copies of Home Made Explosives recipes by members of the Services is to be authorised by the appropriate IE. All individual recipes and processing techniques must be approved by the Defence Science and Technology Laboratory (DSTL). The manufacturing process is to be detailed in Technical Instructions, which are to be on a restricted distribution and are to meet the requirements of civil legislation. Only named individuals filling specific appointments must carry out the manufacture. Their written authority to manufacture lasts only for the duration of their tenure in the appointment. Exceptionally, for operational reasons in theatres, the relevant IE may authorise the production of previously unencountered HMEs for trials purposes. It will not be made in quantities of more than 10 grammes until it has been cleared as safe to do so by DSTL.

4.7.2 Experimental explosives will only be made by DSTL. The first priority when manufacturing new experimental explosives is to obtain sensitiveness and other essential safety data on the material. Such data will include information on chemical stability. The explosives will initially be made remotely in quantities sufficient only to obtain this data. All such manufacture will be specifically authorised by the relevant IE, usually through the issue of an explosives licence, and will be carried out in accordance with local procedures written to specifically cover such manufacture. Similar procedures will apply to the manufacture of copies of Home Made Explosives recipes by the Research Establishments. Experimental explosives may only be transported or made outside of DSTL sites once an Explosives Hazard Data Sheet has been prepared.

4.8 Low Risk Operations

4.8.1 The holding within process facilities of quantities of explosives in excess of that necessary for half a day's work may be acceptable where the risks have been assessed as being particularly low. The following is an example of such a situation. The task has intrinsically very low risks associated with it due to a low probability of initiation, e.g. the visual inspection and marking of articles; in addition, the bulk of the explosives are held in receipt and issue bays separated by a substantial wall and the explosives will not give rise to mass effects, e.g. Hazard Divisions 1.2 and 1.4 explosives or small quantities of Hazard Division 1.3. Performing separate tasks with different natures of munitions in a single location is not normally permitted. However, where a situation such as that described in this paragraph exists similar but separate tasks may be permitted to be carried out simultaneously, for instance visual inspection of small quantities of two different types of small arms ammunition. The key to permitting both of the foregoing situations is that the overall risks are reduced by decreasing transport and movements etc. This policy will never apply where exposed explosives substances are present or could be exposed as a result of the process. See also paragraph 4.1 above.

4.9 Supervision, Training and Competency

4.9.1 Training needs will also be considered as a part of the risk assessment. Training in general health and safety and basic explosives safety as well as task specific training is a fundamental requirement. Records of training must be maintained and be available for scrutiny. Staff must have appropriate written authorisation indicating their competency to carry out particular tasks, competency being a combination of factors including training and experience. This authorisation will normally be by the appropriate line manager. It is permissible to train staff "on the job" providing they are under the close supervision of an experienced operative and are being trained to a recognised standard. Adequate supervision at all levels will ensure standards are maintained by passing on the lessons of experience.

4.10 Work Instructions

4.10.1 As a part of the risk assessment process, the risk assessor will consider the provision and adequacy of work instructions as they form one of the most important control measures and are complementary with training and supervision. The level of detail required will be determined by the level of training and competency of the operatives, as well as the complexity of the process and/or weapon. They will be available at the process facility during working hours. They may consist of task specific work instructions supplemented by general instructions in which case both must be present. They may take the form of manuals etc. For completely new processes a "dummy run" or "slow run through" using inert materials will often aid the compilation of work instructions. For new high throughput or very complex tasks the optimum layout of the work may be established using a proving exercise. Records of these exercises shall be maintained to justify the selection of particular working methods. Work instructions must be authorised by a competent person. This will normally be the most senior officer with intimate knowledge of the process and must not be below the level of Major or equivalent. He must himself be authorised as competent by his senior officer who must be a Lieutenant Colonel or equivalent.

4.11 Configuration Management and Interface Specification

4.11.1 Where it is applicable, i.e. to new munitions intended for the MoD inventory, the Integrated Project Team is responsible for ensuring that the principles of Configuration Management, as defined in Def Stan 05-57, is applied from product concept to disposal. The level of application of Configuration Management should be defined in the contract and detailed in the Configuration Management Plan. Configuration Management ensures that the internal and external interfaces and various parts of a complete product or system remain compatible, including spares, test equipment, tools ancillaries, support documentation, software, and the munitions hardware.

4.11.2 In addition, where the above applies, an Interface Specification shall be provided and maintained by the Integrated Project Team. The Interface Specification shall define the specification, standard and responsibility for the supply of building services that interfaces with the munitions system i.e. electrical, gaseous, pneumatic, mechanical, environment, cleanliness etc.

5 CONTROLLING THE RISKS- PRACTICAL ARRANGEMENTS

5.1 Facility

5.1.1 Work may only be carried out in an explosives processing facility that is assessed as completely suitable in all respects for the task. In addition it must have a valid Explosives Licence which is adequate and suitable in terms of both the quantity and type of explosives concerned and also for the particular nature of the tasks involved (see Chapters 6 and 12).

5.2 Remote and Guarded Testing and Processing

5.2.1 Consideration must always be given to the necessity for the use of remote or guarded operations for any process or test involving explosives. Operating remotely is necessary where the explosives composition is unusually sensitive or the nature of the operation is considered more likely than is normal to lead to a fire or explosion. The use of remote operation must be such as to ensure that operatives are protected from the effects of an explosion or deflagration. The type and extent of separation of the operatives and others from the explosives process or test will depend on the nature and quantity of explosives involved. For small quantities of sensitive substances or small devices adequate explosives guards and appropriate

protective gloves or guarded tweezers combined with suitable Personal Protective Equipment (PPE) may suffice (see paragraphs 5.5 and 5.6 below). The testing of small Electro Explosives Devices (EEDs) is to be carried out with the device secured in a special-to-type vented box or container designed to contain the effects of an inadvertent ignition of the item (see paragraph 5.3 below for electrical precautions). For larger quantities of explosives it may be necessary to construct separate and remote purpose built control rooms and process facilities. The design of all such control rooms and process facilities, which must be sufficient to protect the operators from the effects of an inadvertent ignition or explosion occurring during the process operation, must be endorsed by TA (Structures) to ESTC. Reference to the design document or a copy of TA (Structures) report must form a part of the risk assessment. Such process buildings are to be designed to contain all the expected effects from an inadvertent explosion of the explosives items within it, or to direct the effects and to be sited so that no other facility or any personnel are at risk. Where such facilities are operated it is important to ensure that management control systems are established to prevent personnel entering the area in or around the process building where a hazard exists from blast or debris during processing operations.

5.3 Electrical Testing of Weapons and EEDs

5.3.1 The requirements for remote testing outlined in the previous paragraph will normally also apply to the electrical testing of the electrical circuits of weapons. However, it is permissible to test weapons with the operators remaining along side them under the following circumstances. Alongside testing of such systems needs to be fully justified in a weapon safety case against the principles set out in Def Stan 07-85 (such a case needs to show that no electrical power or induced electromagnetic energy can be applied to the firing circuits and that at least two safety breaks remain in circuit at all times). The safety case must be agreed by DOSG. Even where remote testing is used a safety case will be required covering both the weapon and the test system. The electrical and electromagnetic susceptibility of any system containing an EED needs to be assessed with any test equipment connected as well as in its "bare" configuration. Electrical testing of EEDs will only be carried out with an approved safety ohmmeter or a special to type circuit, which includes equivalent safeguards.

5.4 Explosion Guards

5.4.1 Where the risk assessment identifies the need, equipment used for handling, or operations with explosives will be explosion guarded to ensure maximum protection of the operatives against an explosion. All designs of Explosion Guards must be type-tested and each individual guard fitted with a plate indicating the quantity of explosives for which its use is approved and reference to the type-test of the design and the approval authority. Type-testing involves a 25% overtest of an example of the guard design.

5.5 Personal Protective Equipment and Clothing

5.5.1 A part of the risk assessment is the identification of the need for any PPE or special protective clothing. This will usually serve several functions. Normally it should give some degree of protection against the effects of fire or explosion, it should not give rise to hazards such as static electricity and it may need to give some protection from health hazards (as identified in the COSHH assessment). A suitable material for the construction of process workers garments is specially treated cotton, such as Probanised Cotton, as this material can give the wearer some protection from fire. This material is also less likely to give problems due to static electricity. Probanised Cotton requires special laundering to retain its flame resistant and anti-static properties and account must be taken of the possibility of explosives contamination creating a hazard in drains during the laundering operation. Face

visors or eye protection may also be required. To protect against health hazards disposable gloves and appropriate orinasa facemasks may be needed. The use of facemasks by personnel must not be seen as a substitute for the installation of forced air extraction units, which is always the first choice when the risk assessment identifies a health hazard due to the anticipated presence of hazardous fumes. Where sensitive EEDs, or primary explosives that are sensitive to electrostatic, are handled this will require special clothing and precautions to guard against static electricity (see paragraph 5.14 below).

5.6 Authorised Equipment, Tools and Use Lists

5.6.1 A formal system must be put in place to ensure that only approved tools and equipment are used in processing; they must be assessed as being safe for use and evidence retained to show that this has been done. Where appropriate the relevant IPT is responsible for the supply of appropriately assessed equipment for processing munitions. See Annex B for detailed advice regarding the construction of equipment for processing and testing of explosives. Tools and equipment authorised for use in a process building must be listed in the "Use List" or "Building Equipment List" and the list must be available within the building to which it applies. Alternatively the approved tool list may form part of a safe system of work for a specific task. The need for all non-fixed items of equipment must be considered in addition to tools; this includes portable electrical equipment, stools, benches, brooms, buckets and waste containers. Where such lists are specific to a building rather than to a task, the risk assessor must consider the suitability of the list for each specific task and if particular tools are considered undesirable, or additional tools are required, authorised amendments must be made to the list. The use of iron or steel tools is normally to be avoided but, if an operation can be carried out more safely by using such items, their use may be authorised. There are special requirements regarding the authorisation for use of portable electrical equipment and these may be found in Chapter 8 (see also Chapter 12 paras 5.18.2 and 5.18.3).

5.7 Pre and Post Work Inspection

5.7.1 Before each working period or process task commences, the process building, plant, tools etc. are to be inspected by a competent person to ensure that everything is clean, in good order and a report made to a senior officer or supervisor if anything is noticed to be missing, damaged or otherwise out of order. Unserviceable tools or equipment are to be quarantined and removed from the work area at the first opportunity. Shadow boards or similar are recommended where large numbers of tools are required. At close of work a tool and equipment muster must be conducted to ensure no tool has been inadvertently mislaid inside a munition or a machine and that the work area and equipment is left in a clean condition.

5.8 Clear Exits

5.8.1 At the beginning of each work period all entrances and exits are to be checked to ensure that they are unobstructed, that doors are unfastened or unlocked and that any securing bars to them have been removed and bolts withdrawn. This requirement may be implemented by including a statement in the work instructions for the building or by notices on the doors. The contents of the room should be so arranged that there is a clear passageway to the means of escape at all times.

5.9 Flammable Material

5.9.1 Cotton rags, paints and solvents used for cleaning, or other flammable materials, will only be taken into process buildings in minimum quantities for immediate use. All material remaining after use will be removed to suitable metal cupboards outside the building. The cupboards will be sited away from the wall of the building and at least 1 metre from the building door, unless an approved purpose

built flammable materials store is integral to the building. Oily cotton waste and rags are liable to spontaneous combustion and their use should be avoided. If they must be used they should be removed from the building immediately after use and placed in a suitable metal container, which must be emptied at cessation of work for the day.

5.10 Waste

5.10.1 Explosives waste must always be segregated from other waste material and each type of waste explosives must be kept in separate containers appropriately marked to identify each type. It is particularly important that initiators are kept separate from other waste explosives. Articles and cleaning materials, which may be contaminated with explosives, are to be treated as waste explosives. They are always to be stored separately from waste explosives and from other waste material. All waste from explosives buildings must be appropriately identified and adequate arrangements made for its collection and safe disposal. The disposal must be in accordance with the requirements of Environmental Legislation (see JSP 418). Unless otherwise approved, removal of waste from the process facility is to be conducted at least daily and all waste must be removed from the process building at the end of the working day. Exceptionally, IEs may authorise a less frequent collection regime in research laboratories where the daily waste is a very small quantity. In large throughput facilities the collection regime may need to be more frequent than daily to ensure that the build up of waste does not present an unacceptable hazard. In all cases the facility supervisor must ensure that an unacceptable build up of waste does not occur. Emissions and effluent produced as a by product of any explosives process must be dealt with in a manner designed to avoid or limit pollution of the air, soil or water courses (see JSP418 for detailed guidance). Excess dunnage and empty explosives boxes that are no longer required for the process must not be allowed to accumulate in process buildings.

5.11 Temperature of Process Buildings and Heating Explosives

5.11.1 The temperature of process buildings should be maintained at a level consistent with the comfort of the operatives and the safe processing of the explosives. To this end the minimum temperature should normally be 13 degrees Celsius. Explosives that are sensitive to static electricity will require special arrangements to maintain the relative humidity at appropriate levels. (See Chapter 8). Where it is necessary to heat explosives the method must be authorised as a part of the work instructions (see Chapter 17, paras 2). Unpackaged explosives are not to be exposed to direct sunlight.

5.12 Segregation of Explosives

5.12.1 During explosives processing, care must be taken to keep different types of explosives articles apart until they are brought together in an approved manner. For example high explosives shell and their fuzes.

5.13 Clean Area Procedures

5.13.1 Arrangements will be made to minimise the entry of grit and dirt into process buildings and to prevent clothing and footwear contaminated with explosives from being worn outside of the explosives area. This is usually achieved by requiring personnel to change into special footwear and clothing on entering the "Clean Area" and removing it on leaving. The clothing and footwear may also be required to have flame resistant and anti-static properties (see paragraph 5.5 above). Entry to such areas should be clearly defined, usually by a barrier or line. Floors, benches and fittings in the explosives processing room will be maintained in a scrupulously clean condition. To this end cleaning schedules, appropriate to the particular processes, will be devised and implemented.

5.13.2 Where explosives dust can arise in a Process Building all internal finishes are to effectively eliminate all cracks so that the surfaces of the walls, floor and ceiling can be kept clean. All finishes including flooring which may come into contact with the explosives must be durable, not liable to crack, chemically compatible and non-absorbent. The junction between the floors and wall is to be sealed to avoid dust traps.

5.14 Prevention of Ignition by Electrostatic Discharge

5.14.1 In order to minimise the risk of ignition from electrostatic discharge, precautions will be required for explosives such as EEDs and sensitive primary explosives that are susceptible to ignition by static electricity. These precautions will normally require the exclusion of electrical insulators, the grounding of electrical conductors including personnel, special outer clothing that must be grounded either through the wearer or a deliberate connection to ground and control of relative humidity. These precautions will ensure the absence of any hazardous source of electrostatic charge and hence discharge. See para 5.5 above, also Chapter 8 gives guidance on how to obtain the electrostatic environment required to permit personnel to safely handle sensitive EEDs. There are no exceptions to the foregoing requirement to exclude electrical insulators, therefore normal polythene and other electrically insulating plastics must never be taken into an electrostatic protected area (EPA) where static sensitive explosives and EEDs may be exposed. Polythene and other plastics may be introduced unwittingly when more than one nature of explosives is present. For example, the polythene packaging of a static insensitive munition component could be removed in a Process Area, designated as an EPA, in close proximity to a static sensitive device. Another possible unintentional source is the wrappings used for inert items that may be taken into the Process area. A clearly designated Quarantine Zone may be used to remove and segregate such materials when to remove them outside the EPA would be impractical or present a greater hazard. Chapter 8 Annex G provides an appreciation of the consequences of relative humidity.

5.15 Prevention of Sparks

5.15.1 The level of precautions necessary to prevent the generation of sparks will be determined on the basis of the sensitivity of the particular explosives as a part of the risk assessment (see paragraph 2.1). These precautions may include footwear with soft soles and clothing without metal fasteners. In addition there may be a requirement for non-ferrous tools or equipment (see paragraph 5.6 above and Annex B). Flooring, fittings and finishes that may give rise to sparks when struck, for instance ceramic floor tiles, must not be used.

5.16 Breaking Down of Explosives Stores

5.16.1 The breaking down of explosives stores is potentially more hazardous than other processing work and therefore it must be carried out under very carefully controlled conditions. Break down will often require special facilities and equipment. Explosives stores are not to be broken down unless the risk can be justified in terms of positive gains in knowledge or safety. See Chapter 17, para 3.2 and Chapter 19 Annex B.

5.17 Decontamination of Plant and Equipment

5.17.1 Whenever any item (including empty ammunition packages and containers), that has been used or is associated with explosives and might conceivably be contaminated with or contain them, is removed from an explosives area it must be accompanied by a document that states whether or not it still contains or is contaminated with explosives. If it can be stated with certainty that it is free from explosives a "Certified Free From Explosives" certificate (CFFE certificate)

will be issued by a trained, competent individual. If an item can not be completely cleaned it must be accompanied by a certificate indicating the level of explosives contamination remaining. Machinery or equipment that has been associated with explosives substances may require cleaning; in which case it must be cleaned by a competent explosives process operative and then examined and certified as free from explosives by an individual who did not carry out the cleaning. Where, even after thorough cleaning, doubt regarding contamination still exists but there is a need for the item to be repaired or disposed of, it must be subject to a "Proving" procedure. This process involves heating the item under precautions to ensure that all explosives residues are completely destroyed. For further guidance on CFFE see Chapter 27.

5.18 Permit to Work System

5.18.1 Engineering work involving repairs, testing or maintenance is not to be carried out in an explosives processing area (or in explosives areas in general) without a supporting permit to work. Further guidance advice is given in Chapter 17, para 6.2 and in Chapter 18.

5.19 Radio Frequency Transmissions

5.19.1 Where EEDs are handled precautions must be taken to limit the risk of accidental initiation due to Radio Frequency transmissions. These precautions may include forbidding the use of mobile telephones in the vicinity and controlling the location of radio transmitters (see Chapter 17, para 3.1 and Chapter 24).

6 CONTINGENCY PLANNING

6.1 Emergency Arrangements

6.1.1 Emergency arrangements must be established for all areas where processing of explosives is to be conducted. See Chapter 17, paras 6.3.

6.2 Thunderstorms

6.2.1 Procedures will be prepared in advance for the action to be taken on the approach of a thunderstorm. In the event that a thunderstorm is expected imminently (where the Met Office warning system is in use this is a Met Office Level 1 risk warning) explosives process work is to be suspended. Work on EEDs and primary explosives is not to be carried out when thunderstorms are in the general vicinity (Met Office Level 2 risk warning). However, due to the nature of the process being conducted, it may not always be possible to stop work immediately and the situation must be made safe before evacuating the process building. Where it can be done without undue risk to the operators, the supervisor will authorise the explosives to be returned to their boxes and stacked at least 0.5 metres away from the building walls. Process buildings are to be made secure after evacuation (See Chapter 17, para 6.4).

6.3 Spillage of and Unsafe Explosives

6.3.1 Procedures are to be established in advance for the spillage of explosives and for dealing with unsafe explosives, such as cases of exudation or munitions that have been inadvertently dropped. The guiding principle is to take no precipitate action but to stop work and seek advice from a supervisor or senior officer. The number of personnel involved in remediation must be the minimum consistent with a safe working procedure and they should be the most experienced and senior staff available. If it can be accomplished without undue risk, the unaffected explosives present in the process building are to be removed before work commences.

7 USE OF MOBILE AMMUNITION INSPECTION FACILITY (MAIF) / MOBILE AMMUNITION INSPECTION TRAILER (MAIT)

7.1 General

7.1.1 Except when used for low risk short duration tasks such as visual inspection and/or repacking of ammunition (see Chapter 12 para 5.19.2(7)), the MAIF/ MAIT must be positioned at a suitable site temporarily licensed specifically for the processing role. (i.e. achieving the appropriate QDs – see Chapter 10 Section 2). Where an existing licensed site such as an unoccupied transit facility or stabling area is utilised, a temporary amendment to the explosives licence must be sought to reflect the change of use. The conditions for processing laid down in this Chapter are to apply.

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CHAPTER 19**ANNEX A****DATA LOGGING****CONTENTS**

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- 1.1 Introduction
- 1.2 Future Ammunition with In-Built Purpose Designed Data Loggers
- 1.3 Stand Alone Equipment

1 DATA LOGGING**1.1 Introduction**

1.1.1 There is a need to standardise Data Logging activities to meet the following objectives:

- (1) Approval of future munitions with in-built purpose designed data loggers.
- (2) Approval of current in-service or imminently expected ammunition with data capture devices and/or procedures.
- (3) Register approved data logging systems and equipment.
- (4) Ensure safety of personnel using data logging systems and equipment.

1.1.2 Technical Adviser (Electrical Safety) has the responsibility for checking all electrical equipment types, which are allowed inside an Ammunition Area, and keeps a register of them. These include some data logging devices and are, therefore already approved for use. Technical Adviser (RADHAZ/EMC) fulfils a similar function in respect of RADHAZ/EMC safety.

1.1.3 A number of ammunition systems already have built in data loggers, which can be accessed through an umbilical cord that does not breach the integrity of the packaging. These systems have been subject to specific approval by ESTC and the parameters of use have been detailed.

1.1.4 The introduction of other data logging systems for the current ammunition stockpile needs to be controlled to ensure that explosives and personnel safety is not compromised.

1.2 Future Ammunition with In-Built Purpose Designed Data Loggers

1.2.1 The need to ensure that future ammunition assets remain serviceable, coupled with the cost, complexity and smaller quantities will demand closer stock control. In part this will be realised through data capture and the use of purpose built systems to accomplish it. It can be expected that each system will be unique. It is therefore important for ESTC to be involved early in the procurement process to ensure that where a data logging system is to be used, it is compatible with the storage, electrical and RADHAZ safety regulations. The PT must provide the evidence of compliance at the Safety Case Review.

1.3 **Stand Alone Equipment**

1.3.1 Details of stand alone equipment and their use is included in the ESTC database. Once the data logger requirement is agreed, the requirements and procedures will be added to Chapter 8.

CHAPTER 19**ANNEX B****EQUIPMENT FOR PROCESSING AND TESTING EXPLOSIVES****CONTENTS**

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1 INTRODUCTION

1 INTRODUCTION

1.1 All tools and equipment used for processing explosives and munitions must comply with the requirements of the relevant national legislation. Examples of such legislation include the following: The Dangerous Substances and Explosives Atmospheres Regulations (DSEAR) 2002, The Supply of Machinery (Safety) Regulations 1992 (this includes amongst other things the requirement to CE mark where relevant), The Provision and Use of Work Equipment Regulations 1998 and the Lifting Operations and Lifting Equipment Regulations (LOLER) 1998. A formal system of approval should be operated which confirms that the tools and equipment are suitable for use in the relevant processing environment, comply with the national legislation, MoD Regulatory requirements and, where appropriate, are acceptable to the Technical Authority for the munition concerned.

1.2 Manufacturing activities that have a high risk of igniting propellants may be carried out non-remotely providing the operator is protected by a suitable water drench system. Such systems are designed to deliver large quantities of water in a very short time and are often pressurised by carbon dioxide.

1.3 All materials used in the construction of a machine, its tools and associated equipment that are likely to come into contact with explosives are to be approved as compatible with the explosives concerned. Compatibility in this context means that the material shall not produce any chemical or physical interaction to cause the explosives to deteriorate and cause fire, explosion or render them unserviceable. Due regard must be given to the requirement that the material chosen must not be liable to produce sparks.

1.4 All equipment and machinery and their related components will be bonded together and earthed to prevent electrical discharges. See Chapter 8.

1.5 Hoppers etc. feeding explosives to machines will be sited and protected to minimise the transmission of fire and explosion and their effects on the operatives. The quantity of explosives will be kept as low as possible bearing in mind the need for efficient operation. Particular care is required with small arms propellants as these may burn to detonation if the depth of bed is sufficient (see the Explosives Hazard Data Sheet for the particular propellant).

1.6 Machinery for use with explosives will be designed to keep frictional effects of moving parts to a minimum. Consideration must be given to the robustness of the machines and any possibility of distortion under load that could compromise the clearances between moving parts during operation.

1.7 Where there is a possibility that they could work loose and fall into mixing machinery, nuts should be secured in position by drilling through them and their bolts and securing them with twisted wire. Blind holes in a machine where explosives can accumulate, especially if threaded, are to be avoided. Where such cavities are unavoidable they will be closed off or filled.

1.8 When machines are designed or selected, due regard will be paid to their suitability for inspection, dismantling and cleaning. A suitable receptacle will be provided where leakage or spillage of explosives or oil from a machine occurs. Receptacles should be readily removable so that they may be emptied frequently.

1.9 Electrical circuits must be designed to the requirements of Chapter 8.

1.10 All control gear will be designed to fail to a known safe condition.

1.11 A maintenance regime will be devised, in conjunction with the manufacturer of the equipment, for all machinery used for processing of explosives. This will be recorded and held by the user of the machine. It must include the measurement of any critical clearances and the location of all lubrication points on a machine. Only lubricants compatible with the materials being processed will be used. Plant will be designed to prevent the lubricant and explosives from contaminating each other. The maintenance regime will include a visual examination to ensure that explosives dust does not accumulate. Details of the routine maintenance carried out, including lubrication will be recorded in the maintenance logbook for each machine.

1.12 Where especially hazardous manufacturing operations are to be carried out, and electrically operated machines or equipment are required to be installed in an explosives building, it is preferable for motors and control gear to be located in a separate plant room having no direct access to the rooms containing explosives. At the point where the mechanical power is transmitted into the explosives room through a shaft from the plant room the shaft is to be fitted with a gland to prevent the entry of explosives dust into the plant room.