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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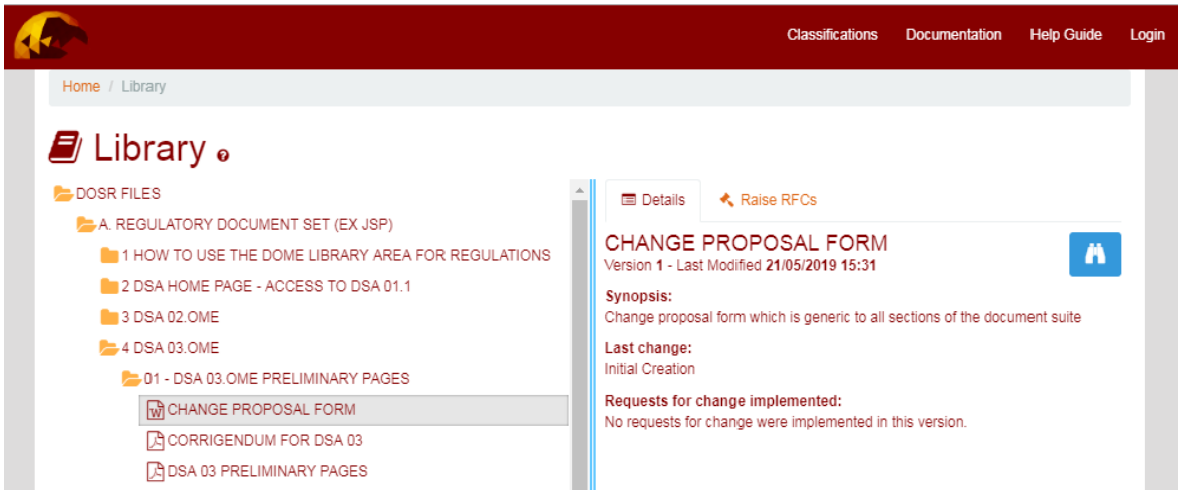

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AMENDMENT RECORD

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No	**Section**	**Para**	**Amendment Summary**	**Agreed**	**Date**

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CHAPTER 10

SECTION 2

QUANTITY DISTANCES AND OTHER EXPLOSIVES LICENSING CRITERIA FOR ABOVE GROUND STORAGE

CONTENTS

1 SECTION TWO

1.1 Introduction

1.1.1 This section details the general regulations pertaining to the application of the Quantity Distance (QD) Tables and to various other criteria used in the licensing of above ground explosives storage within the MOD. It should be noted that special provisions are made for limited quantities of explosives, and for emergency/field storage.

2 QUANTITY DISTANCES

2.1 Introduction

2.1.1 The QD are based on trials, some wartime bombing damage data and data from some accidental explosions in different countries, including UK. However, QD are subject to uncertainty owing to the variability of explosions and the uncertainty of the available data. The QD will be subject to revision as more data becomes available and to this end DOSR are actively involved in trials work both in UK and abroad as well as gathering data from explosives incidents.

2.1.2 QD are generated by distance functions subject, in certain cases, to fixed minimum distances. QD are applied to all Potential Explosion Sites (PES) and are fundamentally dependent upon the Hazard Division (HD) of the explosives being stored (except for HD 1.4, which has fixed minimum distances instead of QD). The types of QD are as follows:

(1) Inside Quantity Distance (IQD). There are two types of IQD:
  (a) Inter-magazine Distance (IMD).
  (b) Process Building Distance (PBD).

(2) Outside Quantity Distance (OQD). There are three types of OQD:
  (a) Public Traffic Route Distance (PTRD).
  (b) Inhabited Building Distance (IBD).
  (c) Vulnerable Building Distance (VBD).

2.1.3 The QD for a HD may be dependent on one or more of the following factors:

(1) The NEQ at the PES and the type, sensitiveness and packaging of the explosives at the ES.

(2) The type, use, method of construction and orientation of both the PES and the ES.

(3) The presence of effective traverses.

(4) The degree of protection required at the PES and ES.

(5) The adequacy of evacuation arrangements.

(6) The HD sub-division for storage.

2.1.4 In general, the provision of stronger buildings allows the use of smaller QD for a given degree of protection or achieves a better standard of protection at a given distance, especially in the case of ES near a PES containing explosives of HD 1.1. However, stronger buildings are more likely to increase OQDs in certain circumstances as their heavier structure can produce large, long-range fragments in the event of an explosion within.

3 INSIDE QUANTITY DISTANCES

3.1 Introduction

3.1.1 IQD are the minimum distances to be observed between PES and ES that contain explosives, and between PES and Process Buildings.

3.2 Inter-Magazine Distances

3.2.1 IMD are the minimum distances to be observed between individual PES and ES that contain explosives and are designed to provide specified degrees of protection to explosives at an ES. Primarily, these distances are intended to prevent direct propagation expected at each ES for each HD. An explosion at a PES may lead indirectly to explosions at an ES due to secondary fires, but this situation is more likely at the lowest degree of protection, detailed below.

3.3 Process Building Distances

3.3.1 PBD are the minimum distances to be observed either between PES and Process Buildings, or between Process Buildings. They are intended to give a reasonable degree of immunity to personnel within a Process Building from the effects of a nearby explosion. Light structured Process Buildings are likely to be damaged if not destroyed.

3.3.2 PBD also provide a high degree of protection against immediate or subsequent propagation of explosion in the Process Building. PBD are generally intended for situations where personnel are regularly employed in the preparation or processing of explosives.

4 OUTSIDE QUANTITY DISTANCES

4.1 Introduction

4.1.1 OQD are the minimum distances to be observed between PES and ES such as public roads, railways, civil airport facilities, inhabited buildings and other buildings/areas, whether they be inside or outside the explosives area, which are used by the general public and/or MOD personnel. In certain circumstances, minimum fragment distances are applied.

4.2 Public Traffic Route Distances

4.2.1 PTRD are the minimum distances to be observed between PES and routes used by the general public, which are generically referred to as Public Traffic Routes. These include:

(1) Roads.

(2) Railways.

(3) Waterways, including rivers, canals and lakes.

(4) Public Rights of Way (e.g. footpaths) defined as such on the current appropriate 1:50 000 scale OS Landranger map of the area concerned. The distance required is based on the amount of usage of the route by vehicles, people, etc, also known as traffic density.

4.2.2 As ES, Public Traffic Routes present very diverse situations such that three alternatives, dependent on the average public usage of the route, are considered, as follows:

(1) The full IBD for High Density Usage routes.

(2) The PTRD, generally two thirds of the IBD, for Medium Density Usage routes.

(3) Half of appropriate IBD for routes that have Low Density Usage.

4.2.3 Among the dominant factors which determine the number and severity of road casualties due to distraction by an explosive event are the traffic speed and density, the width of the traffic lanes and their number, the presence of crash

barriers, the surface conditions and the radius of any bends. Factors of lesser importance are the presence or absence of roadside trees and ditches, and of separate carriageways for opposing traffic. For other types of routes, it is essentially the density and speed of the 'traffic' which are the critical factors. Where water borne traffic is concerned, consideration may need to be taken of special factors (e.g. passenger ferries, which, though they cross a hazarded area more quickly than other craft, merit special attention due to the numbers of people aboard).

4.2.4 It is important to appreciate that Public Traffic Routes, rights of way and common access areas should not be treated independently of each other or of any other constraints around a licensed site. They should be viewed within the overall picture and the guide-lines used to indicate whether a situation is likely to require consideration. Ideally a full risk analysis should be conducted to ascertain how these additional risks would fit into the overall risk picture. Only then can informed decisions be made regarding the soundness of a licence. The underlying principle of calculating the numbers of people exposed to the hazard and their relative times of exposure has been applied to allow the established recommendations for road users to be applied to other types of route.

4.3 Determination of Usage

4.3.1 Usage of roads, railways, waterways and public rights of way is to be determined by the average of the traffic or people counted, as appropriate, over several 24-hour periods.

4.3.2 It is clearly prudent for units to be alert to the possibility of new routes being constructed, or changes in existing traffic route densities. Therefore, observation of Public Traffic Route usage is to form part of the Safeguarding survey required by. In addition, for a PES where PTRD is the limiting factor in the licensing of that PES, the relevant traffic density data is to be recorded as additional information on the Explosives Licence. Information regarding vehicle traffic density, based on up-to-date Government censuses, may be obtained from IE or DSA DOSR CIE (MOD) staffs.

4.4 Recreational Facilities

4.4.1 Similar guide-lines to those suggested for public rights of way may also be applied to playing fields, golf courses and similar recreational facilities. These are subject to the same minimum distance requirements.

4.5 Inhabited Building Distances

4.5.1 IBD are the minimum distances to be observed between PES and buildings or sites where members of the general public or personnel not involved in explosives handling either work, live or congregate. The distances are intended to prevent serious structural damage to traditional types (i.e. 230 mm solid brick or equivalent) of inhabited buildings or caravans, and any consequential death or serious injury to their occupants. Persons in the open would not suffer direct injury from the effects of blast and radiant heat at these distances. The distances do not however exclude the risk to the public from projections, broken glass, displaced tiles etc, or the risk of some minor injury to occupants. Glazing is an important factor in building occupant protection and protective features are relatively easy to provide. Advice on appropriate glazing at ES can be obtained from Defence Estates through DSA DOSR CIE (MOD) staff.

4.6 Fixed Minimum Distances

4.6.1 IBD are normally subject to fixed minimum distances to give protection against fragments emanating from a PES. In certain circumstances, solely Service buildings and facilities may be permitted within the normal IBD.

4.7 Vulnerable Building Distance

4.7.1 Where an inhabited building is of Vulnerable Construction or is a large facility of special construction or importance, larger distances (normally $44.4Q^{1/3}$) are required for HD 1.1 to afford a similar degree of protection.

5 QUANTITY DISTANCES FOR ABOVE-GROUND STORAGE

5.1 Introduction

5.1.1 The following gives prescriptions applicable to the above-ground storage and handling of explosives and presents tables of quantity distances for HD 1.1, and Storage Sub-Division (SsD) 1.2.1, SsD 1.2.2, SsD 1.3.3 and SsD 1.3.4, which are at Annex A. Distances for quantities of less than 50 kg are to be taken as the 50 kg prescription in the relevant table unless otherwise stated.

5.1.2 There are difficulties with the QD tables for HD 1.1 and SsD 1.2.1 where the NEQs under consideration are less than 3500 kg. The HD 1.1 and 1.2 (and indeed 1.3) tables have been built from different foundations. The problems stem partly from this and partly because the HD 1.1 tables have never taken due account of the effects of debris and fragments. The HD 1.1 tables are based on considerations of blast damage with a bolt on to try and cope with the problem of debris/fragments and there are ongoing investigations within NATO, primarily by the US and the UK, to produce a QD type approach which properly takes account of debris and fragments. Until this is resolved and there is at least UK/US agreement on the approach the situation will not improve. There is also a fundamental issue in the way that the hazards are both perceived and dealt with for the differing HDs. There is no common hazard criterion across the HDs giving rise to many circumstances where the actual hazard at, say, IBD for HD 1.2 appears to be significantly higher than that for HD 1.1. The QD tables for HD 1.2 also fail to take account of the time over which the hazard is “delivered”. This was recognised when the tables were generated in the late 90s but there was then, and still is now, no definitive method by which time could be realistically factored into the table. This needs to be borne in mind when licensing facilities for the storage of SsD 1.2.1 only.

6 QUANTITY DISTANCES FOR HD 1.1

6.1 Inter-Magazine Distances

6.1.1 Levels of protection are as follows:

(1) Significance of Fires at ES Fires involving HD 1.1 should not be fought after the initial stages. The probability of fires spreading to other ES increases as the chosen level of protection is decreased. This factor must therefore be considered when choosing the level of protection.

(2) Levels of Protection The igloo design affords extremely good protection to its contents. Weaker buildings and open stacks would not be expected to give such good protection although concrete structures are considered to be superior generally to brick from an exposed site point of view. The level of protection depends on the vulnerability or robustness of the explosives stored at an ES and the type of traversing used. The following paragraphs describe the three levels of protection which are incorporated in nnex A Table 1 and which are intended to provide an adequate basis for the selection of a QD. Some entries in the table show only one level of protection due to a lack of data. The levels of protection at an ES given by the various IMD are as follows:

(a) Virtually Complete Protection: Gives virtually complete protection against practically instantaneous propagation of an explosion by ground shock, blast, flame and high velocity projections. There are unlikely to be fires or subsequent explosions caused by these effects or by lobbed munitions. The stocks are likely to remain serviceable, however, ground shock may cause indirect damage and even explosions among especially vulnerable types of explosives, or in

conditions of saturated soil. These exceptional circumstances require individual assessment rather than use of the quantity distances in Annex A Table 1. This level of protection is primarily used when both the PES and the ES are earth-covered structures.

(b) High Degree of Protection: Gives a high degree of protection against practically instantaneous propagation of an explosion by ground shock, blast, flame and high velocity projections. There may be occasional fires or subsequent explosions caused by these effects or by lobbed munitions. Heavy cased items (e.g. ac Bombs and robust shell) are likely to remain serviceable although they may be covered by building or traverse debris. However, there is a significant increase in the probability that other stocks of explosives will be lost through subsequent propagation from lobbed explosive items or the spread of burning debris. This is particularly so where flammable material, such as wooden packages or dunnage, is present at the ES.

(c) Limited Degree of Protection: Gives only a limited degree of protection against practically instantaneous propagation of an explosion by ground shock, blast, flame and high velocity projections. There are likely to be fires or subsequent explosions caused by these effects or by lobbed munitions. Heavy cased munitions are likely to be damaged and rendered unserviceable and are likely to be completely buried by debris. There is a high probability that stocks of explosives will be lost through subsequent propagation from lobbed munitions or the spread of burning debris. This is particularly so where flammable materials such as wooden packages or dunnage are present at the ES.

6.1.2 Only Complete and High degrees of protection are normally to be used. However, if circumstances warrant it, and the loss of stocks is acceptable to the HOE/Duty Holder, then IEs can approve the application of the lesser QD which gives a Limited degree of protection.

6.2 **Choices of IMD for HD 1.1**

6.2.1 The QD at Annex A, Table 1, for IMD, are intended to prevent propagation of explosives in an adjacent ES. Where Table 1 gives a choice of IMD, the following paragraphs apply:

(1) For open stacks and normal buildings, other than those covered with earth, at distances less than D5 it is probable that, even though propagation may not have taken place, the stocks are likely to be unserviceable and covered by debris from the collapsed building. Stocks at distances of D7 and greater are only likely to be serviceable if the building has not suffered serious structural damage although some structural damage at the D7 distance, dependent on the type of building, can be expected.

(2) For igloos, which are designed to resist external blast, an IMD of D3 will normally ensure that stocks remain serviceable, although ground shock may damage sensitive electronic components e.g. in missiles and may also affect primary and other sensitive explosives (e.g. detonators). An individual assessment may be required.

(3) It is possible for the blast at the PES to cause practically instantaneous initiation at the ES of packaged primary explosives substances and certain other sensitive explosives such as Blasting Gelatine even if it is traversed and situated at the D4 distance. Storage conditions for such explosives are to be assessed individually, taking account of the protection afforded by packaging and the construction of the ES.

(4) Only articles such as Detonators and similar articles classified 1.1B are to be treated as Primary Explosives for explosives storage purposes. Articles of HD 1.1D, which have two or more effective protective features as part of their design, such as aircraft fuses and prepared iron bombs fitted with fuses, are not considered as Primary Explosives for explosives storage purposes.

6.3 Process Building Distances for HD 1.1

6.3.1 For HD 1.1, the standard Process Building Distance (PBD) should be the D10 distances prescribed in Annex A Table 1. At this distance, the major effects to be considered are:

(1) The peak side-on overpressure, which is anticipated to be no greater than 21 kPa.

(2) Debris, which would be a very significant effect, though difficult to accurately predict.

6.3.2 The smaller PBD (D9A), valid below 4000 kg, will still provide a reasonable degree of protection for persons within a process building at the exposed site. These smaller distances are based on impulse considerations since smaller explosive events are of shorter duration and a higher pressure is therefore needed to produce the same level of damage as that expected at D10 distances for much larger quantities of explosives. However, the actual risk depends as much on the type of structures involved as on the quantity of explosives at the PES. It is rather unpredictable in general terms although it could be evaluated in individual cases by the procedures detailed in ESTC Leaflet 6 Part 3. These smaller distances can only be used with the following provisos:

(1) The number of persons involved in the Process Building is small (up to 10).

(2) Buildings should be constructed in accordance with DSA02.OME.

6.3.3 When siting and designing Process Buildings the following effects should be borne in mind amongst others. A person in a building designed to withstand the anticipated blast loading and without windows would be merely startled by the noise of the explosion at an adjacent site. However, a person in a brick building with windows might suffer eardrum damage or suffer indirect injuries through his translation by blast, and subsequent impact on hard objects, or through possible collapse of the building upon him.

6.3.4 Where the QD tables specify a PBD of less than 270 m, this may not give protection from projected debris generated from an untraversed heavy or medium walled PES to personnel in Process Buildings which only have light roofs. Therefore, consideration must be given to maintaining this 270 m distance as the minimum separation from the nearest storage site containing explosives of HD 1.1 to provide additional protection from debris, where the ES is untraversed.

6.4 Public Traffic Route Distances for HD 1.1

6.4.1 PTRD are subject to minimum distances to provide some protection against projections, and the PTRD to be used for HD 1.1 are in Annex A, Tables 1A-C, Rows 20-22 as follows:

(1) Roads:

(a) High Density Usage - If more than 5000 vehicles use the road in any average 24-hour period, the D13 distance is to be used, subject to applicable minimum distance quoted in QD tables.

(b) Medium Density Usage - If less than 5000 vehicles but more than 1000 vehicles use the road in any average 24-hour period, the D11 distance is to be used, subject to applicable minimum distance quoted in QD tables.

(c) Low Density Usage - If less than 1000 vehicles but more than 20 vehicles use the road in any average 24-hour period, then half the IBD (i.e. ½ D12) is to be used, but with no applicable minimum distance.

(d) Very Low-Density Usage – If less than 20 vehicles use the road in any average 24-hour period no QD separation is required.

(2) Railways:

(a) PTRD for railways is similarly dependent on traffic density. The passenger density may be determined from the published normal weekday service timetable (i.e. not Bank Holidays etc) and is to be based on the assumption that each scheduled train carries 50% of its maximum seated passenger capacity.

(b) High Density Usage - For all rail lines where the passenger traffic density exceeds 5000 passengers in any average 24-hour period, the D13 distance is to be used, subject to applicable minimum distance quoted in QD tables.

(c) Medium Density Usage - For railway lines where the passenger traffic density exceeds 1000 passengers but does not exceed 5000 passengers in any average 24-hour period, the D11 distance is to be used, subject to applicable minimum distance quoted in QD tables.

(d) Low Density Usage - For railway lines where the passenger traffic does not exceed 1000 passengers in any average 24-hour period, then half the IBD (i.e. ½ D12) is to be used, but with no applicable minimum distance.

(3) Waterways (Including Rivers, Canals and Lakes):

(a) High Density Usage - For waterways where the average number of persons using it in any average 24-hour period exceeds 1800, the D13 distance is to be used, subject to applicable minimum distance quoted in QD tables.

(b) Medium Density Usage - For waterways where the average number of persons using it an any average 24-hour period is more than 400, but less than 1800, the D11 distance is to be used, subject to applicable minimum distance quoted in QD tables.

(c) Low Density Usage - For waterways where the average numbers of persons using it in any average 24-hour period is less than 400, the PTRD is to be calculated as half the appropriate IBD, but with no applicable minimum distance.

(d) Very Low-Density Usage – If less than 20 persons use the waterway in any average 24-hour period no QD separation is required.

(4) Public Rights of Way/Recreational Facilities:

(a) High Density Usage - For a Public Right of Way/Recreational Facilities where the average number of persons using it is greater than 900 in any average 24-hour period, the D13 distance is to be used, subject to applicable minimum distance quoted in QD tables.

(b) Medium Density Usage - For a Public Right of Way / Recreational Facilities where the average number of persons using it is less than 900, but greater than 200, in any average 24-hour period, the D11 distance is to be used, subject to applicable minimum distance quoted in QD tables.

(c) Low Density Usage - For Public Rights of Way/ Recreational Facilities where the average number of persons using it is less than 200, but greater than 20, in any average 24-hour period, the PTRD is to be calculated as half the IBD (i.e. ½ D12), but with no applicable minimum distance.

(d) Very Low-Density Usage - For Public Rights of Way/Recreational Facilities where the average number of persons using it is less than 20 in any 24-hour period no QD separation is required.

Inhabited Building Distances for HD1.1

6.4.2 The distances for HD 1.1 are based on a tolerable level of damage expected from a peak side-on overpressure of 5kPa. The distances are not sufficiently large to either prevent superficial damage to buildings which are largely of glass construction or to avoid injuries to their occupants by flying glass. The debris produced from an accidental explosion of HD 1.1 explosives would not be expected to exceed one lethal fragment, having an energy more than 80 Joules, per $56m^2$ at this distance.

6.4.3 The series of Australian/UK Stack Fragmentation trials conducted in the 1980's has demonstrated that, for NEQ less than 5600kg, if the PES is of light construction, typically 230mm solid brick or equivalent or less, and traversed then the hazard from projections is tolerable at D13 distances subject to a minimum of

270m. However, if a heavier construction is employed at the PES then the hazard from projections requires a minimum of 400m. the trials have indicated that concrete buildings of 200mm thickness or greater, with NEQs greater than several tonnes, might warrant a greater protection distance. Specialist advice should be sought on a case by case basis. For NEQ greater than 5600kg the prescribed Inhabited Building distance D13 will provide an acceptable degree of protection from both blast and projections.

6.4.4 These trials also demonstrated that the hazard from projections is not constant and shows a marked directional effect. Basically, there is a very low ground density of projections in directions directly away from the corners of the structure. The density rises rapidly to a maximum in the direction normal to any face of the structure. This is repeated on all sides of the structure irrespective of whether the structure is traversed or not. It is extremely difficult to interpret the results to give general guidelines and it is advised that where it is considered that the siting of the ES with respect to the PES might be beneficial then the Stack Trial results should be considered in detail for each specific case.

6.4.5 A 400m minimum Inhabited Building distance is required to protect against structural debris from igloos, other earth covered structures or untraversed buildings. For heavily built up areas consideration should be given to using a minimum distance of 400m.

6.4.6 The distances for explosives of HD 1.1 are based on the behaviour of typical packaged military explosives. They take account of the ESTC trials using bulk explosives in wooden packages or pallets in open stacks. In certain special circumstances, for NEQ of less than 5600 kg, these distances are unduly conservative as hazardous projections cannot arise. Such circumstances may occur at PES where bulk explosives, devoid of metal casings or components, are in un-palletized fibre-board packaging, and are in open stacks or light frangible buildings. In these special circumstances, the Annex A Table 1, D13 distances may be used without the minimum distances referred to in para 6.5.2, above after consultation with DSA DOSR CIE(MOD) and subject to a minimum distance of 25m.

6.5 Buildings of Vulnerable Construction

6.5.1 Certain types of construction are known to be susceptible to significant damage at and beyond the normal IBD and may therefore cause injuries and fatalities disproportionate to the scale of the event. This may result either from materials used (e.g. extensive glazed areas) or from the risk of global collapse which could crush and kill occupants who would otherwise be expected to survive in the open or in more traditional forms of construction. Such buildings are normally to be sited at 44.4QP1/3P.

6.6 Recording and Audit

6.6.1 Where buildings of vulnerable construction have been permitted within $44.4Q^{1/3}$, their presence, usage and population are to be detailed as supplementary information on the Explosives Licence for the PES concerned. During their safety inspections, IE Inspectors will check that the original conditions applicable to the acceptance of the building have not materially changed.

7 REDUCED QUANTITY DISTANCES FOR HD 1.1

7.1 Earth-Covered Buildings

7.1.1 No reductions are proposed to the front of igloos, primarily because of the extensive debris problem generated by the breakup of the igloo headwall. Where a specific earth-covered structure has not been accepted as a UK standard igloo, then these reduced QD should not be applied and the default functions of $22.2Q^{1/3}$, $14.8Q^{1/3}$ and $8.0Q^{1/3}$ for IBD, PTRD and PBD are to be used instead.

(1) Inhabited Building Distance: D15 distances in Annex A Table 1A may be used from the sides of an earth-covered PES, and D14 distances from the rear of the same building, with a minimum distance of 400 m.

(2) Public Traffic Route Distance:

(a) High Density Usage - Full IBD, defined as D14 from the rear and D15 from the side of an earth-covered PES is to be used, with a minimum distance of 400 m.

(b) Medium Density Usage - Reduced PTRD, defined as D16 from the rear and D17 from the side of an earth-covered PES is to be used, with a minimum distance of 270m.

(c) Low Density Usage – Half IBD, defined as 0.5 x D14 from the rear and 0.5 x D15 from the side of an earth-covered PES is to be used, with no applicable minimum distance.

(3) Process Building Distance: No reduction in PBD is permitted from the sides of an earth-covered PES to a Process Building. However, a reduced D18 distance is permitted from the rear of a UK standard igloo to a Process Building.

7.2 Traversed Storage of Aircraft Bombs

7.2.1 Because of their robust nature, aircraft GP bombs of UK manufacture, whether unboxed or in All-Up Round Containers (AURC), or Paveway III in Near All-Up-Round Containers (NAURC), may be stored in traversed storage at the reduced IMD detailed in Annex A Table 1C subject to the following conditions and criteria:

(1) The D1 distance may be used up to a maximum of 30 000 kg NEQ and the D2 distance used for quantities of 30 001 kg up to a maximum of 125 000 kg NEQ.

(2) The stacks are to be separated by earth traverses.

(3) There should be a minimum of flammable material or dunnage etc. that could catch fire and lead to a subsequent mass explosion risk.

(4) The bombs are classified as HD 1.1 by DOSR and must be strong enough to withstand intense air shock without being crushed.

7.2.2 In the event of an explosion of one stack, these distances will prevent simultaneous detonation of the bombs in adjacent stacks. However, adjacent stacks will be severely disrupted, and bombs will be thrown a considerable distance, perhaps as far as IBD. Some of the bombs at the exposed site may be buried and not immediately accessible, and some may be slightly damaged, particularly those with sensitive fusing components. There may be occasional fires and delayed low order explosions, particularly if bombs are stacked on concrete storage pads. These reduced IMD are only to be applied where both the PES and the ES are used for the storage of ac bombs.

7.2.3 There is no fundamental reason why the above rationale cannot be applied to other types of ac GP bombs, particularly those of US manufacture. Indeed, much of the supporting data is derived from trials using US bombs. However, the appropriate IE is to be consulted before applying the above criteria to bomb types other than those detailed above.

7.3 Untraversed Storage of Robust Shell

7.3.1 Shells with an explosives content not exceeding 20% of the gross weight (excluding any associated propellant charge), and with a shell wall that is sufficiently robust to prevent perforation by high velocity primary or secondary fragments, may be stored untraversed at the D9 distance in Annex A Table 1C without the risk of practically instantaneous propagation. However, shells in adjacent ES may be damaged.

7.4 Untraversed Storage of BL Shell

7.4.1 Certain types of HE BL shell of HD 1.1 filled with TNT (e.g. 155 mm M107) may be stored in stacks that comply with the principle that, although an explosion is likely to propagate through the stack, it would be unlikely to propagate from one stack to another. Storage under these conditions presents the risk of explosion of a single stack only rather than a mass explosion involving all the stacks in one module or building. In this case, the NEQ of the appropriate single stack may be used to determine the QD for each entire module or building so used.

8 QUANTITY DISTANCES FOR HD 1.2

8.1 Fragments and Lobbed Items of SsD 1.2.1

8.1.1 Items of SsD 1.2.1 comprise those munitions that contain a high explosive charge and may also contain a propellant or pyrotechnic charge such that the NEQ of the individual item is 0.73 kg or greater. It is impractical to specify distances that will allow for the maximum flight ranges of projected or propelled items. However, the likely range of packaged items that may be involved in an event during storage and processing is typical of this more hazardous category of HD 1.2.

8.1.2 Munitions that explode in an event will rarely function in their design mode. In a fire situation, explosive fillings may melt or expand thus breaching their casing and burn, possibly to detonation. These events may involve all or only a small part of the filling dependent upon how much filling has escaped through the breach in the casing. The fragments produced by such reactions are totally different to those produced in the design mode. The casing splits open such that large fragments (2 kg to 3 kg for a 105 mm HE shell) with velocities of 100 msP-1P to 500msP-1P are produced (in the design function, many more fragments of much higher velocity are normally produced). These larger fragments are likely to be projected further than the smaller fragments of the design mode and may travel further than fragments from a designed HD 1.1 event. Additionally, quantities of unexploded items, sub-assemblies or sub-munitions may also be projected, some to considerable distances. These, due to thermal or mechanical damage, may be more hazardous than when in pristine condition.

8.1.3 Data on individual item characteristics obtained from trials may be used to determine the validity of including specific items in this more hazardous category or having it included in the less hazardous SsD 1.2.2 category. Conversely, it may be

necessary to take the vulnerability of the items and the buildings in which they are stored as the ES into consideration.

8.2 Fragments and Lobbed Munitions of SsD 1.2.2

8.2.1 This less hazardous part of HD 1.2 comprises those items with an individual NEQ of 0.73 kg or less. Trials have shown that many of the items in this category produce fragments and lobbed items with a range that is significantly less than for those in SsD 1.2.1 above.

8.2.2 It should be noted that Table 2G specifies the pre-calculated distances and is applicable to SsD 1.2.1 and 1.2.2.

8.3 Hazard from SsD 1.2.3

8.3.1 This is a special sub-division of HD 1.2 used for storage purposes only. In general munitions that qualify for this category would have been already qualified as Insensitive Munitions.

8.3.2 The hazard from SsD 1.2.3 items can be described as the combination of the hazard from the first munition operating essentially in design mode and the hazard from the totality of the 1.2.3 munitions being stored simply burning. It should be realised that there is still a large element of faith in accepting this way forward since there is no objective evidence of what would happen with bulk storage quantities of IM. For the moment it is accepted that there are no credible scenarios where bulk quantities of IM could be driven to mass explosion.

8.4 Number of Fragments and Lobbed Items at an ES

8.4.1 Following initiation of a PES event, there will be a delay before there are any violent events, and projections. This delay will be dependent on the nature, dimensions and packaging of the items concerned, and may be as short as 2 minutes or as long as 20 minutes. Once items start to react, the rate of reactions increases rapidly and then decreases more slowly. Reactions may still occur several hours after an event.

8.4.2 The ability of the PES structure to contain fragments and lobbed items will determine, both in terms of time and density, the effects at the ES. For medium and light structured PES where, at some stage, the roof will be destroyed, the modifying effect of the PES is not considered. In view of the difficulties in determining the effects of fragmentation in terms of time and quantity, firefighting will generally be inadvisable. However, the installation of automatic fire suppression equipment could be invaluable from both the asset preservation and event containment perspectives. Evacuation from PTRD and beyond may be possible. However, the QDs assume no reliance on firefighting or evacuation distance, being based purely on the total fragmentation that may hazard the ES.

8.5 Effect of Building Structure

8.5.1 Where the PES, or the ES, is an earth-covered building, or a building that has been assessed as capable of containing the effects of an event, and subject to there being access for rescue and firefighting, IMDs are not generally prescribed. However, where there is an aperture such as a door in the PES, and the ES has either an unprotected and undefined door facing the PES or offering no protection to its contents, then the QDs prescribed in Annex A, Table 2A-F, are to be applied.

8.6 Medium Walled Buildings

8.6.1 A medium wall building, defined as one having brick walls of 215 mm or equivalent, doors of minimum 16mm steel thickness, and a protective roof of 150 mm RC with suitable supports, containing explosives of SsD 1.2.1, attracts the same PBD and OQD as an open stack. This is because such a building is not considered to provide any protection from the effects of an internal event. A medium wall building containing explosives of SsD 1.2.2 attracts no OQD as trials have shown that such a building will contain all the effects of such explosives when subjected to a fire stimulus. When acting as an ES, such a building containing SsD 1.2.1 and/or SsD 1.2.2 would attract no IMD as it is considered to provide almost complete protection to its contents. This protection would not be as great as that

provided by an earth- covered structure and is therefore only deemed to provide a high degree of protection (see para 8.7.1(2), below). Where the door(s) do not meet the minimum standard for a medium wall building the face(s) concerned must be treated as an open stack and the QD derived accordingly.

8.7 Inter-Magazine Distances for HD 1.2 Levels of Protection

8.7.1 The IMD for HD 1.2 relate essentially to three levels of protection to ES. Any of the three Protection Levels may be used for licensing purposes, however, if the lesser QD is selected, which gives a Limited degree of protection the potential loss of stock must be accepted by the HOE/Duty Holder prior to IE approval the levels of protection are:

(1) Virtually Complete Protection: There is virtually complete protection against subsequent fires and explosions caused by blast, flame, firebrands, projections and lobbed munitions. The stocks are likely to be serviceable.

(2) High degree of protection: There is a high degree of protection against subsequent explosions caused by blast, flame and projections. There may be occasional fires or subsequent explosions caused by firebrands, projections and lobbed munitions. The extent of the loss of stocks at ES is determined by the effectiveness of fire-fighting.

(3) Limited degree of protection: There is only a limited degree of protection against subsequent fires and explosions caused by blast, flame, firebrands, projections and lobbed munitions, so effective fire-fighting is essential to conserve stocks at ES.

8.8 Process Building Distances for HD 1.2

8.8.1 Since primary and secondary fragmentation hazards are the predominant feature of HD 1.2 and the IBD is based on an appreciation of these hazards, then the PBD is generally determined as 36% of the IBD. However, where the PES is an earth- covered building, or a building that can contain the effects of an event, no QD are necessary to adjacent Process Buildings, although separation between the Process Building and the PES will be dependent on construction criteria and access for rescue and firefighting.

8.8.2 Where the PES is an earth-covered building, or a building that can contain the effects of an event within but has a door or other aperture in the direction of the ES, the PBD is determined as 36% of the IBD. Where the Process Building is protected by an effective traverse and has a protective roof, it is considered that the occupants are afforded a high degree of protection. However, the level of protection decreases if no traverse or protective roof is present and in the absence of either protective feature, the degree of protection for personnel is limited. Process Buildings with no protective features are to be sited at PTRD unless prompt and safe evacuation of personnel can be guaranteed. In these circumstances, no QDs are necessary.

8.8.3 Because of the special nature of SsD 1.2.3 munitions specific advice should be sought from DOSR as to the appropriate Process Building distances to be applied for the munitions under consideration. Advice already promulgated for qualified IM is available from DOSR.

8.9 Public Traffic Route Distances for HD 1.2

8.9.1 Where the PES is an earth- covered building, or a building that can contain the effects of an event, PTRD is generally a fixed distance based on the sub-division of HD 1.2 stored:

(1) For SsD 1.2.1 60 m.

(2) For SsD 1.2.2 30 m.

8.9.2 However, where there is an aperture such as a door in the PES, or where the PES is assessed as being unable to contain the effects of an event, PTRD is based on traffic density (see para 6.4, above, for usage figures). Therefore, the QD prescribed in Annex A, Table 2A-F are to be applied unless it can be demonstrated

that the ES are under MOD control and it can be guaranteed that traffic can be promptly and safely stopped without detriment to personnel.

8.9.3 Because of the special nature of SsD 1.2.3 munitions specific advice should be sought from DOSR as to the appropriate Public Traffic Route distances to be applied for the munitions under consideration. Advice already promulgated for qualified IM is available from DOSR and will be published as an DOSR Standard in due course.

8.10 **Inhabited Building Distances for HD 1.2**

8.10.1 The IBD for HD 1.2 is based on the tolerable risk from fragments and debris, derived from evidence of extensive trials, such that the density would not be expected to exceed one lethal fragment (i.e., one having an energy of more than 80 j) in every 56 m^2 at this distance. Where the PES is an earth-covered building, or a building that can contain the effects of an event, IBD is generally a fixed distance based on the sub-division of HD 1.2 stored:

(1) For SsD 1.2.1 60 m.

(2) For SsD 1.2.2 30 m.

8.10.2 In all other cases, the QD to be used are shown in Annex A Table 2A-F, unless it can be demonstrated that the ES are under MOD control and can be guaranteed to be promptly and safely evacuated without detriment to personnel. In these cases, no QD are necessary, though this would be subject to an assessment by the appropriate IE.

8.10.3 Because of the special nature of SsD 1.2.3 munitions specific advice should be sought from DOSR as to the appropriate Inhabited Building distances to be applied for the munitions under consideration. Advice already promulgated for qualified IM is available from DOSR and will be published as an DOSR Standard in due course.

9 **QUANTITY DISTANCES FOR HD 1.3**

9.1 **General**

9.1.1 Although many hazardous effects are common to both sub-divisions of HD 1.3, the dominant hazards used as the basis for the QD are different in the two cases, thus the need for the separate tables shown at Annex A. The QD are based on the prevention of propagation of explosion; they do not take account of general structural requirements, space for roads or access for firefighting. These practical considerations may require greater distances than given in the tables.

9.1.2 Annex A, Table 3A-C, the QDs for SsD 1.3.3 (i.e., the more hazardous items of HD 1.3), are based on the measured thermal effects from the most hazardous explosives in the division (i.e. propellants). The effect of quite normal winds may increase the flame radius by 50%. Additionally, buildings of asymmetrical construction, such as igloos, or buildings with a protective roof and walls but with one weak wall, or with windows or doors, induce directional effects (jetting) from flames and the projection of burning packages. In such cases, nearby ES facing the directional jetting effect may be lost.

9.1.3 The QDs for SsD 1.3.4 (the less hazardous items of HD 1.3), are given in Annex A Table 3D-F and are, with the exception of PTRD and IBD, fixed distances based on the smaller thermal hazard from the less hazardous explosives in the division. It should be noted that Table 3G specifies the pre-calculated distances and is applicable to SsD 1.3.3 and 1.3.4. Firebrands and minor projections are likely, and the projections may include fragments, but these are less hazardous than those from HD 1.2.

9.2 **Inter-Magazine Distances for HD 1.3 Levels of Protection**

9.2.1 The IMD for HD 1.3 relate essentially to two levels of protection of explosives at an ES against immediate or subsequent fires. These are as follows:

(1) Virtually Complete Protection: There is virtually complete protection against immediate or subsequent fires caused by flame, radiant heat,

firebrands, projections and lobbed items among the contents of an ES. Combustible parts of the building may ignite but this is unlikely to spread to the contents even if the fire service is unable to attend promptly.

(2) High Degree of Protection: There is a high degree of protection against the immediate propagation of fire caused by flame, radiant heat, firebrands, projections and lobbed items to the contents of an ES. Considerable risk exists that the effects of the fire, especially lobbed items, are likely to ignite the contents directly or as a result of ignition of combustible parts of the ES unless prompt and effective firefighting is able to prevent such consequences.

9.3 Process Building Distances for HD 1.3

9.3.1 For HD 1.3.3, the D2 distances prescribed in Annex A Table 3A-C are to be used, with a minimum distance of 25m. These distances depend on the Process Building, as an ES, providing protection against the expected thermal effects and controlled venting at the PES in a direction away from the Process Building. If venting from the PES is directed towards the Process Building, then a minimum distance of 60 m is to be used. If the Process Building is provided with suitable protection, such as a traverse, then the minimum distance can be reduced to 25 m.

9.3.2 For HD 1.3.4, the choice of distance in Annex A Table 3D-F are to be used is governed by the following factors:

(1) If the PES or Process Building, as an ES, provide structural protection against the effects of the HD 1.3.4 explosives, then the lesser distance of 10 m may be used. This protection will be enhanced if there is controlled venting at the PES away from the Process Building.

(2) If neither the PES nor the Process Building provide such protection, then the larger distance of 25 m is to be used.

9.4 Public Traffic Route Distances for HD 1.3

9.4.1 The PTRD for HD 1.3, detailed below, are based on traffic density as well as sub-division, downwind hazard, and the ability to stop traffic promptly. PTRD are generally subject to a minimum distance of 60 m if jetting or venting towards the route is a factor, but a lesser distance may be used after due consideration of traffic density, duration of exposure, speed of traffic and road conditions assuming that jetting is not a factor. For Annex A Table 3A-C, measures to stop traffic within the first ½ hour of an incident are considered to be prompt action.

9.5 Roads

9.5.1 If more than 5000 vehicles use the road in any average 24-hour period (High Density Usage), the PTRD is calculated as follows:

(1) SsD 1.3.3 - Table 3A-C - D4.

(2) SsD 1.3.4 - Table 3D-F - 60m.

9.5.2 If less than 5000 vehicles, but more than 1000 vehicles use the road in an average 24-hour period (Medium Density Usage), the PTRD is calculated as follows:

(1) SsD 1.3.3 – Table 3A-C - D3.

(2) SsD 1.3.4 - Table 3D-F – 25m.

9.5.3 If less than 1000 vehicles use the road in an average 24-hour period (Low Density Usage), the PTRD is calculated as follows:

(1) SsD 1.3.3 - Table 3A-C – 0.5 x D4.

(2) SsD 1.3.4 - Table 3D-F – 10m.

9.5.4 If less than 20 vehicles use the road in any average 24-hour period (Very Low-Density Usage) no QD separation is required

9.6 **Railways**

9.6.1 The method of determination of railway usage is as per para 6.4.1(2), above. For railway lines where the passenger density exceeds 5000 passengers in an average 24-hour period (High Density Usage), PTRD are calculated as follows:

(1) SsD 1.3.3 - Table 3A-C - D4.

(2) SsD 1.3.4 - Table 3D-F - 60m.

9.6.2 For railway lines where the passenger traffic exceeds 1000 passengers but does not exceed 5000 passengers in any average 24-hour period (Medium Density Usage), PTRD are calculated as follows:

(1) SsD 1.3.3 - Table 3A–C - D3.

(2) SsD 1.3.4 - Table 3D-F – 25m.

9.6.3 For railway lines where the passenger density does not exceed 1000 passengers in an average 24-hour period (Low Density Usage), PTRD are calculated as follows:

(1) SsD 1.3.3 - Table 3A-C – 0.5 x D4.

(2) SsD 1.3.4 - Table 3D-F – 10m.

9.7 **Waterways**

9.7.1 For a waterway where the number of people using it in an average 24-hour period exceeds 1800 (High Density Usage), the PTRD is calculated as follows:

(1) SsD 1.3.3 - Table 3A–C - D4.

(2) SsD 1.3.4 - Table 3D-F - 60m.

9.7.2 For a waterway where the number of people using it in an average 24-hour period is less than 1800, but more than 400 (Medium Density Usage), the PTRD is calculated as follows:

(1) SsD 1.3.3 - Table 3A–C - D3.

(2) SsD 1.3.4 - Table 3D-F – 25m.

9.7.3 For a waterway where the number of people using it in an average 24-hour period is less than 400 (Low Density Usage), the PTRD is calculated as follows:

(1) SsD 1.3.3 - Table 3A-C – 0.5 x D4.

(2) SsD 1.3.4 - Table 3D-F – 10m.

9.7.4 If less than 20 people use the waterway in any average 24-hour period (Very Low-Density Usage) no QD separation is required

9.8 **Public Rights of Way/Recreational Facilities**

9.8.1 For a Public Right of Way/Recreational Facility where the number of people using it exceeds 900 in an average 24-hour period (High Density Usage), the PTRD is calculated as follows:

(1) SsD 1.3.3 - Table 3A-C- D4.

(2) SsD 1.3.4 - Table 3D-F - 60m.

9.8.2 For a Public Right of Way/ Recreational Facility where the number of people using it is less than 900 but more than 200 in an average 24-hour period (Medium Density Usage), the PTRD is calculated as follows:

(1) SsD 1.3.3 - Table 3A–C - D3.

(2) SsD 1.3.4 - Table 3D-F – 25m.

9.8.3 For a Public Right of Way/Recreational Facility where the number of people using it is less than 200 in an average 24-hour period (Low Density Usage), the PTRD is calculated as follows:

(1) SsD 1.3.3 - Table 3A-C – 0.5 x D4.

(2) SsD 1.3.4 - Table 3D-F – 10m.

9.8.4 If less than 20 people use the Right of Way/Recreational Facility in any average 24-hour period (Very Low-Density Usage) no QD separation is required

9.9 **Inhabited Building Distances for HD 1.3**

9.9.1 The IBD for HD 1.3 are based on a thermal dose criterion of 62.8 kJm^{-2} and also consider the effects of firebrands and augmentation of flame radius. It is anticipated that occupants of traditional UK types of houses would not suffer injury unless standing in front of windows. Personnel in the open are likely to experience reddening of any exposed skin area. Where venting from a PES is directed towards an ES at IBD, a minimum distance of 60 m is to be applied for both SsD 1.3.3 and SsD 1.3.4.

10 **OTHER QUANTITY DISTANCES**

10.1 **For HD 1.4**

10.1.1 Distances from a PES containing explosives of HD 1.4 to an ES are not a function of NEQ. Separation distances are prescribed on the basis of an assessment of fire risks and consideration of the firefighting facilities available. Open stacks or non- fire-resistant buildings should normally be separated by a distance of 10 m, primarily to allow fire-fighting access. Buildings assessed as providing adequate fire resistance need only be separated by a nominal distance sufficient to provide emergency access.

10.2 **For HD 1.5**

10.2.1 HD 1.5 comprises intensitive explosives substances. These substances are so insensitive that there is very little likelihood of initiation or transition from burning to detonation, however, they are treated as HD 1.1 for the purposes of storage. Information regarding storage of HD 1.5 is to be obtained from the relevant IE.

10.3 **For HD 1.6**

10.3.1 HD 1.6 comprises extremely insensitive explosives articles which do not have a mass explosion hazard. Therefore, it is reasonable to assume that the maximum credible event that could occur with HD 1.6 would be one of the following:

(1) Detonation of a single article without propagation, either instantaneous or delayed to other articles of HD 1.6.

(2) Moderate combustion of the full quantity of articles present.

10.3.2 QDs can be derived from consideration of the alternative credible events above by adopting the larger of the distances as follows:

(1) The distance determined by considering the explosion effects generated by the detonation of the single article as the equivalent NEQ of HD 1.1.

(2) The distance determined by considering the explosion effects generated by the combustion of the total contents of the PES as the equivalent NEQ of HD 1.3.

10.3.3 The actual distances to be used in any given situation will depend principally, though not exclusively, on the following factors:

(1) The NEQ and type of the individual article.

(2) The total NEQ and structure of the PES.

(3) The protection available at the ES.

10.3.4 One of the major difficulties in defining of QDs for the storage of HD 1.6 is that there are currently no practical examples in Service. This, in turn, means that there is no practical experience on the hazards associated with storage or transportation of such articles. Because of this lack of practical data, each case would need to be considered on merit and advice on the QDs to be adopted sought from CIE (MOD) staff.

11 QUANTITY-DISTANCE TABLES

11.1 Igloos Containing HD 1.1

11.1.1 The tables at Annex A provide QD for PES containing up to 250 000 kg NEQ. However, certain designs of igloo require a lower limit in the case of HD 1.1. The reason is that the blast loading from an exploding igloo as a PES is a function of the NEQ, whereas the blast resistance of an igloo as an ES depends upon its design. The limitations for a particular igloo must be obtained from the design authority (usually TA (Structures)).

11.2 Groups of PES

11.2.1 Where the appropriate IMD does not separate two or more PES, they are to be considered as a single site and the aggregate NEQ used for determining QD except where the rules for compartmented storage are used (see para 11.6).

11.3 Application of Quantity-Distance Tables

11.3.1 In applying the tables to a specific PES (or Process Building), the following procedure is to be adopted:

(1) Ascertain the exact distance from the PES to the nearest building containing explosives (ES).

(2) Ascertain the exact distance from the PES to the nearest Inhabited Building, Public Traffic Route (ES) and Vulnerable Construction.

(3) Refer to the tables for each HD and determine the permitted NEQ, by HD, at each distance specified in sub-paras (1) and (2) above, having due regard to the structure and use of the ES. The approved NEQ for the PES is the least of the quantities of each hazard division determined.

11.4 Integrated Weapons Complex (IWC)

11.4.1 The unique design and layout of an IWC necessitates the use of Quantity Distances which are different from those normally used for standard above ground facilities.

11.4.2 The major difference is that the design of a Weapon Assembly and Check Room (WACR) is such that any debris from an internal explosion will be contained within the area designated an IWC Complex, and therefore the standard minimum debris related distances from an above ground PES are not applicable.

11.4.3 The four individual WACRs of an IWC are to be licensed separately. As WACRs and the Test Equipment House (TEH) have been specifically designed to withstand the effects of an explosives incident in an adjacent WACR, no Quantity Distances need be applied to these facilities when considered as Exposed Sites on WACR licences; it is not necessary to record the TEH as an ES.

11.4.4 When an individual WACR is licensed, the other three WACRs are to be included as ES on the licence.

11.4.5 Standard WACR limits are as follows. However, where IWC roofs do not conform to the stipulated design standard then lower limits will apply. The IE should be consulted who will then make an assessment on a case by case basis.

11.4.6 Additionally, in order to demonstrate ALARP principles, Authorised Limits for WACRs should, in all cases, be set at the lowest level required to meet business needs.

(1) HD 1.1 680 kgs.

(2) HD 1.21 680 kgs.

(3) HD 1.22 680 kgs.

(4) HD 1.33 680 kgs.

(5) HD 1.34 680 kgs.

(6) HD 1.4 1000 kgs.

11.4.7 As all four WACRs are licensed separately, there is no need to aggregate the explosives contents of all four WACRs.

11.4.8 When considering another IWC WACR as an Exposed Site the 680kg limit will apply. When considered as an Exposed Site from other PESs, an IWC is to be treated as an Explosives Process Building without protective roof, traversed.

11.4.9 Due to the requirement to licence WACRs independently rather than considering an IWC as a single entity, careful consideration needs to be given to the recording of the numbers of personnel shown as working in each WACR. It is accepted that the numbers within a WACR will vary according to the task. Where working practices enable Depots to advise exact WACR complements, these limits will be reflected on licences. In other circumstances, the total complement of the IWC divided by four will be recorded as the number of personnel per WACR. This is based on the understanding that in practice, Depots will be allowed the flexibility to exceed the individual WACR personnel limits providing the total does not exceed the complement of the IWC.

11.5 **Unitization**

11.5.1 The principle of unitization, i.e., partition of explosives in individual compartments using dividing walls, or by using internal traverses (e.g. autoclaved aerated concrete blocks), enables reduced quantity distances to be used. These distances are based on the largest quantity of explosives in a compartment, or in a cell within a compartment, instead of the total NEQ for the whole building.

11.5.2 The function of the dividing walls or internal traverses is to prevent practically instantaneous propagation, i.e., to delay substantially the communication of an event between explosives on opposite sides of a wall or internal traverse thereby reducing the maximum credible event. The regulations below only apply when the explosives are to be stored in their approved packaging.

11.5.3 For fragmenting HD 1.1 explosives, the full applicable Annex A Table 1A-C QDs are to be applied unless the building is specifically designed to contain the effects. However, where the storage of HD 1.1 is limited to non-fragmenting explosives e.g. demolition explosives (including detonators) and saluting cartridges, the principle of unitization may be adopted for which a fixed QD of 50 m may be applied. Unitization is achieved by dividing compartments into cells using autoclaved aerated concrete blocks (or equivalent) as barriers. The barrier thickness is to be a minimum of 300 mm thick. Autoclaved aerated concrete blocks are designed to be sacrificial, having a density of 550 kg/m^3 to 750 kg/m^3 and a compressive strength of 4 N/mm^2 to 5 N/mm^2. The blocks need not be mortared together thus enabling cells to be readily adjustable in size to suit storage requirements. Additionally, the following storage criteria must be met:

(1) Explosives in a compartment are not to be placed within 0.5 m of that compartment wall. This distance may include the thickness of any autoclaved aerated concrete block barrier. The resulting area in which the explosives may be stored is to be suitably demarcated.

(2) No more than 10 kg of non-fragmenting HD 1.1 explosives is to be placed in each cell.

(3) The minimum distance between the faces of the packages forming each stack is to be at least 1 m. This distance may include the thickness of the autoclaved aerated concrete block barrier.

(4) There must be no direct line of sight between stacks.

(5) Detonators may be stored in the same compartment provided that they are placed in an individual cell and subject to the criteria above.

(6) Where either a permanent arrangement is required, or where the height of the block wall dictates, blocks may be mortared together using either weak mortar which is no stronger than the blocks (so that high energy projectiles are not formed) or by the use of expanding polyurethane foam (aerosol based commercial/DIY products), the bond of which is stronger than the blocks, but will not produce fragments.

11.6 **Compartmented Buildings**

11.6.1 A compartmented building is a variant on the principle of unitization which allows the storage of explosives of different HDs within a single location, without the need for aggregation. The overall NEQ can be reduced when calculating QDs by considering each compartment as an individual PES. To achieve this aim, the compartments storing the more hazardous explosives must be separated by introducing buffer compartments between them.

11.6.2 A compartmented building is one with separate rooms, without connecting doors, in which the dividing walls are constructed of brick or concrete block not less than a nominal 215 mm thickness, or, if an R&I bay or similar process facility is present, 680 mm. Walls of lesser thickness are not to be considered as efficient partitions.

11.6.3 Each compartment can be considered as an individual PES by separating compartments storing the more hazardous explosives of HD 1.1, SsD 1.2.1 and SsD 1.3.3 by introducing buffer compartments between them. These buffer compartments can be empty, filled with inert items, or contain less hazardous items of SsD 1.2.2, SsD 1.3.4 and SsD 1.4.

11.6.4 Unitization of the compartmented PES is subject to the following rules:

(1) The building is to be constructed in accordance with this document.

(2) The NEQ in any one compartment is to be aggregated using normal mixing rules and is not to exceed the quantity governed by the available QDs, or the following quantities, whichever is the lesser:

(a) HD 1.1 - 2500 kg.

(b) HD 1.3.3 - 5000 kg.

(c) HD 1.2.1, SsD 1.2.2, SsD 1.3.4 and HD 1.4 - To licensed capacity.

(3) HD 1.1 must be separated from HD 1.1 by three buffer compartments the centre one of which may contain SsD 1.2.1 or SsD 1.3.3.

(4) HD 1.1 must be separated from SsD 1.2.1 by one buffer compartment.

(5) HD 1.1 must be separated from SsD 1.3.3 by one buffer compartment.

(6) SsD 1.2.1 may be stored adjacent to SsD 1.2.1 without aggregation. This is based on the principle that HD 1.2 will not propagate from compartment to compartment and therefore explosives in adjacent compartments will not be affected.

(7) SsD 1.2.1 must be separated from SsD 1.3.3 by one buffer compartment.

(8) SsD 1.3.3 must be separated from SsD 1.3.3 by one buffer compartment.

11.6.5 Schematic plans of such compartmented PES are at Fig 1 to Fig 4 below.

R & I	HD 1.1	SsD 1.2.2 and/or SsD 1.3.4 and/or HD 1.4	SsD 1.2.1 or SsD 1.3.3	SsD 1.2.2 and/or SsD 1.3.4 and/or HD 1.4	HD 1.1

Fig 1 Schematic Plan of Compartmented PES

R & I	SsD 1.2.2	SsD 1.2.1	SsD 1.2.1	SsD 1.2.2 and/or SsD 1.3.4 and/or HD 1.4	HD 1.1

Fig 2 Schematic Plan of Compartmented PES

R & I	SsD 1.3.3	SsD 1.2.2 and/or SsD 1.3.4 and/or HD 1.4	SsD 1.3.3	SsD 1.2.2 and/or SsD 1.3.4 and/or HD 1.4	HD 1.1

Fig 3 Schematic Plan of Compartmented PES

HD 1.1	HD 1.4	HD 1.3	HD 1.2

Fig 4 Schematic Plan of Compartmented PES

11.7 **Implementation**

11.7.1 In addition to other applicable criteria within these regulations, a multi-compartmented PES is to be sited in accordance with the following:

(1) The appropriate QD to be used is for the largest NEQ/HD for any one compartment using the aggregation and mixing rules.

(2) HD 1.1 explosives are to be effectively segregated from other explosives and where practical are to be stored in an end compartment. As a further safety measure, and in line with the principles of buffered storage, any HD 1.4 explosives present are to be stored in the compartment adjacent to the HD 1.1, or the HD 1.2 explosives if no HD 1.1 is stored.

12 INFLUENCE OF TRAVERSES

12.1 General

12.1.1 The details of what constitutes an effective traverse are given in this document.

12.2 HD 1.1

12.2.1 For HD 1.1 this is as follows:

(1) IQD. the presence of a traverse reduces the risk of propagation by high velocity projections at low elevation; therefore, the IMD and PBD for effectively traversed PES have been reduced in the tables for HD 1.1.

(2) OQD. Investigations of damage caused by blast in recorded accidents and after trials show that, in the case of HD 1.1, the difference between the OQD required for traversed and untraversed PES is too small to be taken into account. However, empirical evidence suggests that there is a very significant reduction in fragment/debris projection when a traverse is used around a PES containing NEQs up to 5600 kg of HD 1.1. Therefore, a reduced minimum distance is applied to traversed medium and light structures.

12.3 Earth-Covered Buildings

12.3.1 An earth-covered building may be considered as a traversed PES provided it fulfils the following requirements. The earth-cover over buildings must be at least 0.6 m thick. Where the earth-cover on a building intersects the earth-cover of an adjacent building at above normal ground level and, providing the point of intersection does not exceed half the internal storage height of either PES, there is no restriction on capacity of either building. However, if the intersection is more than 50% but less than 75% of the internal storage height, the maximum NEQ is to be limited by the D4 requirements of Annex A Table 1. If the intersection is more than 75% of the internal height of either PES, the NEQ is limited by the D5 requirements of Annex A Table 1 or, alternatively, the NEQ of the two (or more)

PES can be aggregated. A minimum slope of two parts horizontal to one-part vertical, starting directly above each edge of the roof, is required.

12.4 **Natural Traverses**

12.4.1 It is acceptable to take advantage of natural terrain where this provides protection equivalent to that of artificial traverses. However, it is found that hills are usually insufficiently steep or near enough to the explosives to be relied upon to provide the required protection. However, in certain circumstances, woods may provide an effective degree of traversing.

13 **DOOR BARRICADES FOR EARTH-COVERED BUILDINGS**

13.1 **General**

13.1.1 Details of what constitutes a door barricade are given in this document.

13.2 **HD 1.1**

13.2.1 A door barricade is of limited value for HD 1.1 explosives. It is superfluous as far as IMD is concerned when igloos or other earth-buildings are sited side-to-side or rear-to-rear. When the front of such a building at an ES faces the side or rear of an earth-covered building at a PES, a door barricade may intercept concrete debris. However, the major consideration is the blast resistance of the headwall and door at the ES and this is not much affected by the barricade. When such buildings are orientated front to front, a door barricade may be similarly ineffective. As regards personnel hazards, a door barricade, even of reasonable height, does not intercept debris that is lobbed or projected in a high trajectory.

13.3 **HD 1.2**

13.3.1 A fire in an earth-covered building containing explosives of HD 1.2 produces a serious hazard through the doorway from fragments and ejected unexploded items. Providing a separate traverse with a vertical wall facing the door reduces this hazard.

13.4 **SsD 1.3.3 and SsD 1.3.4**

13.4.1 SsD 1.3.3 and SsD 1.3.4 are as follows:

(1) SsD 1.3.3 the deflagration of SsD 1.3.3 propellants in an igloo or similar earth-covered building can produce marked directional effects in the hazardous sector (the hazardous sector is taken to be the area bounded by the lines drawn from the centre of the door and inclined at 30□ on either side of a line perpendicular to the door). This hazard is reduced by a door barricade, at the PES, which has a vertical wall facing the door, preferably backed with earth, and permits reduced QD in Annex A Table 3A. This door barricade is not necessary when the door of the PES faces the earth-covered rear or side wall of an ES, or faces a Process Building that has both a traverse and a protective roof.

(2) SsD 1.3.4. Any burning of items of SsD 1.3.4 in an igloo or similar earth-covered building is more likely to produce a hazard from fragments and projected items in the hazardous sector (defined above). Providing a door barricade with a vertical wall facing the door reduces this hazard. Such a door traverse at both PES and ES permits reduced QD in Annex A Table 3B.

14 CONSTRUCTION OF PES

14.1 General

14.1.1 The interpretation of the pictographs used in the QD tables is in some cases dependent upon detailed advice concerning the structure of the building. Guidance on structural features of PES is given in this document.

14.2 Igloos

14.2.1 Igloos that conform to the minimum design criteria qualify for reduced IMD compared with other types of above ground PES. Igloos of a strength that exceeds the minimum prescription may warrant further reductions in IMD. Questions concerning the design of igloos are to be referred to TA (Structures) through the relevant IE.

14.3 Brick Buildings

14.3.1 Brickwork offers good fire and fragment resistance. However, in relation to the blast from HD 1.1, brick does not have the blast resistance of reinforced concrete (e.g. igloos) and does not collapse or disintegrate to give relatively harmless projections as would a prefabricated construction. Therefore, for HD 1.1, a building (PES or ES) of medium wall construction is to be considered as being equivalent to a light construction for the purposes of calculating QD.

14.4 Pressure Release

14.4.1 Structures for storage of relatively small quantities of HD 1.1 and HD 1.3 explosives can be designed to survive an event within largely intact if a frangible wall is provided which will permit the rapid release of the pressures generated.

15 SPECIAL CONDITIONS FOR THE APPLICATION OF QUANTITY-DISTANCE TABLES

15.1 Protection from Effects of Items of HD 1.1

15.1.1 It may be possible for high velocity projections emanating from an explosion at a PES to penetrate the headwall or door(s) of an igloo or other earth-covered building at the ES and retain sufficient energy to initiate the contents practically instantaneously. Certain of the QD in Annex A, Table 1 presume the headwall and door(s) of the building at the ES arrest such high velocity projections and fragments from lobbed munitions which explode on impact. If this is not the case, greater QD are to be used.

15.1.2 For types of PES other than igloos, a traverse is preferred because of the increased protection it affords to attack by high velocity fragments. If a traverse is not used, large separation distances, typically D13, will be required.

15.2 HD 1.1 Blast Resistance of Structures at Exposed Sites

15.2.1 It is possible for a structure at an ES to fail under blast loading so that its contents are initiated practically instantaneously. This may be the result of major internal spalling from the walls, implosion of the doors, or catastrophic failure of the entire structure. The QD in Annex A Table 1A-C presume that a structure at an ES is either strong enough to withstand the blast, or that secondary projections from the structure are not energetic enough to initiate the contents, taking account of their sensitiveness. An ES containing explosives vulnerable to attack by heavy spalling (e.g. unboxed missile warheads filled with relatively sensitive high explosive) requires special consideration and the greater QD indicated in Annex A Table 1A-C are to be used.

15.3 **Protection from the Effects of Items of HD 1.2 or HD 1.3**

15.3.1 Certain types of construction provide a reasonable degree of protection against firebrands, comparatively low velocity projections and lobbed munitions. Examples are:

(1) An earth-covered building with headwall and door(s) of 150 mm RC and equivalent.

(2) A heavy walled building.

(3) A traversed Process Building with a protective roof.

15.3.2 In such cases, the lesser IQD of Annex A, Table 2A-F or Table 3A-C may be used. If the door or one wall etc does not completely conform to the above requirements, such short distances are only to be authorised after a special assessment of the relative orientation of the weak elements and the hazards involved.

15.4 **Propulsive Rockets**

15.4.1 Rockets or missiles, including MLRS, stored unpackaged in a propulsive state in a PES which has not been designed to resist their thrust, are to be stored either pointed at a vertically faced traverse or be held by approved devices to prevent their flight. In any case, they must not point at the doors of the PES. The QD given in the tables apply only when these conditions are met. Rockets that are 'non-self-propulsive' may be stored in accordance with the QD Tables without regard for the flight range.

15.5 **Separation of Miscellaneous Occupied Buildings**

15.5.1 Separation distances for picquet posts, site offices and other occupied buildings within or directly supporting an explosives facility are given in this document.

15.6 **Non-Explosives Stores**

15.6.1 Buildings containing empty packages and non-explosive stores are to be separated from a PES by a distance based on the risk to the explosives in the PES from a fire in the building and/or consideration of the separation of valuable packages from the PES. The minimum distance for any empty box store/building is to be 10m to allow emergency access. For stacks/buildings containing non-explosive stores or high value packaging, consideration should be given to providing the full IMD.

16 **SPECIFIC PROVISIONS**

16.1 **Ammunition Containing Depleted Uranium**

16.1.1 The general regulations pertaining to storage and transportation of Depleted Uranium (DU) are contained in this document and ESTC Guidance Notes No 1 and No 5. Advice regarding specific DU natures currently in the MOD inventory are contained in ESTC Standard 10 (120 mm APFSDS) and Standard 11 (20 mm DS Phalanx).

16.2 **EOD Unit Garages and Parking Areas**

16.2.1 The general regulations pertaining to the licensing of garages and parking areas for EOD vehicles is detailed in Annex C.

CHAPTER 10

SECTION 2

ANNEX A

QUANTITY-DISTANCE MATRICES

CONTENTS

1 Pictographs

1 The pictographs in the following tables are introduced to aid the presentation of information in the QD Tables. The pictographs are purely diagrammatic; their shapes do not imply that actual structures should have similar shapes and proportions. The orientation shown is intended to indicate the direction of principle concern for blast, flame, radiant heat and projections shown by arrows. In the actual situation, every direction must be considered in turn. At a PES, there are relatively few significant variations, but at an ES it is necessary to distinguish among different types of construction and among different functions of buildings. For these reasons, a given building may require one symbol when it is being considered as a PES and a different symbol when it is considered as an ES.

2 Notes

2 The notes within the QD tables give references to paragraphs. The short text of each note is not to be used as a substitute for proper study.

It is essential to study the text in this chapter, when using this table since they are complementary. Where “No QD” is shown on the matrix practical considerations will dictate actual separation distances.

Table 1A HD 1.1 QD Matrix for Earth Covered Storage

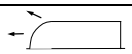
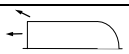
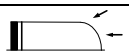
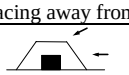
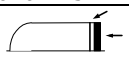
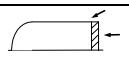
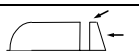
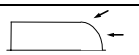
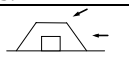
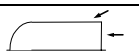
PES ➤ / ES ▼	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	D3 Virtually complete protection 6.2.1(3) No primary explosives	D3 Virtually complete protection 6.2.1(3) No primary explosives	D4 Virtually complete protection 6.2.1(3) No primary explosives
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	D3 Virtually complete protection 6.2.1(3) No primary explosives	D3 Virtually complete protection 6.2.1(3) No primary explosives	D5 Virtually complete protection 6.2.1(3) No primary explosives
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	D4 Virtually complete protection 6.2.1(3) No primary explosives	D5 Virtually complete protection 6.2.1(3) No primary explosives or D4 High degree of protection	D7 High degree of protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D9 Limited degree of protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D9 High degree of protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	D4 Virtually complete protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D5 Virtually complete protection 6.2.1(3) No primary explosives	D4 Virtually complete protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D5 Virtually complete protection 6.2.1(3) No primary explosives	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D6 Virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	D6 Virtually complete protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D6 Virtually complete protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D6 Limited degree of protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D9 Limited degree of protection

Table 1A HD 1.1 QD Matrix for Earth Covered Storage

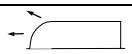
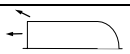
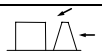
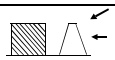
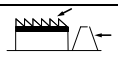
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D7 High degree of protection D5 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D7 High degree of protection D5 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D9 Limited degree of protection or D12 High degree of protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall or D7 High degree of protection	D9 Limited degree of protection or D12 High degree of protection
 **15** Process Building with protective roof, traversed	D9A 6.3.2 Less than 10 personnel D10 or D18 7.1.1 Reduced QD for standard igloos All options give high degree of protection for personnel	D9A 6.3.2 Less than 10 personnel D10 All options give high degree of protection for personnel	D9A 6.3.2 Less than 10 personnel D10 All options give high degree of protection for personnel
 **16** Process Building without protective roof, traversed	D10(≥270m) or D18 (≥270m) 7.1.1 Reduced QD for standard igloos Limited degree of protection for personnel	D10(≥270m) Limited degree of protection for personnel	D10(≥270m) Limited degree of protection for personnel

Table 1A HD 1.1 QD Matrix for Earth Covered Storage

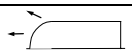
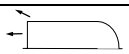
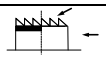
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **17** Process Building with or without protective roof, untraversed	D10(≥270m) or D18 (≥270m) 7.1.1 Reduced QD for standard igloos Limited degree of protection for personnel	D10(≥270m) Limited degree of protection for personnel	D13(≥270m) Limited degree of protection for personnel
18 Transfer Shed Traversed Occupied by less than 10 persons	D7 No protection for personnel – only prevents propagation	D7 No protection for personnel – only prevents propagation	D7 No protection for personnel – only prevents propagation
Occupied by 10 persons or more	D10(≥270m) or D18(≥270m) 7.1.1 Reduced QD for standard igloos All options give only limited degree of protection for personnel	D10(≥270m) Limited degree of protection for personnel	D10(≥270m) Limited degree of protection for personnel
19 Transfer Shed Untraversed Occupied by less than 10 persons	D7 No protection for personnel – only prevents propagation	D7 No protection for personnel – only prevents propagation	D12 No protection for personnel – only prevents propagation
Occupied by 10 persons or more	D10(≥270m) or D18(≥270m) 7.1.1 Reduced QD for standard igloos All options give only limited degree of protection for personnel	D10(≥270m) Limited degree of protection for personnel	D13(≥270m) Limited degree of protection for personnel
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	0.5 x D12 or 0.5 x D14 7.1.1 Reduced QD for standard igloos 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way /Recreational Facilities	0.5 x D12 or 0.5 x D15 7.1.1 Reduced QD for standard igloos 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way /Recreational Facilities	0.5 x D12 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way /Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	D11(≥270m) or D16(≥270m) 7.1.1 Reduced QD for standard igloos	D11(≥270m) or D17(≥270m) 7.1.1 Reduced QD for standard igloos	D11(≥270m)

Table 1A HD 1.1 QD Matrix for Earth Covered Storage

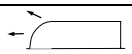
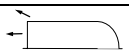
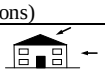
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 para 4.2 for full definitions)	D13(≥400m) or D14(≥400m) 7.1.1 Reduced QD for standard igloos	D13(≥400m) or D15(≥400m) 7.1.1 Reduced QD for standard igloos	D13(≥400m)
 **23** Inhabited Building Places of Assembly	D13(≥400m) or D14(≥400m) 7.1.1 Reduced QD for standard igloos	D13(≥400m) or D15(≥400m) 7.1.1 Reduced QD for standard igloos	D13(≥400m)
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	2 x D12 or 2 x D14 7.1.1 Reduced QD for standard igloos	2 x D12 or 2 x D15 7.1.1 Reduced QD for standard igloos	2 x D12
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D11(≥270m) or D16(≥270m) 7.1.1 Reduced QD for standard igloos	D11(≥270m) or D17(≥270m) 7.1.1 Reduced QD for standard igloos	D11(≥270m)
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D13(≥400m) or D14(≥400m) 7.1.1 Reduced QD for standard igloos	D13(≥400m) or D15(≥400m) 7.1.1 Reduced QD for standard igloos	D13(≥400m)
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD

Table 1A HD 1.1 QD Matrix for Earth Covered Storage

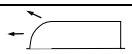
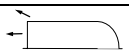
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
26 Overhead Power Grid Supergrid Network and associated substations	D13 D14 7.1.1 Reduced QD for standard igloos	D13 D15 7.1.1 Reduced QD for standard igloos	D13
Normal Network and associated substations	D11 D16 7.1.1 Reduced QD for standard igloos	D11 D17 7.1.1 Reduced QD for standard igloos	D11
Minor Network and associated substations	D10 or D18 7.1.1 Reduced QD for standard igloos	D10	D10
27 POL Facilities inc pipelines Protected or Underground	0.5 x D7 (≥25m)	0.5 x D7 (≥25m)	0.5 x D7 (≥25m)
Unprotected, aboveground vital	D13 (≥400m)	D13 (≥400m)	D13 (≥400m)
Unprotected, aboveground, non-vital	D13	D13	D13
Small Quantities (Chapter 10 Sect. 7 para 3.4)	10m	10m	10m
28 Boiler Houses Manned or Vital	D13(≥400m)	D13(≥400m)	D13(≥400m)
Unmanned, non-vital	D8	D8	D8
Unmanned, local	45m	45m	45m

Table 1B HD 1.1 QD Matrix for Non-Earth Covered Heavy Storage

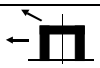
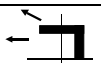
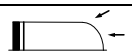
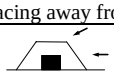
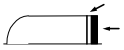
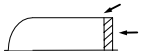
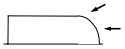
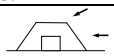
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	D5 Virtually complete protection	D5 Virtually complete protection	D5 Virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	D5 Virtually complete protection	D5 Virtually complete protection	D5 Virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	D8 High degree of protection or D12 Virtually complete protection	D8 High degree of protection or D12 Virtually complete protection	D8 High degree of protection or D12 Virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	D9 Limited degree of protection	D9 Limited degree of protection	D9 Limited degree of protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	D9 High degree of protection	D9 High degree of protection	D9 High degree of protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	D6 High degree of protection	D6 High degree of protection	D6 High degree of protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	D6 High degree of protection	D6 High degree of protection	D6 High degree of protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	D9 Limited degree of protection	D9 Limited degree of protection	D9 Limited degree of protection

Table 1B HD 1.1 QD Matrix for Non-Earth Covered Heavy Storage

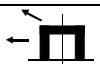
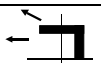
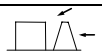
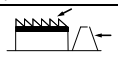
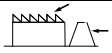
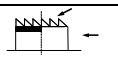
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	D9 Limited degree of protection or D12	D9 Limited degree of protection or D12	D9 Limited degree of protection or D12
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions	D4 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall Limited degree of protection or D7 High degree of protection Without the above restrictions
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	D9 Limited degree of protection or D12	D9 Limited degree of protection or D12	D9 Limited degree of protection or D12
 **15** Process Building with protective roof, traversed	D9A 6.3.2 Less than 10 personnel D10 All options give high degree of protection for personnel	D9A 6.3.2 Less than 10 personnel D10 All options give high degree of protection for personnel	D9A 6.3.2 Less than 10 personnel D10 All options give high degree of protection for personnel
 **16** Process Building without protective roof, traversed	D10(≥270m) Only limited degree of protection for personnel	D10(≥270m) Only limited degree of protection for personnel	D10(≥270m) Only limited degree of protection for personnel Minimum distance NOT applicable to IWC 11.4 Further information on IWC
 **17** Process Building with or without protective roof, untraversed	D13(≥270m) Only limited degree of protection for personnel	D13(≥270m) Only limited degree of protection for personnel	D13(≥270m) Only limited degree of protection for personnel Minimum distance NOT applicable to IWC

Table 1B HD 1.1 QD Matrix for Non-Earth Covered Heavy Storage

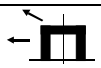
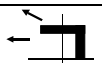
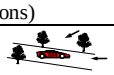
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
18 Transfer Shed Traversed Occupied by less than 10 persons	D7 No protection for personnel – only prevents propagation	D7 No protection for personnel – only prevents propagation	D7 No protection for personnel – only prevents propagation
Occupied by 10 persons or more	D10 (≥270m) Only limited degree of protection for personnel	D10 (≥270m) Only limited degree of protection for personnel	D10 (≥270m) Only limited degree of protection for personnel Minimum distance NOT applicable to IWC
19 Transfer Shed Untraversed Occupied by less than 10 persons	D12 No protection for personnel – only prevents propagation	D12 No protection for personnel – only prevents propagation	D12 No protection for personnel – only prevents propagation **D7** can be used if PES is IWC
Occupied by 10 persons or more	D13 (≥270m) Only limited degree of protection for personnel	D13 (≥270m) Only limited degree of protection for personnel	D13 (≥270m) Only limited degree of protection for personnel Minimum distance NOT applicable to IWC **D10** can be used if PES is IWC
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	0.5 x D12 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way /Recreational Facilities	0.5 x D12 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way /Recreational Facilities	0.5 x D12 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way /Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	D11 (≥270m)	D11 (≥270m)	D11 (≥270m) Minimum distance NOT applicable to IWC
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	D13 (≥400m)	D13 (≥400m)	D13 (≥400m) Minimum distance NOT applicable to IWC

Table 1B HD 1.1 QD Matrix for Non-Earth Covered Heavy Storage

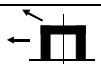
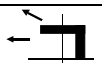
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **23** Inhabited Building Places of Assembly	D13 (≥400m)	D13 (≥400m)	D13 (≥400m) Minimum distance NOT applicable to IWC
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	2 x D12	2 x D12	2 x D12
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D11 (≥270m)	D11 (≥270m)	D11 (≥270m) Minimum distance NOT applicable to IWC
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D13 (≥400m)	D13 (≥400m)	D13 (≥400m) Minimum distance NOT applicable to IWC
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD
26 Overhead Power Grid Supergrid Network and associated substations	D13	D13	D13
Normal Network and associated substations	D11	D11	D11
Minor Network and associated substations	D10	D10	D10
27 POL Facilities inc pipelines Protected or Underground	0.5 x D7 (≥25m)	0.5 x D7 (≥25m)	0.5 x D7 (≥25m)
Unprotected, aboveground vital	D13 (≥400m)	D13 (≥400m)	D13 (≥400m) Minimum distance NOT applicable to IWC
Unprotected, aboveground, non-vital	D13	D13	D13
Small Quantities (Chapter 10 Sect. 7 para 3.4)	10m	10m	10m
28 Boiler Houses Manned or Vital	D13 (≥400m)	D13 (≥400m)	D13 (≥400m) Minimum distance NOT applicable to IWC
Unmanned, non-vital	D8	D8	D8
Unmanned, local	45m	45m	45m

Table 1C HD 1.1 QD Matrix for Non-Earth Covered Medium/Light Storage

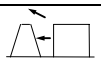
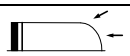
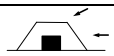
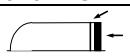
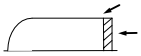
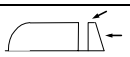
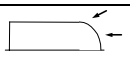
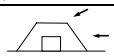
PES / ES	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	D5 Virtually complete protection	D5 Virtually complete protection	D5 Virtually complete protection	D5 Virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	D5 Virtually complete protection	D5 Virtually complete protection	D5 Virtually complete protection	D5 Virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	D7 High degree of protection	D7 High degree of protection	D7 High degree of protection	D7 High degree of protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	D9 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D9 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D9 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D9 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	D9 High degree of protection	D9 High degree of protection	D9 High degree of protection	D9 High degree of protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	D6 High degree of protection	D6 High degree of protection	D6 High degree of protection	D6 High degree of protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	D6 High degree of protection	D6 High degree of protection	D6 High degree of protection	D6 High degree of protection

Table 1C HD 1.1 QD Matrix for Non-Earth Covered Medium/Light Storage

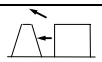
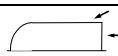
PES / ES	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	D9 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D9 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D9 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D9 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	D7 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D7 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D7 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D7 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	D7 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D7 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D7 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D7 High degree of protection or D4 Limited protection only 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall D1 or D2 High degree of protection 7.2 Open bomb bay storage	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall D1 or D2 High degree of protection 7.2 Open bomb bay storage
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D9 Limited degree of protection or D12	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall D1 or D2 High degree of protection 7.2 Open bomb bay storage	D9 Limited degree of protection 7.3-7.4 Untraversed storage robust munitions or D12
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall

Table 1C HD 1.1 QD Matrix for Non-Earth Covered Medium/Light Storage

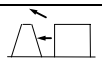
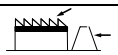
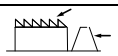
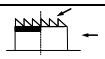
PES / ES	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D9 Limited degree of protection or D12	D7 High degree of protection or D4 High degree of protection 6.2.1(3) No primary explosives 15.2 No items vulnerable to spall	D9 Limited degree of protection or D12
 **15** Process Building with protective roof, traversed	D9A 6.3.2 Less than 10 personnel D10 All options give high degree of protection for personnel	D9A 6.3.2 Less than 10 personnel D10 All options give high degree of protection for personnel	D9A 6.3.2 Less than 10 personnel D10 All options give high degree of protection for personnel	D9A 6.3.2 Less than 10 personnel D10 All options give high degree of protection for personnel
 **16** Process Building without protective roof, traversed	D9A 6.3.2 Less than 10 personnel D10 All options give only limited degree of protection for personnel	D9A 6.3.2 Less than 10 personnel D10 All options give only limited degree of protection for personnel	D9A 6.3.2 Less than 10 personnel D10 All options give only limited degree of protection for personnel	D9A 6.3.2 Less than 10 personnel D10 All options give only limited degree of protection for personnel
 **17** Process Building with or without protective roof, untraversed	D9A 6.3.2 Less than 10 personnel 6.3.4 Use 270m minimum distances for buildings without protective roof D10 All options give only limited degree of protection for personnel 6.3.4 Use 270m minimum distances for buildings without protective roof	D13 (≥270m) High degree of protection for personnel	D9A 6.3.2 Less than 10 personnel D10 All options give only limited degree of protection for personnel	D13 (≥270m) High degree of protection for personnel
18 Transfer Shed Traversed Occupied by less than 10 persons Occupied by 10 persons or more	D7 No protection for personnel – only prevents propagation D10 (≥270m) Only limited degree of protection for personnel	D7 No protection for personnel – only prevents propagation D10 (≥270m) Only limited degree of protection for personnel	D7 No protection for personnel – only prevents propagation D10 (≥270m) Only limited degree of protection for personnel	D7 No protection for personnel – only prevents propagation D10 (≥270m) Only limited degree of protection for personnel
19 Transfer Shed Untraversed Occupied by less than 10 persons Occupied by 10 persons or more	D7 No protection for personnel – only prevents propagation D10 Only limited degree of protection for personnel	D12 No protection for personnel – only prevents propagation D13 (≥270m) Only limited degree of protection for personnel	D7 No protection for personnel – only prevents propagation D10 Only limited degree of protection for personnel	D12 No protection for personnel – only prevents propagation D13 (≥270m) Only limited degree of protection for personnel
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	0.5 x D12 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D12 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D12 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D12 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities

Table 1C HD 1.1 QD Matrix for Non-Earth Covered Medium/Light Storage

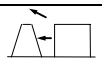
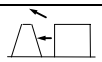
PES / ES	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	D11 (≥180m)	D11 (≥270m)	D11 (≥180m)	D11 (≥270m)
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	D13 (≥270m)	D13 (≥400m)	D13 (≥270m)	D13 (≥400m)
 **23** Inhabited Building Places of Assembly	D13 (≥270m)	D13 (≥400m)	D13 (≥270m)	D13 (≥400m)
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	2 x D12	2 x D12	2 x D12	2 x D12
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D11 (≥180m)	D11 (≥270m)	D11 (≥180m)	D11 (≥270m)
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D13 (≥270m)	D13 (≥400m)	D13 (≥270m)	D13 (≥400m)
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD	No QD

Table 1C HD 1.1 QD Matrix for Non-Earth Covered Medium/Light Storage

PES ➤ / ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
26 Overhead Power Grid				
Supergrid Network and associated substations	D13	D13	D13	D13
Normal Network and associated substations	D11	D11	D11	D11
Minor Network and associated substations	D10	D10	D10	D10
27 POL Facilities inc pipelines				
Protected or Underground	0.5 x D7 (≥25m)	0.5 x D7 (≥25m)	0.5 x D7 (≥25m)	0.5 x D7 (≥25m)
Unprotected, aboveground vital	D13 (≥270m)	D13 (≥400m)	D13 (≥270m)	D13 (≥400m)
Unprotected, aboveground, non-vital	D13	D13	D13	D13
Small Quantities (Chapter 10 Sect. 7 para 3.4)	10m	10m	10m	10m
28 Boiler Houses				
Manned or Vital	D13 (≥270m)	D13 (≥400m)	D13 (≥270m)	D13 (≥400m)
Unmanned, non-vital	D8	D8	D8	D8
Unmanned, local	45m	45m	45m	45m

It is essential to study the text in Chapter 10, Section 2, when using this table since they are complementary.

TABLE 1D QUANTITY DISTANCES FOR HAZARD DIVISION 1.1

2.1 NEQ (kg)	2.2 Quantity- Distances (m)													
2.3	2.4 **1**	2.5 **2**	2.6 **3**	2.7 **4**	2.8 **5**	2.9 **6**	2.10 **7**	2.11 **8**	2.12 **9**	2.13 **9A**	2.14 **10**	2.15 **11**	2.16 **12**	2.17 **13**
50	1		2	3	5	7	9	14	18	18	30	14	82	13
60	1		2	4	5	8	10	15	19	19	32	16	87	23
70	1		3	4	5	8	10	15	20	20	33	17	92	26
80	1		3	4	5	8	11	16	21	21	35	19	96	28
90	2		3	4	5	9	11	17	22	22	36	21	100	31
100	2		3	4	6	9	12	17	23	23	38	22	105	33
120	2		3	4	6	9	12	18	24	24	40	25	110	37
140	2		3	5	6	10	13	19	25	25	42	27	120	41
160	2		3	5	6	10	14	20	27	27	44	30	125	45
180	2		3	5	7	11	14	21	28	28	46	32	130	48
200	2		3	5	7	11	15	22	29	29	47	35	130	52
250	2		4	6	7	12	16	23	31	31	51	40	140	60
300	2		4	6	8	13	17	25	33	33	54	45	150	68
350	2		4	6	8	13	17	26	34	34	57	50	160	75
400	3		4	6	9	14	18	27	36	36	59	55	165	82
500	3		5	7	9	15	20	29	39	39	64	63	180	95
600	3		5	7	10	16	21	31	41	42	68	72	190	110
700	4		5	8	10	16	22	32	43	45	72	79	200	120
800	4		5	8	11	17	23	34	45	48	75	87	210	130
900	4		5	8	11	18	24	35	47	50	78	94	215	140
1 000	4		5	8	11	18	24	36	48	53	80	100	225	150
1 200	4		6	9	12	20	26	39	52	58	86	115	240	170
1 400	4		6	9	13	21	27	41	54	63	90	130	250	190
1 600	5		6	10	13	22	29	43	57	68	94	140	260	210
1 800	5		7	10	14	22	30	44	59	73	98	150	270	225
2 000	5		7	11	14	23	31	46	61	78	105	160	280	240
2 500	5		7	11	15	25	33	49	66	90	110	185	305	280
3 000	6		8	12	16	26	35	52	70	105	120	205	325	305
3 500	6		8	13	17	28	37	55	73	115	125	220	340	330
4 000	6		8	13	18	29	39	58	77	130	130	235	355	350
5 000	6		9	14	19	31	42	62	83	140	140	255	380	380
6 000	7		10	15	20	33	44	66	88	150	150	270	405	405
7 000	7		10	16	22	35	46	69	92	155	155	285	425	425
8 000	7		10	16	22	36	48	72	96	160	160	300	445	445
9 000	8		11	17	23	38	50	75	100	170	170	310	465	465
10 000	8		11	18	24	39	52	78	105	175	175	320	480	480
12 000	9		12	19	26	42	55	83	110	185	185	340	510	510
14 000	9		13	20	27	44	58	87	120	195	195	360	540	540
16 000	10		13	21	28	46	61	91	125	205	205	375	560	560
18 000	10		14	21	29	48	63	95	130	210	210	390	590	590
20 000	10		14	22	30	49	66	98	135	220	220	405	610	610
25 000	11		15	24	33	53	71	110	145	235	235	435	650	650
30 000	11		16	25	35	56	75	115	150	250	250	460	690	690
35 000		15	17	27	36	59	79	120	160	265	265	485	730	730
40 000		16	18	28	38	62	83	125	165	275	275	510	760	760
50 000		17	19	30	41	67	89	135	180	295	295	550	820	820
60 000		18	20	32	44	71	94	145	190	315	315	580	870	870
70 000		19	21	33	46	75	99	150	200	330	330	610	920	920
80 000		19	22	35	48	78	105	160	210	345	345	640	960	960
90 000		20	23	36	50	81	110	165	220	360	360	670	1000	1000
100 000		21	24	38	52	84	115	170	225	375	375	690	1040	1040
120 000		22	25	40	55	89	120	180	240	395	395	730	1100	1100
140 000			26	42	58	94	125	190	250	420	420	770	1160	1160
160 000			28	44	60	98	135	200	265	435	435	810	1220	1220
180 000			29	46	63	105	140	205	275	455	455	840	1260	1260
200 000			30	47	65	110	145	215	285	470	470	870	1300	1300
250 000			32	51	70	115	155	230	305	510	510	940	1400	1400

Distance Functions

$D1 = 0.35Q^{1/3}$ $D2 = 0.44Q^{1/3}$ $D3 = 0.5Q^{1/3}$ $D4 = 0.8Q^{1/3}$ $D5 = 1.1Q^{1/3}$ $D6 = 1.8Q^{1/3}$ $D7 = 2.4Q^{1/3}$	$D8 = 3.6Q^{1/3}$ $D9 = 4.8Q^{1/3}$ D9A = D9 for $Q \leq 500$ D9A = (NEQ + 1000) / 39.37 for Q >500 and < 4000 D9A = D10 for Q > 4000 $D10 = 8.0Q^{1/3}$ $D11 = 1.0Q^{2/3}$ for $Q \leq 2500$ $D11 = 3.6Q^{1/2}$ for $Q > 2500$ to ≤ 4500	$D11 = 14.8Q^{1/3}$ for $Q \geq 4500$ $D12 = 22.2Q^{1/3}$ $D13 = 1.5Q^{2/3}$ for $Q \leq 2500$ $D13 = 5.5Q^{1/2}$ for $Q > 2500 \leq 4500$ $D13 = 22.2Q^{1/3}$ for $Q > 4500$

TABLE 1D QUANTITY DISTANCES FOR HAZARD DIVISION 1.1					
2.18 **NEQ (kg)**	2.19 **Quantity-Distances (m)**				
2.20	2.21 **D14**	2.22 **D15**	2.23 **D16**	2.24 **D17**	2.25 **D18**
100	400	400	270	270	28
250	400	400	270	270	38
500	400	400	270	270	48
1000	400	400	270	270	60
2500	400	400	270	270	82
5000	400	400	270	270	105
6000	400	400	270	270	110
7000	400	400	270	270	115
8000	400	400	270	280	120
9000	400	400	270	295	125
10000	400	410	270	305	130
12000	400	435	270	320	140
14000	400	460	270	340	145
16000	400	480	280	355	155
18000	410	500	290	370	160
20000	420	520	300	380	165
25000	455	560	325	410	175
30000	485	590	345	435	190
35000	510	630	360	460	200
40000	530	650	380	480	205
50000	580	700	405	520	225
60000	610	750	430	550	235
70000	640	790	455	580	250
80000	670	820	475	610	260
90000	700	860	495	630	270
100000	720	890	510	650	280
120000	770	940	550	690	300
140000	810	990	580	730	315
160000	850	1040	600	760	325
180000	880	1080	630	790	340
200000	910	1120	650	820	350
250000	980	1200	700	890	380
Distance Functions	D14= $15.5Q^{1/3}$	D15 = $19.0\ Q^{1/3}$	D16 = $11.0\ Q^{1/3}$	D17=$14.0Q^{1/3}$	D18 = $6.0\ Q^{1/3}$

It is essential to study the text in Chapter 10, Section 2, when using this table since they are complementary. Where “No QD” is shown on the matrix practical considerations will dictate actual separation distances.

Table 2A SsD 1.2.1 QD Matrix for Earth Covered Storage

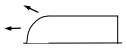
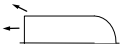
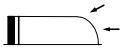
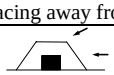
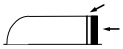
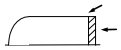
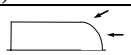
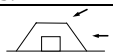
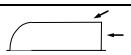
PES ➤ ES ▼	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	No QD Virtually complete protection	No QD Virtually complete protection	No QD High degree of protection

Table 2A SsD 1.2.1 QD Matrix for Earth Covered Storage

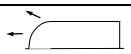
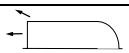
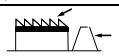
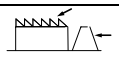
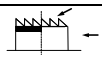
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	No QD Virtually complete protection	No QD Virtually complete protection	D8 Limited degree of protection
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	No QD Virtually complete protection	No QD Virtually complete protection	D8 Limited degree of protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	No QD Virtually complete protection	No QD Virtually complete protection	D8 Limited degree of protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	No QD Virtually complete protection	No QD Virtually complete protection	No QD High degree of protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	No QD Virtually complete protection	No QD Virtually complete protection	No QD High degree of protection
 **15** Process Building with protective roof, traversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly
 **16** Process Building without protective roof, traversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D4 Limited degree of protection for personnel No QD If personnel can be evacuated promptly
 **17** Process Building with or without protective roof, untraversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D6 Limited degree of protection for personnel No QD If personnel can be evacuated promptly

Table 2A SsD 1.2.1 QD Matrix for Earth Covered Storage

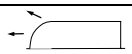
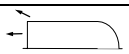
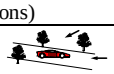
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
18 Transfer Shed Traversed Occupied by less than 10 persons	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel
Occupied by 10 persons or more	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D4 Limited degree of protection for personnel No QD If personnel can be evacuated promptly
19 Transfer Shed Untraversed Occupied by less than 10 persons	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D4 Limited degree of protection for personnel No QD If personnel can be evacuated promptly
Occupied by 10 persons or more	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D6 Limited degree of protection for personnel No QD If personnel can be evacuated promptly
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D2 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	No QD	No QD	D6 or No QD If controlled traffic can be stopped promptly
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	60m or No QD If controlled traffic can be stopped promptly	60m or No QD If controlled traffic can be stopped promptly	D2 or No QD If controlled traffic can be stopped promptly

Table 2A SsD 1.2.1 QD Matrix for Earth Covered Storage

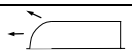
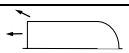
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **23** Inhabited Building Places of Assembly	60m or No QD If personnel can be evacuated promptly	60m or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	120m	120m	2 x D2
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	30m	30m	D6 or No QD If personnel can be evacuated promptly
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	60m or No QD If personnel can be evacuated promptly	60m or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD
26 Overhead Power Grid Supergrid Network and associated substations	60m	60m	60m
Normal Network and associated substations	30m	30m	30m
Minor Network and associated substations	No QD	No QD	No QD
27 POL Facilities inc pipelines Protected or Underground	25m	25m	25m
Unprotected, aboveground vital	60m	60m	60m
Unprotected, aboveground, non-vital	30m	30m	30m
Small Quantities (Chapter 10 Sect. 7 para 3.4)	No QD	No QD	No QD
28 Boiler Houses Manned or Vital	60m	60m	60m
Unmanned, non-vital	30m	30m	30m
Unmanned, local	No QD	No QD	No QD

Table 2B SsD 1.2.1 QD Matrix for Non-Earth Covered Heavy Storage

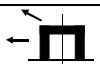
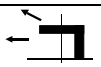
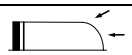
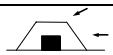
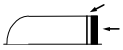
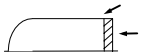
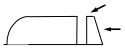
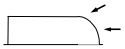
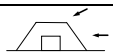
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection

Table 2B SsD 1.2.1 QD Matrix for Non-Earth Covered Heavy Storage

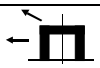
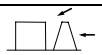
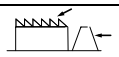
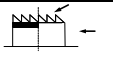
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	D8 Only limited degree of protection	D8 Only limited degree of protection
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	D8 Only limited degree of protection	D8 Only limited degree of protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	D8 Only limited degree of protection	D8 Only limited degree of protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **15** Process Building with protective roof, traversed	No QD High degree of protection for personnel	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly
 **16** Process Building without protective roof, traversed	No QD High degree of protection for personnel	D4 Limited degree of protection for personnel No QD If personnel can be evacuated promptly	D4 Limited degree of protection for personnel No QD If personnel can be evacuated promptly
 **17** Process Building with or without protective roof, untraversed	No QD High degree of protection for personnel	D6 Limited degree of protection for personnel No QD If personnel can be evacuated promptly	D6 Limited degree of protection for personnel No QD If personnel can be evacuated promptly

Table 2B SsD 1.2.1 QD Matrix for Non-Earth Covered Heavy Storage

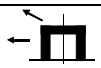
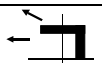
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
18 Transfer Shed Traversed Occupied by less than 10 persons	No QD High degree of protection for personnel	No QD Only limited degree of protection for personnel	No QD Only limited degree of protection for personnel
Occupied by 10 persons or more	No QD High degree of protection for personnel	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
19 Transfer Shed Untraversed Occupied by less than 10 persons	No QD High degree of protection for personnel	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
Occupied by 10 persons or more	No QD High degree of protection for personnel	D6 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D6 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5xD2 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5xD2 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	No QD	D6 or No QD If controlled traffic can be stopped promptly	D6 or No QD If controlled traffic can be stopped promptly

Table 2B SsD 1.2.1 QD Matrix for Non-Earth Covered Heavy Storage

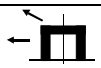
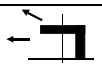
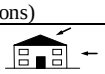
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	60m or No QD If controlled traffic can be stopped promptly	D2 or No QD If controlled traffic can be stopped promptly	D2 or No QD If controlled traffic can be stopped promptly
 **23** Inhabited Building Places of Assembly	60m or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	120m	2xD2	2xD2
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	30m	60m or No QD If personnel can be evacuated promptly	60m or No QD If personnel can be evacuated promptly
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	60m or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD

Table 2B SsD 1.2.1 QD Matrix for Non-Earth Covered Heavy Storage

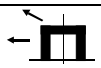
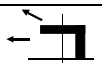
PES ➤ / ES ▼	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
26 Overhead Power Grid Supergrid Network and associated substations	60m	60m	60m
Normal Network and associated substations	30m	30m	30m
Minor Network and associated substations	No QD	No QD	No QD
27 POL Facilities inc pipelines Protected or Underground	25m	25m	25m
Unprotected, aboveground vital	60m	60m	60m
Unprotected, aboveground, non-vital	30m	30m	30m
Small Quantities (Chapter 10 Sect. 7 para 3.4)	No QD	No QD	No QD
28 Boiler Houses Manned or Vital	60m	60m	60m
Unmanned, non-vital	30m	30m	30m
Unmanned, local	No QD	No QD	No QD

Table 2C SsD 1.2.1 QD Matrix for Non-Earth Covered Medium/Light Storage

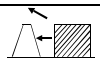
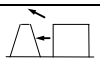
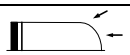
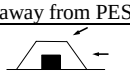
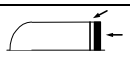
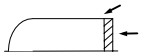
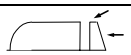
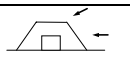
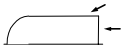
PES / ES	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection

Table 2C SsD 1.2.1 QD Matrix for Non-Earth Covered Medium/Light Storage

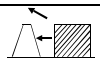
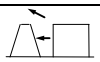
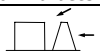
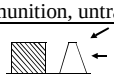
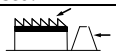
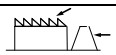
PES ➤ ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	D2 High degree of protection or D8 Limited degree of protection	D2 High degree of protection or D8 Limited degree of protection	D2 High degree of protection or D8 Limited degree of protection	D2 High degree of protection or D8 Limited degree of protection
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	D2 High degree of protection or D8 Limited degree of protection	D2 High degree of protection or D8 Limited degree of protection	D2 High degree of protection or D8 Limited degree of protection	D2 High degree of protection or D8 Limited degree of protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	D2 High degree of protection or D8 Limited degree of protection	D2 High degree of protection or D8 Limited degree of protection	D2 High degree of protection or D8 Limited degree of protection	D2 High degree of protection or D8 Limited degree of protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection
 **15** Process Building with protective roof, traversed	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly
 **16** Process Building without protective roof, traversed	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly

Table 2C SsD 1.2.1 QD Matrix for Non-Earth Covered Medium/Light Storage

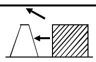
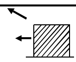
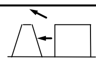
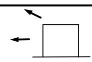
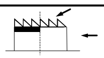
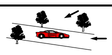
PES ➤ ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **17** Process Building with or without protective roof, untraversed	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly	D4 High degree of protection for personnel No QD If personnel can be evacuated promptly	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
18 Transfer Shed Traversed Occupied by less than 10 persons	No QD Only limited degree of protection for personnel	No QD Only limited degree of protection for personnel	No QD Only limited degree of protection for personnel	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
Occupied by 10 persons or more	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D6 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
19 Transfer Shed Untraversed Occupied by less than 10 persons	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D4 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D6 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
Occupied by 10 persons or more	D6 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D6 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D6 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D2 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	0.5xD2 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5xD2 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5xD2 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5xD2 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities

Table 2C SsD 1.2.1 QD Matrix for Non-Earth Covered Medium/Light Storage

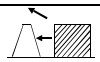
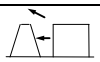
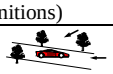
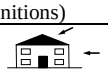
PES / ES	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	D6 or No QD If controlled traffic can be stopped promptly	D6 or No QD If controlled traffic can be stopped promptly	D6 or No QD If controlled traffic can be stopped promptly	D6 or No QD If controlled traffic can be stopped promptly
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	D2 or No QD If controlled traffic can be stopped promptly	D2 or No QD If controlled traffic can be stopped promptly	D2 or No QD If controlled traffic can be stopped promptly	D2 or No QD If controlled traffic can be stopped promptly
 **23** Inhabited Building Places of Assembly	D2 or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	2xD2	2xD2	2xD2	2xD2
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D6 or No QD If personnel can be evacuated promptly	D6 or No QD If personnel can be evacuated promptly	D6 or No QD If personnel can be evacuated promptly	D6 or No QD If personnel can be evacuated promptly
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D2 or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly	D2 or No QD If personnel can be evacuated promptly
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD	No QD

Table 2C SsD 1.2.1 QD Matrix for Non-Earth Covered Medium/Light Storage

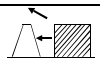
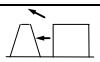
PES ➤ / ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
26 Overhead Power Grid				
Supergrid Network and associated substations	60m	60m	60m	60m
Normal Network and associated substations	30m	30m	30m	30m
Minor Network and associated substations	No QD	No QD	No QD	No QD
27 POL Facilities inc pipelines				
Protected or Underground	25m	25m	25m	25m
Unprotected, aboveground vital	60m	60m	60m	60m
Unprotected, aboveground, non-vital	30m	30m	30m	30m
Small Quantities (Chapter 10 Sect. 7 para 3.4)	No QD	No QD	No QD	No QD
28 Boiler Houses				
Manned or Vital	60m	60m	60m	60m
Unmanned, non-vital	30m	30m	30m	30m
Unmanned, local	No QD	No QD	No QD	No QD

Table 2D SsD 1.2.2 QD Matrix for Earth Covered Storage

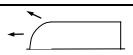
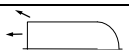
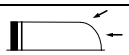
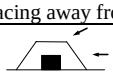
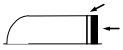
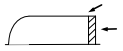
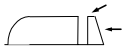
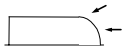
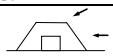
PES ➤ ES ▼	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	No QD Virtually complete protection	No QD Virtually complete protection	No QD High degree of protection
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD Virtually complete protection	No QD Virtually complete protection	No QD Virtually complete protection

Table 2D SsD 1.2.2 QD Matrix for Earth Covered Storage

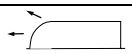
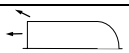
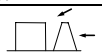
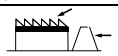
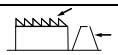
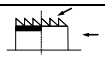
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	No QD Virtually complete protection	No QD Virtually complete protection	D7 Limited degree of protection
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	No QD Virtually complete protection	No QD Virtually complete protection	D7 Limited degree of protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	No QD Virtually complete protection	No QD Virtually complete protection	D7 Limited degree of protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	No QD Virtually complete protection	No QD Virtually complete protection	No QD High degree of protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	No QD Virtually complete protection	No QD Virtually complete protection	No QD High degree of protection
 **15** Process Building with protective roof, traversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D3 High degree of protection for personnel No QD If personnel can be evacuated promptly
 **16** Process Building without protective roof, traversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D3 Limited degree of protection for personnel No QD If personnel can be evacuated promptly
 **17** Process Building with or without protective roof, untraversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D5 Limited degree of protection for personnel No QD If personnel can be evacuated promptly

Table 2D SsD 1.2.2 QD Matrix for Earth Covered Storage

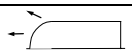
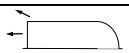
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
18 Transfer Shed Traversed Occupied by less than 10 persons	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel
Occupied by 10 persons or more	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D3 Limited degree of protection for personnel No QD If personnel can be evacuated promptly
19 Transfer Shed Untraversed Occupied by less than 10 persons	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D3 Limited degree of protection for personnel No QD If personnel can be evacuated promptly
Occupied by 10 persons or more	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D5 Limited degree of protection for personnel No QD If personnel can be evacuated promptly
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D1 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	15m or No QD If controlled traffic can be stopped promptly	15m or No QD If controlled traffic can be stopped promptly	D5 or No QD If controlled traffic can be stopped promptly

Table 2D SsD 1.2.2 QD Matrix for Earth Covered Storage

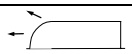
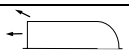
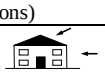
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	30m or No QD If controlled traffic can be stopped promptly	30m or No QD If controlled traffic can be stopped promptly	D1 or No QD If controlled traffic can be stopped promptly
 **23** Inhabited Building Places of Assembly	30m or No QD If personnel can be evacuated promptly	30m or No QD If personnel can be evacuated promptly	D1 or No QD If personnel can be evacuated promptly
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	60m	60m	2 x D1
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	15m	15m	D5 or No QD If personnel can be evacuated promptly
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	30m or No QD If personnel can be evacuated promptly	30m or No QD If personnel can be evacuated promptly	D1 or No QD If personnel can be evacuated promptly
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD

Table 2D SsD 1.2.2 QD Matrix for Earth Covered Storage

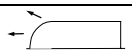
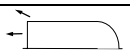
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
26 Overhead Power Grid Supergrid Network and associated substations	30m	30m	30m
Normal Network and associated substations	15m	15m	15m
Minor Network and associated substations	No QD	No QD	No QD
27 POL Facilities inc pipelines Protected or Underground	25m	25m	25m
Unprotected, aboveground vital	30m	30m	30m
Unprotected, aboveground, non-vital	15m	15m	15m
Small Quantities (Chapter 10 Sect. 7 para 3.4)	No QD	No QD	No QD
28 Boiler Houses Manned or Vital	30m	30m	30m
Unmanned, non-vital	15m	15m	15m
Unmanned, local	No QD	No QD	No QD

Table 2E SsD 1.2.2 QD Matrix for Non-Earth Covered Heavy Storage

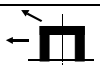
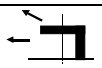
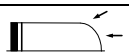
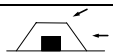
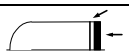
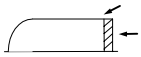
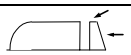
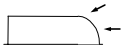
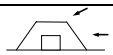
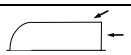
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection

Table 2E SsD 1.2.2 QD Matrix for Non-Earth Covered Heavy Storage

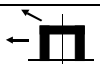
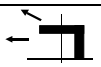
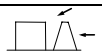
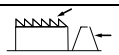
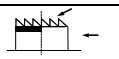
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	D7 Only limited degree of protection	D7 Only limited degree of protection
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	D7 Only limited degree of protection	D7 Only limited degree of protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	D7 Only limited degree of protection	D7 Only limited degree of protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **15** Process Building with protective roof, traversed	No QD High degree of protection for personnel	D3 High degree of protection for personnel No QD If personnel can be evacuated promptly	D3 High degree of protection for personnel No QD If personnel can be evacuated promptly
 **16** Process Building without protective roof, traversed	No QD High degree of protection for personnel	D3 Limited degree of protection for personnel No QD If personnel can be evacuated promptly	D3 Limited degree of protection for personnel No QD If personnel can be evacuated promptly
 **17** Process Building with or without protective roof, untraversed	No QD High degree of protection for personnel	D5 Limited degree of protection for personnel No QD If personnel can be evacuated promptly	D5 Limited degree of protection for personnel No QD If personnel can be evacuated promptly

Table 2E SsD 1.2.2 QD Matrix for Non-Earth Covered Heavy Storage

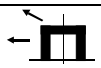
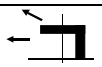
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
18 Transfer Shed Traversed Occupied by less than 10 persons	No QD High degree of protection for personnel	No QD Only limited degree of protection for personnel	No QD Only limited degree of protection for personnel
Occupied by 10 persons or more	No QD High degree of protection for personnel	D3 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D3 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
19 Transfer Shed Untraversed Occupied by less than 10 persons	No QD High degree of protection for personnel	D3 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D3 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
Occupied by 10 persons or more	No QD High degree of protection for personnel	D5 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D5 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5xD1 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5xD1 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	No QD	D5 or No QD If controlled traffic can be stopped promptly	D5 or No QD If controlled traffic can be stopped promptly

Table 2E SsD 1.2.2 QD Matrix for Non-Earth Covered Heavy Storage

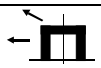
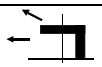
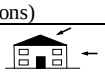
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	30m or No QD If controlled traffic can be stopped promptly	D1 or No QD If controlled traffic can be stopped promptly	D1 or No QD If controlled traffic can be stopped promptly
 **23** Inhabited Building Places of Assembly	30m or No QD If personnel can be evacuated promptly	D1 or No QD If personnel can be evacuated promptly	D1 or No QD If personnel can be evacuated promptly
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	60m	2xD1	2xD1
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	15m	D5 or No QD If personnel can be evacuated promptly	D5 or No QD If personnel can be evacuated promptly
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	30m or No QD If personnel can be evacuated promptly	D1 or No QD If personnel can be evacuated promptly	D1 or No QD If personnel can be evacuated promptly
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD

Table 2E SsD 1.2.2 QD Matrix for Non-Earth Covered Heavy Storage

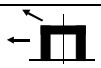
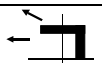
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
26 Overhead Power Grid Supergrid Network and associated substations	30m	30m	30m
Normal Network and associated substations	15m	15m	15m
Minor Network and associated substations	No QD	No QD	No QD
27 POL Facilities inc pipelines Protected or Underground	25m	25m	25m
Unprotected, aboveground vital	30m	30m	30m
Unprotected, aboveground, non-vital	15m	15m	15m
Small Quantities (Chapter 10 Sect. 7 para 3.4)	No QD	No QD	No QD
28 Boiler Houses Manned or Vital	30m	30m	30m
Unmanned, non-vital	15m	15m	15m
Unmanned, local	No QD	No QD	No QD

Table 2F SsD 1.2.2 QD Matrix for Non-Earth Covered Medium/Light Storage

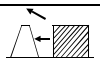
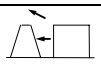
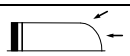
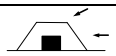
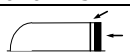
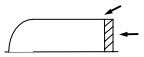
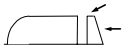
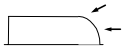
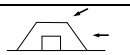
PES / ES	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection

Table 2F SsD 1.2.2 QD Matrix for Non-Earth Covered Medium/Light Storage

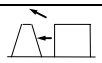
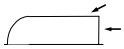
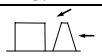
PES / ES	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	No QD High degree of protection	No QD High degree of protection	D1 High degree of protection Or D7 Limited degree of protection	D1 High degree of protection Or D7 Limited degree of protection
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	No QD High degree of protection	No QD High degree of protection	D1 High degree of protection Or D7 Limited degree of protection	D1 High degree of protection Or D7 Limited degree of protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	No QD High degree of protection	No QD High degree of protection	D1 High degree of protection Or D7 Limited degree of protection	D1 High degree of protection Or D7 Limited degree of protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection

Table 2F SsD 1.2.2 QD Matrix for Non-Earth Covered Medium/Light Storage

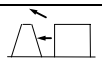
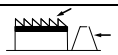
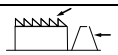
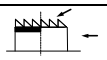
PES ➤ ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **15** Process Building with protective roof, traversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D3 High degree of protection for personnel No QD If personnel can be evacuated promptly	D3 High degree of protection for personnel No QD If personnel can be evacuated promptly
 **16** Process Building without protective roof, traversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D3 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D3 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
 **17** Process Building with or without protective roof, untraversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	D5 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D5 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
18 Transfer Shed Traversed Occupied by less than 10 persons Occupied by 10 persons or more	No QD High degree of protection for personnel No QD High degree of protection for personnel	No QD High degree of protection for personnel No QD High degree of protection for personnel	No QD Only limited degree of protection for personnel D3 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D3 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly D5 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
19 Transfer Shed Untraversed Occupied by less than 10 persons Occupied by 10 persons or more	No QD High degree of protection for personnel No QD High degree of protection for personnel	No QD High degree of protection for personnel No QD High degree of protection for personnel	D3 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly D5 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly	D5 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly D1 Only limited degree of protection for personnel No QD If personnel can be evacuated promptly
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5xD1 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5xD1 or No QD If controlled traffic can be stopped promptly 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities

Table 2F SsD 1.2.2 QD Matrix for Non-Earth Covered Medium/Light Storage

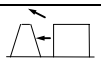
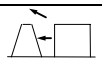
PES ➤ ES ➤	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	15m or No QD If controlled traffic can be stopped promptly	15m or No QD If controlled traffic can be stopped promptly	D5 or No QD If controlled traffic can be stopped promptly	D5 or No QD If controlled traffic can be stopped promptly
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	30m or No QD If controlled traffic can be stopped promptly	30m or No QD If controlled traffic can be stopped promptly	D1 or No QD If controlled traffic can be stopped promptly	D1 or No QD If controlled traffic can be stopped promptly
 **23** Inhabited Building Places of Assembly	30m or No QD If personnel can be evacuated promptly	30m or No QD If personnel can be evacuated promptly	D1 or No QD If personnel can be evacuated promptly	D1 or No QD If personnel can be evacuated promptly
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	60m	60m	2xD1	2xD1

Table 2F SsD 1.2.2 QD Matrix for Non-Earth Covered Medium/Light Storage

PES ➤ / ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	15m	15m	D5 or No QD If personnel can be evacuated promptly	D5 or No QD If personnel can be evacuated promptly
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	30m or No QD If personnel can be evacuated promptly	30m or No QD If personnel can be evacuated promptly	D1 or No QD If personnel can be evacuated promptly	D1 or No QD If personnel can be evacuated promptly
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD	No QD
26 Overhead Power Grid Supergrid Network and associated substations	30m	30m	30m	30m
Normal Network and associated substations	15m	15m	15m	15m
Minor Network and associated substations	No QD	No QD	No QD	No QD
27 POL Facilities inc pipelines Protected or Underground	25m	25m	25m	25m
Unprotected, aboveground vital	30m	30m	30m	30m
Unprotected, aboveground, non-vital	15m	15m	15m	15m
Small Quantities (Chapter 10 Sect 7 para 3.4)	No QD	No QD	No QD	No QD
28 Boiler Houses Manned or Vital	30m	30m	30m	30m
Unmanned, non-vital	15m	15m	15m	15m
Unmanned, local	No QD	No QD	No QD	No QD

It is essential to study the text in Chapter 10, Section 2, when using this table since they are complementary.

TABLE 2G QUANTITY DISTANCES FOR STORAGE SUB-DIVISIONS 1.2.1 AND 1.2.2

2.26 NE Q (kg)	2.27 Quantity –Distances (m)							
2.28	2.29 D1	2.30 D2	2.31 D3	2.32 D4	2.33 D5	2.34 D6	2.35 D7	2.36 D8
10	32	60	20	20	30	60	10	10
20	36	60	20	20	30	60	10	19
50	44	88	20	32	30	60	10	21
70	47	110	20	39	32	73	10	23
80	49	120	20	42	33	78	11	25
90	50	125	20	45	34	83	11	26
100	51	130	20	47	35	87	11	28
120	53	140	20	51	36	94	12	30
140	55	150	20	54	37	100	12	32
160	57	160	21	57	39	105	12	33
180	59	165	22	59	40	110	13	35
200	60	170	22	61	41	115	13	36
250	64	185	24	66	43	125	14	39
300	66	195	24	70	45	130	14	41
350	69	200	25	72	47	135	15	42
400	71	210	26	75	48	140	15	44
500	75	220	27	80	51	150	16	47
600	78	230	29	83	53	155	17	49
700	81	240	30	86	55	160	18	50
800	83	245	30	89	56	165	18	52
900	86	255	31	91	58	170	19	53
1000	88	260	32	93	59	175	19	54
1200	91	270	33	96	61	180	20	56
1400	94	275	34	99	63	185	20	58
1600	97	285	35	105	65	190	21	60
1800	100	290	36	105	67	195	21	61
2000	105	295	37	110	69	200	22	62
2500	110	305	39	115	72	205	23	64
3000	115	315	40	115	75	210	24	66
3500	115	320	42	120	77	215	24	68
4000	120	330	43	120	80	220	25	69
4500	120	335	44	120	81	225	26	70
5000	125	340	45	125	83	230	26	71
6000	130	350	46	125	86	235	27	73
7000	135	355	48	130	88	240	28	75
8000	135	360	49	130	91	245	29	76
9000	140	365	50	135	93	245	29	77
10000	145	370	51	135	95	250	30	78
12000	150	380	53	140	98	255	31	80
14000	150	390	54	140	105	260	32	82
16000	155	395	56	145	105	265	33	83
18000	160	400	57	145	110	270	33	84
20000	160	405	58	145	110	275	34	85
25000	170	415	60	150	115	280	35	87
30000	175	420	62	155	120	285	37	89
35000	180	430	64	155	120	290	38	90
40000	185	435	66	160	125	295	39	91
45000	185	440	67	160	125	295	39	92
50000	190	445	68	160	130	300	40	93
60000	195	450	70	165	130	305	41	95
70000	200	455	72	165	135	305	42	96
80000	205	465	74	170	140	310	43	97
90000	210	470	75	170	140	315	44	98
100000	215	470	76	170	145	315	45	99
120000	220	480	79	175	150	320	46	105
140000	225	485	80	175	150	325	47	105
160000	230	490	82	180	155	330	48	105
180000	235	495	84	180	155	335	49	105
200000	235	500	85	180	160	335	50	105
250000	245	510	88	185	165	340	52	110
500000	270	540	97	195	185	360	57	115

D1 = 28.127-2.364*LN(NEQ)+1.577*((LN(NEQ)) P^{2P})
D2 = -167.648+70.345*LN(NEQ)-1.303*((LN(NEQ)) P^{2P})
D1 NEQ = exp [0.7495+ (-17.274 + 0.6341*IBD) $P^{½ P}$]
D2 NEQ = exp [27.000- (600.287 – 0.768*IBD) $P^{½ P}$]

D3 = 0.36*D1
D4 = 0.36*D2
D5 = 0.67*D1

D6 = 0.67*D2
D7 = 0.21*D1
D8 = 0.21*D2

It is essential to study the text in Chapter 10, Section 2 when using these tables since they are complementary. Where "No QD" is shown on the matrix practical considerations will dictate actual separation distances.

Table 3A SsD 1.3.3 QD Matrix for Earth Covered Storage

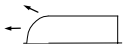
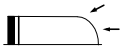
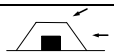
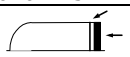
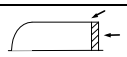
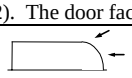
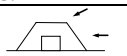
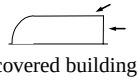
PES ➤ / ES ▼	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 (≥25m) These combinations of structures would always be deemed to provide virtually complete protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 (≥25m) These combinations of structures would always be deemed to provide virtually complete protection

Table 3A SsD 1.3.3 QD Matrix for Earth Covered Storage

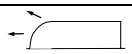
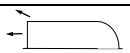
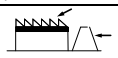
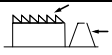
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 (≥25m) These combinations of structures would always be deemed to provide virtually complete protection
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 (≥25m) These combinations of structures would always be deemed to provide virtually complete protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 (≥25m) These combinations of structures would always be deemed to provide virtually complete protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 (≥25m) These combinations of structures would always be deemed to provide virtually complete protection
 **15** Process Building with protective roof, traversed	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel
 **16** Process Building without protective roof, traversed	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel	D2 (≥25m)
 **17** Process Building with or without protective roof, untraversed	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel	D2 (≥60m)

Table 3A SsD 1.3.3 QD Matrix for Earth Covered Storage

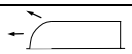
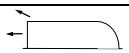
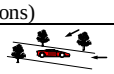
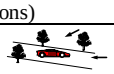
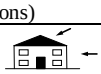
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
18 Transfer Shed Traversed Occupied by less than 10 persons	D1 (≥25m) High degree of protection for personnel	D1 (≥25m) High degree of protection for personnel	D1 (≥25m) High degree of protection for personnel
Occupied by 10 persons or more	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel
19 Transfer Shed Untraversed Occupied by less than 10 persons	D1 (≥25m) High degree of protection for personnel	D1 (≥25m) High degree of protection for personnel	D2 (≥60m) High degree of protection for personnel
Occupied by 10 persons or more	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel	D4 (≥60m) High degree of protection for personnel
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	0.5 x D4 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D4 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D4 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	D3 (≥60m)	D3 (≥60m)	D3 (≥60m)
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)
 **23** Inhabited Building Places of Assembly	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	2 x D4	2 x D4	2 x D4

Table 3A SsD 1.3.3 QD Matrix for Earth Covered Storage

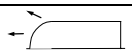
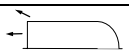
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D3 (≥60m)	D3 (≥60m)	D3 (≥60m)
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD
26 Overhead Power Grid Supergrid Network and associated substations	D4	D4	D4
Normal Network and associated substations	D3	D3	D3
Minor Network and associated substations	D2	D2	D2
27 POL Facilities inc pipelines Protected or Underground	25m	25m	25m
Unprotected, aboveground vital	D4	D4	D4
Unprotected, aboveground, non-vital	D3	D3	D3
Small Quantities (Chapter 10 Sect 7 para 3.4)	10m	10m	10m
28 Boiler Houses Manned or Vital	D4	D4	D4
Unmanned, non-vital	D2	D2	D2
Unmanned, local	25m	25m	25m

Table 3B SsD 1.3.3 QD Matrix for Non-Earth Covered Heavy Storage

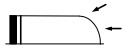
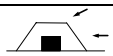
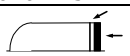
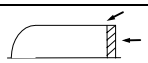
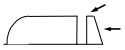
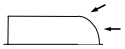
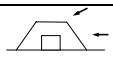
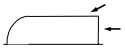
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection

Table 3B SsD 1.3.3 QD Matrix for Non-Earth Covered Heavy Storage

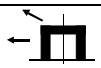
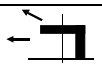
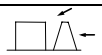
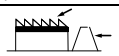
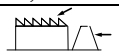
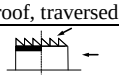
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **15** Process Building with protective roof, traversed	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel
 **16** Process Building without protective roof, traversed	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) Limited degree of protection for personnel	D2 (≥25m) Limited degree of protection for personnel
 **17** Process Building with or without protective roof, untraversed	D2 (≥25m) High degree of protection for personnel	D2 (≥60m) Limited degree of protection for personnel	D2 (≥60m) Limited degree of protection for personnel

Table 3B SsD 1.3.3 QD Matrix for Non-Earth Covered Heavy Storage

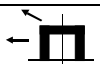
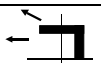
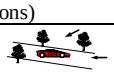
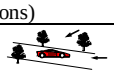
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
18 Transfer Shed Traversed Occupied by less than 10 persons	D1 (≥25m) High degree of protection for personnel	D1 (≥25m) Limited degree of protection for personnel	D1 (≥25m) Limited degree of protection for personnel
Occupied by 10 persons or more	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) Limited degree of protection for personnel	D2 (≥25m) Limited degree of protection for personnel
19 Transfer Shed Untraversed Occupied by less than 10 persons	D2 (≥25m) Limited degree of protection for personnel	D2 (≥60m) Limited degree of protection for personnel	D2 (≥60m) Limited degree of protection for personnel
Occupied by 10 persons or more	D4 (≥25m) Limited degree of protection for personnel	D4 (≥60m) Limited degree of protection for personnel	D4 (≥60m) Limited degree of protection for personnel
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	0.5 x D4 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D4 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D4 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	D3 (≥60m)	D3 (≥60m)	D3 (≥60m)
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)
 **23** Inhabited Building Places of Assembly	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	2 x D4	2 x D4	2 x D4

Table 3B SsD 1.3.3 QD Matrix for Non-Earth Covered Heavy Storage

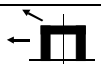
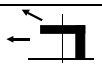
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D3 (≥60m)	D3 (≥60m)	D3 (≥60m)
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD
26 Overhead Power Grid Supergrid Network and associated substations	D4	D4	D4
Normal Network and associated substations	D3	D3	D3
Minor Network and associated substations	D2	D2	D2
27 POL Facilities inc pipelines Protected or Underground	25m	25m	25m
Unprotected, aboveground vital	D4	D4	D4
Unprotected, aboveground, non-vital	D3	D3	D3
Small Quantities (Chapter 10 Sect 7 para 3.4)	10m	10m	10m
28 Boiler Houses Manned or Vital	D4	D4	D4
Unmanned, non-vital	D2	D2	D2
Unmanned, local	25m	25m	25m

Table 3C SsD 1.3.3 QD Matrix for Non-Earth Covered Medium/Light Storage

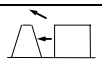
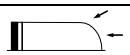
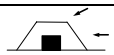
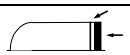
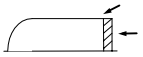
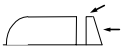
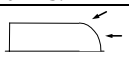
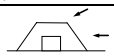
PES ➤ ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	D1 (≥10m)	D1 (≥25m)	D1 (≥25m)	D1 (≥25m)
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection

Table 3C SsD 1.3.3 QD Matrix for Non-Earth Covered Medium/Light Storage

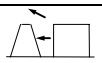
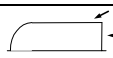
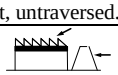
PES / ES	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	D1 (≥10m)	D1 (≥25m)	D1 (≥25m)	D1 (≥25m)
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	D1 (≥10m)	D1 (≥25m)	D1 (≥25m)	D1 (≥25m)
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	D1 (≥10m)	D1 (≥25m)	D1 (≥25m)	D1 (≥25m)
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	D1 (≥10m)	D1 (≥25m)	D1 (≥25m)	D1 (≥25m)
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	D1 (≥10m)	D1 (≥25m)	D1 (≥25m)	D1 (≥25m)
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	D1 (≥10m)	D1 (≥25m)	D1 (≥25m)	D1 (≥25m)
 **15** Process Building with protective roof, traversed	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel

Table 3C SsD 1.3.3 QD Matrix for Non-Earth Covered Medium/Light Storage

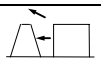
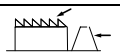
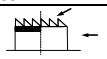
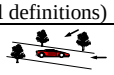
PES ➤ ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **16** Process Building without protective roof, traversed	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) High degree of protection for personnel	D2 (≥25m) Limited degree of protection for personnel	D2 (≥25m) Limited degree of protection for personnel
 **17** Process Building with or without protective roof, untraversed	D2 (≥25m) High degree of protection for personnel	D2 (≥60m) High degree of protection for personnel	D2 (≥25m) Limited degree of protection for personnel	D2 (≥60m) Limited degree of protection for personnel
18 Transfer Shed Traversed Occupied by less than 10 persons Occupied by 10 persons or more	D1 (≥25m) High degree of protection for personnel D2 (≥25m) High degree of protection for personnel	D1 (≥25m) High degree of protection for personnel D2 (≥25m) High degree of protection for personnel	D1 (≥25m) Limited degree of protection for personnel D2 (≥25m) Limited degree of protection for personnel	D1 (≥25m) Limited degree of protection for personnel D2 (≥25m) Limited degree of protection for personnel
19 Transfer Shed Untraversed Occupied by less than 10 persons Occupied by 10 persons or more	D2 (≥25m) High degree of protection for personnel D4 (≥25m) High degree of protection for personnel	D2 (≥60m) High degree of protection for personnel D4 (≥60m) High degree of protection for personnel	D2 (≥25m) Limited degree of protection for personnel D4 (≥25m) Limited degree of protection for personnel	D2 (≥60m) Limited degree of protection for personnel D4 (≥60m) Limited degree of protection for personnel
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	0.5 x D4 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D4 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D4 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	0.5 x D4 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	D3 (≥60m)	D3 (≥60m)	D3 (≥60m)	D3 (≥60m)

Table 3C SsD 1.3.3 QD Matrix for Non-Earth Covered Medium/Light Storage

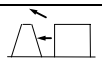
PES / ES	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)
 **23** Inhabited Building Places of Assembly	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	2 x D4	2 x D4	2 x D4	2 x D4
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D3 (≥60m)	D3 (≥60m)	D3 (≥60m)	D3 (≥60m)
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)	D4 (≥60m)
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD	No QD
26 Overhead Power Grid Supergrid Network and associated substations	D4	D4	D4	D4
Normal Network and associated substations	D3	D3	D3	D3
Minor Network and associated substations	D2	D2	D2	D2
27 POL Facilities inc pipelines Protected or Underground	25m	25m	25m	25m
Unprotected, aboveground vital	D4	D4	D4	D4
Unprotected, aboveground, non-vital	D3	D3	D3	D3
Small Quantities (Chapter 10 Sect 7 para 3.4)	10m	10m	10m	10m

Table 3C SsD 1.3.3 QD Matrix for Non-Earth Covered Medium/Light Storage

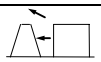
PES ➤ ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed. **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
28 Boiler Houses Manned or Vital	D4	D4	D4	D4
Unmanned, non-vital	D2	D2	D2	D2
Unmanned, local	25m	25m	25m	25m

Table 3D SsD 1.3.4 QD Matrix for Earth Covered Storage

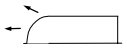
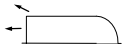
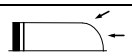
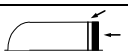
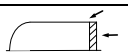
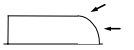
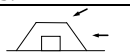
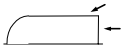
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 These combinations of structures would always be deemed to provide virtually complete protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 These combinations of structures would always be deemed to provide virtually complete protection
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection

Table 3D SsD 1.3.4 QD Matrix for Earth Covered Storage

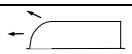
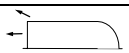
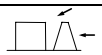
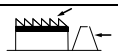
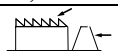
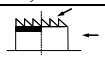
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 These combinations of structures would always be deemed to provide virtually complete protection
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 These combinations of structures would always be deemed to provide virtually complete protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 These combinations of structures would always be deemed to provide virtually complete protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	D1 These combinations of structures would always be deemed to provide virtually complete protection
 **15** Process Building with protective roof, traversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD High degree of protection for personnel
 **16** Process Building without protective roof, traversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel
 **17** Process Building with or without protective roof, untraversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel

Table 3D SsD 1.3.4 QD Matrix for Earth Covered Storage

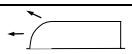
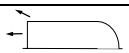
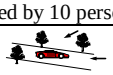
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
18 Transfer Shed Traversed Occupied by less than 10 persons	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel
Occupied by 10 persons or more			
19 Transfer Shed Untraversed Occupied by less than 10 persons	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel
Occupied by 10 persons or more			
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	10m 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	10m	10m	25m
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	25m	25m	60m
 **23** Inhabited Building Places of Assembly	25m	25m	60m
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	50m	50m	120m

Table 3D SsD 1.3.4 QD Matrix for Earth Covered Storage

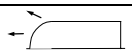
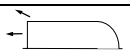
PES / ES	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are away from an Exposed Site. **(a)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are perpendicular to the direction of an ES. **(b)**	 Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Exposed Site **(c)**
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	10m	10m	25m
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	25m	25m	60m
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD
26 Overhead Power Grid			
Supergrid Network and associated substations	25m	25m	60m
Normal Network and associated substations	10m	10m	25m
Minor Network and associated substations	No QD	No QD	10m
27 POL Facilities inc pipelines			
Protected or Underground	25m	25m	25m
Unprotected, aboveground vital	25m	25m	25m
Unprotected, aboveground, non-vital	10m	10m	10m
Small Quantities (Chapter 10 Sect 7 para 3.4)	No QD	No QD	No QD
28 Boiler Houses			
Manned or Vital	25m	25m	25m
Unmanned, non-vital	10m	10m	10m
Unmanned, local	No QD	No QD	No QD

Table 3E SsD 1.3.4 QD Matrix for Non-Earth Covered Heavy Storage

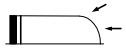
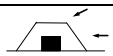
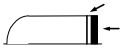
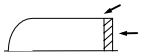
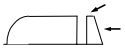
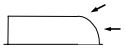
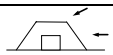
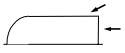
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection

Table 3E SsD 1.3.4 QD Matrix for Non-Earth Covered Heavy Storage

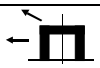
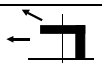
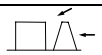
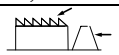
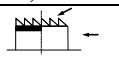
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD Limited degree of protection	No QD Limited degree of protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection
 **15** Process Building with protective roof, traversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD High degree of protection for personnel
 **16** Process Building without protective roof, traversed	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel	No QD Limited degree of protection for personnel
 **17** Process Building with or without protective roof, untraversed	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel	No QD Limited degree of protection for personnel

Table 3E SsD 1.3.4 QD Matrix for Non-Earth Covered Heavy Storage

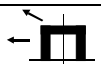
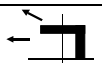
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
18 Transfer Shed Traversed Occupied by less than 10 persons	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel	No QD Limited degree of protection for personnel
Occupied by 10 persons or more			
19 Transfer Shed Untraversed Occupied by less than 10 persons	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel	No QD Limited degree of protection for personnel
Occupied by 10 persons or more			
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	10m 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	10m 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	10m	25m	25m
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	25m	60m	60m
 **23** Inhabited Building Places of Assembly	25m	60m	60m
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	50m	120m	120m

Table 3E SsD 1.3.4 QD Matrix for Non-Earth Covered Heavy Storage

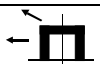
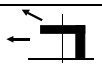
PES / ES	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. **(a)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. Door or another large aperture faces an ES. **(b)**	 Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) without a protective roof. Integrated Weapons Complex **(c)**
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	10m	25m	25m
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	25m	60m	60m
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD
26 Overhead Power Grid			
Supergrid Network and associated substations	25m	60m	60m
Normal Network and associated substations	10m	25m	25m
Minor Network and associated substations	No QD	10m	10m
27 POL Facilities inc pipelines			
Protected or Underground	25m	25m	25m
Unprotected, aboveground vital	25m	25m	25m
Unprotected, aboveground, non-vital	10m	10m	10m
Small Quantities (Chapter 10 Sect 7 para 3.4)	No QD	No QD	No QD
28 Boiler Houses			
Manned or Vital	25m	25m	25m
Unmanned, non-vital	10m	10m	10m
Unmanned, local	No QD	No QD	No QD

Table 3F SsD 1.3.4 QD Matrix for Non-Earth Covered Medium/Light Storage

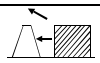
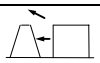
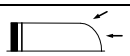
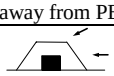
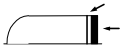
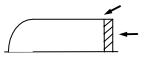
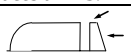
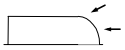
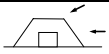
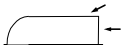
PES ➤ ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **1** Standard UK Igloo designed in accordance with Chapter 6, with the door facing away from PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **2** Standard UK Igloo designed in accordance with Chapter 6, with the door facing perpendicularly to the direction of PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **3** Standard UK Igloo designed in accordance with Chapter 6, with the door towards a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **4** Earth-covered building not complying with Chapter 6, but with a headwall and door(s) resistant to high velocity projections (see Chapter 10 Section 2). The door faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **5** Earth-covered building not complying with Chapter 6, but with a door barricade, (see Chapter 10 Section 2). The door faces a PES.	D1 These combinations of structures would always be deemed to provide virtually complete protection	D1 These combinations of structures would always be deemed to provide virtually complete protection	D1 These combinations of structures would always be deemed to provide virtually complete protection	D1 These combinations of structures would always be deemed to provide virtually complete protection
 **6** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces away from a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **7** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), but the door faces perpendicularly to the direction of a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **8** Earth-covered building not complying with Chapter 6, with or without a headwall and door(s) resistant to fire and low velocity projections, (see Chapter 10 Section 2), with the door facing a PES	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD High degree of protection	No QD High degree of protection

Table 3F SsD 1.3.4 QD Matrix for Non-Earth Covered Medium/Light Storage

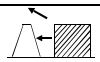
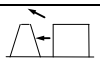
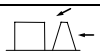
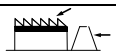
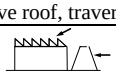
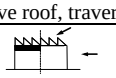
PES ➤ ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
 **9** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent) and protective roof of 150 mm RC with suitable support. The door is traversed if it faces a PES.	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection	No QD These combinations of structures would always be deemed to provide virtually complete protection
 **10** Building of non-combustible construction with walls of nominal 450 mm RC (680 mm brick or equivalent), without a protective roof. The door is traversed if it faces a PES.	No QD High degree of protection	No QD High degree of protection	No QD Limited degree of protection	No QD Limited degree of protection
 **11** Open air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed.	No QD High degree of protection	No QD High degree of protection	No QD Limited degree of protection	No QD Limited degree of protection
 **12** Open air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed.	No QD High degree of protection	No QD High degree of protection	No QD Limited degree of protection	No QD Limited degree of protection
 **13** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed.	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection
 **14** Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed.	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection	No QD High degree of protection
 **15** Process Building with protective roof, traversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD High degree of protection for personnel
 **16** Process Building without protective roof, traversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel	No QD Limited degree of protection for personnel
 **17** Process Building with or without protective roof, untraversed	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel	No QD Limited degree of protection for personnel

Table 3F SsD 1.3.4 QD Matrix for Non-Earth Covered Medium/Light Storage

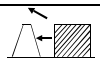
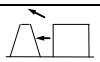
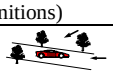
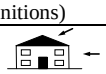
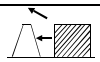
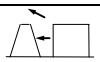
PES ➤ ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
18 Transfer Shed Traversed Occupied by less than 10 persons Occupied by 10 persons or more	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel	No QD Limited degree of protection for personnel
19 Transfer Shed Untraversed Occupied by less than 10 persons Occupied by 10 persons or more	No QD High degree of protection for personnel	No QD High degree of protection for personnel	No QD Limited degree of protection for personnel	No QD Limited degree of protection for personnel
 **20** Low Density Usage Roads – Less than 1000 vehicles per day Railways – Less than 1000 passengers per day Waterways – Less than 400 users per day Public Rights of Way or Recreational Facilities – Less than 200 users per day (See Sect 2 paras 4.2 for full definitions)	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	No QD 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	10m 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities	10m 6.4 No QD for Very Low-Density Usage Roads, Waterways and Public Rights of Way/Recreational Facilities
 **21** Medium Density Usage Roads – 1000 or more but less than 5000 vehicles per day Railways – 1000 or more but less than 5000 passengers per day Waterways – 400 or more but less than 1800 users per day Public Rights of Way or Recreational Facilities – 200 or more but less than 900 users per day (See Sect 2 paras 4.2 for full definitions)	10m	10m	25m	25m
 **22** High Density Usage Roads – 5000 or more vehicles per day Railways – 5000 or more passengers per day Waterways – 1800 or more users per day Public Rights of Way or Recreational Facilities – 900 or more users per day (See Sect 2 paras 4.2 for full definitions)	25m	25m	60m Reduced to 25m if in an ISO container or equivalent	60m Reduced to 25m if in an ISO container or equivalent
 **23** Inhabited Building Places of Assembly	25m	25m	60m Reduced to 25m if in an ISO container or equivalent	60m Reduced to 25m if in an ISO container or equivalent
24 Vulnerable Constructions (See Chapter 6 para 8.1 & Chapter 10 sect 1 para 8.1.2 for full definition)	50m	50m	120m Reduced to 50m if in an ISO container or equivalent	120m Reduced to 50m if in an ISO container or equivalent

Table 3F SsD 1.3.4 QD Matrix for Non-Earth Covered Medium/Light Storage

PES ➤ ES ▼	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, traversed **(a)**	 Building constructed with walls of 215 mm brick (or equivalent) and protective roof of 150 mm concrete with suitable support, untraversed. **(b)**	 Open-air stack or light structure, traversed. Truck, trailer, rail-car or freight container loaded with ammunition, traversed. **(c)**	 Open-air stack or light structure, untraversed. Truck, trailer, rail-car or freight container loaded with ammunition, untraversed. **(d)**
25 Office, Non-explosives workshop, Canteen with less than 20 persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	10m	10m	25m	25m
Office, Non-explosives workshop, Canteen with 20 or more persons who are directly associated with the explosives task in a support role (Chapter 10 Sect 7 para 8.1.6)	25m	25m	60m	60m
Office or Amenity Changing facility used by Explosives Workers or EASW (Chapter 9 para 14)	No QD	No QD	No QD	No QD
26 Overhead Power Grid				
Supergrid Network and associated substations	25m	25m	60m	60m
Normal Network and associated substations	10m	10m	25m	25m
Minor Network and associated substations	No QD	No QD	10m	10m
27 POL Facilities inc pipelines Protected or Underground	25m	25m	25m	25m
Unprotected, aboveground vital	25m	25m	25m	25m
Unprotected, aboveground, non-vital	10m	10m	10m	10m
Small Quantities (Chapter 10 Sect 7 para 3.4)	No QD	No QD	No QD	No QD
28 Boiler Houses				
Manned or Vital	D4	D4	25m	25m
Unmanned, non-vital	D2	D2	10m	10m
Unmanned, local	25m	25m	No QD	No QD

It is essential to study the text in Chapter 10, Section 2 when using this table since they are complementary.

TABLE 3G QUANTITY-DISTANCE MATRIX STORAGE SUB-DIVISIONS 1.3.3 AND 1.3.4

2.37 **NEQ** 2.38 **(kg)** 2.41	2.39 **Quantity Distances** 2.40 **(m)**			
	2.42 **D1**	2.43 **D2**	2.44 **D3**	2.45 **D4**
50	10	12	25	25
60	10	13	25	26
70	10	14	25	27
80	10	14	25	28
90	10	15	25	29
100	10	15	25	30
120	10	16	25	32
140	10	17	25	34
160	10	18	25	35
180	10	19	25	37
200	10	19	25	38
250	10	21	27	41
300	10	22	29	43
350	10	23	30	46
400	10	24	32	48
500	10	26	34	51
600	10	27	36	54
700	10	29	38	57
800	10	30	40	60
900	10	31	42	62
1000	10	32	43	64
1200	10	34	46	69
1400	10	36	49	72
1600	10	38	50	75
1800	10	39	52	78
2000	10	41	54	81
2500	11	44	58	87
3000	12	47	62	93
3500	13	49	65	98
4000	14	51	68	105
5000	16	55	73	110
6000	18	59	78	120
7000	19	62	82	125
8000	20	64	86	130
9000	21	67	89	135
10 000	22	68	92	140
12 000	25	74	98	150
14 000	27	78	105	155
16 000	28	81	110	165
18 000	30	84	115	170
20 000	32	87	120	175
25 000	35	94	125	190
30 000	39	100	135	200
35 000	42	105	140	210
40 000	44	110	150	220
50 000	50	120	160	240
60 000	54	130	170	255
70 000	59	135	180	265
80 000	63	140	185	280
90 000	66	145	195	290
100 000	70	150	200	300
120 000	77	160	215	320
140 000	83	170	225	335
160 000	88	175	235	350
180 000	94	185	245	365
200 000	99	190	250	375
250 000	110	205	270	405
Distance Functions	$D1 = 0.22\ Q^{1/2}$	$D2 = 3.2\ Q^{1/3}$	$D3 = 4.3\ Q^{1/3}$	$D4 = 6.4Q^{1/3}$

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CHAPTER 10

SECTION 2

ANNEX B

DEFINITIONS OF FRONT/SIDE/REAR CONFIGURATIONS FOR EARTH-COVERED BUILDINGS

CONTENTS

1 HD 1.1 and HD 1.3

1.1 The directional effects for HD 1.1 and HD 1.3 from buildings that meet the design criteria for earth-covered buildings are considered to occur:

(a) Through the front in the area bounded by lines drawn at 150° to the front face of the PES from its front corners.
(b) Through the rear in the area bounded by lines drawn at 135° to the rear face of the PES from its rear corners.
(c) All areas around a PES, not included in sub-para 1.1 or sub-para 1.2, above, are considered to be to the side of the PES. In those cases where an Exposed Site (ES) lies on the line separating rear/side of a PES, the greater quantity-distance is to be observed.

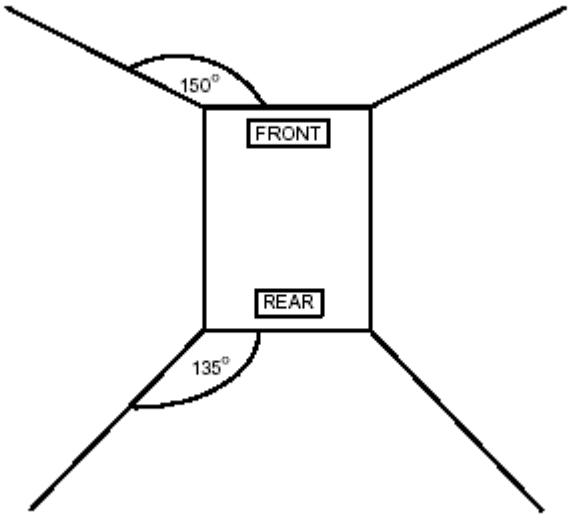

Fig 1 Earth Covered Building Containing HD 1.1 or HD 1.3 as a PES or ES

2 **HD 1.2**

2.1 The directional effects for HD 1.2 from buildings that meet the design criteria for standard igloos or HD 1.2 containment buildings are considered to occur through the front of the building in the area bounded by lines drawn at 100□ to the front face of the PES from the front corners.

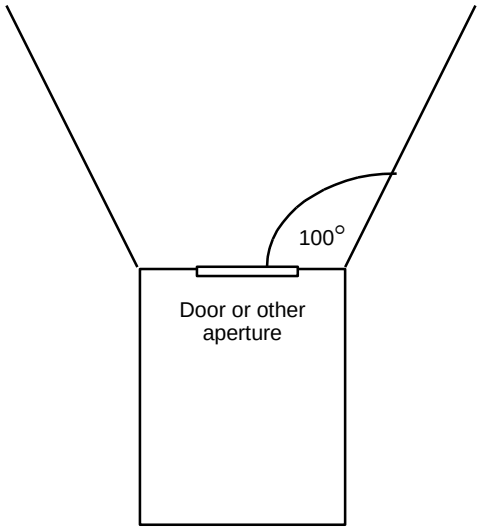

Fig 2 Earth Covered Building Containing HD 1.2 as a PES or ES

CHAPTER 10

SECTION 2

ANNEX C

EOD UNIT GARAGES AND EOD VEHICLE PARKING AREAS

CONTENTS

1 EOD UNIT GARAGES AND EOD VEHICLE PARKING AREAS

1.1 Introduction

1.1.1 To meet the requirements of the MOD Military Aid to the Civil Power (MACP), various Service units have a mandate to maintain EOD vehicles at a high state of readiness. These vehicles are garaged or parked with certain explosives aboard, and this would ordinarily require these garages and parking areas to be licensed. It is recognised however that such licences would be problematic. A method of authorisation has therefore been developed based on ESTC trials conducted with the EOD vehicles concerned.

1.2 Applicability

1.2.1 An Explosives Licence (MOD Form 1659) may be authorised to permit the use of specific garages/parking areas to contain recognised EOD unit vehicles, on stand-by, carrying their normal operational suite of EOD/IEDD explosives provided that the conditions stipulated below are met.

1.3 Licensing Criteria

1.3.1 The total NEQ of the vehicle may be as required for Operations but is to be unitised within the vehicle in such a manner that no single ‘stack’ of HD 1.1/1.3 explosives exceeds 3.5kg subject to the following conditions:

(1) All detonators, detonating cord and Charge Linear Cutting (CLC) are to be stored a minimum of 1m from any HD1.1 explosives.

(2) There is to be a minimum of 1m between any two stacks of HD1.1/1.3 explosives.

(3) The IE/SATO is to stipulate on the MOD Form 1659 the type and quantities of explosives authorised.

(4) EOD recoveries are not to be stored in the vehicle or the garage.

Note: The NEQ of HD 1.4 explosives are not aggregated for the purpose of storage.

1.4 Parking Areas

1.4.1 Any secure area acceptable to the HoE and unit Fire Officer/FFP may be used to park an EOD vehicle. A minimum distance of 15 m is to be applied to any ES.

1.5 **Garages**

1.5.1 Garages are to be as follows:

(1) Structure. EOD garages are normally to be constructed of blast resistant reinforced concrete. Where appropriate QDs can be achieved, brick construction may be used with the following constraints:

(a) Windows in the walls should preferably be avoided, but if unavoidable (e.g. existing buildings), the opening must have a security barset fitted in the opening (as described in JSP 440) together with a very lightweight frangible weather cover on the outside (glass is not acceptable). Brickwork for in-filled windows must be adequately tied in and bonded to the surrounding brickwork.

(b) The structure should preferably have a lightweight frangible roof. Where a reinforced concrete roof is used, close attention must be given to providing adequate venting arrangements, and any consequent increased directional effects.

(c) Blockwork should be avoided, particularly if there is also a concrete roof present. QDs may need to be greater due to the increased hazard.

(2) Quantity Distances. Where necessary, advice should be sought from TA (Structures) through the relevant IE.

(a) EOD Complex The standard reinforced concrete EOD complex (or separate component parts) has been designed with an OQD - an effective 'sanitation' zone of 15m to all sides.

(b) EOD Garage As a result of burning trials, it has been assessed that the explosives carried on an EOD vehicle will not burn to detonation. Therefore, there is no requirement for an IBD around the garage. However, the FSA must be consulted in order to establish an adequate firefighting distance.

(3) Vehicle Positioning. The vehicle must be reversed into the garage so that the front of the vehicle is facing the garage door(s).

(4) Other Criteria Additionally:

(a) The garage must meet the security requirements of JSP 440.

(b) The unit Senior Fire Officer/FFP must specify any additional fire prevention and firefighting requirements.

(c) The appropriate fire and supplementary symbols are to be displayed.

(d) A Lightning Protection Systems (LPS) is not required for an EOD garage that is purely a garage and has no explosives storage within another area of the building.

(e) The main garage is to meet a minimum of Cat ‘D’ electrical standards, with the exception of the specialist cable for the on-board vehicle charger, which is Cat ‘C’.

(f) Any portable equipment battery charging may be carried out in the garage provided it is separated from EOD Vehicles by a wall of minimum single brick thickness and a door with a minimum 30-minute fire resistance.

1.6 **Other Considerations**

1.6.1 More than one EOD vehicle may be stored in the same garage or parking area if operationally imperative. However, it should be noted that whilst an event in one vehicle will not propagate to the others, the other vehicles are likely to be severely damaged.

1.6.2 If any of the criteria detailed above cannot be met, advice is to be sought from CIE (MOD) staff through the appropriate IE.

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