VOLUME 3 – ENCLOSURE 3: QD CRITERIA FOR ACCIDENTAL DETONATIONS

V3.E3.1. HD 1.1

V3.E3.1.1. Permissible Exposures to Airblast Overpressure

V3.E3.1.1.1. 12 psi [82.7 kilopascals (kPa)] at $9W^{1/3}$ where W is weight in pounds (lbs) [$3.57Q^{1/3}$ where Q is NEQ in kilograms (kg)]. Barricading is required.

V3.E3.1.1.1.1. Buildings that house the following are permitted at this overpressure:

V3.E3.1.1.1.1.1. Successive steps of a single production, renovation, or maintenance operation.

V3.E3.1.1.1.1.2. A security alert force.

V3.E3.1.1.1.1.3. A tactical missile site, where greater distances from the PES cannot be provided for technical or tactical reasons.

V3.E3.1.1.1.1.4. Break rooms and change houses that are both part of an operating line and used exclusively by personnel operating the line. An exception is when the break room is integral to the PES and used only by personnel from that PES. For this situation, no QD applies.

V3.E3.1.1.1.1.5. Dunnage preparation or similar non-AE operations, if used only by personnel employed at the PES.

V3.E3.1.1.1.1.6. Temporary holding areas for AE conveyances servicing production or maintenance facilities.

V3.E3.1.1.1.1.7. AE-related operations in magazine areas, when performing minor maintenance, preservation, packaging, or surveillance inspection.

V3.E3.1.1.1.1.8. Barricaded service magazines that are part of an operating line. Separation distances are based on the NEWQD and the HD of the AE in the magazine and not that in other parts of the operating line.

V3.E3.1.1.1.2. Exceptions include:

V3.E3.1.1.1.2.1. Unmanned auxiliary utility facilities (e.g., transformer stations, water treatment and pollution abatement facilities) that serve, but are not an integral function in, the PES and would not create an immediate secondary hazard if lost. Such unmanned facilities need not be barricaded. Paragraph V4.E5.2.2. addresses situations where auxiliary facilities

serving only one PES or AE operation may be separated from the facility or operation they support based only on fire separation distance.

V3.E3.1.1.1.2.2. Unmanned auxiliary power generation or conversion facilities that exclusively supply power to an AE storage area or security fence lighting may be located at fire protection distance (50 feet (ft) [15.2 meters (m)] for non-combustible structures, 100 ft [30.5 m] for combustible structures) from AE facilities.

V3.E3.1.1.2. 3.5 psi [24 kPa] at $18W^{1/3}$ [$7.14Q^{1/3}$].

V3.E3.1.1.2.1. Facilities that house the following are permitted at this overpressure:

V3.E3.1.1.2.1.1. Labor-intensive AE operations (e.g., surveillance, maintenance, inspection) closely related to the PES.

V3.E3.1.1.2.1.2. Buildings, excluding magazine-area loading docks, for comfort, safety, or convenience (e.g., lunchrooms, motor pools, area offices, auxiliary fire stations, transportation dispatch points, and shipping and receiving buildings) that are used exclusively in support of the PES.

V3.E3.1.1.2.1.3. Parallel operating lines, whether or not barricaded, provided the AE involved in each operating line present similar hazards. The criticality or survivability of one or more of the operating lines may require that each line be given IBD-level protection.

V3.E3.1.1.2.1.4. Operational support buildings (e.g., day rooms, operation offices, and similar functions) that only personnel from the activity operating the PES use or attend.

V3.E3.1.1.2.1.5. Training functions (e.g., classroom and field training of personnel who may be required to engage in AE work) that only personnel from the activity operating the PES use or attend. Maneuver areas, proving ground tracks, and similar facilities for armored vehicles also may be exposed to 3.5 psi [24 kPa] because the vehicles provide adequate protection to the operators from fragments and debris.

V3.E3.1.1.2.1.6. Maintenance of military vehicles or equipment that are located outside the United States, when the PES is a basic load or a ready storage area. In such cases:

V3.E3.1.1.2.1.6.1. The NEWQD at each PES is limited to 8,818 pounds (lbs) [4,000 kilograms (kg)] or less.

V3.E3.1.1.2.1.6.2. The maintenance work must be performed exclusively for the unit for which the basic load of AE is stored.

V3.E3.1.1.2.1.7. Auxiliary power and utilities functions, including auxiliary power plants; compressor stations; electric power transformers; tool and consumable supplies storage and issue; and handling equipment service, battery charging, and minor repair.

V3.E3.1.1.2.1.7.1. When such facilities serve an entire naval station or base complex, or when loss of the facility causes an immediate loss of vital function, the minimum exposure level is IBD (40-50$W^{1/3}$ [15.87-19.84$Q^{1/3}$]).

V3.E3.1.1.2.1.7.2. Naval station "cold-iron" ship support facilities (e.g., supply and mechanical support) are excluded from QD criteria when they are not continuously manned; when they are serving only the waterfront area; and when the PES is a ship or AE handling location on the waterfront.

V3.E3.1.1.2.1.8. Minimum distance between separate groups of AE-loaded, combat-configured aircraft or between aircraft and a pre-load or "quick-turn" site that serves to arm an aircraft. The use of intervening barricades is required to eliminate propagation by primary fragment impact, thereby eliminating the need to total NEWQD. Loading AE aboard aircraft can be accomplished within each group of aircraft without additional protection.

V3.E3.1.1.2.1.9. Unbarricaded service magazine separation distances are based on the NEWQD and the HD of the AE in the magazine and not that in other parts of the operating line.

V3.E3.1.1.2.1.10. Container stuffing and unstuffing operations that provide routine support to a PES. This applies only to main support functions that are set aside for support of ship-loading, depot, or manufacturing operations. When in connection with ship loading and unloading and the ES is an AE ship, the quantity at the container site governs. Container stuffing and unstuffing in a magazine area are permitted at IMD in accordance with paragraph V3.E3.1.5. Criteria applicable to the loading and unloading of a conveyance at a magazine are addressed in section V4.E5.19.

V3.E3.1.1.2.1.11. Combat aircraft support facilities:

V3.E3.1.1.2.1.11.1. Between AE-loaded combat aircraft and those non-AE facilities that directly support the servicing and launching of a unit's armed aircraft. Such facilities include operating facilities that handle AE on the flight line, or prepare and service armed aircraft, and facilities that house personnel who fly combat aircraft.

V3.E3.1.1.2.1.11.2. Direct flight line combat aircraft associated facilities, which may contain field offices, break rooms, unit training rooms, and equipment and supply rooms, as well as petroleum, oils, and lubricants hydrant facilities, and civil engineer fire protection stations. Morale, welfare, and recreation (MWR) facilities; base civil engineering headquarters; and industrial facilities, including central base supply, are required to be at IBD.

V3.E3.1.1.2.2. Exposures indicated in paragraphs V3.E3.1.1.2.1.1. through V3.E3.1.1.2.1.11. that are provided blast suppression and structure hardening to achieve comparable protection levels for personnel and equipment as provided by 18$W^{1/3}$ [7.14$Q^{1/3}$] may be sited at 9$W^{1/3}$ [3.57$Q^{1/3}$].

V3.E3.1.1.3. 2.3 psi [15.8 kPa] at $24W^{1/3}$ [$9.52Q^{1/3}$]. Personnel exposed to remotely controlled operations.

V3.E3.1.1.4. 2.3-1.7 psi [15.8-11.7 kPa] at $24\text{-}30W^{1/3}$ [$9.52\text{-}11.9Q^{1/3}$].

V3.E3.1.1.4.1. Public traffic routes (PTRs) with medium and low traffic densities, as described in paragraph V3.E3.1.2.1.1.5.

V3.E3.1.1.4.2. On-base roads. The DoD Components may provide protection less than 60 percent of IBD to installation-related personnel transiting QD arcs when the risks are evaluated, documented, and in accordance with DoD Component-established procedures. Effective October 1, 2000, all new construction of AE storage and operating facilities, and any change in operations within existing facilities that increases the explosives safety risk, should provide both the general public and installation-related personnel who are not involved in munitions-related operations protection that provides a minimum of 60 percent of IBD. When a DoD Component determines exposures at less than 60 percent of IBD are necessary, the DoD Component should consider use of methods to inform transients of potential risks (e.g., written acknowledgment of the risk by vendors or others with a recurring need to transit the explosives safety quantity-distance (ESQD) area, warning signs, flashing lights, physical barriers). The DoD Component's decision to provide transients protection at less than 60 percent of IBD will be:

V3.E3.1.1.4.2.1. Supported by a qualitative risk assessment considering factors such as:

V3.E3.1.1.4.2.1.1. Operational necessity.

V3.E3.1.1.4.2.1.2. The operation being performed (e.g., static storage, maintenance, production).

V3.E3.1.1.4.2.1.3. Operational activity cycles.

V3.E3.1.1.4.2.1.4. Alternate routes.

V3.E3.1.1.4.2.1.5. Traffic density.

V3.E3.1.1.4.2.1.6. Accident records.

V3.E3.1.1.4.2.1.7. Time interval of exposure.

V3.E3.1.1.4.2.1.8. Type and quantity of AE in proximity to the area transited.

V3.E3.1.1.4.2.1.9. The closest distance from the area transited to the PES.

V3.E3.1.1.4.2.1.10. The need for installation-related personnel to transit the ESQD arc.

V3.E3.1.1.4.2.2. Reviewed as changes occur to operations, which would increase the explosives safety risk, or the number of exposed, and upon change of the approving authority.

V3.E3.1.1.4.3. Open-air recreation facilities (e.g., baseball diamonds, golf courses, and volleyball courts), which do not contain structures, used for MWR and community relations purposes at military installations and activities. As an exception, neither blast nor fragment criteria apply when such facilities are located near AE support operations and used by off-duty military, on-duty military, or DoD civilians or contractors (e.g., munitions workers, security guards, firefighters) who directly support these AE operations. However, such facilities should fully comply with this manual when possible.

V3.E3.1.1.4.4. Training areas (e.g., observation points, classrooms or other instruction areas for ranges, and similar fixed facilities designed for occasional use coincident with the use of the range). As an exception, to allow for realism in training, this separation does not apply to AE needed for any particular exercise or on-the-job training. However, this separation or equivalent protection is required from permanent PES and AE supply points.

V3.E3.1.1.4.5. Open-air aircraft passenger loading and unloading areas.

V3.E3.1.1.4.6. Parking lots for administrative areas. Minimum fragment distances apply; see paragraph V3.E3.1.2.

V3.E3.1.1.4.7. Inert storage located in the open (no structures involved) when not directly related to the explosives mission and when accessed by personnel not directly related to the explosives mission. If located within a structure, apply paragraph V3.E3.1.1.6.9.

V3.E3.1.1.5. 1.7 psi [11.7 kPa] at $30W^{1/3}$ [$11.9Q^{1/3}$]. Combat aircraft parking areas (CAPAs) exposed to AE storage and operating facilities.

V3.E3.1.1.6. 1.2-0.90 psi [8.3-6.2 kPa] at $40\text{-}50W^{1/3}$ [$15.87\text{-}19.84Q^{1/3}$].

V3.E3.1.1.6.1. Inhabited buildings and administrative and housing areas.

V3.E3.1.1.6.2. An installation boundary, unless the area outside the boundary naturally prohibits access, is government land that is not open to the public, or access is restricted and controlled by other means. When IBD QD arcs penetrate an installation's boundary, the Service must certify that IBD protection does not apply to the encumbered area and must establish procedures to monitor the area for any change in status.

V3.E3.1.1.6.3. Recreation facilities (e.g., baseball diamonds, golf courses, and volleyball courts) that contain structures.

V3.E3.1.1.6.4. Flight-line passenger service functions (e.g., terminal buildings).

V3.E3.1.1.6.5. Main powerhouses that provide vital utilities to a major portion of an installation.

V3.E3.1.1.6.6. Shops that by reason of their vital strategic nature, or high intrinsic value of their contents, should not be placed at risk.

V3.E3.1.1.6.7. Functions that, if momentarily put out of action, would cause an immediate secondary hazard by reason of their failure to function.

V3.E3.1.1.6.8. PTRs with high traffic density as described in paragraph V3.E3.1.2.1.1.5.

V3.E3.1.1.6.9. Inert storage located in a structure when not directly related to the explosives mission and when accessed by personnel not directly related to the explosives mission. If no structure is involved, apply paragraph V3.E3.1.1.4.7.

V3.E3.1.2. Minimum Fragment Distances

V3.E3.1.2.1. The minimum distance for protection from hazardous fragments is based on primary and secondary fragments from the PES and the population or traffic density of the ES. It is defined as the distance at which the density of hazardous fragments becomes 1 per 600 square feet (ft^2) [55.7 square meters (m^2)] (this distance is not the maximum fragment distance (MFD)). DDESB-approved analyses or approved tests may be used to determine minimum distances for primary and secondary fragments. DDESB Technical Paper 13 illustrates a method of determining minimal distances for building debris, while DDESB Technical Paper 16 provides similar information to determine minimal distances for primary fragments. In the absence of appropriate analyses or tests, default hazardous debris distances (HDDs) apply.

V3.E3.1.2.1.1. For populous locations provided IBD protection, the minimum distance is the HFD. If this distance is not known:

V3.E3.1.2.1.1.1. For all types of HD 1.1 in quantities less than or equal to ($\leq$) 450 lbs [204 kg] NEWQD, the HFD is determined according to the criteria in paragraphs V3.E3.1.2.1.1.1.1. through V3.E3.1.2.1.1.1.9. (PTRD is 60 percent of the specified HFD):

V3.E3.1.2.1.1.1.1. For HD 1.1 in a 7-Bar or a 3-Bar ECM, use ECM distances shown in Table V3.E3.T1., as discussed in paragraph V3.E3.1.3. The ILD must be in accordance with paragraph V3.E3.1.4.1.

V3.E3.1.2.1.1.1.2. For HD 1.1 in an Undefined ECM where the loading density (or NEWQD/internal volume) is $\leq$ 0.028 lbs/cubic foot (ft^3) [0.449 kg/cubic meter (m^3)], use ECM distances shown in Table V3.E3.T1., as discussed in paragraph V3.E3.1.3. ILD must be in accordance with paragraph V3.E3.1.4.1.

V3.E3.1.2.1.1.1.3. For HD 1.1 in an Undefined ECM where the loading density is greater than (>) 0.028 lbs/ft^3 [0.449 kg/m^3], use "ECM side and rear" distances of Table V3.E3.T1. and for front exposure, apply the greater of the "ECM – front" IBD distance of

Table V3.E3.T1. or the HFD from Table V3.E3.T2., for the NEW in the ECM.   For application of Table V3.E3.T2., if the ECM headwall meets the definition of aboveground structure, heavy wall (AGS (H) use the "Structure" column, otherwise, use the "Structure" column for nonprimary fragment producing explosives or the "Open" column for primary fragment producing explosives. ILD must be in accordance with paragraph V3.E3.1.4.1.

    V3.E3.1.2.1.1.1.4. Where ECMs, regardless of structural designation, have been designed, analyzed, or tested to have a reduced IBD and approved by the DDESB, use the approved IBD. ILD must be in accordance with paragraph V3.E3.1.4.1.

    V3.E3.1.2.1.1.1.5. For HD 1.1 in a structure (excluding ECM) capable of stopping primary fragments, but which can contribute to the debris hazard, use the HFD listed in the "Structure" column of Table V3.E3.T2. ILD must be in accordance with paragraph V3.E3.1.4. Structures that are capable of stopping primary fragments include all AGS (H and aboveground structure, heavy wall and roof (H/R). Doors and other openings through which primary fragments could exit must be capable of stopping primary fragments from exiting the facility or must be barricaded in accordance with section V2.E5.4. to trap primary fragments that could exit the facility.

    V3.E3.1.2.1.1.1.6. For primary fragment-producing HD 1.1 in the open or in a structure incapable of stopping primary fragments, use HFD listed in the "Open" column of Table V3.E3.T2. ILD must be in accordance with paragraph V3.E3.1.4. Structures (other than ECM) that are capable of stopping primary fragments include all AGS (H) and AGS (H/R). All other structures (other than ECM) are considered incapable of stopping primary fragments.

    V3.E3.1.2.1.1.1.7. For non-primary fragment-producing explosives in any structure (excluding ECM), truck, trailer, or railcar that may contribute to the debris hazard, use the HFD listed in the "Structure" column of Table V3.E3.T2.

    V3.E3.1.2.1.1.1.8. Selected items have been evaluated for minimum HFD with results shown in Table V3.E3.T3. Other items, through testing, have been hazard classified with a specific HFD presented in the format HD (xx)1.1. The HFD for these items is specified in hundreds of feet (in parenthesis), and they may not be listed in Table V3.E3.T3. The distances for these two categories of select items apply only to items in the open. When in facilities, secondary debris as well as primary fragments must be considered. If in a facility that can contain primary fragments, apply criteria of paragraphs V3.E3.1.2.1.1.1.1. through V3.E3.1.2.1.1.1.5. If in a facility that cannot stop primary fragments, use the greater distance from Table V3.E3.T3. (for the item being considered) or the HFD associated with the HD (xx)1.1 item or from the "Open" column of Table V3.E3.T2. for determining the applicable HFD. ILD must be in accordance with paragraph V3.E3.1.4.

    V3.E3.1.2.1.1.1.9. For bare explosives in the open, distance is computed by the formula $D = 40W^{1/3}$ [$15.87Q^{1/3}$].

Table V3.E3.T1. HD 1.1 IBD and PTRD

NEWQD	IBD From:			Other PES[d]	PTRD From:			Other PES[e]
	ECM				ECM			
	Front[a, b]	Side[a]	Rear[c]		Front[e, f]	Side[e]	Rear[e]	
(lbs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
[kg]	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*
1	500	250	250	Footnote d	300	150	150	Footnote e
0.45	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
1.5	500	250	250		300	150	150	
0.68	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
2	500	250	250		300	150	150	
0.91	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
3	500	250	250		300	150	150	
1.4	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
5	500	250	250		300	150	150	
2.3	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
7	500	250	250		300	150	150	
3.2	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
10	500	250	250		300	150	150	
4.5	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
15	500	250	250		300	150	150	
6.8	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
20	500	250	250		300	150	150	
9.1	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
30	500	250	250		300	150	150	
13.6	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
50	500	250	250		300	150	150	
22.7	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
70	500	250	250		300	150	150	
31.8	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
100	500	250	250		300	150	150	
45.4	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
150	500	250	250		300	150	150	
68.0	*152.4*	*76.2*	*76.2*		*91.4*	*45.7*	*45.7*	
200	700	250	250		420	150	150	
90.7	*213.6*	*76.2*	*76.2*		*128.0*	*45.7*	*45.7*	
300	700	250	250		420	150	150	
136.1	*213.6*	*76.2*	*76.2*		*128.0*	*45.7*	*45.7*	
450	700	250	250		420	150	150	
204.1	*213.6*	*76.2*	*76.2*		*128.0*	*45.7*	*45.7*	
500	1,250	1,250	1,250	1,250	750	750	750	750
226.8	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*
700	1,250	1,250	1,250	1,250	750	750	750	750
317.5	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*

Table V3.E3.T1. HD 1.1 IBD and PTRD, Continued

| NEWQD | IBD From: | | | | PTRD From: | | | |
| | ECM | | | Other | ECM | | | Other |
	Front[a, b]	Side[a]	Rear[c]	PES[d]	Front[e, f]	Side[e]	Rear[e]	PES[e]
(lbs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
[kg]	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*
1,000	1,250	1,250	1,250	1,250	750	750	750	750
453.6	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*
1,500	1,250	1,250	1,250	1,250	750	750	750	750
680.4	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*
2,000	1,250	1,250	1,250	1,250	750	750	750	750
907.2	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*
3,000	1,250	1,250	1,250	1,250	750	750	750	750
1,360.8	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*
5,000	1,250	1,250	1,250	1,250	750	750	750	750
2,268.0	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*
7,000	1,250	1,250	1,250	1,250	750	750	750	750
3,175.1	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*
10,000	1,250	1,250	1,250	1,250	750	750	750	750
4,535.9	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*
15,000	1,250	1,250	1,250	1,250	750	750	750	750
6,803.9	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*
20,000	1,250	1,250	1,250	1,250	750	750	750	750
9,071.8	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*
30,000	1,250	1,250	1,250	1,250	750	750	750	750
13,607.7	*381.0*	*381.0*	*381.0*	*381.0*	*228.6*	*228.6*	*228.6*	*228.6*
45,000	1,250	1,250	1,250	1,423	750	750	750	854
20,411.6	*381.0*	*381.0*	*381.0*	*433.7*	*228.6*	*228.6*	*228.6*	*260.3*
50,000	1,289	1,289	1,250	1,474	774	774	750	884
22,679.5	*392.9*	*392.9*	*381.0*	*448.9*	*235.7*	*235.7*	*228.6*	*269.4*
70,000	1,442	1,442	1,250	1,649	865	865	750	989
31,751.3	*439.5*	*439.5*	*381.0*	*502.2*	*263.7*	*263.7*	*228.6*	*301.3*
100,000	1,625	1,625	1,250	1,857	975	975	750	1,114
45,359.0	*495.0*	*495.0*	*381.0*	*565.6*	*297.0*	*297.0*	*228.6*	*339.4*
150,000	2,177	2,177	1,804	2,346	1,306	1,306	1,083	1,408
68,038.5	*663.5*	*663.5*	*550.0*	*715.2*	*398.1*	*398.1*	*330.0*	*429.1*
200,000	2,680	2,680	2,469	2,770	1,608	1,608	1,481	1,662
90,718.0	*816.8*	*816.8*	*752.5*	*844.4*	*490.1*	*490.1*	*451.5*	*506.6*
250,000	3,149	3,149	3,149	3,151	1,889	1,889	1,889	1,891
113,397.5	*959.8*	*959.8*	*959.8*	*960.4*	*575.9*	*575.9*	*575.9*	*576.2*
300,000	3,347	3,347	3,347	3,347	2,008	2,008	2,008	2,008
136,077.0	*1,020.5*	*1,020.5*	*1,020.5*	*1,020.5*	*612.3*	*612.3*	*612.3*	*612.3*
500,000	3,969	3,969	3,969	3,969	2,381	2,381	2,381	2,381
226,795.0	*1,209.9*	*1,209.9*	*1,209.9*	*1,209.9*	*725.9*	*725.9*	*725.9*	*725.9*

NEWQD	IBD From:				PTRD From:			
	ECM			Other PES[d]	ECM			Other PES[e]
	Front[a, b]	Side[a]	Rear[c]		Front[e, f]	Side[e]	Rear[e]	
(See paragraph V3.E3.1.2.1.1.)								

a | For NEWQD less than (<) 45,000 lbs [20,412 kg], the distance is controlled by fragments. When fragments are absent or if the HFD ($1/600$ ft^2 [$1/55.7$ m^2]) is less than the blast hazard range, then the blast criteria in this footnote may be used.

English equations (EQNs) (NEWQD in lbs, distance (D) in ft)

NEWQD $\leq$ 45,000 lbs:	D = 35*NEWQD$^{1/3}$	EQN V3.E3.T1-1
45,000 lbs < NEWQD $\leq$ 100,000 lbs:	D = 35*NEWQD$^{1/3}$	EQN V3.E3.T1-2
100,000 lbs < NEWQD $\leq$ 250,000 lbs:	D = 0.3955*NEWQD$^{0.7227}$	EQN V3.E3.T1-3
250,000 lbs < NEWQD:	D = 50*NEWQD$^{1/3}$	EQN V3.E3.T1-4

Metric EQNs (NEWQD in kg, D in m)

NEWQD $\leq$ 20,412 kg:	*D = 13.88*NEWQD$^{1/3}$*	*EQN V3.E3.T1-5*
20,412 kg < NEWQD $\leq$ 45,359 kg:	*D = 13.88*NEWQD$^{1/3}$*	*EQN V3.E3.T1-6*
45,359 kg < NEWQD $\leq$ 113,398 kg:	*D = 0.2134*NEWQD$^{0.7227}$*	*EQN V3.E3.T1-7*
113,398 kg < NEWQD:	*D = 19.84*NEWQD$^{1/3}$*	*EQN V3.E3.T1-8*

English EQNs (D in ft, NEWQD in lbs)

D $\leq$ 1,245 ft:	NEWQD = D^3/42,875	EQN V3.E3.T1-9
1,245 ft < D $\leq$ 1,625 ft:	NEWQD = D^3/42,875	EQN V3.E3.T1-10
1,625 ft < D $\leq$ 3,150 ft:	NEWQD = 3.60935*D$^{1.3837}$	EQN V3.E3.T1-11
3,150 ft < D:	NEWQD = D^3/125,000	EQN V3.E3.T1-12

Metric EQNs (D in m, NEWQD in kg)

D $\leq$ 379.3 m:	*NEWQD = D^3/2,674.04*	*EQN V3.E3.T1-13*
379.3 m < D $\leq$ 495.0:	*NEWQD = D^3/2,674.04*	*EQN V3.E3.T1-14*
495.0 m < D $\leq$ 960.3 m:	*NEWQD = 8.4761*D$^{1.3837}$*	*EQN V3.E3.T1-15*
960.3 m < D:	*NEWQD = D^3/7,809.53*	*EQN V3.E3.T1-16*

b | IBD for frontal exposures applies to all directions from HPMs. The MCE in the HPM is used as the NEWQD. The limit on the design MCE in an HPM is 60,000 lbs [27,215 kg].

c | For NEWQD < 100,000 lbs [45,359 kg], the distance is controlled by fragments and debris. When fragments and debris are absent or the range to a hazardous debris density of $1/600$ ft^2 [$1/55.7$ m^2] is less than the blast hazard range, then the blast criteria in this footnote may be used.

English EQNs (NEWQD in lbs, D in ft)

NEWQD $\leq$ 100,000 lbs:	D = 25*NEWQD$^{1/3}$	EQN V3.E3.T1-17
100,000 lbs < NEWQD $\leq$ 250,000 lbs:	D = 0.004125*NEWQD$^{1.0898}$	EQN V3.E3.T1-18
250,000 lbs < NEWQD:	D = 50*NEWQD$^{1/3}$	EQN V3.E3.T1-19

Metric EQNs (NEWQD in kg, D in m)

NEWQD $\leq$ 45,359 kg:	*D = 9.92*NEWQD$^{1/3}$*	*EQN V3.E3.T1-20*
45,359 kg < NEWQD $\leq$ 113,398 kg:	*D = 0.002976*NEWQD$^{1.0898}$*	*EQN V3.E3.T1-21*
113,398 kg < NEWQD:	*D = 19.84*NEWQD$^{1/3}$*	*EQN V3.E3.T1-22*

English EQNs (D in ft, NEWQD in lbs)

D $\leq$ 1,160 ft:	NEWQD = D^3/15,625	EQN V3.E3.T1-23
1,160 ft < D $\leq$ 3,150 ft:	NEWQD = 154.2006*D$^{0.91760}$	EQN V3.E3.T1-24
3,150 ft < D:	NEWQD = D^3/125,000	EQN V3.E3.T1-25

Metric EQNs (D in m, NEWQD in kg)

D $\leq$ 353.8 m:	*NEWQD = D^3/976.19*	*EQN V3.E3.T1-26*
353.8 m < D $\leq$ 960.3 m:	*NEWQD = 208.0623*D$^{0.91760}$*	*EQN V3.E3.T1-27*
960.3 m < D:	*NEWQD = D^3/7,809.53*	*EQN V3.E3.T1-28*

(See paragraph V3.E3.1.2.1.1.)	
d	For NEWQD < 30,000 lbs [13,608 kg], the distance is controlled by fragments and debris. Lesser distances may be permitted for certain situations.

	English EQNs (NEWQD in lbs, D in ft)		
	30,000 lbs < NEWQD $\leq$ 100,000 lbs:	$D = 40*NEWQD^{1/3}$	EQN V3.E3.T1-29
	100,000 lbs < NEWQD $\leq$ 250,000 lbs:	$D = 2.42*NEWQD^{0.577}$	EQN V3.E3.T1-30
	250,000 lbs < NEWQD:	$D = 50*NEWQD^{1/3}$	EQN V3.E3.T1-31
	Metric EQNs (NEWQD in kg, D in m)		
	13,608 kg < NEWQD $\leq$ 45,359 kg:	*$D = 15.87*NEWQD^{1/3}$*	*EQN V3.E3.T1-32*
	45,359 kg < NEWQD $\leq$ 113,398 kg:	*$D = 1.1640*NEWQD^{0.577}$*	*EQN V3.E3.T1-33*
	113,398 kg < NEWQD:	*$D = 19.84*NEWQD^{1/3}$*	*EQN V3.E3.T1-34*
	English EQNs (D in ft, NEWQD in lbs)		
	1,243 ft < D $\leq$ 1,857 ft:	$NEWQD = D^3/64,000$	EQN V3.E3.T1-35
	1,857 ft < D $\leq$ 3,150 ft:	$NEWQD = 0.2162*D^{1.7331}$	EQN V3.E3.T1-36
	3,150 ft < D:	$NEWQD = D^3/125,000$	EQN V3.E3.T1-37
	Metric EQNs (D in m, NEWQD in kg)		
	378.6 m < D $\leq$ 565.6 m:	*$NEWQD = D^3/3,989.42$*	*EQN V3.E3.T1-38*
	565.6 m < D $\leq$ 960.3 m:	*$NEWQD = 0.7686*D^{1.7331}$*	*EQN V3.E3.T1-39*
	960.3 m < D:	*$NEWQD = D^3/7,809.53$*	*EQN V3.E3.T1-40*
e	Computed as 60 percent of applicable IBD.		
f	PTRD applies to all directions from an HPM. The MCE in the HPM is used as the NEWQD.		

Table V3.E3.T2. HD 1.1 HFD[a, b]

NEWQD	Open[c, d]	Structure[e, f]
(lbs)	(ft)	(ft)
[kg]	[m]	[m]
≤ 0.5	236	200
≤ 0.23	71.9	61.0
0.7	263	200
0.3	80.2	61.0
1	291	200
0.45	88.8	61.0
2	346	200
0.91	105.5	61.0
3	378	200
1.4	115.3	61.0
5	419	200
2.3	127.7	61.0
7	445	200
3.2	135.6	61.0
10	474	200
4.5	144.4	61.0
15	506	200
6.8	154.2	61.0
20	529	200
9.1	161.1	61.0
30	561	200
13.6	170.9	61.0
31	563.0	200
14.1	171.7	61.0
50	601	388
22.7	183.2	118.2
70	628	519
31.8	191.3	158.1
100	658	658
45.4	200.4	200.4
150	815	815
68.0	248.5	248.5
200	927	927
90.7	282.6	282.6
300	1,085	1,085
136.1	330.6	330.6
450	1,243	1,243
204.1	378.7	378.7
> 450	1,250	1,250
>204.1	381.0	381.0

	See paragraph V3.E3.1.2.1.1.		
a	Use of equations given in Footnotes c through f to determine other HFD-NEWQD combinations is allowed.		
b	PTRD is 60 percent of HFD.		
c	English EQNs (NEWQD in lbs, HFD in ft; ln is natural logarithm)		
	NEWQD < 100 lbs:	HFD = 291.3 + [79.2*ln(NEWQD)], with a minimum distance of 236 ft	EQN V3.E3.T2-1
	NEWQD >) 100 lbs:	HFD = -1133.9 + [389*ln(NEWQD)]	EQN V3.E3.T2-2
	Metric EQNs (NEWQD in kg, HFD in m; ln is natural logarithm)		
	NEWQD < 45.4 kg:	*HFD = 107.87 + [24.14*ln(NEWQD)],with a minimum distance of 71.9 m*	*EQN V3.E3.T2-3*
	NEWQD ≥ 45.4 kg:	*HFD = -251.87 + [118.56*ln(NEWQD)]*	*EQN V3.E3.T2-4*
d	English EQNs (NEWQD in lbs, HFD in ft; exp [x] is e^x)		
	HFD < 658 ft:	NEWQD = exp [(HFD/79.2) – 3.678]	EQN V3.E3.T2-5
	658 ft ≤ HFD < 1,250 ft:	NEWQD = exp [(HFD/389) + 2.914]	EQN V3.E3.T2-6
	Metric EQNs (NEWQD in kg, HFD in m; exp [x] is e^x)		
	HFD < 200.5 m:	*NEWQD = exp [(HFD/24.14) – 4.4685]*	*EQN V3.E3.T2-7*
	200.5 m ≤ HFD < 381 m:	*NEWQD = exp [(HFD/118.56) + 2.1244]*	*EQN V3.E3.T2-8*
e	English EQNs (NEWQD in lbs, HFD in ft; ln is natural logarithm)		
			EQN V3.E3.T2-9
	NEWQD ≤ 31 lbs:	HFD = 200 ft	
	31 lbs < NEWQD ≤ 450 lbs:	HFD = -1133.9 + [389*ln(NEWQD)]	
	Metric EQNs (NEWQD in kg, HFD in m; ln is natural logarithm)		
			EQN V3.E3.T2-10
	NEWQD ≤ 14.1 kg:	*HFD = 61.0 m*	
	14.1 kg < NEWQD ≤ 204.1 kg:	*HFD = -251.87 + [118.56*ln(NEWQD)]*	
f	English EQNs (NEWQD in lbs, HFD in ft; exp [x] is e^x)		
	HFD ≤ 200 ft:		
	200 ft < HFD ≤ 1,250 ft:		EQN V3.E3.T2-11
		NEWQD ≤ 31 lbs	
		NEWQD = exp [(HFD/389) + 2.914]	
	Metric EQNs (NEWQD in kg, HFD in m; exp [x] is e^x)		
			EQN V3.E3.T2-12
	HFD ≤ 61.0 m:	*NEWQD ≤ 14.1 kg*	
	61.0 m < HFD ≤ 381.0 m:	*NEWQD = exp [(HFD/118.56) + 2.2144]*	

Table V3.E3.T3. HFD for Open Stacks of Selected HD 1.1 AE[a]

Nomenclature	Number of Units									
	1	2	3	4	5	6	7	8	9	10
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
	[m]	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*
Sparrow, AIM-7[b]	280	565	770	955	1,120	1,245				
	85.3	*172.2*	*234.7*	*291.1*	*341.4*	*379.5*				
Sidewinder, AIM-9	400	400	400	400	400	400	400	400	400	400[c]
	121.9	*121.9*	*121.9*	*121.9*	*121.9*	*121.9*	*121.9*	*121.9*	*121.9*	*121.9[c]*
Chaparral, MIM-72H	400	400	400	400	400	400	400	400	400	400[c]
	121.9	*121.9*	*121.9*	*121.9*	*121.9*	*121.9*	*121.9*	*121.9*	*121.9*	*121.9[c]*
Maverick, AGM 65 A/B/D	400	500	500							
	121.9	*152.4*	*152.4*							
Maverick, AGM 65 E/F/G	670	900[d]	1,200[d]							
	204.2	*274.3[d]*	*365.8[d]*							
Anti-Submarine Rocket (ASROC)	500	500	500							
	152.4	*152.4*	*152.4*							
Cluster Bomb Unit-87[e]	800	800	910	945	965	982	1,000	1,020	1,035	1,055[f]
	243.8	*243.8*	*277.4*	*288.0*	*291.4*	*299.3*	*304.8*	*310.9*	*315.5*	*321.6[f]*
Improved Hawk	900	900	900	900	900	900	900	900	900	900[c]
	274.3	*274.3*	*274.3*	*274.3*	*274.3*	*274.3*	*274.3*	*274.3*	*274.3*	*274.3[c]*
Penguin[e]	500	500	500							
	152.4	*152.4*	*152.4*							
Projectile, 105 millimeter (mm)[g]	340	355	525	660	725	775	810	845	870	890[f]
	103.6	*108.2*	*160.0*	*201.2*	*221.0*	*236.2*	*246.9*	*257.6*	*265.2*	*271.3[f]*
Projectile, 155 mm	415	590	770	955	1,035	1,095	1,145	1,195	1,235	
	126.5	*179.8*	*234.7*	*291.1*	*315.5*	*333.8*	*349.0*	*364.2*	*376.4*	
Projectile, 5 inch/54	300	375	475	570	680	790	860	925	1,005	1,085
	91.4	*114.3*	*144.8*	*173.7*	*207.3*	*240.8*	*262.1*	*281.9*	*306.3*	*330.7*
Harpoon[e]	500	600[h]	600[h]	600[h]						
	152.4	*182.9[h]*	*182.9[h]*	*182.9[h]*						
Tomahawk[e]	500	600[h]	600[h]	600[h]						
	152.4	*182.9[h]*	*182.9[h]*	*182.9[h]*						
Tomahawk Loading on a Submarine, Guided Missile, Nuclear-Powered (SSGN)[i]	750									
	228.6									
Bomb, 500-pound, MK 82	670									
	204.2									
Bomb, 1,000-pound, MK 83	815									
	248.4									
Bomb, 2,000-pound, MK 84	925									
	281.9									
Bomb, BLU-109	880									
	268.2									
Bomb, 750-pound, M117	690									
	210.3									

Table V3.E3.T3. HFD for Open Stacks of Selected HD 1.1 AE,ᵃ Continued

Nomenclature	Number of Units									
	1	2	3	4	5	6	7	8	9	10
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
	[m]	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*
Torpedo, MK 46	500	500	500	500	500	500	500	500		
	152.4	*152.4*	*152.4*	*152.4*	*152.4*	*152.4*	*152.4*	*152.4*		
Torpedo, MK 48 [j, k] (2½-ton truck, or larger, unshielded)	630	775	875	925						
	192.0	*236.2*	*266.7*	*281.9*						
Torpedo, MK 48[j, l] (Shielded, or other means of transport)	500	500	550	600	635	670	700	725	755	780[f]
	152.4	*152.4*	*167.6*	*182.9*	*193.5*	*204.2*	*213.4*	*221.0*	*230.1*	*237.7[f]*

a	All of the HFDs in this table may be applied to both packaged and unpackaged configurations.
b	Those items with a WAU-17 warhead.
c	Ten units or more until the point is reached at which this distance is exceeded by the distance requirements of Table V3.E3.T1.
d	Use the distance shown only where there are less than 25 unrelated people exposed in any arc encompassing 45 degrees from 900 ft [274 m] to 1,250 ft [381 m] from the PES.
e	HFDs include fragments from shipping or storage container(s).
f	More than 10 units may be involved before 1,250 ft [381 m] is exceeded. For distances involving more than 10 units, consult the applicable Service guidance.
g	105-mm projectiles and 105-mm complete rounds not in standard storage or shipping containers are HD 1.1.
h	When handling more than one missile, the missiles must be transported or handled in a nose-to-tail configuration and in their launch capsule or shipping container; furthermore, they must be aligned and handled so that each group of two missiles is located outside of the warhead fragment beam spray region of the other two missiles.
i	Handling is limited to one launch tube at a time, with other tubes closed; risks associated with possible propagation from the Tomahawk being handled to all other AE in the SSGN, as well as to AE in nearby combatant ships and boats, must be assumed by the Navy in accordance with an appropriate deviation from these standards. If handling is not limited to one launch tube at a time, with other tubes closed, the NEW of the full SSGN load will apply for siting in accordance with this manual. The reduced QD arc is drawn from the tube. Pier-side staging areas must be sited; however, the reduced QD in this table for Tomahawk missiles may be used, provided the restrictions of Footnote h are applied.
j	All models, including Advanced Capability.
k	These distances must be used when handling torpedo(es) from 2½-ton trucks (or larger) where sandbag (or other equivalent) shielding (as described in Footnote l) is not present between the leading edge of the torpedo(es) warhead and the truck crew cab to prevent the crew cab and windshield from contributing to the debris.
l	These distances may be used when handling torpedo(es) from: 1. 2½-ton trucks (or larger) with sandbag (or other equivalent) shielding between the leading edge of the torpedo(es) warhead and the truck crew cab to prevent the crew cab and windshield from contributing to the debris (sandbag shield requirement is equivalent to a minimum thickness of 2 ft [0.61 m] of sand between the truck crew cab and the torpedo(es). The sandbags must shield all parts of the crew cab and windshield from the torpedo warhead.); or 2. Other means of transport such as flatbed trailers, boats, torpedo transporters, forklifts, or portable cranes.

V3.E3.1.2.1.1.2. For HD 1.1 NEWQDs in the range 451 to 30,000 lbs [205 to 13,608 kg], HFD is determined according to the criteria in paragraphs V3.E3.1.2.1.1.2.1. through V3.E3.1.2.1.1.2.7. PTRD is 60 percent of the specified HFD, and ILD must be in accordance with paragraph V3.E3.1.4.

V3.E3.1.2.1.1.2.1. The minimum HFD must be 1,250 ft [381 m], as shown in Table V3.E3.T1. Lesser distances are permitted if supported by a structural analysis. Facilities sited at 1,235 ft [376 m] or 1,245 ft [380 m] in accordance with past standards will be considered to be in compliance with the 1,250 ft [381 m] minimum requirement.

V3.E3.1.2.1.1.2.2. For HD 1.1 in a 7-Bar or a 3-Bar ECM, use ECM distances shown in Table V3.E3.T1., as discussed in paragraph V3.E3.1.3.

V3.E3.1.2.1.1.2.3. For HD 1.1 in an Undefined ECM where the loading density is ≤ 0.028 lbs/ft^3 [0.449 kg/m^3], use ECM distances shown in Table V3.E3.T1., as discussed in paragraph V3.E3.1.3.

V3.E3.1.2.1.1.2.4. For HD 1.1 in an Undefined ECM with minimum internal dimensions of 26 ft [7.92 m] wide and 60 ft [18.29 m] long, use "ECM side and rear" distances of Table V3.E3.T1. and "Other PES" distances of Table V3.E3.T1. for the front exposure.

V3.E3.1.2.1.1.2.5. For HD 1.1 in an Undefined ECM where the loading density is > 0.028 lbs/ft^3 [0.449 kg/m^3] and internal dimensions are less than 26 ft [7.92 m] wide and 60 ft [18.29 m] long, use "Other PES" distances of Table V3.E3.T1. for front, side, and rear exposures.

V3.E3.1.2.1.1.2.6. Selected items have been evaluated for minimum HFD with results shown in Table V3.E3.T3. Other items, through testing, have been hazard classified with a specific HFD presented in the format HD (xx)1.1. The HFD for these items is specified in hundreds of feet (in parentheses), and they may not be listed in Table V3.E3.T3. The distances for these two categories of select items apply only to items in the open. When these items are placed in a facility, apply the criteria of paragraphs V3.E3.1.2.1.1.2.1. through V3.E3.1.2.1.1.2.5. as appropriate.

V3.E3.1.2.1.1.2.7. For bare explosives in the open, distance is computed by the formula D = 40W$^{1/3}$ [15.87Q$^{1/3}$].

V3.E3.1.2.1.1.3. For HD 1.1 NEWQDs > 30,000 lbs [13,608 kg] HFD will be in accordance with Table V3.E3.T1. Lesser distances are permitted if supported by a structural analysis. PTRD is 60 percent of HFD and ILD must be in accordance with paragraph V3.E3.1.4. The following apply to use of the reduced ECM distances shown in Table V3.E3.T1. for the NEW range between 30,000 lbs [13,608 kg] and 250,000 lbs [113,398 kg]:

V3.E3.1.2.1.1.3.1. For HD 1.1 in a 7-Bar or a 3-Bar ECM where internal dimensions are a minimum of 26 ft [7.92 m] wide and 60 ft [18.29 m] long, use ECM distances shown in Table V3.E3.T1.

V3.E3.1.2.1.1.3.2. For HD 1.1 in a 7-Bar or a 3-Bar ECM where internal dimensions are less than 26 ft [7.92 m] wide and 60 ft [18.29 m] long, use "Other PES" distances of Table V3.E3.T1. for front, side, and rear exposures.

V3.E3.1.2.1.1.3.3. For HD 1.1 in an Undefined ECM where internal dimensions are a minimum of 26 ft [7.92 m] wide and 60 ft [18.29 m] long, use "ECM side and rear" distances of Table V3.E3.T1. and "Other PES" distances of Table V3.E3.T1. for the front exposure.

V3.E3.1.2.1.1.3.4. For HD 1.1 in an Undefined ECM where internal dimensions are < 26-ft [7.92 m] wide and 60-ft [18.29 m] long, use "Other PES" distances of Table V3.E3.T1. for front, side, and rear exposures.

V3.E3.1.2.1.1.4. For sparsely populated locations (i.e., no more than 25 persons located in any sector bounded by the sides of a 45-degree angle, with the vertex at the PES, and the 900-ft [274-m] and 1,250-ft [381-m] arcs from the PES), the minimum 1,250-ft [381-m] fragment distance may be reduced to 900 ft [274 m] if the NEWQD of the PES does not exceed 11,400 lbs [5,171 kg]. These minimum fragment distance reductions may not be applied to PTRs, even those to which IBD is required, such as a joint DoD–non-DoD use runway, or a high traffic density road.

V3.E3.1.2.1.1.5. For PTRs, the minimum fragment distance for HD 1.1 AE is based on the traffic density considered at three levels: high, medium, and low. The traffic density is averaged over a normal (non-holiday) week in terms of number of passengers during a 24-hour period. Minimum fragment distance reductions based on sparse population considerations addressed in paragraph V3.E3.1.2.1.1.4. do not apply to PTRs, even those to which IBD is required, such as a joint DoD–non-DoD use runway, or a high traffic density road. In applying criteria other than the default values given in paragraphs V3.E3.1.2.1.1.5.1. through V3.E3.1.2.1.1.5.3. (which are based on car (and rail) speed of 50 miles per hour (mph) [80 kilometers per hour (kph)], and a ship speed of 10 mph [16 kph]), other applicable considerations must be taken into account to establish exposure levels. Examples of other considerations include: speed of vehicles, number of passengers per vehicle, protection afforded by the vehicle, variation in daily traffic levels in relation to AE activities, and seasonal traffic trends. The default value of two passengers per car may be used to estimate traffic density.

V3.E3.1.2.1.1.5.1. High-Traffic Density. If routes have 10,000 or more car or rail passengers per day, or 2,000 or more ship passengers per day, then IBD criteria apply.

V3.E3.1.2.1.1.5.2. Medium-Traffic Density. If routes have between 400 and 10,000 car or rail passengers per day, or between 80 and 2,000 ship passengers per day, 60 percent of the specified minimum fragment distance for IBD applies. At a minimum, these criteria apply to any recreational activity that is extensive and occurs on a regular basis.

V3.E3.1.2.1.1.5.3. Low-Traffic Density. If routes have fewer than 400 car or rail passengers per day, or fewer than 80 ship passengers per day, no minimum fragment distance is required. Minimum distance is 60 percent of IBD based on blast criteria only.

V3.E3.1.2.1.1.5.4. Other Exposures. For other exposures that are permitted at PTRD, fragment distance minimums for HD 1.1 AE are at least 60 percent of the specified minimum fragment distance for IBD.

V3.E3.1.2.1.2. Minimum fragment distances apply to:

V3.E3.1.2.1.2.1. An installation's boundary, unless the area outside the boundary naturally prohibits access or is government land that is not open to the public. When a QD arc extends beyond an installation's boundary and this exclusion applies, the DoD Component will certify IBD protection need not be applied to the encumbered area and establish procedures to monitor the area for any change in status.

V3.E3.1.2.1.2.2. Administration and housing areas.

V3.E3.1.2.1.2.3. Recreation facilities (e.g., baseball diamonds, golf courses, and volleyball courts). Paragraph V3.E3.1.2.1.3.1. describes situations where minimum fragment distances do not apply to recreational facilities.

V3.E3.1.2.1.2.4. Flight-line passenger service functions (e.g., terminal buildings).

V3.E3.1.2.1.2.5. Main powerhouses that provide vital utilities to a major portion of an installation.

V3.E3.1.2.1.2.6. Inert storage and shops that, by reason of their vital strategic nature or high intrinsic value of their contents, should not be placed at risk.

V3.E3.1.2.1.2.7. Functions that, if momentarily put out of action, would cause an immediate secondary hazard by reason of their failure to function.

V3.E3.1.2.1.2.8. Private vehicles parked in administrative areas.

V3.E3.1.2.1.3. Examples when minimum fragment and firebrand distances need not apply are:

V3.E3.1.2.1.3.1. Recreation or training facilities, when such facilities are located near AE support operations and are used by off-duty military or on-duty military or DoD civilians or contractors (e.g., munitions workers, security guards, and firefighters) who directly support these AE operations.

V3.E3.1.2.1.3.2. Related and support DoD-controlled functions for which IMD and ILD would normally apply.

V3.E3.1.2.1.3.3. Maintenance, supply, training facilities, and operations offices for logistical or operational support of combat aircraft, battalion-size or smaller delivery or AE supply units, separate air defense firing batteries, or a single pier or wharf for which the AE in a PES is intended.

V3.E3.1.2.1.3.4. Between a PES and inert storage, whether in a facility or in the open.

V3.E3.1.2.1.3.5. Between facilities in an operating line, between operating lines, and between operating lines and storage locations.

V3.E3.1.3. IBD and PTRD. Paragraph V3.E3.1.2.1.1. specifies required separation distances to inhabited buildings and PTRs for ECMs and other types of PESs containing HD 1.1. Permissible exposures at these distances are listed in paragraphs V3.E3.1.1.4. through V3.E3.1.1.6.

V3.E3.1.3.1. ECM. Specified separations from ECMs consider reductions in blast overpressure attributable to the earth cover of ECMs, when the earth cover has a minimum thickness of 2 ft [0.61 m]. See paragraph V3.E3.1.2.1.1. for application of the ECM distances in Table V3.E3.T1. to 7-Bar, 3-Bar, and Undefined ECMs. Descriptions of "front," "side," and "rear" for ECMs follow and are illustrated in Figure V3.E3.F1. in the appendix to this enclosure.

V3.E3.1.3.1.1. The forward sector, or "front," of an ECM is that area 60 degrees either side of the ECM's centerline (120 degrees combined angle), with the vertex of the angle placed so that the sides of the angle pass through the intersection of the headwall and sidewalls.

V3.E3.1.3.1.2. The rear sector, or "rear," of an ECM is that area 45 degrees either side of the magazine centerline (90 degrees combined angle) with the vertex of the angle placed so that the sides of the angle pass through the intersection of the rear and side walls.

V3.E3.1.3.1.3. All other orientations are considered "side" sectors.

V3.E3.1.3.2. HPM. Testing has shown that the design of the earth-bermed HPM attenuates pressures relative to an unconfined surface burst similar to that indicated in paragraph V3.E3.1.3.1. for an ECM. The following pertain to siting of an HPM:

V3.E3.1.3.2.1. An HPM has a "front" sector and a "side" sector. The definition of "front" for an ECM in paragraph V3.E3.1.3.1.1. also applies to an HPM. All other orientations are considered "side" sectors. Figure V3.E3.F2. in the appendix to this enclosure illustrates the sectors associated with an HPM. An HPM has no "rear" sector.

V3.E3.1.3.2.2. The values shown in Table V3.E3.T1. for front exposure from an ECM also apply to the front of an HPM.

V3.E3.1.3.2.3. The values shown in Table V3.E3.T1. for side exposure from an ECM apply to the remainder (all but the front) of an HPM.

V3.E3.1.4. ILD. Separation distances required between AE and non-AE buildings and sites within an AE operating line are listed for various quantities of HD 1.1 AE in Table V3.E3.T4. Permissible exposures at ILD are listed in paragraphs V3.E3.1.1.1. (barricaded ILD) and V3.E3.1.1.2. (unbarricaded ILD). In order to apply barricaded ILD, barricades must comply with paragraph V2.E5.4.2.3. The separation distance between an operating building and its service magazine is based on the NEWQD and the HD of the AE in the magazine and not that in other parts of the operating line.

V3.E3.1.4.1. ILD From ECM. Testing has shown that some attenuation of airblast overpressure relative to an unconfined surface burst occurs out the sides and rear of an ECM and a slight increase occurs out the front of an ECM. The equivalent $9W^{1/3}$ [$3.57Q^{1/3}$] (12 psi [82.7 kPa] (barricaded)) and $18W^{1/3}$ [$7.14 Q^{1/3}$] (3.5 psi [24 kPa] (unbarricaded)) ILD from an ECM, when accounting for this attenuation, are given in Table V3.E3.T5. Airblast forms the bases for the equations given in the footnotes for Table V3.E3.T5.

V3.E3.1.4.2. Barricaded ILD From an ECM. Paragraph V3.E3.1.5.4. provides criteria for the application of barricaded ILD from an ECM.

V3.E3.1.4.3. ILD From HPM. The values shown in Table V3.E3.T5. for front exposure from an ECM also apply to front exposures from an HPM. The values shown in Table V3.E3.T5. for side exposure from an ECM apply to all other orientations of an HPM. The side of an HPM is considered barricaded, provided the earth barricading complies with the design drawing.

V3.E3.1.5. IMD. Magazines for HD 1.1 will be separated one from another in accordance with Tables V3.E3.T6., V3.E3.T7., and V3.E3.T8. Table V3.E3.T6. provides orientation relationships for ECM and Tables V3.E3.T7. and V3.E3.T8. provide the actual separation distances.

V3.E3.1.5.1. Siting Rules. For examples of siting rules for various magazine orientations see Figures V3.E3.F1. through V3.E3.F8. in the appendix to this enclosure.

V3.E3.1.5.2. Barricaded IMD From ECM. Paragraph V3.E3.1.5.4. provides criteria for the application of barricaded IMD from ECM.

V3.E3.1.5.3. Other Factors Limiting ECM Storage. Other factors limiting ECM storage include:

V3.E3.1.5.3.1. Quantities above 500,000 lbs [226,795 kg] NEWQD in one ECM are not authorized, except for energetic liquids.

V3.E3.1.5.3.2. The 7-ft [2.1-m] separation distance given in Table V3.E3.T7. for 100 lbs [45.4 kg] NEWQD constitutes the minimum side-to-side magazine separation distance.

Table V3.E3.T4. HD 1.1 ILD

NEWQD	Barricaded Distance[a]	Unbarricaded Distance[b]
(lbs)	(ft)	(ft)
[kg]	*[m]*	*[m]*
50[c]	33	66
22.7[c]	*10.1*	*20.2*
70	37	74
31.8	*11.3*	*22.6*
100	42	84
45.4	*12.7*	*25.5*
150	48	96
68.0	*14.6*	*29.1*
200	53	105
90.7	*16.0*	*32.1*
300	60	120
136.1	*18.4*	*36.7*
500	71	143
226.8	*21.8*	*43.5*
700	80	160
317.5	*24.4*	*48.7*
1,000	90	180
453.6	*27.4*	*54.9*
1,500	103	206
680.4	*31.4*	*62.8*
2,000	113	227
907.2	*34.6*	*69.1*
3,000	130	260
1,360.8	*39.6*	*79.1*
5,000	154	308
2,268.0	*46.9*	*93.8*
7,000	172	344
3,175.1	*52.5*	*104.9*
10,000	194	388
4,535.9	*59.1*	*118.2*
15,000	222	444
6,803.9	*67.6*	*135.3*
20,000	244	489
9,071.8	*74.5*	*148.9*
30,000	280	559
13,607.7	*85.2*	*170.5*
50,000	332	663
22,679.5	*101.1*	*202.1*

Table V3.E3.T4. HD 1.1 ILD, Continued

NEWQD	Barricaded Distance[a]	Unbarricaded Distance[b]
(lbs)	(ft)	(ft)
[kg]	*[m]*	*[m]*
70,000	371	742
31,751.3	*113.0*	*226.1*
100,000	418	835
45,359.0	*127.3*	*254.6*
150,000	478	956
68,038.5	*145.7*	*291.5*
200,000	526	1,053
90,718.0	*160.4*	*320.8*
300,000	602	1,205
136,077.0	*183.6*	*367.2*
500,000[d]	714	1,429
226,795.0[d]	*217.7*	*435.4*
700,000	799	1,598
317,513.0	*243.6*	*487.1*
1,000,000	900	1,800
453,590.0	*274.3*	*548.6*
1,500,000	1,030	2,060
680,385.0	*314.0*	*628.0*
2,000,000	1,134	2,268
907,180.0	*345.6*	*691.2*
3,000,000	1,298	2,596
1,360,770.0	*395.6*	*791.2*
5,000,000	1,539	3,078
2,267,950.0	*469.0*	*938.1*

a	English EQNs (D in ft, NEWQD in lbs)

$D = 9*NEWQD^{1/3}$ EQN V3.E3.T4-1

$NEWQD = D^3/729$ EQN V3.E3.T4-2

Metric EQNs (D in m, NEWQD in kg)

$D = 3.57*NEWQD^{1/3}$ *EQN V3.E3.T4-3*

$NEWQD = D^3/45.511$ *EQN V3.E3.T4-4*

b	English EQNs (D in ft, NEWQD in lbs)

$D = 18*NEWQD^{1/3}$ EQN V3.E3.T4-5

$NEWQD = D^3/5,832$ EQN V3.E3.T4-6

Metric EQNs (D in m, NEWQD in kg)

$D = 7.14*NEWQD^{1/3}$ *EQN V3.E3.T4-7*

$NEWQD = D^3/364.086$ *EQN V3.E3.T4-8*

c	For less than 50 lbs [22.7 kg], less distance may be used when structures, blast mats, and the like can completely contain fragments and debris. This table is not applicable when blast, fragments, and debris are completely confined, as in certain test firing barricades.
d	Quantities above 500,000 lbs [226,795 kg] NEWQD are authorized only for HD 1.1 energetic liquids.

Table V3.E3.T5. HD 1.1 ILD from ECM

NEWQD	Barricaded Distance			Unbarricaded Distance		
	Front[a]	Side[b]	Rear[c]	Front[d]	Side[e]	Rear[f]
(lbs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
[kg]	[m]	[m]	[m]	[m]	[m]	[m]
50	37	26	22	66	59	44
22.7	11.2	7.9	6.7	20.2	18.0	13.5
70	41	29	25	74	66	49
31.8	12.6	8.8	7.5	22.6	20.1	15.1
100	46	32	28	84	74	56
45.4	14.2	9.9	8.5	25.5	22.6	17.0
150	53	37	32	96	85	64
68.0	16.2	11.3	9.7	29.1	25.9	19.4
200	58	41	35	105	94	70
90.7	17.8	12.5	10.7	32.1	28.5	21.4
300	67	47	40	120	107	80
136.1	20.4	14.3	12.2	36.7	32.7	24.5
500	79	56	48	143	127	95
226.8	24.2	17.0	14.5	43.5	38.7	29.0
700	89	62	53	160	142	107
317.5	27.1	19.0	16.2	48.7	43.3	32.5
1,000	100	70	60	180	160	120
453.6	30.5	21.4	18.3	54.9	48.8	36.6
1,500	114	80	69	206	183	137
680.4	34.9	24.5	20.9	62.8	55.9	41.9
2,000	126	88	76	227	202	151
907.2	38.4	26.9	23.0	69.1	61.5	46.1
3,000	144	101	87	260	231	173
1,360.8	44.0	30.8	26.4	79.1	70.4	52.7
5,000	171	120	103	308	274	205
2,268.0	52.2	36.5	31.3	93.8	83.4	62.5
7,000	191	134	115	344	306	230
3,175.1	58.4	40.9	35.0	104.9	93.3	70.0
10,000	215	151	129	388	345	259
4,535.9	65.7	46.0	39.4	118.2	105.1	78.8
15,000	247	173	148	444	395	296
6,803.9	75.2	52.7	45.1	135.3	120.3	90.2
20,000	271	190	163	489	434	326
9,071.8	82.8	58.0	49.6	148.9	132.4	99.3
30,000	311	218	186	559	497	373
13,607.7	94.8	66.4	56.8	170.5	151.6	113.6
50,000	368	258	221	663	589	442
22,679.5	112.4	78.7	67.4	202.1	179.7	134.7

Table V3.E3.T5. HD 1.1 ILD from ECM, Continued

NEWQD	Barricaded Distance			Unbarricaded Distance		
	Front[a]	Side[b]	Rear[c]	Front[d]	Side[e]	Rear[f]
(lbs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
[kg]	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*
70,000	412	288	247	742	659	495
31,751.3	*125.7*	*88.0*	*75.4*	*226.1*	*201.1*	*150.7*
100,000	464	325	278	835	743	557
45,359.0	*141.6*	*99.1*	*84.9*	*254.6*	*226.5*	*169.8*
150,000	531	372	319	956	850	653
68,038.5	*162.1*	*113.5*	*97.2*	*291.5*	*259.2*	*199.1*
200,000	585	409	351	1,053	936	746
90,718.0	*178.4*	*124.9*	*106.9*	*320.8*	*285.3*	*227.4*
300,000	669	469	402	1,205	1,071	937
136,077.0	*204.2*	*143.0*	*122.4*	*367.2*	*326.6*	*285.7*
500,000	715	714	714	1,429	1,429	1,429
226,795.0	*218.0*	*217.7*	*217.7*	*435.4*	*435.4*	*435.4*

a English EQNs (NEWQD in lbs, D in ft)

NEWQD $\leq$ 300,000 lbs:	$D = 10*NEWQD^{1/3}$	EQN V3.E3.T5-1
300,000 lbs < NEWQD $\leq$ 500,000 lbs:	$D = (13.659 - 1.6479 \times 10^{-5}*NEWQD + 1.4358 \times 10^{-1}*NEWQD^2)*NEWQD^{1/3}$	EQN V3.E3.T5-2
D $\leq$ 669 ft:	$NEWQD = D^3/1000$	EQN V3.E3.T5-3
669 ft < D $\leq$ 715 ft:	$NEWQD = 1.50138 \times 10^8 - 6.73914 \times 10^5*D + 1002.9*D^2 - 0.4938*D^3$	EQN V3.E3.T5-4

Metric EQNs (NEWQD in kg, D in m)

NEWQD $\leq$ 136,077 kg:	$D = 3.97*NEWQD^{1/3}$	*EQN V3.E3.T5-5*
136,077 kg < NEWQD $\leq$ 226,795 kg:	$D = (5.419 - 1.4410 \times 10^{-5}*NEWQD + 2.7684 \times 10^{-11}*NEWQD^2)*NEWQD^{1/3}$	*EQN V3.E3.T5-6*
D $\leq$ 204.2 m:	$NEWQD = D^3/62.429$	*EQN V3.E3.T5-7*
204.2 < D $\leq$ 218.0 m:	$NEWQD = 6.80924 \times 10^7 - 1.002764 \times 10^6*D + 4895.93*D^2 - 7.90884*D^3$	*EQN V3.E3.T5-8*

b English EQNs (NEWQD in lbs, D in ft)

NEWQD $\leq$ 300,000 lbs:	$D = 7*NEWQD^{1/3}$	EQN V3.E3.T5-9
300,000 lbs < NEWQD $\leq$ 400,000 lbs:	$D = (1.0848 + 1.986 \times 10^{-5}*NEWQD)*NEWQD^{1/3}$	EQN V3.E3.T5-10
NEWQD > 400,000 lbs:	$D = 9*NEWQD^{1/3}$	EQN V3.E3.T5-11
D $\leq$ 469 ft:	$NEWQD = D^3/343$	EQN V3.E3.T5-12
469 ft < D $\leq$ 663 ft:	$NEWQD = 57,424 + 515.89*D$	EQN V3.E3.T5-13
D > 663 ft:	$NEWQD = D^3/729$	EQN V3.E3.T5-14

Metric EQNs (NEWQD in kg, D in m)

NEWQD $\leq$ 136,077 kg:	$D = 2.78*NEWQD^{1/3}$	*EQN V3.E3.T5-15*
136,077 kg < NEWQD $\leq$ 181,434 kg:	$D = (0.4303 + 1.7369 \times 10^{-5}*NEWQD)*NEWQD^{1/3}$	*EQN V3.E3.T5-16*
NEWQD > 181,436 kg:	$D = 3.57*NEWQD^{1/3}$	*EQN V3.E3.T5-17*
D $\leq$ 143.7 m:	$NEWQD = D^3/21.413$	*EQN V3.E3.T5-18*
143.7 m < D $\leq$ 202.8 m:	$NEWQD = 26,048 + 767.73*D$	*EQN V3.E3.T5-19*
D > 202.8 m:	$NEWQD = D^3/45.511$	*EQN V3.E3.T5-20*

c	English EQNs (NEWQD in lbs, D in ft)		
	NEWQD $\leq$ 300,000 lbs:	$D = 6*NEWQD^{1/3}$	EQN V3.E3.T5-21
	300,000 lbs < NEWQD $\leq$ 400,000 lbs:	$D = (-3.059 + 3.0228 \times 10^{-5}*NEWQD)$ $* NEWQD^{1/3}$	EQN V3.E3.T5-22
	NEWQD > 400,000 lbs:	$D = 9*NEWQD^{1/3}$	EQN V3.E3.T5-23
	D $\leq$ 402 ft:	$NEWQD = D^3/216$	EQN V3.E3.T5-24
	402 ft < D $\leq$ 665 ft:	$NEWQD = 148,160 + 379.7*D$	EQN V3.E3.T5-25
	D > 665 ft:	$NEWQD = D^3/729$	EQN V3.E3.T5-26
	Metric EQNs (NEWQD in kg, D in m)		
	NEWQD $\leq$ 136,077 kg:	$D = 2.38*NEWQD^{1/3}$	*EQN V3.E3.T5-27*
	136,077 kg < NEWQD $\leq$ 181,436 kg:	$D = (-1.2135 + 2.6437 \times 10^{-5}*NEWQD)$ $*NEWQD^{1/3}$	*EQN V3.E3.T5-28*
	NEWQD > 181,436 kg:	$D = 3.57*NEWQD^{1/3}$	*EQN V3.E3.T5-29*
	D $\leq$ 122.6 m:	$NEWQD = D^3/13.485$	*EQN V3.E3.T5-30*
	122.6 m < D $\leq$ 202.8 m:	$NEWQD = 67,206 + 565.05*D$	*EQN V3.E3.T5-31*
	D > 202.8 m:	$NEWQD = D^3/45.511$	*EQN V3.E3.T5-32*
d	English EQNs (NEWQD in lbs, D in ft)		
	NEWQD $\leq$ 500,000 lbs:	$D = 18*NEWQD^{1/3}$	EQN V3.E3.T5-33
	D $\leq$ 1,429 ft:	$NEWQD = D^3/5,832$	EQN V3.E3.T5-34
	Metric EQNs (NEWQD in kg, D in m)		
	NEWQD $\leq$ 226,795 kg:	$D = 7.14*NEWQD^{1/3}$	*EQN V3.E3.T5-35*
	D > 435.4 m:	$NEWQD = D^3/364.086$	*EQN V3.E3.T5-36*
e	English EQNs (NEWQD in lbs, D in ft)		
	NEWQD $\leq$ 300,000 lbs:	$D = 16*NEWQD^{1/3}$	EQN V3.E3.T5-37
	300,000 lbs < NEWQD $\leq$ 400,000 lbs:	$D = (9.9683 + 2.0135 \times 10^{-5}*NEWQD)$ $*NEWQD^{1/3}$	EQN V3.E3.T5-38
	NEWQD > 400,000 lbs:	$D = 18*NEWQD^{1/3}$	EQN V3.E3.T5-39
	D $\leq$ 1071 ft:	$NEWQD = D^3/4,096$	EQN V3.E3.T5-40
	1,071 ft < D $\leq$ 1,328 ft:	$NEWQD = -118,180 + 390.35*D$	EQN V3.E3.T5-41
	D > 1,328 ft:	$NEWQD = D^3/5,832$	EQN V3.E3.T5-42
	Metric EQNs (NEWQD in kg, D in m)		
	NEWQD $\leq$ 136,077 kg:	$D = 6.35*NEWQD^{1/3}$	*EQN V3.E3.T5-43*
	136,077 kg < NEWQD $\leq$ 181,436 kg:	$D = (3.9544 + 1.76097 \times 10^{-5}*NEWQD)$ $*NEWQD^{1/3}$	*EQN V3.E3.T5-44*
	NEWQD > 181,436 kg:	$D = 7.14*NEWQD^{1/3}$	*EQN V3.E3.T5-45*
	D $\leq$ 326.6 m:	$NEWQD = D^3/255.709$	*EQN V3.E3.T5-46*
	122.6 m < D $\leq$ 202.8 m:	$NEWQD = -53,605 + 580.89*D$	*EQN V3.E3.T5-47*
	D > 404.7 m:	$NEWQD = D^3/364.086$	*EQN V3.E3.T5-48*

f	**English EQNs (NEWQD in lbs, D in ft)**		
	NEWQD $\leq$ 100,000 lbs:	$D = 12*NEWQD^{1/3}$	EQN V3.E3.T5-49
	100,000 lbs < NEWQD $\leq$ 300,000 lbs:	$D = (11.521 + 1.9918 \times 10^{-6}*NEWQD$ $+ 2.0947 \times 10^{-11}*NEWQD^2)*NEWQD^{1/3}$	EQN V3.E3.T5-50
	300,000 lbs < NEWQD $\leq$ 400,000 lbs:	$D = (1.9389 + 4.0227 \times 10^{-5}*NEWQD)$ $* NEWQD^{1/3}$	EQN V3.E3.T5-51
	NEWQD > 400,000 lbs:	$D = 18*NEWQD^{1/3}$	EQN V3.E3.T5-52
	D $\leq$ 557 ft:	$NEWQD = D^3/1{,}728$	EQN V3.E3.T5-53
	557 ft < D $\leq$ 938 ft:	$NEWQD = -193{,}080 + 526.83*D$	EQN V3.E3.T5-54
	938 ft < D $\leq$ 1,328 ft:	$NEWQD = 60{,}778 + 255.83*D$	EQN V3.E3.T5-55
	D > 1,328 ft:	$NEWQD = D^3/5{,}832$	EQN V3.E3.T5-56
	Metric EQNs (NEWQD in kg, D in m)		
	NEWQD $\leq$ 45,359 kg:	$D = 4.76*NEWQD^{1/3}$	*EQN V3.E3.T5-57*
	45,359 kg < NEWQD $\leq$ 136,077 kg:	$D = (4.5704 + 1.7420 \times 10^{-6}*NEWQD$ $+ 4.0389 \times 10^{-11}*NEWQD^2)*NEWQD^{1/3}$	*EQN V3.E3.T5-58*
	136,077 kg < NEWQD $\leq$ 181,436 kg:	$D = (0.7692 + 3.5182 \times 10^{-5}*NEWQD)$ $*NEWQD^{1/3}$	*EQN V3.E3.T5-59*
	NEWQD > 181,436 kg:	$D = 7.14*NEWQD^{1/3}$	*EQN V3.E3.T5-60*
	D $\leq$ 169.8 m:	$NEWQD = D^3/107.877$	*EQN V3.E3.T5-61*
	169.8 m < D $\leq$ 285.7 m:	$NEWQD = -87{,}578 + 784.00*D$	*EQN V3.E3.T5-62*
	285.7 m < D $\leq$ 404.7 m:	$NEWQD = 27{,}568 + 380.7*D$	*EQN V3.E3.T5-63*
	D > 404.7 m:	$NEWQD = D^3/364.086$	*EQN V3.E3.T5-64*

Table V3.E3.T6. HD 1.1 IMD Hazard Factors

To ES		ECM[a]				AGM or Aboveground Operating Building[b]		Modules or Cells		HPM[c, d]	
		S	R	FB	FU	B	U	B	U	S	F[e]
		(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)
		[m/kg$^{1/3}$]	[m/kg$^{1/3}$]	[m/kg$^{1/3}$]	[m/kg$^{1/3}$]	[m/kg$^{1/3}$]	[m/kg$^{1/3}$]	[m/kg$^{1/3}$]	[m/kg$^{1/3}$]	[m/kg$^{1/3}$]	[m/kg$^{1/3}$]
ECM (7-Bar)	S	1.25	1.25	2.75	2.75	4.5	4.5	4.5	4.5	1.25	2.75
		0.50	*0.50*	*1.09*	*1.09*	*1.79*	*1.79*	*1.79*	*1.79*	*0.50*	*1.09*
	R	1.25	1.25	2	2	4.5	4.5	4.5	4.5	1.25	2
		0.50	*0.50*	*0.79*	*0.79*	*1.79*	*1.79*	*1.79*	*1.79*	*0.50*	*0.79*
	FU	2.75	2	6	6	6	6	6	6	2.75	6
		1.09	*0.79*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*1.09*	*2.38*
	FB[f]	2.75	2	4.5	6	4.5	6	4.5	6	2.75	6
		1.09	*0.79*	*1.79*	*2.38*	*1.79*	*2.38*	*1.79*	*2.38*	*1.09*	*2.38*
ECM (3-Bar)	S	1.25	1.25	2.75	2.75	6	6	6	6	1.25	2.75
		0.50	*0.50*	*1.09*	*1.09*	*2.38*	*2.38*	*2.38*	*2.38*	*0.50*	*1.09*
	R	1.25	1.25	2	2	6	6	6	6	1.25	2
		0.50	*0.50*	*0.79*	*0.79*	*2.38*	*2.38*	*2.38*	*2.38*	*0.50*	*0.79*
	FU	4.5	4.5	6	9	6	9	6	9	4.5	9
		1.79	*1.79*	*2.38*	*3.57*	*2.38*	*3.57*	*2.38*	*3.57*	*1.79*	*3.57*
	FB[f]	4.5	4.5	6	6	6	6	6	6	4.5	6
		1.79	*1.79*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*1.79*	*2.38*
ECM (Undefined)	S	1.25[g]	1.25[g]	4.5[g]	4.5[g]	6	6	6	6	1.25	4.5
		0.50[g]	*0.50[g]*	*1.79[g]*	*1.79[g]*	*2.38*	*2.38*	*2.38*	*2.38*	*0.50*	*1.79*
		2[h]	2[h]	6[h]	6[h]						
		0.79[h]	*0.79[h]*	*2.38[h]*	*2.38[h]*						
	R	1.25	1.25	2	2	6	6	6	6	1.25	2
		0.50	*0.50*	*0.79*	*0.79*	*2.38*	*2.38*	*2.38*	*2.38*	*0.50*	*0.79*
	FU	6	6	6	11	6	11	6	11	6	11
		2.38	*2.38*	*2.38*	*4.36*	*2.38*	*4.36*	*2.38*	*4.36*	*2.38*	*4.36*
	FB[f]	6	6	6	6	6	6	6	6	6	6
		2.38	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*
AGM	U	6	6	6	11	6	11	6	11	6	11
		2.38	*2.38*	*2.38*	*4.36*	*2.38*	*4.36*	*2.38*	*4.36*	*2.38*	*4.36*
	B	6	6	6	6	6	6	6	6	6	6
		2.38	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*	*2.38*
Modules or Cells	U	6	6	6	11	6	11	1.1[i]	11	6	11
		2.38	*2.38*	*2.38*	*4.36*	*2.38*	*4.36*	*0.44[i]*	*4.36*	*2.38*	*4.36*
	B	1.25	1.25	6	6	6	6	1.1[i]	1.1[i]	1.25	6
		0.50	*0.50*	*2.38*	*2.38*	*2.38*	*2.38*	*0.44[i]*	*0.44[i]*	*0.50*	*2.38*
HPM	S,F[d]	1.25	1.25	2.75	2.75	4.5	4.5	4.5	4.5	1.25	2.75
		0.50	*0.50*	*1.09*	*1.09*	*1.79*	*1.79*	*1.79*	*1.79*	*0.50*	*1.09*

S = side; R = rear; F = front; B = barricaded; U = unbarricaded; FU = front unbarricaded; FB = front barricaded; AGM = aboveground magazine	
a	Descriptions of ECMs are in section V2.E5.5.; ECMs are categorized as 7-Bar, 3-Bar, or Undefined, which refers to the structural strength of the headwall and door(s).
b	AGMs are all types of above grade (non-earth-covered) magazines or storage pads. See paragraphs V3.E3.1.1.1.1.8. and V3.E3.1.1.2.1.9. for separation of service magazines from operating buildings.
c	A description of an HPM can be found at section V2.E5.7. Additional information is provided in paragraph V3.E3.1.3. The MCE in an HPM is limited to a maximum of 60,000 lbs [27,216 kg].
d	The storage areas in the HPM are barricaded on all sides and protected by a reinforced concrete cover. All directions are, therefore, considered to be side orientations when it is the ES. For siting purposes, an HPM has no rear sector. See Figure V3.E3.F2. in the appendix to this enclosure for an illustration of the front and side sectors of an HPM.
e	The unbarricaded front (entrance to loading area) is a factor when the HPM is the PES because the MCE includes AE in the loading area. The hazard factors have been determined accordingly.
f	Those barricades serve to mitigate both fragments and overpressure hazards. Section V2.E5.4. identifies requirements for their design, construction and location.
g	Use this K-factor for NEWQD in PESs up to 250,000 lbs [113,398 kg].
h	Use this K-factor for NEWQD in PESs greater than 250,000 lbs [113,398 kg].
i	Modules and cells are defined in section V2.E5.6.

Table V3.E3.T7. QD for HD 1.1 AE for K = 1.1, 1.25, 2, 2.75, 4.5, and 5

NEWQD	Hazard Factor, K					
	1.1	1.25	2	2.75	4.5	5
	0.44	*0.50*	*0.79*	*1.09*	*1.79*	*1.98*
(lbs)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)
[kg]	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*
100	7.0	7.0	9.3	13	21	23
45.4	*2.1*	*2.1*	*2.8*	*3.9*	*6.4*	*7.1*
150	7.0	7.0	11	15	24	27
68.0	*2.1*	*2.1*	*3.2*	*4.4*	*7.3*	*8.1*
200	7.0	7.3	12	16	26	29
90.7	*2.1*	*2.2*	*3.5*	*4.9*	*8.0*	*8.9*
300	7.4	8.4	13	18	30	33
136.1	*2.3*	*2.6*	*4.1*	*5.6*	*9.2*	*10.2*
500	8.7	9.9	16	22	36	40
226.8	*2.7*	*3.0*	*4.8*	*6.6*	*10.9*	*12.1*
700	9.8	11	18	24	40	44
317.5	*3.0*	*3.4*	*5.4*	*7.4*	*12.2*	*13.5*
1,000	11	13	20	27	45	50
453.6	*3.4*	*3.8*	*6.1*	*8.4*	*13.8*	*15.2*
1,500	13	14	23	31	52	57
680.4	*3.9*	*4.4*	*6.9*	*9.6*	*15.7*	*17.4*
2,000	14	16	25	35	57	63
907.2	*4.3*	*4.8*	*7.6*	*10.6*	*17.3*	*19.2*
3,000	16	18	29	40	65	72
1,360.8	*4.9*	*5.5*	*8.8*	*12.1*	*19.8*	*21.9*
5,000	19	21	34	47	77	85
2,268.0	*5.8*	*6.6*	*10.4*	*14.3*	*23.5*	*26.0*

Table V3.E3.T7. QD for HD 1.1 AE for K-factor (K) = 1.1, 1.25, 2, 2.75, 4.5, and 5, Continued

NEWQD	Hazard Factor, K					
	1.1	1.25	2	2.75	4.5	5
	0.44	*0.50*	*0.79*	*1.09*	*1.79*	*1.98*
(lbs)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)
[kg]	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*
7,000	21	24	38	53	86	96
3,175.1	*6.5*	*7.3*	*11.6*	*16.0*	*26.3*	*29.1*
10,000	24	27	43	59	97	108
4,535.9	*7.3*	*8.3*	*13.1*	*18.0*	*29.6*	*32.8*
15,000	27	31	49	68	111	123
6,803.9	*8.3*	*9.5*	*15.0*	*20.7*	*33.9*	*37.5*
20,000	30	34	54	75	122	136
9,071.8	*9.2*	*10.4*	*16.5*	*22.7*	*37.3*	*41.3*
30,000	34	39	62	85	140	155
13,607.7	*10.5*	*11.9*	*18.9*	*26.0*	*42.7*	*47.3*
50,000	41	46	74	101	166	184
22,679.5	*12.5*	*14.2*	*22.4*	*30.9*	*50.7*	*56.0*
70,000	45	52	82	113	185	206
31,751.3	*13.9*	*15.8*	*25.0*	*34.5*	*56.7*	*62.7*
100,000	51	58	93	128	209	232
45,359.0	*15.7*	*17.8*	*28.2*	*38.9*	*63.8*	*70.6*
150,000	58	66	106	146	239	266
68,038.5	*18.0*	*20.4*	*32.3*	*44.5*	*73.1*	*80.8*
200,000	64	73	117	161	263	292
90,718.0	*19.8*	*22.5*	*35.5*	*49.0*	*80.4*	*89.0*
300,000	74	84	134	184	301	335
136,077.0	*22.6*	*25.7*	*40.6*	*56.1*	*92.1*	*101.8*
500,000	87	99	159	218	357	397
226,795.0	*26.8*	*30.5*	*48.2*	*66.5*	*109.2*	*120.7*
700,000	98	111	178	244	400	444
317,513.0	*30.0*	*34.1*	*53.9*	*74.4*	*122.1*	*135.1*
1,000,000	110	125	200	275	450	500
453,590.0	*33.8*	*38.4*	*60.7*	*83.7*	*137.5*	*152.1*

Table V3.E3.T8. QD for HD 1.1 AE for K = 6, 8, 9, 11, 18, and 40

NEWQD	Hazard Factor, K					
	6	8	9	11	18	40
	2.38	*3.17*	*3.57*	*4.36*	*7.14*	*15.87*
(lbs)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)
[kg]	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*
100	28	37	42	51	84	186
45.4	*8.5*	*11.3*	*12.7*	*15.5*	*25.5*	*56.6*
150	32	43	48	58	96	213
68.0	*9.7*	*12.9*	*14.6*	*17.8*	*29.1*	*64.8*
200	35	47	53	64	105	234
90.7	*10.7*	*14.2*	*16.0*	*19.6*	*32.1*	*71.3*
300	40	54	60	74	120	268
136.1	*12.2*	*16.3*	*18.4*	*22.4*	*36.7*	*81.6*
500	48	63	71	87	143	317
226.8	*14.5*	*19.3*	*21.8*	*26.6*	*43.5*	*96.8*
700	53	71	80	98	160	355
317.5	*16.2*	*21.6*	*24.4*	*29.7*	*48.7*	*108.3*
1,000	60	80	90	110	180	400
453.6	*18.3*	*24.4*	*27.4*	*33.5*	*54.9*	*121.9*
1,500	69	92	103	126	206	458
680.4	*20.9*	*27.9*	*31.4*	*38.3*	*62.8*	*139.6*
2,000	76	101	113	139	227	504
907.2	*23.0*	*30.7*	*34.6*	*42.2*	*69.1*	*153.6*
3,000	87	115	130	159	260	577
1,360.8	*26.4*	*35.1*	*39.6*	*48.3*	*79.1*	*175.9*
5,000	103	137	154	188	308	684
2,268.0	*31.3*	*41.6*	*46.9*	*57.3*	*93.8*	*208.5*
7,000	115	153	172	210	344	765
3,175.1	*35.0*	*46.6*	*52.5*	*64.1*	*104.9*	*233.3*
10,000	129	172	194	237	388	862
4,535.9	*39.4*	*52.5*	*59.1*	*72.2*	*118.2*	*262.7*
15,000	148	197	222	271	444	986
6,803.9	*45.1*	*60.1*	*67.6*	*82.6*	*135.3*	*300.7*
20,000	163	217	244	299	489	1,086
9,071.8	*49.6*	*66.1*	*74.5*	*90.9*	*148.9*	*331.0*
30,000	186	249	280	342	559	1,243
13,607.7	*56.8*	*75.7*	*85.2*	*104.1*	*170.5*	*378.9*
50,000	221	295	332	405	663	1,474
22,679.5	*67.4*	*89.7*	*101.1*	*123.4*	*202.1*	*449.2*
70,000	247	330	371	453	742	1,649
31,751.3	*75.4*	*100.4*	*113.0*	*138.1*	*226.1*	*502.5*
100,000	278	371	418	511	835	1,857
45,359.0	*84.9*	*113.1*	*127.3*	*155.5*	*254.6*	*566.0*

Table V3.E3.T8. QD for HD 1.1 AE for K = 6, 8, 9, 11, 18, and 40, Continued

NEWQD	Hazard Factor, K					
	6	8	9	11	18	40
	2.38	*3.17*	*3.57*	*4.36*	*7.14*	*15.87*
(lbs)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)	(ft/lb$^{1/3}$)
[kg]	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*	*[m/kg$^{1/3}$]*
150,000	319	425	478	584	956	2,125
68,038.5	*97.2*	*129.4*	*145.7*	*178.0*	*291.5*	*647.9*
200,000	351	468	526	643	1,053	2,339
90,718.0	*106.9*	*142.4*	*160.4*	*195.9*	*320.8*	*713.1*
300,000	402	536	602	736	1,205	2,678
136,077.0	*122.4*	*163.1*	*183.6*	*224.3*	*367.2*	*816.3*
500,000	476	635	714	873	1,429	3,175
226,795.0	*145.1*	*193.3*	*217.7*	*265.9*	*435.4*	*967.8*
700,000	533	710	799	977	1,598	3,552
317,513.0	*162.4*	*216.3*	*243.6*	*297.4*	*487.1*	*1,082.7*
1,000,000	600	800	900	1,100	1,800	4,000
453,590.0	*182.9*	*243.6*	*274.3*	*335.0*	*548.6*	*1,219.4*

V3.E3.1.5.4. Application of Barricaded ILD and Barricaded IMD From an ECM. Figure V3.E3.F8. in the appendix to this enclosure illustrates the IMD relationships that can exist between an ECM and AGM, and the ILD relationships that can exist between an ECM and facilities permitted to be at ILD or barricaded ILD from an ECM, when each contain HD 1.1 AE. Permissible exposures at ILD are listed in paragraphs V3.E3.1.1.1. (barricaded ILD) and V3.E3.1.1.2. (unbarricaded ILD). Siting criteria for AGM are provided in Table V3.E3.T6. These criteria apply to the use of barricaded IMD for AGM and for use of barricaded ILD:

V3.E3.1.5.4.1. Front Sector of an ECM. Use of barricaded ILD or barricaded IMD, as applicable, between an ECM and a facility located within the ECM's front sector requires that a properly constructed, intervening barricade be located between the ES and the PES. This barricade must meet the construction and location criteria of section V2.E5.4. If it does not meet these criteria, then unbarricaded IMD or unbarricaded ILD, as applicable, will be used for siting purposes.

V3.E3.1.5.4.2. Side and Rear Sectors of an ECM. If an ECM's earth cover meets all construction criteria of section V2.E5.4. it will qualify as a barricade, and use of barricaded ILD or barricaded IMD, as applicable, from the sides or rear of the ECM is permissible. Failure of the ECM's earth cover to meet these criteria requires use of unbarricaded IMD or unbarricaded ILD, as applicable, for siting purposes.

V3.E3.1.5.5. Application of Barricaded ILD and Barricaded IMD From an HPM. Permissible exposures at ILD are listed in paragraphs V3.E3.1.1.1. (barricaded ILD) and V3.E3.1.1.2. (unbarricaded ILD). Siting criteria for HPM containing HD 1.1 are provided in Table V3.E3.T6. The following applies to an HPM:

V3.E3.1.5.5.1. Front Sector of an HPM. Use of barricaded ILD or barricaded IMD, as applicable, between an HPM and a facility located within the HPM's front sector requires that a properly constructed, intervening barricade be located between the ES and the PES. This barricade must meet the construction and location criteria of section V2.E5.4. If it does not meet these criteria, then unbarricaded IMD or ILD, as applicable, will be used for siting purposes.

V3.E3.1.5.5.2. Side Sector of an HPM. If the earth berm surrounding an HPM meets all construction criteria shown on the DDESB-approved construction drawing, it will qualify as a barricade and use of barricaded ILD or barricaded IMD, as applicable, from the HPM's sides is permissible. Failure to meet these criteria requires use of unbarricaded IMD or unbarricaded ILD, as applicable, for siting purposes.

V3.E3.1.5.6. HD 1.2, HD 1.3 and HD 1.4 AE Storage in Existing ECMs. These IMD standards apply only to storage of HD 1.1 AE. Existing ECM, regardless of orientation, that meet the construction and barricading requirements of Enclosure 5 of Volume 2 and are sited one from another for a minimum of 100 lbs [45.4 kg] NEWQD of HD 1.1 may be used to their physical storage capacity for HD 1.2, HD 1.3, and HD 1.4 AE, provided distances to other exposures comply with applicable QD requirements.

V3.E3.2. HD 1.2

V3.E3.2.1. HD 1.2 are items configured for storage and transportation that do not mass detonate when a single item or package in a stack is initiated. Explosions involving the items result in their burning and exploding progressively with no more than a few at a time reacting. These reactions will project fragments, firebrands, and unexploded items from the explosion site. Blast effects are limited to the immediate vicinity and are not the primary hazard.

V3.E3.2.2. Small quantities of HD 1.2.1 ($\leq$ 450 lbs [204 kg] NEWQD), in certain packaging configurations, will react in a manner more typical of an HD 1.1 event. When located in structures that stop primary fragments but which generate a secondary debris hazard (e.g., certain ECMs and hardened structures), the structural damage and debris hazards produced from these events are more characteristic of an HD 1.1 explosion, rather than the progressive nature of an HD 1.2.1 event. When the NEWQD and the MCE of the packaged HD 1.2.1 items fall within the ranges specified in the equation NEWQD $\leq$ MCE $\leq$ 450 lbs [204 kg], the HD 1.2.1 will be treated as HD 1.1 and the criteria in paragraph V3.E3.1.2.1.1.1. will be used. If they fall outside the ranges of the equation, then the criteria in Table V3.E3.T9. will apply.

V3.E3.2.3. The NEW of an HD 1.2 item (used for transportation) is the sum of the weight of the HD 1.1 and 1.3 material contained within the item. The NEWQD for an item is equal to NEW (NEWQD = NEW) unless testing has been conducted. Based on testing, the NEWQD may include a reduced contribution ($\leq$ 100 percent) from the HD 1.3 material as a result of the functioning of the HD 1.1 material. The NEWQD should be determined by the Single Package Test (UN) Test 6 (a) or its equivalent), not the Bonfire Test (UN Test 6 (c)). The NEWQD for a specific item may be obtained from the JHCS. The effects produced by the functioning of HD 1.2 items vary with the size and weight of the item. HD 1.2 AE is separated into two subdivisions in order to account for the differences in magnitude of these effects for purposes of

setting QD criteria. The more hazardous items are referred to as HD 1.2.1 items. The less hazardous items are referred to as HD 1.2.2. The definitions of these two HD 1.2 subdivisions are provided in paragraphs V3.E3.2.3.1. and V3.E3.2.3.2. It is important not to exaggerate the significance of the value of 1.60 lbs [0.73 kg] used to differentiate between HD 1.2.1 and HD 1.2.2. It is based on a break point in the database supporting the QD relationships and tables and the NEWQD of the rounds tested. If comprehensive data are available for a particular item, then the item may be placed in that category of HD 1.2 supported by the data and allocated the relevant QDs.

V3.E3.2.3.1. HD 1.2.1: NEWQD > 1.60 lbs [0.73 kg].

V3.E3.2.3.2. HD 1.2.2: NEWQD $\leq$ 1.60 lbs [0.73 kg].

V3.E3.2.4. The MCE for HD 1.2.1 is the NEWQD of an item times the number of items in three unpalletized, outer shipping packages, unless a different MCE is demonstrated by testing or analogy. The authorized MCE for a specific HD 1.2.1 item is listed in the JHCS.

V3.E3.2.5. The QD specified for HD 1.2 AE achieves the desired degree of protection against immediate hazards from an incident. Events involving HD 1.2 items lob large amounts of unexploded rounds, components, and subassemblies, which will remain hazardous after impact. Such items are likely to be more hazardous than in their original state because of possible damage to fuze safety devices or other features by heat and impact. Many types of AE containing sub-munitions, such as cluster bombs, can be expected to be projected out to distances as great as the relevant IBDs. Furthermore, it is impractical to specify QDs, which allow for the maximum possible flight ranges of propulsive items.

V3.E3.2.6. Table V3.E3.T9. provides a summary matrix of all the appropriate IBD, PTRD, and ILD separations for HD 1.2.1 and HD 1.2.2 AE for the various combinations of ESs and PESs. When HD 1.2.1 items are stored in structures that may contribute to the debris hazard, the IBD is determined by using the larger of these two distances: either that given in Table V3.E3.T10. for the appropriate explosive weight (number of items times NEWQD per item) or that given in Table V3.E3.T11. for the appropriate MCE. The HDD specified in Table V3.E3.T11. equates to IBD.

V3.E3.2.7. IMD depend on the types of structures acting as both the PES and the ES.

V3.E3.2.8. PTRD provided in Tables V3.E3.T9. through V3.E3.T12. consider the transient nature of the exposure in the same manner as for HD 1.1. PTRD is computed as 60 percent of the IBD for items in this HD, with minimum distances specified in Table V3.E3.T9.

Table V3.E3.T9. Summary of HD 1.2.1, 1.2.2, and 1.2.3 QD[a, b, c]

To ES		From PES				
		ECM		AGS		
		S or R	F	(H)	(H/R)	(L)
ECM (7 Bar/ 3 Bar) (IMD)	S	0[d]	0[d]	0[d]	0[d]	0[d]
	R	0[d]	0[d]	0[d]	0[d]	0[d]
	FU	0[d]	0[d]	0[d]	0[d]	0[d]
	FB	0[d]	0[d]	0[d]	0[d]	0[d]
ECM (Undefined) (IMD)	S	0[d]	0[d]	0[d]	0[d]	0[d]
	R	0[d]	0[d]	0[d]	0[d]	0[d]
	FU	0[d]	200/300/100 ft *61.0/91.4/30.5 m*	200/300/100 ft *61.0/91.4/30.5 m*	200/300/100 ft *61.0/91.4/30.5 m*	200/300/100 ft *61.0/91.4/30.5 m*
	FB	0[d]	0[d]	0[d]	0[d]	0[d]
AGS (H/R) (IMD)	U or B	0[d]	0[d]	0[d]	0[d]	0[d]
AGS (H or L) (IMD)	U or B	0[d]	200/300/100 ft *61.0/91.4/30.5 m*	200/300/100 ft *61.0/91.4/30.5 m*	200/300/100 ft *61.0/91.4/30.5 m*	200/300/100 ft *61.0/91.4/30.5 m*
ILD[e]		0[d]	Footnote f	Footnote f	Footnote f	Footnote f
PTRD[e]		200/300/100 ft *61.0/91.4/30.5 m*	Footnote g	Footnote g	Footnote g	Footnote g
IBD[e]		200/300/100 ft *61.0/91.4/30.5 m*	Footnote h	Footnote h	Footnote h	Footnote h

	AGS (L) = aboveground structure or site, light
a	For PES-ES combinations where three distances are given: the first refers to a PES containing HD 1.2.1 AE with an MCE < 100 lbs [45.4 kg]; the second to a PES containing HD 1.2.1 AE with an MCE $\geq$ 100 lbs [45.4 kg]; and the third refers to a PES containing HD 1.2.2 AE. Where three IMD are given, the IMD from a PES containing only HD 1.2.3 AE to an ES containing other than HD 1.2.3 is K11 [K_m4.36] based on the largest MCE of the HD 1.2.3 AE in the PES.
b	For an ES containing only HD 1.2.3 items, the IMD from any PES to such an ES is 0 (Footnote d).
c	When the NEWQD and the MCE of the packaged HD 1.2.1 items fall within the ranges specified in the equation NEWQD $\leq$ MCE $\leq$ 450 lbs [204 kg], the HD 1.2.1 will be treated as HD 1.1 and the criteria of paragraph V3.E3.1.2.1.1.1., as applicable, will be used (see paragraph V3.E3.2.2.).
d	Practical considerations such as firefighting and security will dictate specific separation distances as specified by the DoD Component.
e	See paragraph V3.E3.2.13. for HD 1.2.3.
f	ILD = 36 percent of IBD with a minimum distance equal to the IMD given in this table for the applicable PES-ES combination.
g	PTRD = 60 percent of IBD with a minimum distance equal to the IMD given in this table for AGS (L).
h	For HD 1.2.1 items in any structure, truck, trailer, or railcar, use the larger of the two applicable values given in Tables V3.E3.T10. and V3.E3.T11.; for HD 1.2.1 items in the open, use Table V3.E3.T10.; for HD 1.2.2 items, use Table V3.E3.T12.

V3.E3.2.9. ILD given in Tables V3.E3.T9. through V3.E3.T12. take into account the progressive nature of explosions involving these items (normally resulting from fire spread), up to the magnitude of the MCE, and the ability to evacuate personnel from endangered areas before the progression involves large numbers of items. Exposed structures may be extensively damaged by projections and delayed propagation of explosions may occur due to the ignition of combustibles by projections. ILD is computed as 36 percent of the IBD for items of this HD,

with a minimum distance equal to the IMD given in Table V3.E3.T9. for the applicable PES-ES combination.

V3.E3.2.10. When storing mixed subdivisions of HD 1.2 AE (HD 1.2.1 and HD 1.2.2), consider each subdivision separately and apply the greater of the two distances. The general mixing rules for HD 1.2 AE are given in Table V3.E3.T13.

V3.E3.2.11. For reasons of operational necessity, and in accordance with DoD Component-defined procedures, limited quantities of HD 1.2.2 items may be stored in facilities such as hangars, arms rooms, security alert force rooms, and manufacturing or operating buildings without the need for siting as a PES. Operations involving limited quantities of HD 1.2.2 items also are permitted without the need for siting as a PES, in accordance with DoD Component-defined procedures and for reasons of operational necessity. The DoD Component procedures should address items such as NEWQD limits, documentation requirements, approval process, and LPS requirements.

V3.E3.2.12. HD 1.2.3 is a special storage subdivision for HD 1.2 AE, as described in paragraph V1.E6.2.1.2.3.

V3.E3.2.13. The IBD for HD 1.2.3 is determined using HD 1.3 QD for the NEWQD of the HD 1.2.3 item multiplied by the number of items present, but with a minimum IBD determined as follows:

V3.E3.2.13.1. If the AE are in a structure that can interrupt primary fragments and can contribute debris, the minimum IBD is the HDD given in Table V3.E3.T11. for the MCE of the HD 1.2.3 AE in the structure.

V3.E3.2.13.2. If the AE are in the open or in a light structure that will not interrupt primary fragments, the minimum IBD is the HFD based on the HD 1.1 hazardous fragment areal number density criteria applied to the MCE of the HD 1.2.3 AE. The HFD applicable to AE in the open is specified in hundreds of ft in parentheses as "(xx) HD 1.2.3."

V3.E3.2.13.3. As an alternative to the preceding HD 1.2.3 QD criteria, when an increase in the allowable quantity or a reduction in the required distance will result, HD 1.2.3 AE may be treated as detailed in paragraphs V3.E3.2.13.3.1. and V3.E3.2.13.3.2.:

V3.E3.2.13.3.1. If the HD 1.2.3 AE MCE is > 1.6 lbs [0.73 kg], consider the items as HD 1.2.1. Use the total NEWQD present, with the MCE of the HD 1.2.3 AE to determine the maximum QD.

Table V3.E3.T10. HD 1.2.1 QD (IBD, PTRD, ILD) for AE with NEWQD > 1.60 lbs [0.73 kg][a, b]

Explosive Weight[c]	IBD[d, e, f]	PTRD[g]	ILD[h]
(lbs)	(ft)	(ft)	(ft)
[kg]	[m]	[m]	[m]
2	200	200	200
0.9	61.0	61.0	61.0
3	200	200	200
1.4	61.0	61.0	61.0
4	200	200	200
1.8	61.0	61.0	61.0
5	200	200	200
2.3	61.0	61.0	61.0
7	200	200	200
3.2	61.0	61.0	61.0
10	200	200	200
4.5	61.0	61.0	61.0
15	200	200	200
6.8	61.0	61.0	61.0
20	200	200	200
9.1	61.0	61.0	61.0
30	200	200	200
13.6	61.0	61.0	61.0
50	200	200	200
22.7	61.0	61.0	61.0
70	200	200	200
31.8	61.0	61.0	61.0
100	268	200	200
45.4	81.7	61.0	61.0
150	348	209	200
68.0	106.0	63.6	61.0
200	403	242	200
90.7	123.0	73.8	61.0
300	481	288	200
136.1	146.5	87.9	61.0
500	576	346	207
226.8	175.5	105.3	63.2
700	638	383	230
317.5	194.3	116.6	70.0
1,000	702	421	253
453.6	213.9	128.3	77.0
1,500	774	464	278
680.4	235.8	141.5	84.9

Table V3.E3.T10. HD 1.2.1 QD (IBD, PTRD, ILD) for AE with NEWQD > 1.60 lbs [0.73 kg],[a, b] Continued

Explosive Weight[c]	IBD[d, e, f]	PTRD[g]	ILD[h]
(lbs)	(ft)	(ft)	(ft)
[kg]	*[m]*	*[m]*	*[m]*
2,000	824	494	296
907.2	*251.0*	*150.6*	*90.4*
3,000	893	536	321
1,361	*272.1*	*163.3*	*98.0*
5,000	978	587	352
2,268	*298.1*	*178.9*	*107.3*
7,000	1,033	620	372
3,175	*314.8*	*188.9*	*113.3*
10,000	1,090	654	392
4,536	*332.3*	*199.4*	*119.6*
15,000	1,154	692	415
6,804	*351.7*	*211.0*	*126.6*
20,000	1,198	719	431
9,072	*365.2*	*219.1*	*131.5*
30,000	1,260	756	453
13,608	*383.9*	*230.3*	*138.2*
50,000	1,335	801	481
22,680	*406.8*	*244.1*	*146.4*
70,000	1,383	830	498
31,751	*421.5*	*252.9*	*151.7*
100,000	1,433	860	516
45,359	*436.8*	*262.1*	*157.3*
150,000	1,489	893	536
68,039	*453.8*	*272.3*	*163.4*
200,000	1,528	917	550
90,718	*465.6*	*279.3*	*167.6*
300,000	1,581	949	569
136,077	*481.8*	*289.1*	*173.5*
500,000	1,646	988	593
226,795	*501.7*	*301.0*	*180.6*
>500,000	Footnote f	Footnote g	Footnote h
>226,795	*Footnote f*	*Footnote g*	*Footnote h*

Table V3.E3.T10. HD 1.2.1 QD (IBD, PTRD, ILD) for AE with NEWQD > 1.60 lbs [0.73 kg],[a, b] Continued

a	The QD criteria for HD 1.2.1 items are based on the hazards from primary fragments. When stored in structures that may contribute to the debris hazard (secondary fragments), the IBD for HD 1.2.1 items whose MCE is greater than 31 lbs [14.1 kg] is determined by using the larger of two distances: those given in this table for the appropriate explosive weight or those given in Table V3.E3.T11. for the appropriate MCE. Structures that may contribute to the debris hazard for storage of HD 1.2.1 AE include: (a) all ECM frontal exposures (side and rear exposures have fixed minimum distances for IBD); (b) all AGS, including (H), (H/R), and (L), unless data or analyses are provided to show that the structural debris contribution is less. Note that ILD and PTRD are based on 36 percent and 60 percent, respectively, of the applicable IBD as determined in this footnote, with ILD minimum distances given in Table V3.E3.T9. for applicable PES-ES combinations and PTRD minimum distances given in Table V3.E3.T9. for AGS (L).
b	See Table V3.E3.T9. for a summary of IMD and minimum distances for ILD and PTRD.
c	Explosive Weight = Number of Items*NEWQD.
d	English EQN (IBD in ft, NEWQD in lbs; ln is natural logarithm) 71 lbs < Explosive Weight: $IBD = -735.186 + [237.559*(ln(\text{Number of items}*NEWQD))] - [4.274*(ln(\text{Number of items}*NEWQD))^2]$, with a minimum of 200 ft EQN V3.E3.T10-1 *Metric EQN (IBD in m, NEWQD in kg; ln is natural logarithm)* *18.6 kg < Explosive Weight $IBD = -167.648 + [70.345*(ln(\text{Number of items}*NEWQD))] - [1.303*(ln(\text{Number of items}*NEWQD))^2]$, with a minimum of 61.0 m* *EQN V3.E3.T10-2*
e	English EQN (IBD in ft, NEWQD in lbs; exp [x] is e^x) 200 ft < IBD < 2,016 ft: $\text{Number of items}*NEWQD = exp[27.791 - (600.392 - 0.234*IBD)^{1/2}]$ EQN V3.E3.T10-3 *Metric EQN (IBD in m, NEWQD in kg; exp [x] is e^x)* *61.0 m < IBD < 614.5 m: $\text{Number of items}*NEWQD = exp[27.000 - (600.287 - 0.768*IBD)^{1/2}]$* *EQN V3.E3.T10-4*
f	Use of equations given in Footnotes d and e to determine other IBD-weight combinations is allowed.
g	PTRD = 60 percent of IBD with a minimum distance equal to the IMD given in Table V3.E3.T9. for AGS (L). For other structures as either ES or PES, see Table V3.E3.T9.
h	ILD = 36 percent of IBD with a minimum distance equal to the IMD given in Table V3.E3.T9. for the applicable PES-ES combination. For structures other than AGS (L) as either ES or PES, see Table V3.E3.T9.

Table V3.E3.T11. HDD for HD 1.2.1 AE Stored in Structures That Can Contribute to the Debris Hazard[a, b]

MCE	HDD[c, d, e]	PTRD[f]	ILD[g]
(lbs)	(ft)	(ft)	(ft)
[kg]	*[m]*	*[m]*	*[m]*
≤ 31	200	200	200
≤14.1	*61.0*	*61.0*	*61.0*
50	388	233	200
22.7	*118.2*	*70.9*	*61.0*
70	519	311	200
31.8	*158.1*	*94.9*	*61.0*
100	658	395	237
45.4	*200.4*	*120.2*	*72.1*
150	815	489	293
68.0	*248.5*	*149.1*	*89.4*
200	927	556	334
90.7	*282.6*	*169.5*	*101.7*
300	1,085	651	391
136.1	*330.6*	*198.4*	*119.0*
400	1,197	718	431
181.4	*364.7*	*218.8*	*131.3*
450	1,243	746	447
204.1	*378.7*	*227.2*	*136.3*
>450	1,250	750	450
>204.1	*381.0*	*228.6*	*137.2*

a	The QD criteria for HD 1.2.1 items are based on the hazards from primary fragments. When stored in structures that may contribute to the debris hazard (secondary fragments), the IBD for HD 1.2.1 items whose MCE is greater than 31 lbs [14.1 kg] is determined by using the larger of two distances: those given in Table V3.E3.T10. for the appropriate explosive weight or those given in this table for the appropriate MCE. Structures that may contribute to the debris hazard for storage of HD 1.2.1 AE include: (a) all ECM frontal exposures (side and rear exposures have fixed minimum distances for IBD); (b) all AGS, including (H), (H/R), and (L), unless data or analyses are provided to show that the structural debris contribution is less. Note that ILD and PTRD are based on 36 percent and 60 percent, respectively, of the applicable IBD, as determined in this footnote with these minimum distances: ILD minimum distances as given in Table V3.E3.T9. for applicable PES-ES combinations, and PTRD minimum distances as given in Table V3.E3.T9. for AGS (L).
b	See Table V3.E3.T9. for a summary of IMD and minimum distances for ILD and PTRD.

c	English EQN (MCE in lbs, HDD in ft; ln is natural logarithm)		
	31 lbs < MCE ≤ 450 lbs: HDD = -1,133.9 + [389*ln(MCE)], with a minimum distance of 200 ft		EQN V3.E3.T11-1
	Metric EQN (MCE in kg, HDD in m; ln is natural logarithm)		
	*14.1 kg < MCE ≤ 204 kg: HDD = -251.87 + [118.56*ln(MCE)],with a minimum distance of 61 m*		*EQN V3.E3.T11-2*
d	English EQN (MCE in lbs, HDD in ft; exp [x] is e^x)		
	200 ft < HDD ≤ 1,250 ft: MCE = exp [(HDD/389) + 2.914]		EQN V3.E3.T11-3
	Metric EQN (MCE in kg, HDD in m; exp [x] is e^x)		
	61.0 m < HDD ≤ 381 m: MCE = exp [(HDD/118.56) + 2.1244]		*EQN V3.E3.T11-4*
e	Use of equations given in Footnotes c and d to determine other HDD-MCE combinations is allowed.		
f	PTRD = 60 percent of IBD with a minimum distance equal to the IMD given in Table V3.E3.T9. for AGS (L). For other structures as either ES or PES, see Table V3.E3.T9.		
g	ILD = 36 percent of IBD with a minimum distance equal to the IMD given in Table V3.E3.T9. for the applicable PES-ES combination. For structures other than AGS (L) as either ES or PES, see Table V3.E3.T9.		

**Table V3.E3.T12. HD 1.2.2 QD (IBD, PTRD, ILD) for AE
with NEWQD ≤ 1.60 lbs [0.73 kg][a, b, c]**

Explosive Weight[d]	IBD[e, f, g]	PTRD[h]	ILD[i]
(lbs)	(ft)	(ft)	(ft)
[kg]	*[m]*	*[m]*	*[m]*
1	100	100	100
0.45	*30.5*	*30.5*	*30.5*
1.5	100	100	100
0.68	*30.5*	*30.5*	*30.5*
2	100	100	100
0.9	*30.5*	*30.5*	*30.5*
3	100	100	100
1.4	*30.5*	*30.5*	*30.5*
5	100	100	100
2.3	*30.5*	*30.5*	*30.5*
7	100	100	100
3.2	*30.5*	*30.5*	*30.5*
10	100	100	100
4.5	*30.5*	*30.5*	*30.5*
15	100	100	100
6.8	*30.5*	*30.5*	*30.5*
20	100	100	100
9.1	*30.5*	*30.5*	*30.5*

Table V3.E3.T12. HD 1.2.2 QD (IBD, PTRD, ILD) for AE with NEWQD ≤ 1.60 lbs [0.73 kg],[a, b, c] Continued

Explosive Weight[d]	IBD[e, f, g]	PTRD[h]	ILD[i]
(lbs)	(ft)	(ft)	(ft)
[kg]	[m]	[m]	[m]
30	107	100	100
13.6	32.7	30.5	30.5
50	118	100	100
22.7	36.1	30.5	30.5
70	127	100	100
31.8	38.8	30.5	30.5
100	138	100	100
45.4	42.1	30.5	30.5
150	152	100	100
68.0	46.2	30.5	30.5
200	162	100	100
90.7	49.5	30.5	30.5
300	179	107	100
136.1	54.6	32.7	30.5
500	202	121	100
226.8	61.7	37.0	30.5
700	219	132	100
317.5	66.8	40.1	30.5
1,000	238	143	100
453.6	72.7	43.6	30.5
1,500	262	157	100
680.4	79.8	47.9	30.5
2,000	279	168	101
907.2	85.2	51.1	30.7
3,000	306	183	110
1,361	93.2	55.9	33.5
5,000	341	205	123
2,268	104.0	62.4	37.4
7,000	366	220	132
3,175	111.6	67.0	40.2
10,000	394	236	142
4,536	120.0	72.0	43.2
15,000	427	256	154
6,804	130.1	78.1	46.8
20,000	451	271	162
9,072	137.5	82.5	49.5
30,000	487	292	175
13,608	148.5	89.1	53.5

Table V3.E3.T12. HD 1.2.2 QD (IBD, PTRD, ILD) for AE with NEWQD ≤ 1.60 lbs [0.73 kg],[a, b, c] Continued

Explosive Weight[d]	IBD[e, f, g]	PTRD[h]	ILD[i]
(lbs)	(ft)	(ft)	(ft)
[kg]	*[m]*	*[m]*	*[m]*
50,000	535	321	193
22,680	*163.0*	*97.8*	*58.7*
70,000	568	341	204
31,751	*173.1*	*103.8*	*62.3*
100,000	604	362	217
45,359	*184.1*	*110.5*	*66.3*
150,000	647	388	233
68,039	*197.1*	*118.3*	*71.0*
200,000	678	407	244
90,718	*206.6*	*124.0*	*74.4*
300,000	723	434	260
136,077	*220.5*	*132.3*	*79.4*
500,000	783	470	282
226,795	*238.8*	*143.3*	*86.0*
>500,000	Footnote g	Footnote h	Footnote i
>226,795	*Footnote g*	*Footnote h*	*Footnote i*

a	The QD criteria for HD 1.2.2 items are based on the hazards from primary fragments.
b	See Table V3.E3.T9. for a summary of IMD and minimum distances for ILD and PTRD.
c	See paragraph V3.E3.2.11. for storage and operations involving limited quantities of HD 1.2.2 without the need for siting as a PES.
d	Explosive Weight = Number of Items*NEWQD.
e	English EQN (IBD in ft, NEWQD in lbs; ln is natural logarithm) 20 lbs < Explosive Weight: IBD = 101.649 – [15.934*(ln(Number of items*NEWQD))] + [5.173*(ln(Number of items*NEWQD))²], with a minimum of 100 ft EQN V3.E3.T12-1 *Metric EQN (IBD in m, NEWQD in kg; ln is natural logarithm)* *9.1 kg < Explosive Weight: IBD = 28.127 – [2.364*(ln(Number of items*NEWQD))] + [1.577*(ln(Number of items*NEWQD))²], with a minimum of 30.5 m EQN V3.E3.T12-2*
f	English EQN (IBD in ft, NEWQD in lbs; exp [x] is e^x) 100 ft < IBD < 1,240 ft: Number of items*NEWQD = exp [1.5401 + (-17.278 + 0.1933*IBD)^{1/2}] EQN V3.E3.T12-3 *Metric EQN (IBD in m, NEWQD in kg; exp [x] is e^x)* *30.5 m < IBD < 378 m: Number of items*NEWQD = exp [0.7495 + (-17.274 + 0.6341*IBD)^{1/2}] EQN V3.E3.T12-4*
g	Use of equations given in Footnotes e and f to determine other IBD-weight combinations is allowed.

h	PTRD = 60 percent of IBD with a minimum distance equal to the IMD given in Table V3.E3.T9. for AGS (L). For other structures as either an ES or PES, see Table V3.E3.T9.
i	ILD = 36 percent of IBD with a minimum distance equal to the IMD given in Table V3.E3.T9. for the applicable PES-ES combination. For structures other than AGS (L) as either an ES or PES, see Table V3.E3.T9.

Table V3.E3.T13. HD 1.2.1, 1.2.2, and 1.2.3 Mixing Rules

Hazard Subdivision Involved	Distances to be Applied
1.2.1	Apply HD 1.2.1 distances[a]
1.2.2	Apply HD 1.2.2 distances[b]
1.2.3	Apply HD 1.2.3 distances[c]
1.2.1 + 1.2.2	Apply greater of two distances
1.2.1 + 1.2.3	Apply greater of two distances
1.2.2 + 1.2.3	Apply greater of two distances
a	HD 1.2.1 distances given in Tables V3.E3.T9., V3.E3.T10., and V3.E3.T11.
b	HD 1.2.2 distances given in Tables V3.E3.T9. and V3.E3.T12.
c	HD 1.2.3 distances given in Table V3.E3.T14. (See paragraph V3.E3.2.13.)

V3.E3.2.13.3.2. If the HD 1.2.3 AE MCE is ≤ than 1.6 lbs [0.73 kg], consider the items as HD 1.2.2, based on the total NEWQD present.

V3.E3.2.14. For storage of mixed HD 1.2.3 AE, multiply the NEWQD for the HD 1.2.3 items by the corresponding number of HD 1.2.3 items and use HD 1.3 QD with the HFD for the mixture based on the largest HFD for the HD 1.2.3 AE in storage. Use the distances given in Table V3.E3.T13., when HD 1.2.3 AE is located with any other HD 1.2 subdivision. The HD 1.2.3 AE is considered HD 1.2 (HD 1.2.1 or HD 1.2.2, according to MCE) for QD purposes, when HD 1.2.3 AE is located with any other HD AE. The mixing rules provided in paragraph V1.E7.2.3. then apply to the combination of the HDs.

V3.E3.3. HD 1.3. HD 1.3 includes items that burn vigorously with little or no possibility of extinguishment in storage situations. Explosions normally will be confined to pressure ruptures of containers and will not produce propagating shock waves or damaging blast overpressure beyond the magazine distance specified in Table V3.E3.T14. A severe hazard of spread of fire may result from tossing about of burning container materials, propellant, or other flaming debris.

V3.E3.4. HD 1.4

V3.E3.4.1. HD 1.4 AE present a fire hazard with minimal blast, fragmentation, or toxic hazards. Separate facilities for storage and handling of these AE will be located in accordance with Table V3.E3.T15.

V3.E3.4.2. In mixed storage, the NEWQD of HD 1.4 is not additive, as indicated in paragraph V1.E7.2.3.1.1. However, QD criteria for each HD present, including HD 1.4, must be determined and the largest value used.

V3.E3.4.3. HD 1.4S AE, as described in paragraph V1.E8.5.5., may be stored, to include associated handling, without regard to the QD criteria in Table V3.E3.T15.

V3.E3.5. HD 1.6. QD separations for HD 1.6 AE are based on the storage location and configuration. This information is detailed in Table V3.E3.T16. A maximum of 500,000 lbs [226,795 kg] NEWQD is permitted at any one location. Any special storage configuration and siting approved for HD 1.1 AE may be used for storage of like explosive weights of HD 1.6 AE.

V3.E3.6. HD 6.1

V3.E3.6.1. HD 6.1 includes items that contain only toxic chemical or riot control agents. AE containing both explosives and toxic chemical or riot control agents may be hazard classified as HD 1.1 through HD 1.4, based on testing in accordance with parts 171-177 of Title 49, CFR.

V3.E3.6.2. Hazard zones for toxic CAs are determined by the relative toxicity of the agents, the amount released to the atmosphere and the rate at which they are released (e.g., evaporation, pressure, or explosive dispersal), terrain features, and meteorological conditions. Hazard zone calculations are based on MCE, using DDESB Technical Paper No. 10. Enclosure 4 of Volume 6 provides specific criteria associated with toxic CAs.

V3.E3.6.3. When siting AE containing toxic CAs, both the explosives and toxic CA hazards are evaluated with the greatest QD governing siting.

Table V3.E3.T14. HD 1.3 QD[a, b]

NEWQD	IBD & PTRD[c]	Aboveground IMD & ILD[d]
(lbs)	(ft)	(ft)
[kg]	*[m]*	*[m]*
≤ 1000[e]	75	50
≤ 453.59[e]	*22.9*	*15.2*
1,500	82	56
680.4	*25.0*	*17.0*
2,000	89	61
907.2	*27.2*	*18.5*

Table V3.E3.T14. HD 1.3 QD,[a, b] Continued

NEWQD	IBD & PTRD[c]	Aboveground IMD & ILD[d]
(lbs)	(ft)	(ft)
[kg]	*[m]*	*[m]*
3,000	101	68
1,360.8	*30.7*	*20.8*
5,000	117	80
2,268.0	*35.8*	*24.3*
7,000	130	88
3,175.1	*39.6*	*26.9*
10,000	145	98
4,535.9	*44.2*	*30.0*
15,000	164	112
6,803.9	*50.1*	*34.0*
20,000	180	122
9,071.8	*54.8*	*37.2*
30,000	204	138
13,607.7	*62.3*	*42.2*
50,000	240	163
22,679.5	*73.2*	*49.5*
70,000	268	181
31,751.3	*81.6*	*55.1*
100,000	300	204
45,359.0	*91.4*	*62.0*
150,000	346	234
68,038.5	*105.3*	*71.4*
200,000	385	260
90,718.0	*117.4*	*79.3*
300,000	454	303
136,077.0	*138.4*	*92.5*
500,000	569	372
226,795.0	*173.6*	*113.4*
700,000	668	428
317,513.0	*203.8*	*130.5*
1,000,000	800	500
453,590.0	*244.0*	*152.3*
1,500,000	936	577
680,385.0	*285.3*	*175.8*
2,000,000	1,008	630
907,180.0	*307.2*	*192.0*

Table V3.E3.T14. HD 1.3 QD[a, b] Continued

<table>
<tr><td>a</td><td colspan="3">For reasons of operational necessity, and in accordance with DoD Component-defined procedures, limited quantities of items in this HD, such as document destroyers, signaling devices, riot control munitions, and the like, may be stored without the need for siting as a PES in accordance with DoD Component fire protection requirements in facilities such as hangars, arms rooms, security alert force rooms, and manufacturing or operating buildings. Operations involving limited quantities of HD 1.3 items are also permitted without the need for siting as a PES, in accordance with DoD Component-defined procedures and for reasons of operational necessity. DoD Component procedures should address items such as NEWQD limits, documentation requirements, approval process, and LPS requirements.</td></tr>
<tr><td>b</td><td colspan="3">Existing ECM, regardless of orientation, that meet the construction and barricading requirements of Enclosure 5 of Volume 2 and are sited one from another for a minimum of 100 lbs [45.4 kg] NEWQD of HD 1.1 using the ECM-to-ECM QD criteria in Table V3.E3.T6., may be used to their physical storage capacity for HD 1.3, provided all other QD relationships are sited in accordance with this table for the HD 1.3 NEWQD.</td></tr>
<tr><td rowspan="13">c</td><td colspan="3">English EQNs (NEWQD in lbs, D in ft; exp [x] is e^x, ln is natural logarithm)</td></tr>
<tr><td>NEWQD $\leq$ 1,000 lbs:</td><td>$D_{IBD,PTRD}$ = 75 ft</td><td></td></tr>
<tr><td>1,000 lbs < NEWQD $\leq$ 96,000 lbs:</td><td>$D_{IBD,PTRD}$ = exp [2.47 + 0.2368* (ln(NEWQD)) + 0.00384* (ln(NEWQD))^2], with a minimum distance of 75 ft</td><td>EQN V3.E3.T14-1</td></tr>
<tr><td>96,000 lbs < NEWQD $\leq$ 1,000,000 lbs:</td><td>$D_{IBD,PTRD}$ = exp [7.2297 − 0.5984* (ln(NEWQD)) + 0.04046* (ln(NEWQD))^2]</td><td>EQN V3.E3.T14-2</td></tr>
<tr><td>1,000,000 lbs < NEWQD:</td><td>$D_{IBD,PTRD}$ = 8*NEWQD$^{1/3}$</td><td>EQN V3.E3.T14-3</td></tr>
<tr><td>75 ft $\leq$ $D_{IBD,PTRD}$ $\leq$ 296 ft:</td><td>NEWQD = exp [-30.833 + (307.465 + 260.417* (ln($D_{IBD,PTRD}$)))$^{1/2}$], with a minimum NEWQD of 1,000 lbs</td><td>EQN V3.E3.T14-4</td></tr>
<tr><td>296 ft < $D_{IBD,PTRD}$ $\leq$ 800 ft:</td><td>NEWQD = exp [7.395 + (-124.002 + 24.716* (ln($D_{IBD,PTRD}$)))$^{1/2}$]</td><td>EQN V3.E3.T14-5</td></tr>
<tr><td>800 ft < $D_{IBD,PTRD}$:</td><td>NEWQD = ($D_{IBD,PTRD}$)^3 /512</td><td>EQN V3.E3.T14-6</td></tr>
<tr><td colspan="3">*Metric EQNs (NEWQD in kg, D in m; exp [x] is e^x, ln is natural logarithm)*</td></tr>
<tr><td>*NEWQD $\leq$ 453.6 kg:*</td><td>*$D_{IBD,PTRD}$ = 22.9 m*</td><td></td></tr>
<tr><td>*453.6 kg < NEWQD $\leq$ 43,544.6 kg:*</td><td>*$D_{IBD,PTRD}$ = exp [1.4715 + 0.2429* (ln(NEWQD)) + 0.00384* (ln(NEWQD))^2], with a minimum distance of 22.9 m*</td><td>*EQN V3.E3.T14-7*</td></tr>
<tr><td>*43,544.6 kg < NEWQD $\leq$ 453,590 kg:*</td><td>*$D_{IBD,PTRD}$ = exp [5.5938 − 0.5344* (ln(NEWQD)) + 0.04046* (ln(NEWQD))^2]*</td><td>*EQN V3.E3.T14-8*</td></tr>
<tr><td>*453,590 kg < NEWQD:*</td><td>*$D_{IBD,PTRD}$ = 3.17*NEWQD$^{1/3}$*</td><td>*EQN V3.E3.T14-9*</td></tr>
<tr><td>*22.9 m $\leq$ $D_{IBD,PTRD}$ $\leq$ 90.2 m:*</td><td>*NEWQD = exp [-31.628 + (617.102 + 260.417* (ln($D_{IBD,PTRD}$)))$^{1/2}$], with a minimum NEWQD of 453.6 kg*</td><td>*EN V3.E3.T14-10*</td></tr>
<tr><td>*90.2 m < $D_{IBD,PTRD}$ $\leq$ 243.8 m:*</td><td>*NEWQD = exp [6.604 + (-94.642 + 24.716*(ln($D_{IBD,PTRD}$)))$^{1/2}$]*</td><td>*EQN V3.E3.T14-11*</td></tr>
<tr><td>*243.8 m < $D_{IBD,PTRD}$:*</td><td>*NEWQD = ($D_{IBD,PTRD}$)^3 /131.964*</td><td>*EQN V3.E3.T14-12*</td></tr>
</table>

d	English EQNs (NEWQD in lbs, D in ft; exp [x] is e^x, ln is natural logarithm)

d			
	NEWQD $\leq$ 1,000 lbs:	$D_{IMD,ILD}$ = 50 ft	
	1,000 lbs < NEWQD $\leq$ 84,000 lbs:	$D_{IMD,ILD}$ = exp [2.0325 + 0.2488* (ln(NEWQD)) + 0.00313* (ln(NEWQD))^2], with a minimum distance of 50 ft	EQN V3.E3.T14-13
	84,000 lbs < NEWQD $\leq$ 1,000,000 lbs:	$D_{IMD,ILD}$ = exp [4.338 − 0.1695* (ln(NEWQD)) + 0.0221* (ln(NEWQD))^2]	EQN V3.E3.T14-14
	1,000,000 lbs < NEWQD:	$D_{IMD,ILD}$ = 5*NEWQD$^{1/3}$	EQN V3.E3.T14-15
	50 ft $\leq$ $D_{IMD,ILD}$ $\leq$ 192 ft:	NEWQD = exp [-39.744 + (930.257 + 319.49*(ln($D_{IMD,ILD}$)))$^{1/2}$], with a minimum NEWQD of 1,000 lbs	EQN V3.E3.T14-16
	192 ft < $D_{IMD,ILD}$ $\leq$ 500 ft:	NEWQD = exp [3.834 + (-181.58 + 45.249*(ln($D_{IMD,ILD}$)))$^{1/2}$]	EQN V3.E3.T14-17
	500 ft < $D_{IMD,ILD}$:	NEWQD = ($D_{IMD,ILD}$)^3/125	EQN V3.E3.T14-18
	Metric EQNs (NEWQD in kg, D in m; exp [x] is e^x, ln is natural logarithm)		
	NEWQD $\leq$ 453.6 kg:	*$D_{IMD,ILD}$ = 15.2 m*	
	453.6 kg < NEWQD $\leq$ 38,101.6 kg:	*$D_{IMD,ILD}$ = exp [1.0431 + 0.2537* (ln(NEWQD)) + 0.00313* (ln(NEWQD))^2], with a minimum distance of 15.2 m*	*EQN V3.E3.T14-19*
	38,101.6 kg < NEWQD $\leq$ 453,590 kg:	*$D_{IMD,ILD}$ = exp [3.0297 − 0.1346* (ln(NEWQD)) + 0.0221* (ln(NEWQD))^2]*	*EQN V3.E3.T14-20*
	453,590 kg < NEWQD:	*$D_{IMD,ILD}$ = 1.98*NEWQD$^{1/3}$*	*EQN V3.E3.T14-21*
	15.2 m $\leq$ $D_{IMD,ILD}$ $\leq$ 58.4 m:	*NEWQD = exp [-40.527 + (1309.19 + 319.49*(ln($D_{IMD,ILD}$)))$^{1/2}$], with a minimum NEWQD of 453.6 kg*	*EQN V3.E3.T14-22*
	58.4 m < $D_{IMD,ILD}$ $\leq$ 152.4 m:	*NEWQD = exp [3.045 + (-127.817 + 45.249*(ln($D_{IMD,ILD}$)))$^{1/2}$]*	*EQN V3.E3.T14-23*
	152.4 m < $D_{IMD,ILD}$:	*NEWQD = ($D_{IMD,ILD}$)^3/7.804*	*EQN V3.E3.T14-24*
e	For quantities less than 1,000 lbs [453.59 kg], the required distances are those specified for 1,000 lbs [453.59 kg]. The use of lesser distances may be approved when supported by test data or analysis.		

Table V3.E3.T15. HD 1.4 QD[a]

NEWQD[b]	IBD/PTRD[c]	ILD[d, e]	AGS (L) IMD[e]	AGS(H) & (H/R) IMD[e, f]	ECM IMD[e]
(lbs)	(ft)	(ft)	(ft)	(ft)	(ft)
[kg]	*[m]*	*[m]*	*[m]*	*[m]*	*[m]*
≤ 3000[g]	75	50	50	0 to and from	0 to and from the sides and rear; see Footnote j for the front
≤ 1,360.8[g]	*22.9*	*15.3*	*15.3*		
>3000[h]	100	100/50[i]	100/50[i]		
>1,360.8[h]	*30.5*	*30.5/15.3[i]*	*30.5/15.3[i]*		

a	HD 1.4 AE may be stored in a general supplies warehouse area rather than in an AE storage area. When storing in a general supplies warehouse area, any weatherproof warehouse structure may serve as an HD 1.4 magazine. Such a structure will be separated from all other warehouses in accordance with the AGS (L) IMD column of this table.
b	See paragraph V1.E7.2.3.1.1. for the applicability of HD 1.4 QD criteria and the determination of NEWQD when HD 1.4 and other HD AE are located in the same site.
c	IBD and PTRD are 50 ft [15.3 m] from the sides and rear of an ECM. IBD and PTRD are 50 ft [15.3 m] from an AGS (H), an AGS (H/R), and an ECM front that meets the definition of AGS (H); doors and other openings will be barricaded in accordance with section V2.E5.4., or the IBD or PTRD column of this table applied from these doors and openings.
d	ILD is 0 ft from the sides and rear of an ECM. ILD is 0 ft from an AGS (H), an AGS (H/R), and an ECM front that meets the definition of AGS (H); doors and other openings will be barricaded in accordance with section V2.E5.4., or the ILD column of this table applied from these doors and openings.
e	Magazines storing only HD 1.4 AE may be located at these IMD or ILD from all other magazines or operating buildings regardless of the HD or NEWQD authorized in those adjacent structures. Because the HD 1.4 AE may be destroyed as the result of an accident involving the assets in those adjacent structures, the DoD Component on a case-by-case basis must accept application of this provision with consideration given to the value of HD 1.4 assets at risk.
f	Doors and other openings will be barricaded in accordance with section V2.E5.4., or the AGS (L) IMD column of this table applied to and from these doors and openings.
g	For reasons of operational necessity and in accordance with DoD Component-defined procedures, limited quantities of HD 1.4 AE (e.g., small arms AE and riot control munitions) may be stored in accordance with DoD Component fire protection requirements within facilities (e.g., hangars, arms rooms, security alert force rooms, and manufacturing or operating buildings) without the need for siting as a PES. Alternatively, operationally necessary HD 1.4 AE may be stored in small magazines external to those facilities without the need for an explosives site plan. Operations involving limited quantities of HD 1.4 items also are permitted without the need for siting as a PES, in accordance with DoD Component-defined procedures and for reasons of operational necessity. DoD Component procedures should address items such as NEWQD limits, documentation requirements, approval process, and LPS requirements.
h	There is no upper limit on the NEWQD specifically required for safety reasons.
i	Use the smaller distance when the ES is of non-combustible construction.
j	Apply the appropriate AGS column of this table based on whether the ECM front meets the definition of AGS (L) or AGS (H).

Table V3.E3.T16. HD 1.6 QD

| NEWQD | Aboveground | | ECM | | |
	IBD or PTRD[a, b, c]	IMD or ILD[a, c, d]	IBD or PTRD	ILD	IMD
(lbs)	(ft)	(ft)	(ft)	(ft)	(ft)
[kg]	[m]	[m]	[m]	[m]	[m]
≤100[e]	37	23	Footnote c	Footnote c	Footnote c
≤45.4[e]	11.3	7.0			
150	43	27			
68.0	12.9	8.1			
200	47	29			
90.7	14.3	8.9			
300	54	33			
136.1	16.3	10.2			
500	63	40			
226.8	19.4	12.1			
700	71	44			
317.5	21.7	13.5			
1,000	80	50			
453.6	24.4	15.2			
1,500	92	57			
680.4	27.9	17.4			
2,000	101	63			
907.2	30.7	19.2			
3,000	115	72			
1,360.8	35.2	22.0			
5,000	137	85			
2,268.0	41.7	26.1			
7,000	153	96			
3,175.1	46.6	29.2			
10,000	172	108			
4,535.9	52.5	32.8			
15,000	197	123			
6,803.9	60.1	37.6			
20,000	217	136			
9,071.8	66.2	41.4			
30,000	249	155			
13,607.7	75.8	47.4			
50,000	295	184			
22,679.5	89.8	56.1			
70,000	330	206			
31,751.3	100.5	62.8			

Table V3.E3.T16. HD 1.6 QD, Continued

NEWQD	Aboveground		ECM		
	IBD or PTRD[a, b, c]	IMD or ILD[a, c, d]	IBD or PTRD	ILD	IMD
(lbs)	(ft)	(ft)	(ft)	(ft)	(ft)
[kg]	[m]	[m]	[m]	[m]	[m]
100,000	371	232	Footnote c	Footnote c	Footnote c
45,359.0	113.2	70.7			
150,000	425	266			
68,038.5	129.6	81.0			
200,000	468	292			
90,718.0	142.6	89.1			
300,000	536	335			
136,077.0	163.2	102.0			
500,000	635	397			
226,795.0	193.5	121.0			

a	Applicable minimum distances:
	English EQNs (D in ft, NEWQD in lbs)
	For IBD or PTRD, based on the NEWQD for the largest single round of AE:
	$\quad D_{IBD,PTRD} = 40*W^{1/3}$ $\qquad$ EQN V3.E3.T16-1
	For IMD or ILD, based on the NEWQD for the largest single round of AE:
	$\quad D_{IMD, ILD} = 18*W^{1/3}$ $\qquad$ EQN V3.E3.T16-2
	Metric EQNs (D in m, NEWQD in kg)
	For IBD or PTRD, based on the NEWQD for the largest single round of AE:
	$\quad D_{IBD,PTRD} = 15.87*Q^{1/3}$ $\qquad$ EQN V3.E3.T16-3
	For IMD or ILD, based on the NEWQD for the largest single round of AE:
	$\quad D_{IMD, ILD} = 7.14*Q^{1/3}$ $\qquad$ EQN V3.E3.T16-4
b	English EQNs (D in ft, NEWQD in lbs)
	$D_{IBD,PTRD} = 8*W^{1/3}$ $\qquad$ EQN V3.E3.T16-5
	$NEWQD = (D_{IBD,PTRD})^3/512$ $\qquad$ EQN V3.E3.T16-6
	Metric EQNs (D in m, NEWQD in kg)
	$D_{IBD,PTRD} = 3.17*Q^{1/3}$ $\qquad$ EQN V3.E3.T16-7
	$NEWQD = (D_{IBD,PTRD})^3/31.86$ $\qquad$ EQN V3.E3.T16-8
c	For HD 1.6 AE packed in non-flammable pallets or packing and stored in an ECM, provided it is acceptable to the DoD Component and the DDESB on a site-specific basis, these QD apply unless a lesser distance is permitted by this table for AGSs (these lesser distances can be applied to ECM storage):
	$\quad D_{IBD,PTRD} = 100$ ft [30.5 m];
	$\quad D_{ILD} = 50$ ft [15.2 m];
	$\quad D_{IMD} = $ no specific requirement.

d	English EQNs (D in ft, NEWQD in lbs)
	$D_{IMD, ILD} = 5*W^{1/3}$ $\qquad\qquad\qquad$ EQN V3.E3.T16-9
	$NEWQD = (D_{IMD, ILD})^3/125$ $\qquad\qquad\qquad$ EQN V3.E3.T16-10
	Metric EQNs (D in m, NEWQD in kg)
	$D_{IMD, ILD} = 1.98*Q^{1/3}$ $\qquad\qquad\qquad$ *EQN V3.E3.T16-11*
	$NEWQD = (D_{IMD, ILD})^3/7.76$ $\qquad\qquad\qquad$ *EQN V3.E3.T16-12*
e	For quantities less than 100 lbs [45.4 kg], the required distances are those specified for 100 lbs [45.4 kg]. The use of lesser distances may be approved when supported by test data or analyses.

Appendix
    Figures Cited in Enclosure 3

APPENDIX: FIGURES CITED IN ENCLOSURE 3

Figure V3.E3.F1. ECM Orientation Effects on IMD: Side-to-Side Orientation[a]

[a] See paragraph V3.E3.1.5.
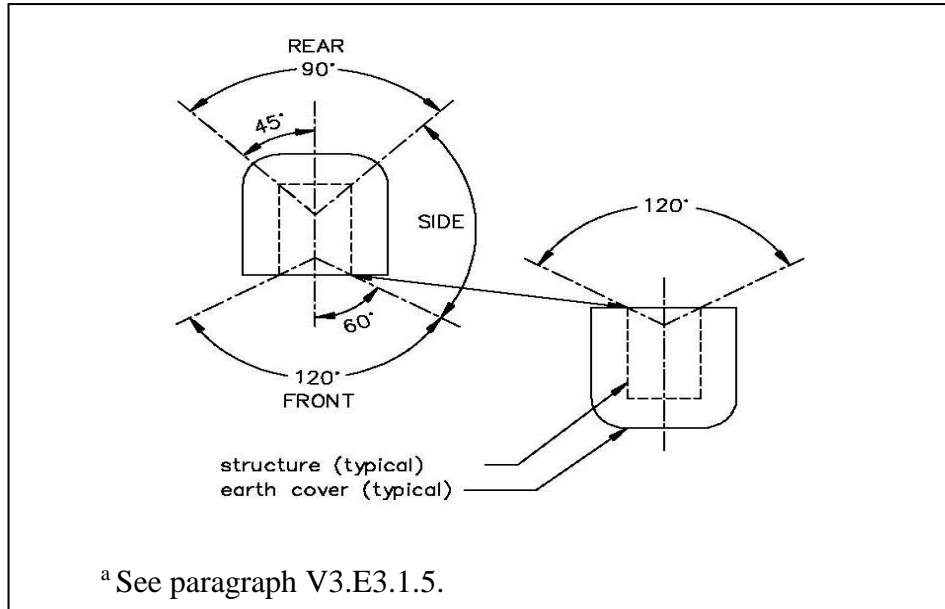
Figure V3.E3.F2. HPM Orientation Effects[a, b, c]

[a] As an ES, treat all exposures as sides.
[b] As a PES, the HPM has a front and all other exposures are considered sides.
[c] See paragraph V3.E3.1.3. for IBD/PTRD criteria, paragraph V3.E3.1.4. for ILD criteria, and paragraph V3.E3.1.5. for IMD criteria associated with an HPM.
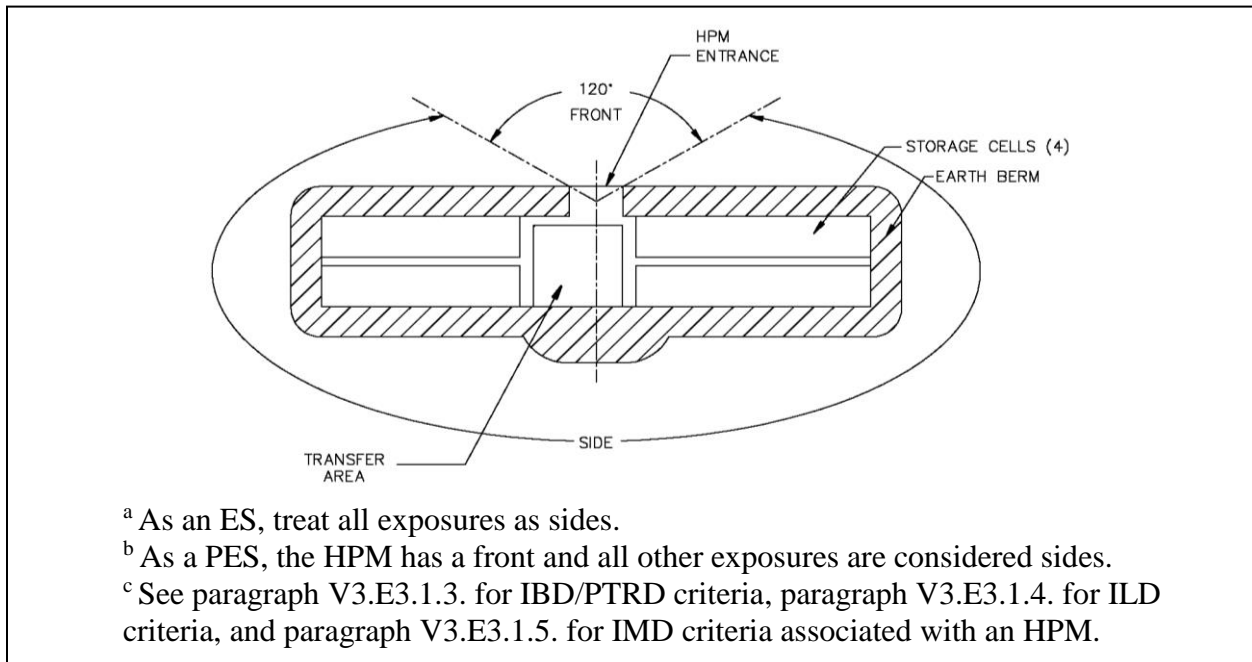
Figure V3.E3.F3. ECM Orientation Effects on IMD: Side-to-Side Orientation[a]

^a See paragraph V3.E3.1.5.
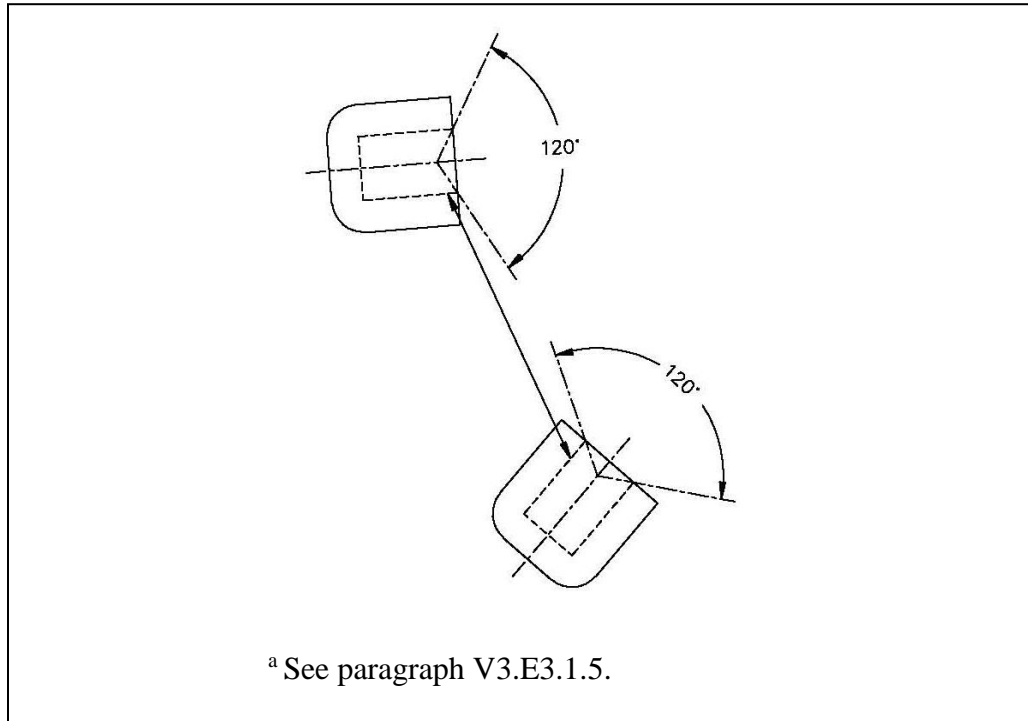
Figure V3.E3.F4. ECM Orientation Effects on IMDa, b, c

^a See paragraph V3.E3.1.5.
^b Site A as a side-to-front (unbarricaded) ES.
^c Site B as a front (unbarricaded)-to-side ES.
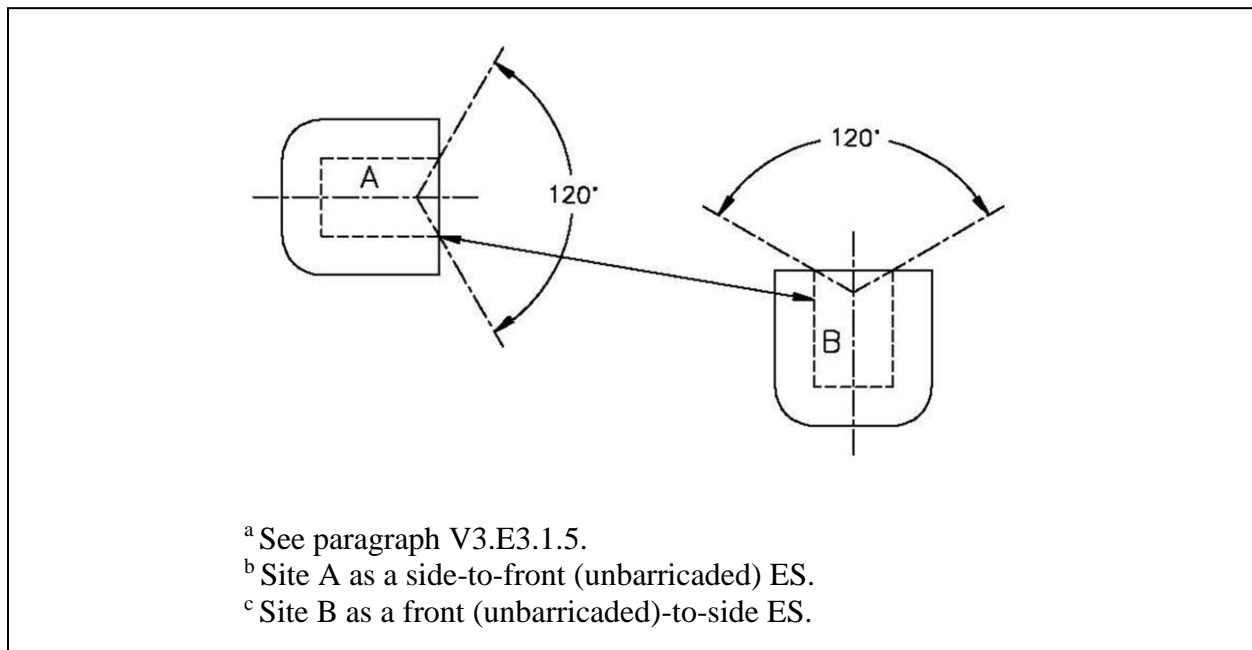
Figure V3.E3.F5. ECM Orientation Effects on IMD[a, b]

[a] See paragraph V3.E3.1.5.
[b] Site each magazine as a front-to-front ES: site C as
a barricaded ES, and B as unbarricaded ESs.
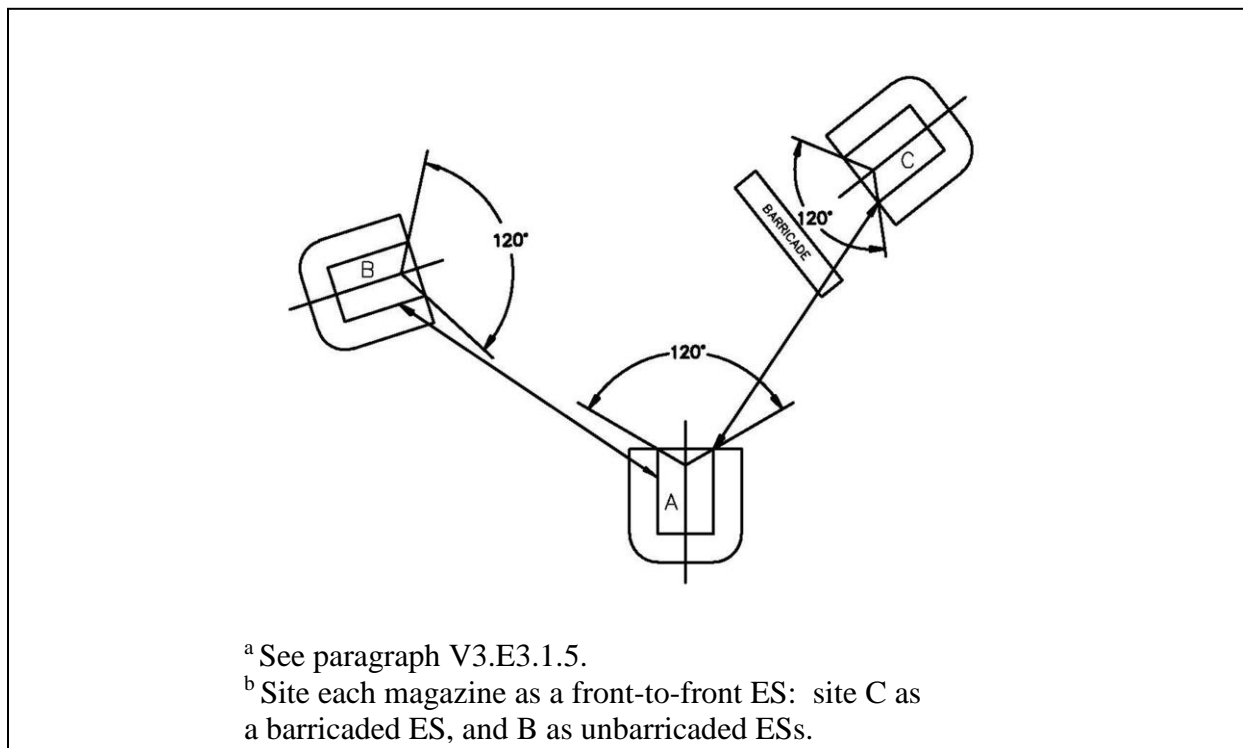
Figure V3.E3.F6. ECM Orientation Effects on IMD: Canted ECMs[a, b, c]

[a] See paragraph V3.E3.1.5.
[b] Site A as a side-to-front (unbarricaded) ES.
[c] Site B as a front (unbarricaded)-to-side ES.
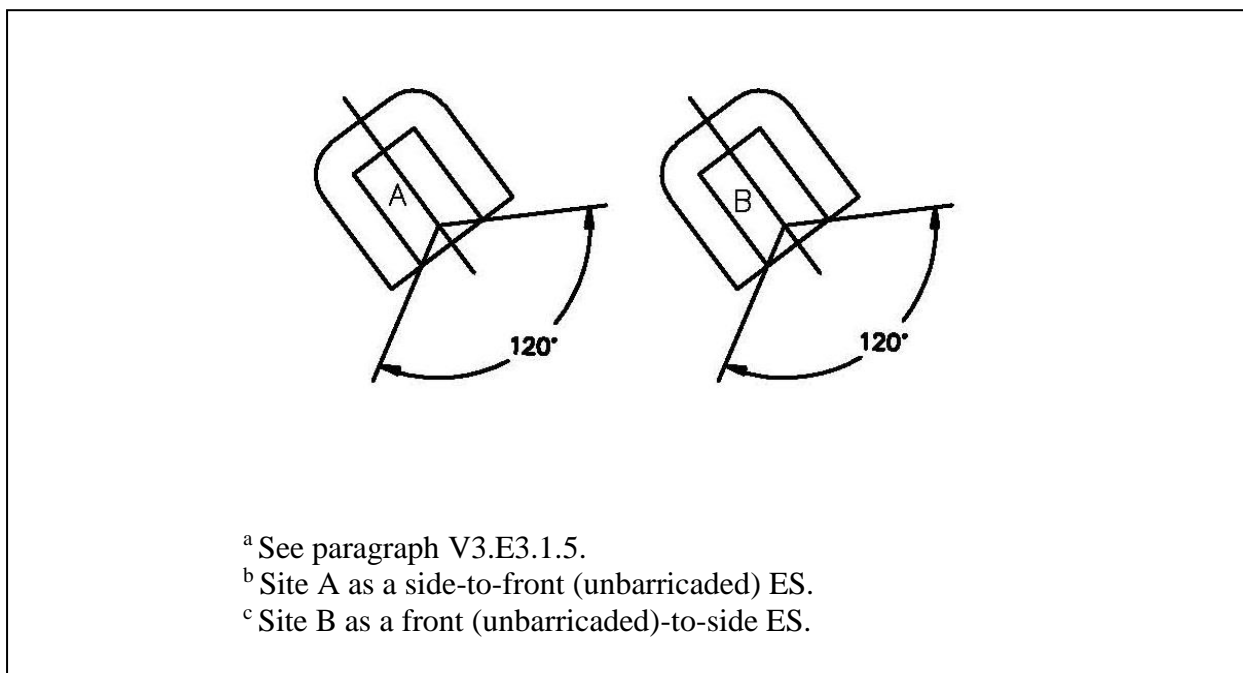
Figure V3.E3.F7. ECM Orientation Effects on IMD: ECMs of Significantly Different Lengths[a, b, c]

[a]See paragraph V3.E3.1.5.
[b]Site A as a side-to-front (unbarricaded) ES.
[c]Site B as a front (unbarricaded)-to-side ES.
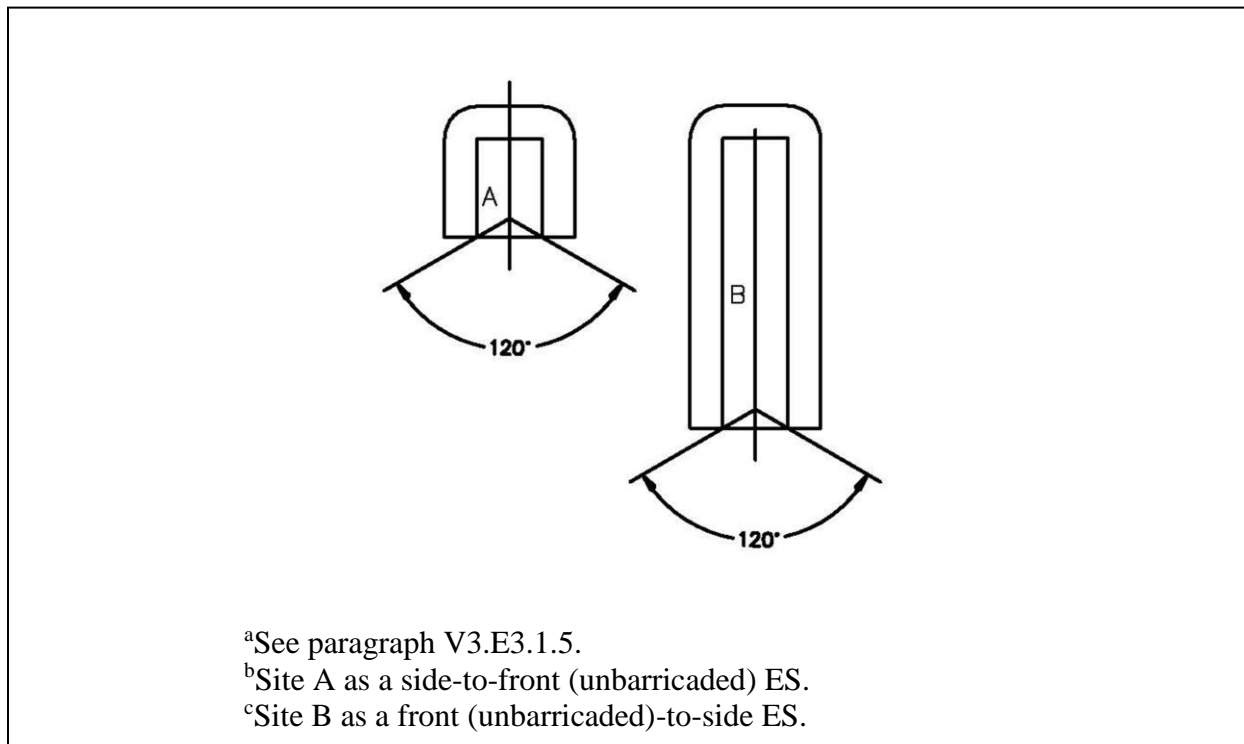
Figure V3.E3.F8. ECM Orientation Effects on Barricaded and Unbarricaded IMD and ILD[a, b, c]
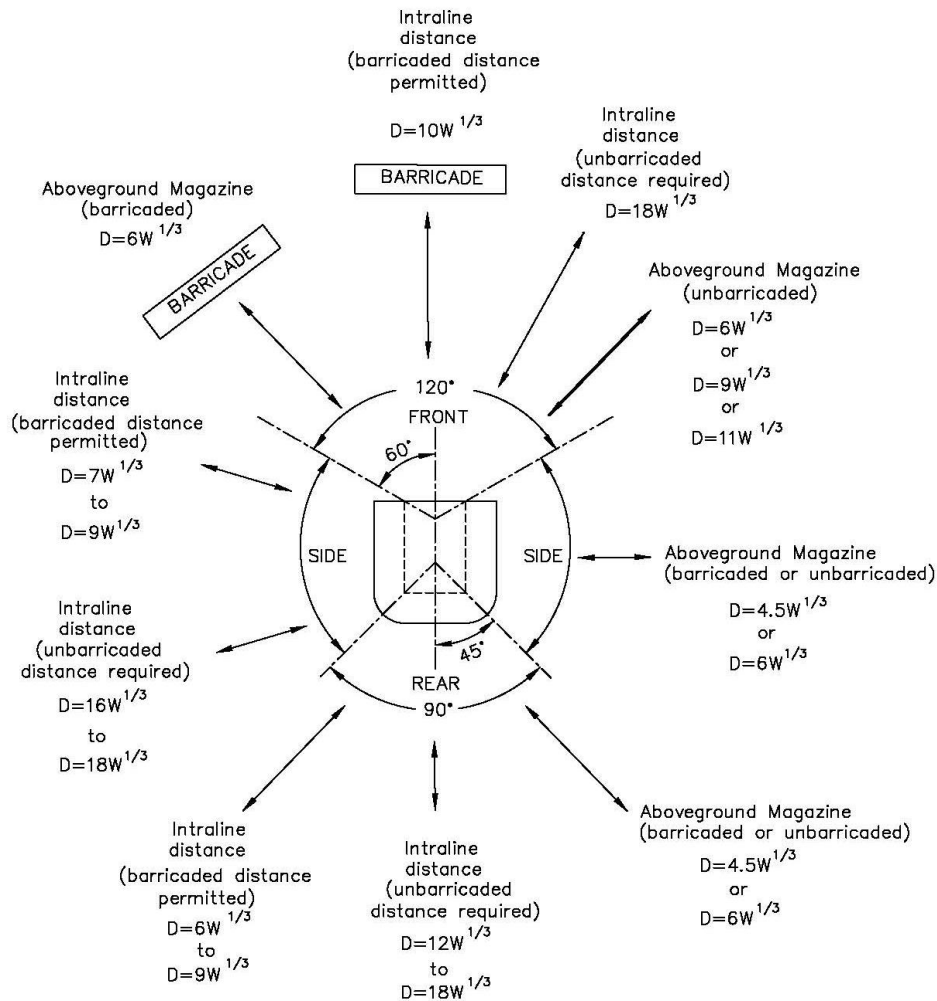
[a]See paragraph V3.E3.1.4.1. for application of ILDs from an ECM.
[b]See paragraph V3.E3.1.5.2. for application of barricaded IMD and ILD from an ECM.
[c]See Table V3.E3.T6. for application of IMDs between ECMs and AGMs.

VOLUME 4 – ENCLOSURE 3: AIRFIELDS AND HELIPORTS

V4.E3.1. SCOPE AND APPLICATION. This enclosure:

V4.E3.1.1. Applies to AE that is under the control and custody of DoD personnel at airfields and heliports. Enclosure 3 of Volume 6 applies when these requirements cannot be met for contingencies, combat operations, and military operations other than war.

V4.E3.1.2. Does not apply to AE installed on aircraft (e.g., egress system components, squibs, and detonators for jettisoning external stores, engine-starter cartridges, fire extinguisher cartridges, and destructors in electronic equipment), contained in survival and rescue kits (e.g., flares, signals, explosives components of emergency equipment), and other such items or materials necessary for safe flight operations.

V4.E3.2. MEASUREMENT OF SEPARATION DISTANCES. In applying Tables V4.E3.T1. and V4.E3.T2., measure distances as follows:

V4.E3.2.1. Loaded Aircraft to Loaded Aircraft. Measure the shortest distance between AE on one aircraft to AE on the adjacent aircraft.

V4.E3.2.2. AE Location to Taxiways and Runways. Measure from the nearest point of the AE location to the:

V4.E3.2.2.1. Nearest point of the taxiway.

V4.E3.2.2.2. Centerline of the runway.

V4.E3.3. AE PROHIBITED AREAS. Areas immediately beyond the ends of runways and along primary flight paths are subject to more aircraft accidents than other areas. For this reason, AE is prohibited from accident potential zones I and II and clear zones of all aircraft landing facilities, as designated and described in detail in the DoD Component airfield and airspace criteria directives.

V4.E3.4. ADDITIONAL SITING CRITERIA. This enclosure's QD criteria must be applied with the airfield clearance criteria that is prescribed by the DoD Component and Federal Aviation Administration (FAA) regulations (part 77 of Title 14, CFR). For airfields and heliports:

V4.E3.4.1. Used Exclusively by the DoD Components and Allied Nation Military Components. CAPAs, AE cargo areas, alert hangars, and shelters may be located within the airfield clearance zone, with the exception of AE prohibited areas (see section V4.E3.3.).

V4.E3.4.2. Not Used Exclusively by the DoD Components and Allied Nation Military Components. CAPAs, AE cargo areas, alert hangars, and shelters must be located as prescribed in Tables V4.E3.T1. and V4.E3.T2.

V4.E3.5. AIRCRAFT PARKING AREAS

V4.E3.5.1. Uploading and downloading of AE must be conducted at explosives-sited aircraft parking areas.

V4.E3.5.2. QD is not required for:

V4.E3.5.2.1. Aircraft loaded with AE shown in paragraphs V4.E3.5.2.1.1. through V4.E3.5.2.1.3. and parked in designated aircraft parking areas that meet airfield criteria when evaluated as a PES:

V4.E3.5.2.1.1. HD 1.2.2: gun AE, 30 millimeter or less.

V4.E3.5.2.1.2. HD 1.3: Captive missiles, aircraft defensive flares or chaff.

V4.E3.5.2.1.3. HD 1.4 AE.

V4.E3.5.2.2. Uploading and downloading AE listed in paragraph V4.E3.5.2.1., at a designated aircraft parking area, provided the quantity of AE involved in the operation is limited to a single aircraft load.

V4.E3.5.2.3. Uploading and downloading of security force ammunition issued to embarked security forces for designated missions.

V4.E3.6. COMBAT AIRCRAFT SUPPORT FACILITIES. See paragraph V3.E3.1.1.2.1.11.
for separation distance criteria associated with such facilities. When operational necessity dictates, separation distances less than K-factor (English system) K18 [K-factor (metric system) K_m 7.14] may be approved; however, it must be demonstrated that K18 [K_m 7.14] equivalent protection is provided.

Table V4.E3.T1. Application of AE Separation Distances for Airfields and Heliports

From ➡ To ⬇	Hardened Aircraft Shelter	Combat Aircraft Parking Area	AE Cargo Area	AE Storage Facility	AE Operating Facility	Ready Ammunition Storage Facility
Hardened Aircraft Shelter (HAS)	a	b	b	c	c	d
Maintenance HAS	e	f	f	c	c	g
CAPA	h	h	h	i	i	h
AE Cargo Area	h	h	h	h	h	h
AE Storage Facility	h	h	h	h	h	h
AE Operating Facility	j	j	j	j	j	j
Ready Ammunition Storage Facility	d	h	h	h	h	h
Inhabited Building	k	k	k	k	k	k
PTR and Taxiway (joint DoD-Non DoD use)	l	l	l	l	l	l
Runway (joint DoD-Non DoD use)	k	k	k	k	k	k
Runway/Taxiway (DoD Component use only)	None	None	None	m	l	None
Aircraft Parking Area	n	n	n	o	o	n
Aircraft Passenger Loading/Unloading Area	p	p	p	p	p	p
Recreation Area	q	q	r	r	r	q

a	See paragraph V4.E3.7.3.
b	If the PES NEWQD is less than or equal to 22,000 lbs [9,979 kg], see paragraph V4.E3.7.3.; treat the PES as a HAS Ready Service AGM for application of Tables V4.E3.T4. and V4.E3.T6. If the PES NEWQD is greater than 22,000 lbs [9,979 kg], apply Footnote h.
c	Apply the storage area ECM or AGM (as applicable) column of Table V4.E3.T6.
d	For HAS Ready Service AGM or ECM, apply Table V4.E3.T4. for HD 1.1 and apply Footnote n for HD 1.2. For any other ready ammunition storage facility, apply Footnote h.
e	See paragraph V4.E3.7.5.
f	See paragraph V4.E3.7.5. If the PES NEWQD is less than or equal to 22,000 lbs [9,979 kg], the PES may be treated as a HAS Ready Service AGM for application of Table V4.E3.T6. If the PES NEWQD is greater than 22,000 lbs [9,979 kg], or Table V4.E3.T6. is not applied for aircraft survivability, then ILD equivalent protection (3.5 psi [24 kPa]) will be provided to personnel within the maintenance HAS.
g	See paragraph V4.E3.7.5. For HAS Ready Service AGM or ECM, Tables V4.E3.T5. and V4.E3.T6. may be applied. For any other ready ammunition storage facility, or if Tables V4.E3.T5. and V4.E3.T6. are not applied for aircraft survivability, then ILD equivalent protection (3.5 psi [24 kPa]) will be provided to personnel within the maintenance HAS.

h	For HD 1.1, use applicable IMD. For HD 1.2, apply Footnote n. Protects against simultaneous detonation of AE on adjacent aircraft, but does not prevent serious damage to aircraft and possible propagation of detonation due to fragments, debris, or fire.
i	Use Table V4.E3.T2. distances for mass-detonating items and applicable PTRD for nonmass-detonating items.
j	Use applicable ILD. Apply ILD in accordance with paragraph V4.E3.7.4. when the PES is a HAS.
k	Use applicable IBD. Apply IBD in accordance with paragraph V4.E3.7.4. when the PES is a HAS.
l	Use applicable PTRD. K4.5 [K$_m$ 1.79] is allowable outside the United States, if deemed operationally essential, and provided the resultant transient risk to military aircraft is acceptable.
m	For HD 1.1, use unbarricaded ILD in accordance with Table V3.E3.T5. from side or rear of ECMs to taxiways; for HD 1.2, HD 1.3 or HD 1.4, no separation is required from side or rear of ECMs to taxiways. Use PTRD from front of ECMs or any other storage locations to taxiways. Use PTRD from all storage locations to runways. K4.5 [K$_m$ 1.79] is allowable outside the United States, if deemed operationally essential and the resultant transient risk to military aircraft is acceptable.
n	Within these areas of airfields and heliports exclusively used by the DoD Components, the separation of aircraft parking areas from CAPAs and their ready AE storage facilities and AE cargo areas are considered to be a command function. At joint DoD/non-DoD use airfields and heliports, the CAPAs and their ready AE storage facilities and AE cargo area must be separated from non-DoD aircraft as specified in Footnote o.
o	Use Table V4.E3.T2. distances for the DoD Components' aircraft parking areas. Use applicable IBD for non-DoD entity aircraft parking areas; apply IBD in accordance with paragraph V4.E3.7.4. when the PES is a HAS.
p	Use applicable PTRD for locations in the open where passengers enplane and deplane; apply PTRD in accordance with paragraph V4.E3.7.4. when the PES is a HAS. Use applicable IBD if a structure is included where passengers assemble, such as a passenger terminal building; apply IBD in accordance with paragraph V4.E3.7.4. when the PES is a HAS.
q	No distance required to recreational areas that are used exclusively for alert personnel manning the combat-loaded aircraft. Other recreational areas where people are in the open must be at applicable PTRD; apply PTRD in accordance with paragraph V4.E3.7.4. when the PES is a HAS. When structures, including bleacher stands, are a part of such areas, use applicable IBD; apply IBD in accordance with paragraph V4.E3.7.4. when the PES is a HAS.
r	Recreational areas, where people are in the open, must be at applicable PTRDs. When structures, including bleacher stands are part of such areas, use applicable IBDs.

Table V4.E3.T2. HD 1.1 QD for Military Aircraft Parking Areas

NEWQD	Distance for Specific Targets Indicated in Table V4.E3.T1.[a, b, c]
(lbs)	(ft)
[kg]	[m]
50	111
22.7	33.7
70	124
31.8	37.7
100	139
45.4	42.4
150	159
68.0	48.6

Table V4.E3.T2. HD 1.1 QD for Military Aircraft Parking Areas, Continued

NEWQD	Distance for Specific Targets Indicated in Table V4.E3.T1.[a, b, c]
(lbs)	(ft)
[kg]	[m]
200	175
90.7	53.5
300	201
136.1	61.2
500	238
226.8	72.6
700	266
317.5	81.2
1,000	300
453.6	91.4
1,500	343
680.4	104.7
2,000	378
907.2	115.2
3,000	433
1,360.8	131.9
5,000	513
2,268.0	156.4
7,000	574
3,175.1	174.9
10,000	646
4,535.9	197.0
15,000	740
6,803.9	225.5
20,000	814
9,071.8	248.2
30,000	932
13,608	284.1
50,000	1,105
22,680	336.9
70,000	1,236
31,751	376.9
100,000	1,392
45,359	424.4
150,000	1,594
68,039	485.8
200,000	1,754
90,718	534.7

Table V4.E3.T2. HD 1.1 QD for Military Aircraft Parking Areas, Continued

NEWQD	Distance for Specific Targets Indicated in Table V4.E3.T1.[a, b, c]
(lbs)	(ft)
[kg]	[m]
300,000	2,008
136,077	612.1
500,000	2,381
226,795	725.8

a	English equations (EQNs) (distance (D) in ft, NEWQD in lbs)	
	$D = 30*W^{1/3}$ with a minimum distance of 111 ft	EQN V4.E3.T2-1
	NEWQD = $D^3/27,000$ with a minimum NEWQD of 50 lbs	EQN V4.E3.T2-2
	Metric EQNs (D in m, NEWQD in kg)	
	$D = 11.9*Q^{1/3}$ with a minimum distance of 33.8 m	*EQN V4.E3.T2-3*
	NEWQD = $D^3/1,685.2$ with a minimum NEWQD of 22.7 kg	*EQN V4.E3.T2-4*
b	Minimum fragment distance requirements for HD 1.1 (see paragraph V3.E3.1.2.) do not apply to targets for which this table is used.	
c	To protect against low-angle, high-speed fragments, barricades should be provided; however, these distances must not be reduced.	

V4.E3.7. HAS

V4.E3.7.1. General

V4.E3.7.1.1. All HASs, except Korean Theatre Air Base Vulnerability (TAB VEE) HAS fronts and Korean flow-through HAS fronts and rears, are structures capable of stopping primary fragments when doors are properly secured. HD 1.1 and HD 1.2.3 parenthetical (xx) fragment distances do not apply except out the front of a Korean TAB VEE and out the front and rear of a Korean flow-through HAS.

V4.E3.7.1.2. The front, side, or rear sectors of a HAS as either a PES or an ES are illustrated in Figure V4.E3.F1.

Figure V4.E3.F1. HAS Orientation Effects[a]

HAS as an ES

HAS as a PES

[a] See paragraph V4.E3.7.1.2.
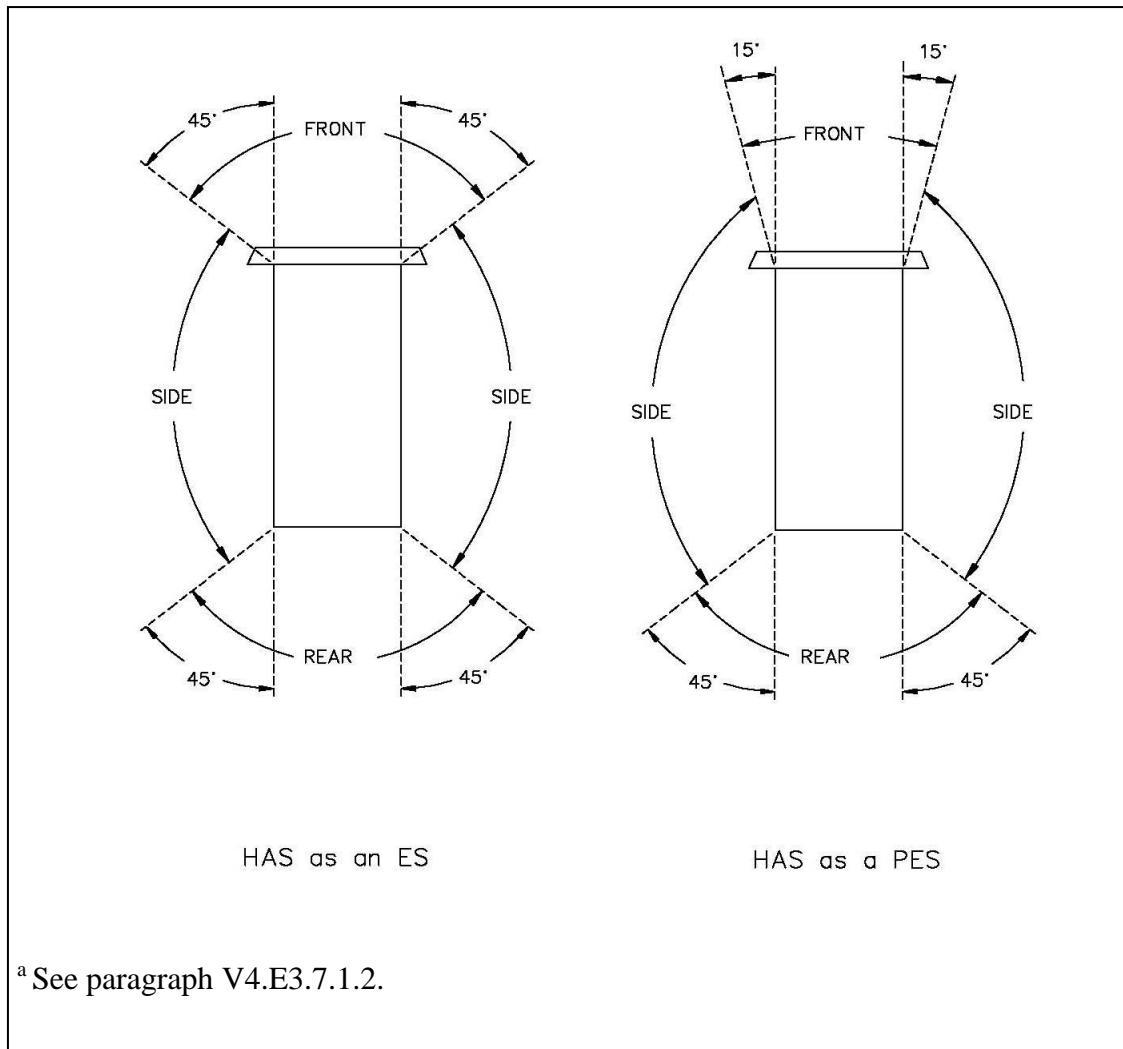
V4.E3.7.2. Allowable NEWQD. First generation and Korean TAB VEE HASs are limited to a maximum NEWQD of 5,863 lbs [2,659.4 kg]. Second generation, third generation, and Korean flow-through HASs are limited to a maximum NEWQD of 11,000 lbs [4,989.5 kg]. Flow-through HAS pairs are limited to a maximum NEWQD of 4,800 lbs [2,177.2 kg] in each HAS. HAS pairs with rear walls or with front and rear walls are limited to a maximum NEWQD of 2,390 lbs [1,084.1 kg] in each HAS. HAS ready service ECM and AGM are limited to a maximum NEWQD of 22,000 lbs [9,979 kg].

V4.E3.7.3. HAS Separation for IMD and Asset Preservation

V4.E3.7.3.1. HASs must be separated according to Tables V4.E3.T3. and V4.E3.T4., which provides IMD (or equivalent) protection. For first, second, and third generation HASs, and Korean TAB VEE modified (with hardened front closure) HASs, these distances will also provide a high degree of protection against delayed propagation of explosion when HAS doors are properly secured. However, the exposed shelter may be damaged heavily and aircraft and

AE therein may be rendered unserviceable. For Korean TAB VEE HAS front and Korean flow-through HAS front and rear (due to openings) at these distances there may be serious damage to aircraft and possible delayed propagation of detonation due to fragments, debris, or fire.

V4.E3.7.3.2. HASs separated according to Tables V4.E3.T5. and V4.E3.T6. (and with HAS doors properly secured) will be provided a higher degree of asset preservation (K30 [K_m 11.9] or equivalent overpressure) than that provided in Tables V4.E3.T3. and V4.E3.T4. An explosion in one shelter or ready storage facility may destroy it and its contents, but aircraft within adjacent shelters will be undamaged provided the doors are closed. These aircraft may not be immediately accessible due to debris.

V4.E3.7.3.3. Tables V4.E3.T3. through V4.E3.T6. criteria are based on first, second, and third generation HAS doors remaining closed, except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of shelters. If doors are left open for extended periods, apply the following criteria:

V4.E3.7.3.3.1. For prevention of simultaneous detonation, apply default IMD to or from an open front. A HAS arch or rear wall may be considered as a barricade for application of K6 [K_m 2.38] to or from a "door open" HAS front. No reduction from K11 [K_m 4.36] is allowed between "door open" HAS front-to-front exposures.

V4.E3.7.3.3.2. For aircraft survivability, apply Table V4.E3.T2. to or from an open front, and to the arch of a HAS with an open front; apply K25 [K_m 9.92], with a minimum distance of 111 ft [33.8 m], to the rear of a HAS with an open front.

V4.E3.7.4. HAS Separation to Unhardened ESs

V4.E3.7.4.1. Apply Table V4.E3.T7. for separation of unhardened ESs from third generation HASs, provided the NEWQD limitation of paragraph V4.E3.7.2. is met. Lesser distances may be permitted to hardened ESs that provide equivalent protection when approved by the DDESB.

V4.E3.7.4.2. Provided the NEWQD limitations of paragraph V4.E3.7.2. are met, apply Table V4.E3.T7. for separation of unhardened ESs from second generation and Korean flow-through HASs:

V4.E3.7.4.2.1. To the front, sides, and rear of a second generation HAS.

V4.E3.7.4.2.2. To the sides of a Korean flow-through HAS. For the front and rear, apply default QD criteria.

V4.E3.7.4.3. Provided the NEWQD limitations of paragraph V4.E3.7.2. are met, apply Table V4.E3.T8. for separation of unhardened ESs from first generation and Korean TAB VEE HASs:

V4.E3.7.4.3.1. To the front, sides, and rear of a first generation HAS.

V4.E3.7.4.3.2. To the sides and rear of a Korean TAB VEE HAS. For the front, apply default QD criteria.

V4.E3.7.4.4. Apply Table V4.E3.T7. or V4.E3.T8. for separation of unhardened ESs from HAS pairs, as appropriate, for the HAS pair design involved.

V4.E3.7.4.5. First, second, and third generation and Korean TAB VEE HASs sited for HD 1.2, HD 1.3, or HD 1.4 explosives, as shown in paragraphs V4.E3.7.4.5.1. through V4.E3.7.4.5.5., do not generate a QD arc out the sides or rear. Korean flow-through HASs sited for HD 1.2, HD 1.3, or HD 1.4 explosives, as shown in paragraphs V4.E3.7.4.5.1. through V4.E3.7.4.5.5., do not generate a QD arc out the sides. For HAS pairs, apply the requirements for the HAS pair design involved. Default QD criteria apply out the front of all HASs, and out the front and rear of Korean flow-through HASs.

V4.E3.7.4.5.1. HD 1.2.1, with a MCE less than 110 lbs [50 kg], and an NEWQD subject to the limitations in paragraph V4.E3.7.2.

V4.E3.7.4.5.2. Mission essential quantities of HD 1.2.2.

V4.E3.7.4.5.3. HD 1.2.3, with an MCE less than 110 lbs [50 kg], and an NEWQD subject to the limitations in paragraph V4.E3.7.2.

V4.E3.7.4.5.4. Mission essential quantities of HD 1.3.

V4.E3.7.4.5.5. Mission essential quantities of HD 1.4.

V4.E3.7.5. Maintenance HASs. A HAS used solely as a maintenance facility would normally be classified as a related facility and would require ILD separation from a supported PES. As an ES, a first, second, or third generation maintenance HAS will provide K30 [K_m 11.9] equivalent protection at the reduced distances shown in Tables V4.E3.T5. and V4.E3.T6. with doors properly secured. If Tables V4.E3.T5. and V4.E3.T6. are not applied for aircraft survivability, then at a minimum, provide ILD equivalent protection (3.5 psi [24 kPa]) to personnel within the maintenance HAS.

Table V4.E3.T3. Minimum Hazard Factor for HASs to Prevent Simultaneous Detonation, Part 1[a, b, c, d]

To ↓	From →	1st Generation HAS			2nd and 3rd Generation HAS			Korean TAB VEE HAS[e]		
		S	R	F	S	R	F	S	R	F
1st Generation HAS	S	2	2	2.75	2	2	2.75	2	2	4.5
		0.79	*0.79*	*1.09*	*0.79*	*0.79*	*1.09*	*0.79*	*0.79*	*1.79*
	R	2	2	2.75	2	2	2.75	2	2	4.5
		0.79	*0.79*	*1.09*	*0.79*	*0.79*	*1.09*	*0.79*	*0.79*	*1.79*
	F	6	4.5	8	6	4.5	9	6	4.5	11
		2.38	*1.79*	*3.17*	*2.38*	*1.79*	*3.57*	*2.38*	*1.79*	*4.36*
2nd and 3rd Generation HAS	S	2	2	2.75	2	2	2.75	2	2	4.5
		0.79	*0.79*	*1.09*	*0.79*	*0.79*	*1.09*	*0.79*	*0.79*	*1.79*
	R	2	2	2.75	2	2	2.75	2	2	4.5
		0.79	*0.79*	*1.09*	*0.79*	*0.79*	*1.09*	*0.79*	*0.79*	*1.79*
	F	4.5	2.75	5	4.5	2.75	6	4.5	2.75	11
		1.79	*1.09*	*1.98*	*1.79*	*1.09*	*2.38*	*1.79*	*1.09*	*4.36*
Korean TAB VEE HAS[e]	S	2	2	2.75	2	2	2.75	2	2	4.5
		0.79	*0.79*	*1.09*	*0.79*	*0.79*	*1.09*	*0.79*	*0.79*	*1.79*
	R	2	2	2.75	2	2	2.75	2	2	4.5
		0.79	*0.79*	*1.09*	*0.79*	*0.79*	*1.09*	*0.79*	*0.79*	*1.79*
	F	6	6	11	6	6	11	6	6	11
		2.38	*2.38*	*4.36*	*2.38*	*2.38*	*4.36*	*2.38*	*2.38*	*4.36*
Korean Flow-Through HAS	S	2	2	2.75	2	2	2.75	2	2	4.5
		0.79	*0.79*	*1.09*	*0.79*	*0.79*	*1.09*	*0.79*	*0.79*	*1.79*
	F/R	6	6	11	6	6	11	6	6	11
		2.38	*2.38*	*4.36*	*2.38*	*2.38*	*4.36*	*2.38*	*2.38*	*4.36*
HAS Ready Service ECM	S	2	2	2.75	2	2	2.75	2	2	6
		0.79	*0.79*	*1.09*	*0.79*	*0.79*	*1.09*	*0.79*	*0.79*	*2.38*
	R	2	2	2.75	2	2	2.75	2	2	6
		0.79	*0.79*	*1.09*	*0.79*	*0.79*	*1.09*	*0.79*	*0.79*	*2.38*
	FB	2.75	2.75	5	2.75	2.75	6	2.75	2.75	6
		1.09	*1.09*	*1.98*	*1.09*	*1.09*	*2.38*	*1.09*	*1.09*	*2.38*
	FU	6	4.5	8	6	4.5	9	6	4.5	11
		2.38	*1.79*	*3.17*	*2.38*	*1.79*	*3.57*	*2.38*	*1.79*	*4.36*
HAS Ready Service AGM	B	2.75	2.75	6	2.75	2.75	6	6	6	6
		1.09	*1.09*	*2.38*	*1.09*	*1.09*	*2.38*	*2.38*	*2.38*	*2.38*
	U	11	11	11	11	11	11	11	11	11
		4.36	*4.36*	*4.36*	*4.36*	*4.36*	*4.36*	*4.36*	*4.36*	*4.36*

Table V4.E3.T3. Minimum Hazard Factor for HASs to Prevent Simultaneous Detonation, Part 1[a, b, c, d] Continued

	F = front; FB = front barricaded; FU = front unbarricaded; R = rear; S = side
a	Separations are based on first, second, and third generation HAS doors remaining closed, except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of shelters. If doors are left open for extended periods, apply default IMD to or from an open front. A HAS arch or rear wall may be considered as a barricade for application of K6 [K_m 2.38] to or from a "door open" HAS front. No reduction from K11 [K_m 4.36] is allowed between "door open" HAS front-to-front exposures.
b	First generation and Korean TAB VEE HASs are limited to a maximum NEWQD of 5,863 lbs [2,659.4 kg]. Second generation, third generation, and Korean flow-through HASs are limited to a maximum NEWQD of 11,000 lbs [4,989.5 kg]. HAS ready service ECMs and AGMs are limited to a maximum NEWQD of 22,000 lbs [9,979 kg].
c	Flow-through HAS pairs are limited to a maximum NEWQD of 4,800 lbs [2,177.2 kg] in each HAS. For this NEWQD, IMD equivalent protection is provided between each HAS in a HAS pair. IMD equivalent protection between a HAS pair and adjacent HASs and HAS ready service ECMs and AGMs must be in accordance with this table or Table V4.E3.T4. for the HAS designs involved.
d	HAS pairs with rear walls or with front and rear walls are limited to a maximum NEWQD of 2,390 lbs [1,084.1 kg] in each HAS. For this NEWQD, IMD equivalent protection is provided between each HAS in a HAS pair. IMD equivalent protection between a HAS pair and adjacent HASs and HAS ready service ECMs and AGMs must be in accordance with this table or Table V4.E3.T4. for the HAS designs involved.
e	A Korean TAB VEE HAS that has been modified to incorporate the hardened front closure of the first generation TAB VEE or TAB VEE modified HAS may be treated as a first generation HAS, provided the doors remain closed except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter.

Table V4.E3.T4. Minimum Hazard Factor for HASs to Prevent Simultaneous Detonation, Part 2[a, b, c, d]

From ➜ To ⬇		Korean Flow-Through HAS		HAS Ready Service ECM				HAS Ready Service AGM	
		S	F/R	S	R	FB	FU	B	U
1st Generation HAS	S	2 *0.79*	4.5 *1.79*	2[f] *0.79[f]*	2[f] *0.79[f]*	2.75 *1.09*	2.75 *1.09*	2.75 *1.09*	2.75 *1.09*
	R	2 *0.79*	4.5 *1.79*	2[f] *0.79[f]*	2[f] *0.79[f]*	2.75 *1.09*	2.75 *1.09*	2.75 *1.09*	2.75 *1.09*
	F	6 *2.38*	11 *4.36*	2[f] *0.79[f]*	2.75 *1.09*	6 *2.38*	9 *3.57*	6 *2.38*	9 *3.57*
2nd and 3rd Generation HAS	S	2 *0.79*	4.5 *1.79*	2[f] *0.79[f]*	2[f] *0.79[f]*	2.75 *1.09*	2.75 *1.09*	2.75 *1.09*	2.75 *1.09*
	R	2 *0.79*	4.5 *1.79*	2[f] *0.79[f]*	2[f] *0.79[f]*	2.75 *1.09*	2.75 *1.09*	2.75 *1.09*	2.75 *1.09*
	F	4.5 *1.79*	11 *4.36*	2[f] *0.79[f]*	2[f] *0.79[f]*	2.75 *1.09*	2.75 *1.09*	2.75 *1.09*	2.75 *1.09*

Table V4.E3.T4. Minimum Hazard Factor for HASs to Prevent Simultaneous Detonation, Part 2,[a, b, c, d] Continued
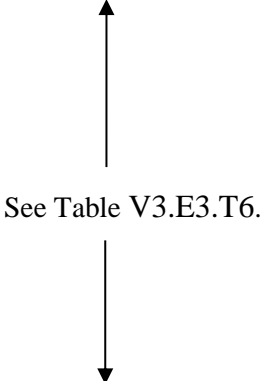
From →		Korean Flow-Through HAS		HAS Ready Service ECM				HAS Ready Service AGM	
To ↓		S	F/R	S	R	FB	FU	B	U
Korean TAB VEE HAS [e]	S	2	4.5	2[f]	2[f]	2.75	2.75	2.75	2.75
		0.79	*1.79*	*0.79[f]*	*0.79[f]*	*1.09*	*1.09*	*1.09*	*1.09*
	R	2	4.5	2[f]	2[f]	2.75	2.75	2.75	2.75
		0.79	*1.79*	*0.79[f]*	*0.79[f]*	*1.09*	*1.09*	*1.09*	*1.09*
	F	6	11	6	6	6	11	6	11
		2.38	*4.36*	*2.38*	*2.38*	*2.38*	*4.36*	*2.38*	*4.36*
Korean Flow-Through HAS	S	2	4.5	2[f]	2[f]	2.75	2.75	2.75	2.75
		0.79	*1.79*	*0.79[f]*	*0.79[f]*	*1.09*	*1.09*	*1.09*	*1.09*
	F/R	6	11	6	6	6	11	6	11
		2.38	*4.36*	*2.38*	*2.38*	*2.38*	*4.36*	*2.38*	*4.36*
HAS Ready Service ECM	S	2	6						
		0.79	*2.38*						
	R	2	6						
		0.79	*2.38*		See Table V3.E3.T6.				
	FB	2.75	6						
		1.09	*2.38*						
	FU	6	11						
		2.38	*4.36*						
HAS Ready Service AGM	B	6	6						
		2.38	*2.38*						
	U	11	11						
		4.36	*4.36*						

a	Separations are based on first, second, and third generation HAS doors remaining closed, except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of shelters. If doors are left open for extended periods, apply default IMD to or from an open front. A HAS arch or rear wall may be considered as a barricade for application of K6 [K_m 2.38] to or from a "door open" HAS front. No reduction from K11 [K_m 4.36] is allowed between "door open" HAS front-to-front exposures.
b	First generation and Korean TAB VEE HASs are limited to a maximum NEWQD of 5,863 lbs [2,659.4 kg]. Second generation, third generation, and Korean flow-through HASs are limited to a maximum NEWQD of 11,000 lbs [4,989.5 kg]. HAS ready service ECMs and AGMs are limited to a maximum NEWQD of 22,000 lbs [9,979 kg].
c	Flow-through HAS pairs are limited to a maximum NEWQD of 4,800 lbs [2,177.2 kg] in each HAS. For this NEWQD, IMD equivalent protection is provided between each HAS in a HAS pair. IMD equivalent protection between a HAS pair and adjacent HASs and HAS ready service ECMs and AGMs must be in accordance with this table or Table V4.E3.T3. for the HAS designs involved.
d	HAS pairs with rear walls or with front and rear walls are limited to a maximum NEWQD of 2,390 lbs [1,084.1 kg] in each HAS. For this NEWQD, IMD equivalent protection is provided between each HAS in a HAS pair. IMD equivalent protection between a HAS pair and adjacent HASs and HAS ready service ECMs and AGMs must be in accordance with this table or Table V4.E3.T3. for the HAS designs involved.

Table V4.E3.T4. Minimum Hazard Factor for HASs to Prevent Simultaneous Detonation, Part 2,[a, b, c, d] Continued

e	A Korean TAB VEE HAS that has been modified to incorporate the hardened front closure of the first generation TAB VEE or TAB VEE modified HAS may be treated as a first generation HAS, provided the doors remain closed except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter.
f	If the ECM loading density is $\leq$ 1.25 lbs/cubic feet (ft^3) [20 kg/cubic meter (m^3)], use:
	English EQN (W in lbs, D in ft) $D = 1.25 * W^{1/3}$ EQN V4.E3.T4-1
	Metric EQN (Q in kg, D in m) *$D = 0.5 * Q^{1/3}$* *EQN V4.E3.T4-2*

Table V4.E3.T5. Minimum Hazard Factor for HASs for Asset Preservation, Part 1[a, b, c]

To ↓ / From →		1st/2nd/3rd Generation HAS S	R	F	Korean TAB VEEHAS[d] S	R	F	Korean Flow-Through HAS S	F/R	HAS Ready Service ECM S	R	FB	FU
1st Generation HAS	S	9	6	9	9	6	11	9	11	2.75	2.75	8	8
		3.57	*2.38*	*3.57*	*3.57*	*2.38*	*4.36*	*3.57*	*4.36*	*1.09*	*1.09*	*3.17*	*3.17*
	R	8	5	8	8	5	11	8	11	2.75	2.75	8	8
		3.17	*1.98*	*3.17*	*3.17*	*1.98*	*4.36*	*3.17*	*4.36*	*1.09*	*1.09*	*3.17*	*3.17*
	F	18	18	18	18	18	24	18	24	11	9	18	18
		7.14	*7.14*	*7.14*	*7.14*	*7.14*	*9.52*	*7.14*	*9.52*	*4.36*	*3.57*	*7.14*	*7.14*
2nd and 3rd Generation HAS	S	9	6	9	9	6	11	9	11	2.75	2.75	8	8
		3.57	*2.38*	*3.57*	*3.57*	*2.38*	*4.36*	*3.57*	*4.36*	*1.09*	*1.09*	*3.17*	*3.17*
	R	8	5	8	8	5	11	8	11	2.75	2.75	8	8
		3.17	*1.98*	*3.17*	*3.17*	*1.98*	*4.36*	*3.17*	*4.36*	*1.09*	*1.09*	*3.17*	*3.17*
	F	11	9	18	11	9	18	11	18	2.75	2.75	8	8
		4.36	*3.57*	*7.14*	*4.36*	*3.57*	*7.14*	*4.36*	*7.14*	*1.09*	*1.09*	*3.17*	*3.17*
Korean TAB VEE HAS[d]	S	30	24	24	30	24	30	30	30	30	24	30	30
		11.9	*9.52*	*9.52*	*11.9*	*9.52*	*11.9*	*11.9*	*11.9*	*11.9*	*9.52*	*11.9*	*11.9*
	R	30	24	24	30	24	30	30	30	30	24	30	30
		11.9	*9.52*	*9.52*	*11.9*	*9.52*	*11.9*	*11.9*	*11.9*	*11.9*	*9.52*	*11.9*	*11.9*
	F	30	24	24	30	24	30	30	30	30	24	30	30
		11.9	*9.52*	*9.52*	*11.9*	*9.52*	*11.9*	*11.9*	*11.9*	*11.9*	*9.52*	*11.9*	*11.9*
Korean Flow-Through HAS	S	30	24	24	30	24	30	30	30	30	24	30	30
		11.9	*9.52*	*9.52*	*11.9*	*9.52*	*11.9*	*11.9*	*11.9*	*11.9*	*9.52*	*11.9*	*11.9*
	F/R	30	24	24	30	24	30	30	30	30	24	30	30
		11.9	*9.52*	*9.52*	*11.9*	*9.52*	*11.9*	*11.9*	*11.9*	*11.9*	*9.52*	*11.9*	*11.9*
1st Generation Maintenance HAS[e]	S	9	8	9	9	8	11	9	11	8	8	8	8
		3.57	*3.17*	*3.57*	*3.57*	*3.17*	*4.36*	*3.57*	*4.36*	*3.17*	*3.17*	*3.17*	*3.17*
	R	8	8	8	8	8	11	8	11	8	8	8	8
		3.17	*3.17*	*3.17*	*3.17*	*3.17*	*4.36*	*3.17*	*4.36*	*3.17*	*3.17*	*3.17*	*3.17*
	F	18	18	18	18	18	24	18	24	11	9	18	18
		7.14	*7.14*	*7.14*	*7.14*	*7.14*	*9.52*	*7.14*	*9.52*	*4.36*	*3.57*	*7.14*	*7.14*
2nd and 3rd Generation Maintenance HAS[e]	S	9	8	9	9	8	11	9	11	8	8	8	8
		3.57	*3.17*	*3.57*	*3.57*	*3.17*	*4.36*	*3.57*	*4.36*	*3.17*	*3.17*	*3.17*	*3.17*
	R	8	8	8	8	8	11	8	11	8	8	8	8
		3.17	*3.17*	*3.17*	*3.17*	*3.17*	*4.36*	*3.17*	*4.36*	*3.17*	*3.17*	*3.17*	*3.17*
	F	11	9	18	11	9	18	11	18	8	8	8	8
		4.36	*3.57*	*7.14*	*4.36*	*3.57*	*7.14*	*4.36*	*7.14*	*3.17*	*3.17*	*3.17*	*3.17*

a	Separations are based on first, second, and third generation HAS doors remaining closed, except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of shelters. If doors are left open for extended periods, apply Table V4.E3.T2. to or from an open front, and to the arch of a HAS with an open front; apply K25 [K_m 9.92], with a minimum distance of 111 ft [33.8 m], to the rear of a HAS with an open front.
b	First generation and Korean TAB VEE HASs are limited to a maximum NEWQD of 5,863 lbs [2,659.4 kg]. Second generation, third generation, and Korean flow-through HASs are limited to a maximum NEWQD of 11,000 lbs [4,989.5 kg]. HAS ready service ECMs used to support daily loading are limited to a maximum NEWQD of 22,000 lbs [9,979 kg] and a loading density of not more than 1.25 lbs/ft^3 [20 kg/m^3]. HAS ready service AGMs are limited to a maximum NEWQD of 22,000 lbs [9,979 kg].
c	Asset preservation is not provided between each HAS in a HAS pair. Flow-through HAS pairs are limited to a maximum NEWQD of 4,800 lbs [2,177.2 kg] in each HAS. HAS pairs with rear walls or with front and rear walls are limited to a maximum NEWQD of 2,390 lbs [1,084.1 kg] in each HAS. Asset preservation distances between a HAS pair and adjacent HASs and HAS ready service ECMs and AGMs must be in accordance with this table or Table V4.E3.T6. for the HAS designs involved.
d	A Korean TAB VEE HAS that has been modified to incorporate the hardened front closure of the first generation TAB VEE or TAB VEE Modified HAS may be treated as a first generation HAS, provided the doors remain closed except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter.
e	These distances reflect K30 [K_m 11.9] equivalent protection (when doors are closed) for the aircraft. If this table or Table V4.E3.T6. is not applied for aircraft survivability, then provide ILD equivalent protection (3.5 psi [24 kPa]) to personnel.

Table V4.E3.T6. Minimum Hazard Factor for HASs for Asset Preservation, Part 2[a, b, c]

From ➜ To ⬇		HAS Ready Service AGM		Storage Area ECM				Storage Area AGM	
		B	U	S	R	FB	FU	B	U
1st Generation HAS	S	8 *3.17*	8 *3.17*	5 *1.98*	5 *1.98*	8 *3.17*	8 *3.17*	8 *3.17*	8 *3.17*
	R	8 *3.17*	8 *3.17*	5 *1.98*	5 *1.98*	8 *3.17*	8 *3.17*	8 *3.17*	8 *3.17*
	F	18 *7.14*	18 *7.14*	18 *7.14*	18 *7.14*	18 *7.14*	18 *7.14*	18 *7.14*	18 *7.14*
2nd and 3rd Generation HAS	S	8 *3.17*	8 *3.17*	5 *1.98*	5 *1.98*	8 *3.17*	8 *3.17*	8 *3.17*	8 *3.17*
	R	8 *3.17*	8 *3.17*	5 *1.98*	5 *1.98*	8 *3.17*	8 *3.17*	8 *3.17*	8 *3.17*
	F	8 *3.17*	8 *3.17*	5 *1.98*	5 *1.98*	8 *3.17*	8 *3.17*	8 *3.17*	8 *3.17*
Korean TAB VEE HAS [d]	S	30 *11.9*	30 *11.9*	30 *11.9*	24 *9.52*	30 *11.9*	30 *11.9*	30 *11.9*	30 *11.9*
	R	30 *11.9*	30 *11.9*	30 *11.9*	24 *9.52*	30 *11.9*	30 *11.9*	30 *11.9*	30 *11.9*
	F	30 *11.9*	30 *11.9*	30 *11.9*	24 *9.52*	30 *11.9*	30 *11.9*	30 *11.9*	30 *11.9*
Korean Flow-Through HAS	S	30 *11.9*	30 *11.9*	30 *11.9*	24 *9.52*	30 *11.9*	30 *11.9*	30 *11.9*	30 *11.9*
	F/R	30 *11.9*	30 *11.9*	30 *11.9*	24 *9.52*	30 *11.9*	30 *11.9*	30 *11.9*	30 *11.9*

Table V4.E3.T6. Minimum Hazard Factor for HASs for Asset Preservation, Part 2,[a, b, c] Continued

From ➜ To ⬇		HAS Ready Service AGM		Storage Area ECM				Storage Area AGM	
		B	U	S	R	FB	FU	B	U
1st Generation Maintenance HAS[e]	S	8 *3.17*	8 *3.17*	5 *1.98*	5 *1.98*	8 *3.17*	8 *3.17*	8 *3.17*	8 *3.17*
	R	8 *3.17*	8 *3.17*	5 *1.98*	5 *1.98*	8 *3.17*	8 *3.17*	8 *3.17*	8 *3.17*
	F	18 *7.14*	18 *7.14*	18 *7.14*	18 *7.14*	18 *7.14*	18 *7.14*	18 *7.14*	18 *7.14*
2nd and 3rd Generation HAS[e]	S	8 *3.17*	8 *3.17*	5 *1.98*	5 *1.98*	8 *3.17*	8 *3.17*	8 *3.17*	8 *3.17*
	R	8 *3.17*	8 *3.17*	5 *1.98*	5 *1.98*	8 *3.17*	8 *3.17*	8 *3.17*	8 *3.17*
	F	8 *3.17*	8 *3.17*	5 *1.98*	5 *1.98*	8 *3.17*	8 *3.17*	8 *3.17*	8 *3.17*

a	Separations are based on first, second, and third generation HAS doors remaining closed, except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of shelters. If doors are left open for extended periods, apply Table V4.E3.T2. to or from an open front, and to the arch of a HAS with an open front; apply K25 [K_m 9.92], with a minimum distance of 111 ft [33.8 m], to the rear of a HAS with an open front.
b	First generation and Korean TAB VEE HASs are limited to a maximum NEWQD of 5,863 lbs [2,659.4 kg]. Second generation, third generation, and Korean flow-through HASs are limited to a maximum NEWQD of 11,000 lbs [4,989.5 kg]. HAS ready service ECMs used to support daily loading are limited to a maximum NEWQD of 22,000 lbs [9,979 kg] and a loading density of not more than 1.25 lbs/ft³ [20 kg/m³]. HAS ready service AGMs are limited to a maximum NEWQD of 22,000 lbs [9,979 kg].
c	Asset preservation is not provided between each HAS in a HAS pair. Flow-through HAS pairs are limited to a maximum NEWQD of 4,800 lbs [2,177.2 kg] in each HAS. HAS pairs with rear walls or with front and rear walls are limited to a maximum NEWQD of 2,390 lbs [1,084.1 kg] in each HAS. Asset preservation distances between a HAS pair and adjacent HASs and HAS ready service ECMs and AGMs must be in accordance with this table or Table V4.E3.T5. for the HAS designs involved.
d	A Korean TAB VEE HAS that has been modified to incorporate the hardened front closure of the first generation TAB VEE or TAB VEE modified HAS may be treated as a first generation HAS, provided the doors remain closed except for aircraft towing, fueling, servicing, run up, or taxi, and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter.
e	These distances reflect K30 [K_m 11.9] equivalent protection (when doors are closed) for the aircraft. If this table or Table V4.E3.T5. is not applied for aircraft survivability, then provide ILD equivalent protection (3.5 psi [24 kPa]) to personnel.

Table V4.E3.T7. QD from a Third Generation HAS PES to an Unhardened ES[a, b, c, d]

NEWQD	Front	Sides	Rear
(lbs)	(ft)	(ft)	(ft)
[kg]	*[m]*	*[m]*	*[m]*
$\leq 5.0^e$	50	50	50
$\leq 2.3^e$	*15.2*	*15.2*	*15.2*
5 < NEWQD $\leq$ 500	230	50	50
2.3 < NEWQD $\leq$ 226.8	*70.1*	*15.2*	*15.2*
500 < NEWQD $\leq$ 1,100	230	394	164
226.8 < NEWQD $\leq$ 498.9	*70.1*	*120.1*	*50*
1,100 < NEWQD $\leq$ 11,000^f	K50	K62	K40
498.9 < NEWQD $\leq$ 4,989.5^f	*K_m 19.84*	*K_m 24.60*	*K_m 15.86*

a	This table may be applied to the front, sides, and rear of a second generation HAS, and to the sides of a Korean flow-through HAS, as allowed in accordance with paragraph V4.E3.7.4.2.; it may be applied to HAS pairs as allowed in accordance with paragraph V4.E3.7.4.4.
b	Separation distances are based on shelter doors remaining closed, except for aircraft towing, fueling, servicing, run-up, or taxiing and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter. Where doors are left open for extended periods, normal CAPA criteria of Table V4.E3.T1. apply from the front.
c	Separate AE from the HAS walls by a distance sufficient to prevent breaching. For less than 1,100 lbs [498.9 kg] NEWQD, a 3-ft [0.91-m] separation from the wall is sufficient.
d	These QD criteria apply to IBD, PTRD, and ILD exposures for quantities less than or equal to 1,100 lbs [498.9 kg] NEWQD.
e	The 50-ft [15.2-m] distance shown is not for QD purposes, but represents a minimum fire separation distance.
f	For quantities over 1,100 lbs [498.9 kg] but less than or equal to 11,000 lbs [4,989.5 kg] NEWQD, these QD only apply to IBD exposures. Use 50 percent of the IBD criteria for PTRD exposures with a 300-ft [91.4-m] minimum distance out the front or rear or a 394-ft [120.1-m] minimum distance off the sides. Use 35 percent of the IBD criteria for intraline exposures with a 300-ft [91.4-m] minimum distance out the front and rear or a 394-ft [120.1-m] minimum distance off the sides.

Table V4.E3.T8. QD from a First Generation HAS PES to an Unhardened ES[a, b, c, d]

NEWQD	Front	Sides	Rear
(lbs)	(ft)	(ft)	(ft)
[kg]	*[m]*	*[m]*	*[m]*
$\leq 2.63^e$	50	50	50
$\leq 1.19^e$	*15.2*	*15.2*	*15.2*
$2.63 < NEWQD \leq 263.8$	230	50	50
$1.19 < NEWQD \leq 119.6$	*70.1*	*15.2*	*15.2*
$263.8 < NEWQD \leq 586.3$	230	394	164
$119.6 < NEWQD \leq 265.9$	*70.1*	*120.1*	*50*
$586.3 < NEWQD \leq 5{,}863^f$	K50	K62	K40
$265.9 < NEWQD \leq 2{,}659.4^f$	*$K_m\,19.84$*	*$K_m\,24.60$*	*$K_m\,15.86$*
a	This table may be applied to the front, sides, and rear of a first generation HAS, and to the sides and rear of a Korean TAB VEE HAS, as allowed in accordance with paragraph V4.E3.7.4.3.; it may be applied to HAS pairs as allowed in accordance with paragraph V4.E3.7.4.4.		
b	Separation distances are based on shelter doors remaining closed, except for aircraft towing, fueling, servicing, run-up, or taxiing and during integrated combat turnarounds or short periods when maintenance equipment or munitions are being moved into or out of the shelter. Where doors are left open for extended periods, normal CAPA criteria of Table V4.E3.T1. apply from the front.		
c	Separate AE from the HAS walls by a distance sufficient to prevent breaching. For less than 1,100 lbs [498.9 kg] NEWQD, a 3-ft [0.91-m] separation from the wall is sufficient.		
d	These QD criteria apply to IBD, PTRD, and ILD exposures for quantities less than or equal to 586.3 lbs [265.9 kg] NEWQD.		
e	The 50-ft [15.2-m] distance shown is not for QD purposes, but represents a minimum fire separation distance.		
f	For quantities over 586.3 lbs [265.9 kg] but less than or equal to 5,863 lbs [2,659.4 kg] NEWQD, these QD only apply to IBD exposures. Use 50 percent of the IBD criteria for PTRD exposures with a 300-ft [91.4-m] minimum distance out the front or rear or a 394-ft [120.1-m] minimum distance off the sides. Use 35 percent of the IBD criteria for intraline exposures with a 300-ft [91.4-m] minimum distance out the front and rear or a 394-ft [120.1-m] minimum distance off the sides.		

V4.E3.8. HELICOPTER LANDING AREAS FOR AE OPERATIONS. Helicopter landing areas for loading and unloading AE within storage sites and quick reaction alert sites are considered AGMs and may be sited at IMD based only upon the NEWQD carried by the helicopter. Such helicopter landing areas must meet the following requirements:

V4.E3.8.1. Flight clearance criteria are met.

V4.E3.8.2. Landing and takeoff approaches are not over any AE facilities.

V4.E3.8.3. Helicopter operations are limited to AE support of the facilities concerned.

V4.E3.8.4. No passengers are carried.

V4.E3.8.5. During helicopter takeoff, landing, or loading or unloading, no AE operations are conducted at any PES located within IBD of the helicopter landing area. During landing or takeoff, PES doors must be closed.

V4.E3.8.6. Observe safety precautions normal to other modes of transportation.

VOLUME 4 – ENCLOSURE 4: PIERS AND WHARFS

V4.E4.1. SCOPE AND APPLICATION. These QDs are for HD 1.1 AE. If only AE of other HDs are involved, the applicable QD will be applied. This enclosure:

V4.E4.1.1. Applies to:

V4.E4.1.1.1. Ship and barge units, referred to in this enclosure as ships.

V4.E4.1.1.2. Piers, wharfs, and associated facilities where AE may be handled or may be present in ships' holds or conveyances.

V4.E4.1.1.3. Loading, off-loading, stowing, and shifting of AE from ships' magazines.

V4.E4.1.2. Does not apply to (i.e., no QD is required for):

V4.E4.1.2.1. AE in static storage in ships' magazines and intended for the service of shipboard armament or aircraft, provided the Secretary of the Military Department concerned formally accepts any explosives risk associated with such storage.

V4.E4.1.2.2. Handling less than or equal to 300 lbs [136.1 kg] NEW of combined HD 1.3 and HD 1.4 AE that are necessary for ship security and safety at sea.

V4.E4.1.2.3. Handling of security force ammunition issued to embarked security forces for designated missions.

V4.E4.2. DETERMINING THE QUANTITY OF EXPLOSIVES IN A SHIP

V4.E4.2.1. The NEWQD on board a ship is determined in accordance with section V1.E7.2.

V4.E4.2.2. When ships are separated by K11 [K$_m$ 4.36] distances or greater, QD is based individually on the quantity of each ship. Lesser separation distances require that the AE in all ships be totaled.

V4.E4.3. MEASUREMENT OF SEPARATION DISTANCES

V4.E4.3.1. Moored Ships

V4.E4.3.1.1. Measurement of separation distances between ships or barges is from the nearest point of one ship's magazine (i.e., the PES) or the barge:

V4.E4.3.1.1.1. For IMD, to the nearest point of another ship's magazine or a barge.

V4.E4.3.1.1.2. For IBD and PTRD, to the nearest point of another ship or a barge.

V4.E4.3.1.2. Measurement of separation distances between ships or barges and shore ESs is from the nearest point of a ship's magazine or the barge to the nearest point of the ES.

V4.E4.3.2. Pier Operations. Measurement of separation distances from piers to surrounding facilities is from the nearest point that AE will be handled to the nearest point of an ES. Movement of railcars or trucks passing through the clear space between ships at a pier or between piers is considered an operational risk. It is generally impracticable to separate berths at a single pier by enough distance to prevent mass detonation of HD 1.1. When operationally feasible, schedule the number of such exposures and total time required to reduce exposure as much as possible.

V4.E4.3.3. Anchorages. Measurements from anchorages generally are from the boundary of the area designated for the explosives anchorage. The explosives anchorage for a single ship is a circle, the radius of which is the distance from the mooring buoy or a ship's anchor to the stern of the ship or of the AE lighters alongside when riding to the full scope of the chain. For an explosives anchorage, the separation distance to an ES will depend upon whether any ships are separated properly as described in paragraph V4.E4.2.2.

V4.E4.4. SITING CRITERIA AND APPLICATION OF QD

V4.E4.4.1. Maritime Prepositioning Ships (MPSs)

V4.E4.4.1.1. Reduced QD criteria may be applied to those MPSs that contain up to 1,300,000 lbs [589,667 kg] NEWQD of AE stored in standard International Standardization Organization (ISO) shipping containers.

V4.E4.4.1.2. IBD and PTRD for MPSs can be determined using K40.85 [K_m 16.21] with a 3,700-ft [1,128-m] minimum fragment distance for IBD and K24.01 [K_m 9.52] with a 2,220-ft [677-m] minimum fragment distance for PTRD for MPS loads where no more than 52 percent of the NEWQD is HD 1.1. When the percentage of HD 1.1 is:

V4.E4.4.1.2.1. Between 52 and 65 percent, use the IBD and PTRD columns of Table V4.E4.T9.

V4.E4.4.1.2.2. Above 65 percent, use the Other PES columns of Table V3.E3.T1. with a 3,700-ft [1,128-m] minimum fragment distance for IBD and a 2,220-ft [677-m] minimum fragment distance for PTRD.

Table V4.E4.T9. Variation of MPS QD Factors with Loadout

Percentage of HD 1.1	IBD[a] (ft/1b$^{1/3}$) [m/kg$^{1/3}$]	PTRD[b] (ft/1b$^{1/3}$) [m/kg$^{1/3}$]	Ship-to-Ship[c] (ft/1b$^{1/3}$) [m/kg$^{1/3}$]
up to 52	40.85	24.01	32.00
	16.21	9.52	12.69
53	40.97	24.08	32.10
	16.25	9.55	12.73
54	41.10	24.16	32.19
	16.30	9.58	12.77
55	41.22	24.23	32.29
	16.35	9.61	12.81
56	41.35	24.30	32.39
	16.40	9.64	12.85
57	41.47	24.37	32.48
	16.45	9.67	12.88
58	41.59	24.44	32.58
	16.50	9.70	12.92
59	41.71	24.52	32.67
	16.55	9.73	12.96
60	41.83	24.59	32.77
	16.59	9.75	13.00
61	41.95	24.66	32.86
	16.64	9.78	13.04
62	42.07	24.73	32.95
	16.69	9.81	13.07
63	42.19	24.80	33.05
	16.74	9.84	13.11
64	42.30	24.86	33.14
	16.78	9.86	13.15
65	42.42	24.93	33.23
	16.83	9.89	13.18

a	With a minimum fragment distance of 3,700 ft [1,128 m].
b	With a minimum fragment distance of 2,220 ft [677 m].
c	With a minimum fragment distance of 3,500 ft [1,067 m].

V4.E4.4.1.3. The QD between applicable MPS piers/anchorages and non-explosives loading piers/anchorages can be determined using K32 [K$_m$ 12.69] with a 3,500-ft [1,067-m] minimum fragment distance for MPS loads, where no more than 52 percent of the total NEWQD is HD 1.1. (An exception for non-explosive MPSs is provided in paragraph V4.E4.4.8.1.) When the percentage of HD 1.1 is:

V4.E4.4.1.3.1. Between 52 and 65 percent, use the ship-to-ship column in Table V4.E4.T9.

V4.E4.4.1.3.2. Above 65 percent, use K40 [K$_m$ 15.87] with a minimum fragment distance of 3,500 ft [1,067 m].

V4.E4.4.2. Scuttling Site. A properly located scuttling site will, when feasible, be provided for positioning a ship for its flooding or sinking in the event it catches fire and must be moved to avert damage to other ships or piers. The location of a scuttling site depends on the greatest NEWQD that may be in a single ship to be scuttled at any one time. (Figure V4.E4.F2. provides the applicable QD.) Additional considerations for the scuttling site include:

V4.E4.4.2.1. The site should have sufficient maneuvering room and depth to permit sinking the largest vessel that may be handled at the installation so that the holds will be flooded completely at low tide.

V4.E4.4.2.2. The scuttling site should provide the best available protection to other ships, piers, and shore installations in the event of a mass explosion.

V4.E4.4.3. Explosives Anchorages

V4.E4.4.3.1. Separation of Explosives Anchorages from Main Ship Channels. Explosives anchorage must be separated from the main ship channel and from normally traversed routes of ships entering or leaving the harbor by the following distances (occasional watercraft passing through the arcs, while outside both the main ship channel and normally traversed routes of ships entering and leaving the harbor, are not subject to QD requirements):

V4.E4.4.3.1.1. The PTRD from "Other PES" column of Table V3.E3.T1. (regardless of traffic density).

V4.E4.4.3.1.2. The turning circles and stopping distances of other ships passing the anchorage but not less than 3,000 ft [914.4 m].

V4.E4.4.3.2. Separation of Ships at Explosives Anchorages. When explosives anchorages are used for both loading and unloading ships and for mooring loaded ships, they must be separated as follows:

V4.E4.4.3.2.1. Loaded ships must be separated one from another by K18 [K$_m$ 7.14].

V4.E4.4.3.2.2. Loading and unloading ships must be separated one from another by K11 [K$_m$ 4.36] and, when possible, by K18 [K$_m$ 7.14].

V4.E4.4.3.2.3. Loaded ships must be separated from ships loading and unloading by K40 [K$_m$ 15.87].

V4.E4.4.3.3. Separation of Explosives Anchorages from Explosives Piers. Explosives anchorages must be separated from explosives piers by K40 [K$_m$ 15.87] except when the anchorage is used only for the loading or unloading of ships. In that case, K18 [K$_m$ 7.14] may be used.

V4.E4.4.4. Separation Distances of Ships at the Same Pier

V4.E4.4.4.1. Berthing of two ships in tandem helps decrease the fragment hazard to the AE cargo of the second ship because of the additional protection afforded by the bow or stern.

V4.E4.4.4.2. When two ships, which cannot be separated by K11 [K_m 4.36], are being loaded through all hatches at the same time, plan the spotting of railcars or trucks and the loading of hatches in both ships to put the greatest possible distance both between the open hatches and the trucks and railcars serving the two ships. When possible, stagger the loading of the ships.

V4.E4.4.5. Separation of Wharf Yard from the Pier. A wharf yard must be separated from the pier, which it serves, by K11 [K_m 4.36] to prevent propagation. If this separation distance cannot be met, then the wharf yard is considered part of the ship or barge and added to it for computation of the total amount of explosives for QD purposes.

V4.E4.4.6. Separation of Explosives Ships from Other Ships. Separate explosives ships being loaded or unloaded from non-explosives carrying ships and from loaded explosives ships that are not underway by K40 [K_m 15.87] distances. Use the PTRD from "Other PES" column of Table V3.E3.T1. for protection of ships that are underway.

V4.E4.4.7. Barge Piers and Anchorages

V4.E4.4.7.1. Barge Piers. Piers and wharfs used exclusively for loading or unloading AE on barges or utility craft (i.e., barge piers) must be sited at IMD from all other PESs (to include from another barge pier or a barge anchorage). As a PES, site barge piers and anchorages in accordance with Figure V4.E4.F2.

V4.E4.4.7.2. Barge Anchorages. Anchorages used only to moor AE-loaded barges and where AE loading or unloading is not permitted (i.e., barge anchorages) must be sited at IMD from all other PESs (to include from another barge anchorage or a barge pier). As a PES, site barge anchorages in accordance with Figure V4.E4.F2. See paragraph V4.E4.4.3. for criteria to apply to anchorages used for AE loading or unloading.

V4.E4.4.8. Separation of Pre-positioning Program Ships at Anchorages. The Military Sealift Command's Pre-positioning Program (i.e., Combat Pre-positioning Force, Maritime Pre-positioning Force, Logistics Pre-positioning Ships) operates both explosives-loaded and non-explosives carrying ships that are then deployed to key locations around the world. These ships are pre-loaded with military equipment and supplies necessary to support military forces on a short-notice basis and thus support a common mission. The following criteria apply to Pre-positioning Program ships at anchorage:

V4.E4.4.8.1. Separate non-explosives carrying ships from explosives-loaded ships by a minimum of K18 [K_m 7.14].

V4.E4.4.8.2. Separate non-explosives carrying ships from non-Pre-positioning Program explosives-loaded ships by K40 [K_m 15.87].

V4.E4.4.8.3. Separate non-explosives carrying ships not associated with the Pre-positioning Program from all explosives carrying ships by K40 [K_m 15.87].

V4.E4.4.8.4. Separate all non-explosives carrying ships from explosives ships being loaded or unloaded by K40 [K_m 15.87].

V4.E4.5. QD TABLES

V4.E4.5.1. Figure V4.E4.F2. illustrates required hazard factors. Table V3.E3.T8. provides the corresponding separation distances.

V4.E4.5.2. Table V3.E3.T1. separation distances must be maintained between explosives pier and wharf facilities and other ESs (e.g., administration and industrial areas, terminal boundaries, main ship channels, and PTRs).

V4.E4.5.3. As an ES, ships must be separated from AE operating and storage facilities (including holding yards) by the appropriate IBD column of Table V3.E3.T1.

V4.E4.5.4. As a PES, ships must be separated from AE operating facilities by either the barricaded IMD (K6 [K_m 2.38]) or unbarricaded IMD (K11 [K_m 4.36]), as applicable. An exception as described in paragraph V3.E3.1.1.2.1.10. is permitted when the ES is a container stuffing and unstuffing operation that routinely supports AE ship loading and unloading operations. QD requirements of paragraph V4.E4.5.3. apply from such container stuffing and unstuffing operations (as a PES) to an AE ship (as an ES).

V4.E4.6. GENERAL CARGO AND VEHICLES AT AE TERMINALS

V4.E4.6.1. Concurrent movements of mission-related general cargo, vehicles, and AE through a terminal may be conducted for the purpose of loading or unloading the same ship.

V4.E4.6.2. Concurrent operations involving other ships will be conducted at applicable QD separations. (See Figure V4.E4.F2.)

V4.E4.6.3. Separation of inert materials and equipment in holding areas must be consistent with section V4.E5.4.

V4.E4.6.3.1. Limit the number and time of exposure of personnel entering inert holding areas that are located within explosives safety QDs.

V4.E4.6.3.2. Any labor intensive activity must take place at IBD or PTRD, as applicable.

Figure V4.E4.F2. Application of Separation Distances for Ship or Barge

1 - K6 [K_m 2.38]
2 - K11 [K_m 4.36]
3 - K18 [K_m 7.14]
3A - K18 [K_m 7.14] (See paragraph V4.E4.4.8. for pre-positioning program ships.)
4 - K40W$^{1/3}$ [K_m 15.87]
5 - Table V3.E3.T1. IBD or PTRD (Other PES columns), as applicable.
6 - Table V3.E3.T1. IBD, as applicable.

Ship or Barge
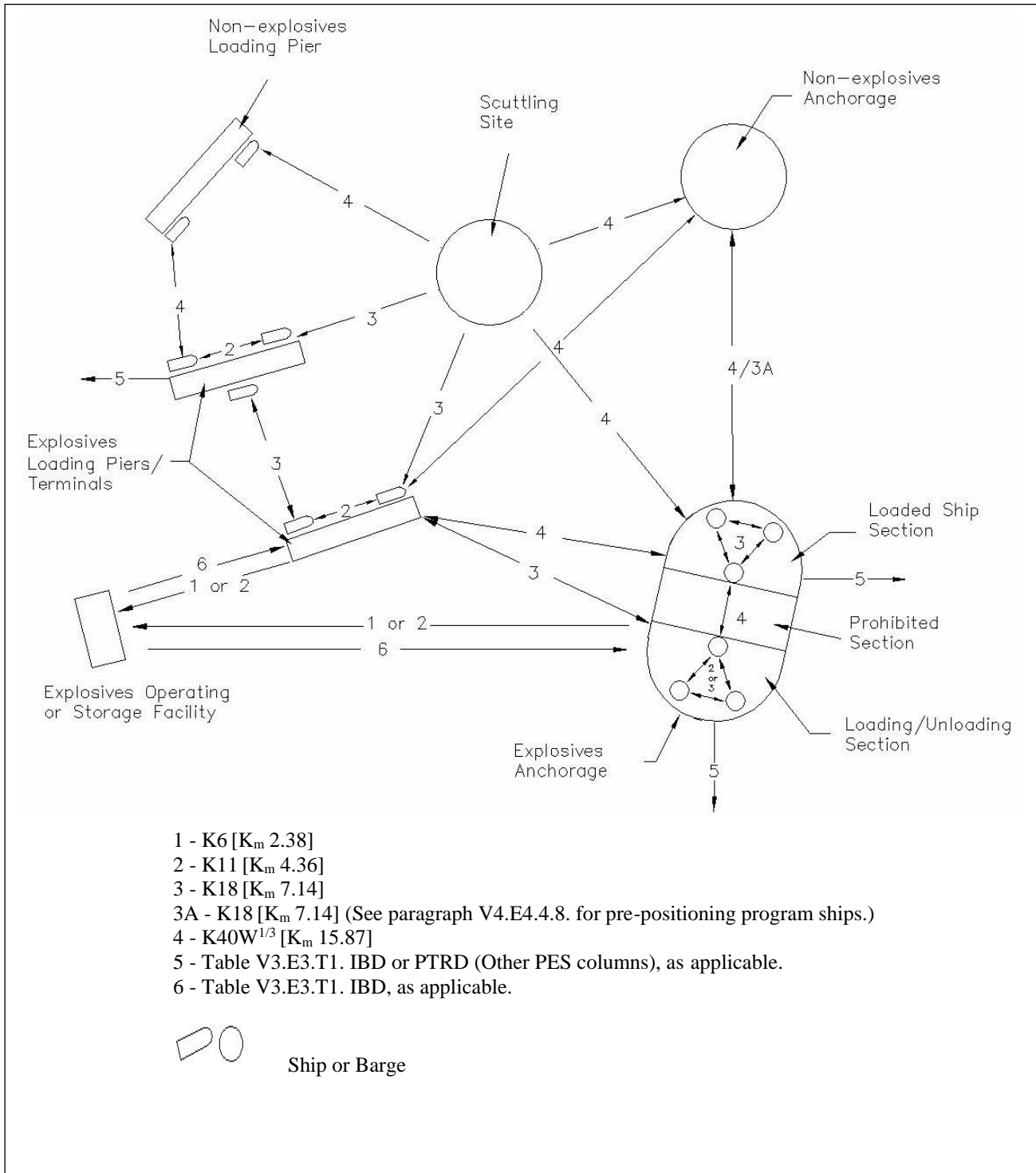
VOLUME 4 – ENCLOSURE 5: SPECIFIC FACILITIES

V4.E5.1. SCOPE AND APPLICATION. This enclosure establishes criteria for siting specific AE and non-AE facilities with respect to PESs.

V4.E5.2. ADMINISTRATION AND INDUSTRIAL AREAS AND AUXILIARY FACILITIES

V4.E5.2.1. Administration and industrial areas must be separated from a PES by IBD.

V4.E5.2.2. Auxiliary facilities (e.g., heating plants, line offices, break areas, briefing rooms for daily work schedules or site safety matters, joiner shops, security posts, and similar functions) located at or near AE operations and servicing only one building or operation may be located at fire protection distance (50 ft [15.2 m] for non-combustible structures, 100 ft [30.5 m] for combustible structures) from the building or operation they support.

V4.E5.2.3. Security response facilities that support response force personnel meeting DoD S-5210.41-M-V1 mission requirements, and are hardened against small arms fire, require no QD separation from the PESs they support.

V4.E5.2.4. Structures necessary for providing personnel or equipment weather protection (including provision of power for such equipment) located at a PES sited at IMD from other PESs (e.g., holding yards, detached loading docks, barge piers), and that support a single PES or operation, may be located at that PES without application of QD separation from any other PES. These structures must meet electrical and lightning protection standards of Enclosures 3 and 4 of Volume 2, as appropriate. These structures require explosives safety site plan approval.

V4.E5.3. CLASSIFICATION YARD

V4.E5.3.1. For protection of the classification yard from a PES, separation distances must be at least the applicable IMD.

V4.E5.3.2. Specific QD separation is not required from the classification yard to ESs when the classification yard is used exclusively for:

V4.E5.3.2.1. Receiving, dispatching, classifying, and switching of cars.

V4.E5.3.2.2. Interchanging trucks, trailers, or railcars between the common carrier and the DoD activity.

V4.E5.3.2.3. Conducting external inspection of motor vehicles or railcars, or opening of free-rolling doors of railcars to remove documents and make a visual inspection of the cargo.

V4.E5.3.3. Apply specific QD separation if the classification yard is used for any other purpose.

V4.E5.4. INERT STORAGE. Locations for inert storage will be determined only after consideration of personnel exposure, the importance of the materiel in relation to the explosives mission, the operational conditions, and the availability of space.

V4.E5.4.1. The DoD Components must determine acceptable locations for inert storage that is directly related to the explosives mission, and for inert storage that is not directly related but where control of and access to such inert storage is restricted only to personnel directly related to the explosives mission. The DoD Components must determine what constitutes "directly related." Site plans meeting these conditions are not required to be submitted to the DDESB for review and approval as addressed in paragraph V1.E5.3.8.

V4.E5.4.2. Inert storage that will be accessed by personnel not related to the explosives mission must be sited in accordance with paragraphs V3.E3.1.1.4.7. and V3.E3.1.1.6.9. (based on blast only). Minimum fragment distances do not apply as addressed in paragraph V3.E3.1.2.1.3.4.

V4.E5.5. INTERCHANGE YARDS

V4.E5.5.1. Truck, trailer, or railcar interchange yards are not subject to QD requirements, when used exclusively:

V4.E5.5.1.1. For the interchange of vehicles or railcars containing AE between the commercial carrier and DoD activities.

V4.E5.5.1.2. To conduct external inspection of the trucks, trailers, or railcars containing AE.

V4.E5.5.1.3. To conduct visual inspection of the external condition of the cargo in vehicles (e.g., trucks, trailers, and railcars) that passed the external inspection.

V4.E5.5.2. Truck, trailer, or railcar interchange used, at any time, for any purpose other than those listed in paragraphs V4.E5.5.1.1. through V4.E5.5.1.3. are subject to applicable QD tables (see paragraph V1.E7.4.3. for QD measurements for AE conveyances).

V4.E5.6. INTER-DoD COMPONENT SUPPORT AND TACTICAL FACILITIES

V4.E5.6.1. General

V4.E5.6.1.1. The separation distances in paragraph V4.E5.6.2. apply between facilities of one DoD Component to those of another DoD Component regardless of the location of the boundaries.

V4.E5.6.1.2. Other safety criteria (e.g., toxicity, noise, radiation, flight trajectory) may require greater distances. In these situations, the predominant hazard criteria apply.

V4.E5.6.2. Minimum QD Relationships. The following minimum QD relationships apply:

V4.E5.6.2.1. AE storage facilities must be separated by IMD.

V4.E5.6.2.2. AE storage or operating locations of one DoD Component must be separated from AE operating locations of another DoD Component by IBD. (See paragraph V4.E5.6.2.3. for an exception to this criterion.)

V4.E5.6.2.3. Explosive operations that present a similar degree of hazard or involve joint or support operations must be separated by ILD.

V4.E5.6.2.4. AE storage or operating locations of one DoD Component must be separated from AE tactical facilities of another DoD Component by IBD. For joint or support operations, determine the separation distance as though both facilities belonged to a single DoD Component.

V4.E5.7. DETACHED LOADING DOCKS. Detached loading docks that service multiple facilities must be sited based on use with regard to the facilities serviced. They must be sited as AGMs with regard to all other facilities.

V4.E5.7.1. When servicing magazines, such docks must be separated from magazines by IMD based only on the explosives limit of the loading dock.

V4.E5.7.2. When servicing operating buildings, such docks must be separated from the operating buildings by ILD based only on the explosives limit of the loading dock.

V4.E5.8. HOLDING YARDS FOR RAILCARS AND TRUCKS CONTAINING AE

V4.E5.8.1. Railcar groups containing AE must be separated from each other by AGM distance in a railcar-holding yard. For example:

V4.E5.8.1.1. If the railcar-holding yard is formed by two parallel ladder tracks connected by diagonal spurs, the parallel tracks and the diagonal spurs must be separated by AGM distance for the quantities of AE involved.

V4.E5.8.1.2. If the railcar-holding yard is a "Christmas tree" arrangement, consisting of a ladder track with diagonal dead-end spurs projecting from each side at alternate intervals, the spurs must be separated by AGM distance for the quantities of AE involved.

V4.E5.8.2. Truck groups containing AE in holding yards must be separated from each other by AGM distance.

V4.E5.8.3. Railcar- and truck-holding yards containing AE must be separated from other facilities by the applicable IBD, PTRD, ILD, or IMD.

V4.E5.8.4. In addition to the temporary parking of railcars, trucks, or trailers containing AE, holding yards may be used to interchange truck, trailers, or railcars between the commercial carrier and the DoD activity, and also to conduct visual inspections.

V4.E5.9. INSPECTION STATIONS FOR RAILCARS AND TRUCKS CONTAINING AE

V4.E5.9.1. Inspection stations for railcars and trucks containing AE that are used exclusively for the activities listed in paragraphs V4.E5.9.1.1. through V4.E5.9.1.3. are not subject to QD criteria. However, these stations should be located as far as practical from other hazards or populated areas. Allowable activities are:

V4.E5.9.1.1. External visual inspection of the railcars or motor vehicles.

V4.E5.9.1.2. Visual inspection of the external condition of the cargo packaging in vehicles that have passed the external inspection indicated in paragraph V4.E5.9.1.1.

V4.E5.9.1.3. Interchange of trucks, trailers, or railcars between the common carrier and the DoD activity.

V4.E5.9.2. Inspection stations used for any other purpose must comply with applicable QD criteria.

V4.E5.10. HOLDING AREAS FOR SUSPECT RAILCARS OR TRUCKS CONTAINING AE. Separate (isolate) railcars or trucks that are suspected of being in a hazardous condition from other PESs or ESs by the applicable QD before any other action.

V4.E5.11. AE TRANSPORTATION MODE CHANGE LOCATIONS. Movement and transfer of DoD-titled AE must comply with national, international, and host-country-specific transportation regulations. QD criteria apply to all transfer operations involving DoD-titled AE, except RO/RO operations that meet these requirements:

V4.E5.11.1. If a sited location is available, it must be used. If a sited location is not available, then the location selected must be as remote as practicable from populated areas to minimize exposure of unrelated personnel.

V4.E5.11.2. The total NEWQD present must not exceed 30,000 lbs.

V4.E5.11.3. All AE present (e.g., trailers, trucks, barges) must be associated only with the RO/RO operation being conducted.

V4.E5.11.4. AE should be located on-site for the minimum time necessary, but the operations must not exceed 24 hours following arrival of the AE.

V4.E5.12. SECURE HOLDING AREA. A secure holding area is an area designated for the temporary parking of commercial carriers' motor vehicles transporting DoD-owned arms, ammunition, and explosives; classified (SECRET or CONFIDENTIAL) materials; and controlled cryptographic items. Criteria for each of the two types of secure holding areas are in paragraphs V4.E5.12.1. and V4.E5.12.2. Although the intent of such areas is to provide a secure storage location for commercial carriers while in transit or during emergencies or other circumstances that are beyond a carrier's control, this manual imposes no requirement for installations to have secure holding areas (see DoDM 5100.76 for installation secure hold responsibilities). Secure holding areas are applicable to areas (continental United States, Hawaii, Alaska, and Puerto Rico) governed by Defense Transportation Regulation 4500.9-R-Part II.

V4.E5.12.1. Secure Explosives Holding Area. Site as a holding yard in accordance with section V4.E5.8.

V4.E5.12.2. Secure Non-explosives Holding Area. No siting is required if located outside all QD arcs. If located within a QD arc, site as an administrative parking lot in accordance with paragraph V3.E3.1.1.4.6. The holding of HD 1.4S materials, without regard to QD, is permitted at this location.

V4.E5.13. STORAGE TANKS FOR HAZARDOUS MATERIALS

V4.E5.13.1. Unprotected, aboveground bulk storage tanks must be separated from PESs by IBD in accordance with Table V3.E3.T1. A dike system satisfying NFPA 30 is required. Aboveground storage tanks that are provided protection against rupture or collapse from blast and fragment hazards may be sited at distances less than Table V3.E3.T1. when supported by testing or analysis.

V4.E5.13.2. For installation of smaller bulk storage tanks, weigh the cost of distance or protective construction against the strategic value of the stored material, the ease of replacement in the event of an accident, and the potential environmental impact. Reduced distances may be approved if:

V4.E5.13.2.1. The DoD Component accepts the losses.

V4.E5.13.2.2. The tanks are sited.

V4.E5.13.2.3. Other exposures are not endangered because spill containment is provided.

V4.E5.13.3. Unprotected service tanks solely supporting AE storage or operating complexes that are supplied by a pipe system designed to resist blast and fragments may be sited at IBD based on blast only with a minimum distance of 400 ft [121.9 m] if:

V4.E5.13.3.1. A dike system meeting the requirements of NFPA 30 is provided.

V4.E5.13.3.2. The DoD Component accepts the possible loss of the tanks and any collateral damage that a fire might cause as a result of the tanks being punctured by fragments.

V4.E5.13.4. No QD separation is required from any PES to a service tank (above or below ground) that supports a single PES or ES. Such tanks must comply with applicable fire protection distances.

V4.E5.13.5. Buried tanks (except service tanks in accordance with paragraph V4.E5.13.4.) and buried pipelines should be separated from all PESs containing HD 1.2, HD 1.3, HD 1.4, or HD 1.6 AE by at least 80 ft [24.4 m]. The required separation distance for HD 1.1 or HD 1.5 AE is K3 [K_m 1.19] with a minimum of 80 ft [24.4 m]. If the PES is designed to contain the effects of an explosion, then no QD is required.

V4.E5.13.6. Small quantities of petroleum, oils, and lubricants or other hazardous materials used for operational purposes require no specific separation distance for explosives safety; however, operating procedures must be implemented to limit adverse environmental impacts in the event of an accidental explosion.

V4.E5.13.7. For underground AE facilities, it is not practical to specify QD criteria that cover all tank storage configurations. The DoD Component must assess each configuration in accordance with Enclosure 5 of Volume 5 of this manual to ensure that protection equivalent to paragraphs V4.E5.13.1. through V4.E5.13.6. is provided.

V4.E5.14. STORAGE TANKS FOR WATER

V4.E5.14.1. Unprotected aboveground water storage tanks must meet the siting requirements of paragraph V4.E5.13.1. if loss of the tank is unacceptable to the DoD Component. Buried tanks and associated components of like value must meet the siting requirements of paragraph V4.E5.13.5. Aboveground storage tanks that are protected against rupture or collapse from blast and fragment hazards may be sited at distances less than Table V3.E3.T1. when supported by testing or analysis. No dike is required.

V4.E5.14.2. QD criteria do not apply to water storage tanks and associated components if loss is acceptable to the DoD Component.

V4.E5.15. UNDERGROUND TANKS OR PIPELINES FOR NON-HAZARDOUS MATERIALS. Apply the criteria of paragraph V4.E5.13.5.

V4.E5.16. TEMPORARY CONSTRUCTION OR MAINTENANCE OPERATIONS.
Construction and maintenance personnel who are temporarily near a PES to perform their job must be provided the maximum practicable protection from the effects of an explosion if one

occurs at a PES. The DoD Component must determine the minimum practicable separation distance from PESs for such personnel and control operations at the PES to minimize exposure of these personnel to hazards from an explosion. Documentation of the rationale for the control measures taken must be maintained until construction or maintenance operations are completed.

V4.E5.17. MILITARY WORKING DOG (MWD) EXPLOSIVES SEARCH TRAINING.
MWD training involves searches to detect explosives that have been hidden in various public places. These training operations typically include handling explosives, cutting or dividing explosive training aids, removing explosives from shipping and storage containers, and repackaging explosives into other containers. For these reasons, training operations must:

V4.E5.17.1. Be conducted by personnel meeting the DoD Component qualifications.

V4.E5.17.2. Be conducted in facilities that meet the requirements of this manual.

V4.E5.17.3. Store explosives in facilities that meet the requirements of this manual.

V4.E5.17.4. Provide non-essential personnel:

V4.E5.17.4.1. K40 [K_m 15.87] separation distance from the training site if an NEWQD of more than 15 lbs [6.8 kg] is being used for the exercise.

V4.E5.17.4.2. 100-ft [30.5-m] separation distance from the training site for an NEWQD equal to or less than 15 lbs [6.8 kg].

V4.E5.17.5. Minimize the number of samples and the quantity of explosives for each sample. The DoD Component must determine the total quantity of explosives permitted during an exercise considering:

V4.E5.17.5.1. The value and importance of the exposed facilities.

V4.E5.17.5.2. The exercise operating conditions.

V4.E5.17.5.3. The available separation distance for non-essential personnel.

V4.E5.17.6. Separate samples a sufficient distance apart to prevent an explosion from propagating from one sample to another.

V4.E5.17.7. Not use any initiating devices or initiating explosives.

V4.E5.17.8. Not place explosives near any heat or spark producing items (e.g., bare electrical wiring, radiators, electric heaters, heating vents).

V4.E5.17.9. Not place explosives in metal containers or other means of confinement that could produce fragments in the event of an accidental explosion.

V4.E5.18. DEMILITARIZATION PROCESSING EQUIPMENT AND OPERATIONS FOR EXPENDED .50-CALIBER AND SMALLER CARTRIDGE CASINGS

V4.E5.18.1. A demilitarization operation for processing expended .50-caliber and smaller cartridge cases can be treated as a non-explosive operation provided:

V4.E5.18.1.1. Cartridge casings to be processed are screened prior to processing. Screening is intended to ensure that only .50-caliber and smaller are processed, and to remove unused .50-caliber and smaller cartridges.

V4.E5.18.1.2. Demilitarization processing equipment is tested to be capable of containing overpressure, fragment, and thermal hazards associated with a worst-case reaction involving a single live round of the most energetic cartridge that could be processed in the equipment.

V4.E5.18.1.3. Demilitarization processing equipment is operated within the manufacturer's specifications and restricted only to the processing of expended .50-caliber and smaller cartridge casings.

V4.E5.18.1.4. Demilitarization processing equipment is inspected and maintained to ensure safe operation.

V4.E5.18.2. The DoD Components must:

V4.E5.18.2.1. Approve the use of specific demilitarization processing equipment.

V4.E5.18.2.2. Establish and implement procedures for:

V4.E5.18.2.2.1. Screening and segregating the material to be processed.

V4.E5.18.2.2.2. Operating, inspecting, and maintaining the demilitarization processing equipment to ensure safe operation.

V4.E5.18.2.2.3. Dispositioning of processed material.

V4.E5.18.3. Explosives safety siting requirements are:

V4.E5.18.3.1. Demilitarization processing operation locations meeting the requirements of paragraphs V4.E5.18.1. and V4.E5.18.2., and located outside of IBD from all PESs, do not require submission of a site plan to the DDESB as addressed in paragraph V1.E5.3.9.

V4.E5.18.3.2. Locations used for demilitarization processing operations that are located within IBD arcs:

V4.E5.18.3.2.1. Require submission of a site plan to the DDESB.

V4.E5.18.3.2.2. Must be sited at ILD, except from the PES to which it is integral.

V4.E5.19. CONVEYANCE LOADING AND UNLOADING AT A MAGAZINE. A conveyance (e.g., truck, trailer, railcar, ISO, or military van container) loading and unloading operation is permitted at a magazine without regard to QD between the magazine and the operation. "At a magazine" means loading and unloading operations at a loading dock attached to the magazine, or on the pad or apron in front of the magazine, or within the established boundaries of an AGM. Detached ramps or loading docks that normally service multiple facilities will be sited in accordance with section V4.E5.7.

V4.E5.20. REDUCED QD MAGAZINES. The criteria in this section address the use of DDESB-approved reduced QD magazines (e.g., GOLAN 5, 10, and 15, NABCO SV-23 and SV-50, EOD Magazine, Advanced EOD Magazine, and other similar magazines listed in Table AP1-4. of DDESB Technical Paper 15 for AE storage.

V4.E5.20.1. Siting of Reduced QD Magazines

V4.E5.20.1.1. Reduced QD magazines must be sited as AGMs, using the reduced QD distances established as part of the DDESB approval package for each type of magazine.

V4.E5.20.1.2. A DDESB-approved site plan is required before the use of a reduced QD magazine for AE storage. However, when circumstances dictate, use of a magazine may proceed before DDESB approval provided the Service-level explosives safety office (i.e., U.S. Army Technical Center for Explosives Safety; Naval Ordnance Safety and Security Activity; Marine Corps Systems Command, PM, Ammunition; or Air Force Safety Center) has reviewed and approved the submission, the submission is at the DDESB for review and approval, and the DoD Component accepts that the DDESB approval process may impose different or additional requirements.

V4.E5.20.1.3. Siting of reduced QD magazines must comply with specific provisions for their use (e.g., venting, grounding) identified as part of the DDESB approval package for each type of magazine.

V4.E5.20.1.4. The QD distances approved by the DDESB for reduced QD magazines do not account for the hazards presented to surrounding exposures when the magazine door is open or when authorized AE operations are conducted at the magazine. The following criteria are intended to minimize these hazards:

V4.E5.20.1.4.1. The reduced QD magazine should be located and oriented to maximize protection of surrounding exposures. The selection of a location for the reduced QD magazine must not be simply for convenience, but must consider the direction of the door, planned operations, and the need to minimize exposure of personnel and facilities.

V4.E5.20.1.4.2. The reduced QD magazine door should be directed away from occupied spaces and facilities, or at a minimum directed away from the highest exposures.

V4.E5.20.1.4.3. For a reduced QD magazine authorized to contain up to 30 lbs [13.60 kg] NEWQD of HD 1.1, a minimum 50-ft [15.24-m] separation distance should be

maintained from the door of the magazine, and from any authorized AE operation at the magazine, to the nearest occupied space or facility. For a reduced QD magazine authorized to contain 30 to 50 lbs [13.60 to 22.68 kg] NEWQD of HD 1.1, a minimum 100-ft [30.50-m] separation distance should be maintained from the door of the magazine, and from any authorized AE operation at the magazine, to the nearest occupied space or facility. At these separation distances, only minor damage to exposed facilities is expected as a result of blast overpressure; however, windows are likely to break and may present some risk to personnel in exposed facilities. Fragmentation hazards are not addressed by these separation distances. Barricades (see paragraph V4.E5.20.2.2.6.) may be used to stop low-angle, high-velocity fragments, which present the greatest threat to surrounding exposures.

V4.E5.20.2. **Authorized Operations at Reduced QD Magazines**. Significant personnel exposure and risk reductions are obtained by the use of reduced QD magazines for AE storage, even when short-duration explosives operations are conducted at such magazines. Therefore, certain AE operations are authorized at a reduced QD magazine, without regard to QD. AE operations not authorized in paragraphs V4.E5.20.2.1.1. through V4.E5.20.2.1.9. require siting as an operating location.

V4.E5.20.2.1. The following AE operations may be conducted at reduced QD magazines, without regard to QD, provided the requirements of paragraph V4.E5.20.2.2. are met (the criteria and guidance in paragraphs V4.E5.20.2.1.1. through V4.E5.20.2.1.9. and paragraph V4.E5.20.2.2. modify the criteria and guidance for AE operations identified as part of the DDESB approval package for each type of magazine):

V4.E5.20.2.1.1. The movement of packaged AE into and out of reduced QD magazines.

V4.E5.20.2.1.2. The removal of internal packaged AE items from outer packaging (e.g., removal of individually packaged dog scent kit samples from their larger shipping container).

V4.E5.20.2.1.3. The rotation and replacement of dynamite samples in dog scent kits, as required to meet DoD criteria.

V4.E5.20.2.1.4. The issuance of security or reaction force AE for installation force protection, antiterrorism, or other similar mission.

V4.E5.20.2.1.5. The removal and replacement of EOD materials contained in the large pumice containers in the advanced EOD magazine (because the pumice containers are too large to transport in and out of the magazine).

V4.E5.20.2.1.6. The conduct of surveillance or inventory inspections that only involve a visual serviceability inspection of AE.

V4.E5.20.2.1.7. The placement of munitions and explosives of concern (MEC) that EOD personnel or unexploded ordnance (UXO)-qualified personnel have assessed and

determined acceptable for movement and storage in an appropriate reduced QD magazine located at a munitions response site (MRS).

V4.E5.20.2.1.8. The conduct of other similar AE operations provided:

V4.E5.20.2.1.8.1. No direct energy is applied to the AE being handled (e.g., cutting, dividing, or crushing), except as allowed in paragraph V4.E5.20.2.1.9.

V4.E5.20.2.1.8.2. The AE being handled have not been sensitized or made more sensitive to initiation (e.g., primed).

V4.E5.20.2.1.8.3. The AE being handled are not in a configuration that makes them more susceptible to an unintentional detonation.

V4.E5.20.2.1.9. The cutting of non-fragmenting AE (e.g., detonation cord, C4) designed to be cut using authorized cutting tools, provided all non-essential personnel are removed to a K40 [K_m 15.87] separation distance with a 100-ft [30.5-m] minimum.

V4.E5.20.2.2. The following requirements apply to authorized AE operations at reduced QD magazines:

V4.E5.20.2.2.1. The total NEWQD present (i.e., within the magazine and involved in the operation) must not exceed the rated NEWQD of the reduced QD magazine.

V4.E5.20.2.2.2. To minimize the size and effects of an unintentional detonation, operations conducted at reduced QD magazines must be limited to the smallest MCE possible.

V4.E5.20.2.2.3. AE operations should not be conducted inside reduced QD magazines unless necessary (as in the case of the advanced EOD magazine). Conducting AE operations inside a magazine increases the MCE and the directional effects of an internal explosion out the door.

V4.E5.20.2.2.4. AE operations at reduced QD magazines should be conducted at times when the exposure of unrelated personnel is at a minimum (i.e., at night, before or after work shifts, on weekends).

V4.E5.20.2.2.5. To take advantage of the barricade-type protection offered by the reduced QD magazine structure, conduct AE operations outside of reduced QD magazines:

V4.E5.20.2.2.5.1. As close to the base of the magazine as possible, with the magazine door closed and secured (not required if the magazine does not contain AE).

V4.E5.20.2.2.5.2. On the side of the magazine that is oriented away from the surrounding area having the greatest exposure to be protected.

V4.E5.20.2.2.6. Consider constructing a barricade (to defeat high-velocity, low-angle fragments) for AE operations at reduced QD magazines. Acceptable barricading materials include sandbags and timber sand-filled walls; the barricade must not generate additional debris hazards. The barricade must be at least 6 ft [1.83 m] high, provide line-of-sight protection between AE operations and exposures to be protected, and be the equivalent of two side-by-side sandbags.

V4.E5.21. CRITERIA FOR NON-DoD EXPLOSIVES ACTIVITIES (AE OPERATIONS AND STORAGE) ON DoD INSTALLATIONS

V4.E5.21.1. Non-DoD explosives activities must only be conducted on DoD installations in accordance with Table V4.E5.T10. These non-DoD explosives activities must also comply with Bureau of Alcohol, Tobacco, Firearms and Explosives, FAA, and other federal, State, and local regulations. Definitions for the terminology used in Table V4.E5.T10. are in the Glossary.

V4.E5.21.2. For these types of non-DoD explosives activities, the DoD is responsible for ensuring that IMD requirements only, as outlined in explosives site plan submissions, are met. DoD oversight of these non-DoD explosives activities is not intended.

V4.E5.21.3. Non-DoD explosives activities are evaluated based on IMD between multiple PESs to ensure non-propagation. Where IMD is not met, then the NEW at each site not meeting IMD separation requirements is added together to determine the basis for the applicable IMD or IBD to use for separation of DoD sites.

Table V4.E5.T10. Criteria for Non-DoD Explosives Activities on DoD Installations

From ➔ To ⬇	Non-DoD Storage	Non-DoD Operations	Shared Launch Facilities	DoD/Joint Storage	DoD Operations
Non-DoD Storage	Check for IMD	Check for IMD	IBD	IMD	IBD
DoD/Joint Storage	IMD	IBD	IBD	IMD	ILD
Non-DoD Operations	Check for IMD	Check for IMD	IBD	IBD	IBD
DoD Operations	IBD	IBD	IBD	ILD	ILD
Shared Launch Facilities	IBD	IBD	ILD	IBD	IBD
DoD Non-Explosives Facilities/Operations Non-Related	IBD	IBD	IBD	IBD	IBD

V4.E5.21.4. In Table V4.E5.T10., "Check for IMD" means that, if IMD is not maintained between each PES, explosives quantities are totaled.

V4.E5.21.5. IBD is determined based on the standards in this manual.

V4.E5.21.6. The DoD site approval for non-DoD explosives activities is limited to the area encumbered by the IBD arcs.

V4.E5.21.7. Review of building design, lightning protection, etc., is not necessary unless design features are used as justification to reduce the IBD arc.

V4.E5.22. RENEWABLE ENERGY PROJECTS

V4.E5.22.1. Equipment, such as wind turbines and solar panel farms, installed to generate renewable energy must be no closer to PESs than PTRD and:

V4.E5.22.1.1. Such equipment must have a full EMR assessment and a comprehensive determination of the EMR environment it generates to allow the DoD Component to fully assess if these sources cause a potential hazard to AE operations. The EMR assessment must be conducted in actual field conditions to allow the DoD to determine if there are potential EMR hazards to DoD facilities and operations introduced by the presence of renewable energy equipment.

V4.E5.22.1.2. Associated power lines must also meet the requirements of section V2.E3.5.

V4.E5.22.1.3. Explosives safety site plans for this equipment must identify the energy customer and the equipment owner (e.g., DoD Component, commercial power company), and include the equipment owner's acknowledgement of the risk for potential damage to the equipment and power disruption in the event of an explosives accident. Associated inhabited structures are sited at IBD.

V4.E5.22.2. The requirements in paragraph V4.E5.22.1. do not preclude the use of individual solar generated power units for lighting, security systems, and building energy reduction systems within explosives storage or operating areas, provided the requirements of Enclosures 3 and 4 of Volume 2 are met as appropriate and the DoD Component approves the installation of the unit.

V4.E5.23. MOBILE MISSILE SYSTEMS USED IN A STATIC, DEFENSIVE ROLE.
Mobile missile systems (e.g., PATRIOT, THAAD, NASAMS) may be deployed in a static (non-mobile) role for the protection of friendly forces and selected geopolitical assets (e.g., main operating base, airfield, city) from aerial and missile attack.

V4.E5.23.1. Mobile missile systems in a static role (MMS(SR)) can generate potential hazards to surrounding AE, operations, personnel, and facilities from:

V4.E5.23.1.1. The explosion effects produced by an accidental explosion involving the AE associated with missile systems.

V4.E5.23.1.2. EMR being emitted by the system (see paragraph V2.E3.7.2. for hazards of EMR to ordnance).

V4.E5.23.1.3. Backblast generated during a launch of a missile, which may place nearby facilities at risk of collapse or damage from backblast pressures; windows may break and generate hazardous glass fragments; personnel within backblast distance may be severely injured.

V4.E5.23.2. The following explosives safety requirements apply to MMS(SR). They are not applicable to the use of static missile systems on an approved range operating under the control and regulations of a DoD Component and where all accidental explosion effects are contained within the established range surface danger zones associated with the range. Criteria for deployed or contingency situations can be found in Enclosure 3 of Volume 6 of this manual.

V4.E5.23.2.1. MMS(SR) are deployed in accordance with their specific, established implementation documentation (e.g., field manual, pamphlet, SOPs) to include establishing prescribed exclusionary RF hazard and backblast zones, as applicable.

V4.E5.23.2.2. Individual launcher stations and any re-loads should be separated from each other by IMD to minimize QD requirements, but if they are not, then NEWQD for all launcher stations and re-loads are summed and used as the basis for determining required QD.

V4.E5.23.2.3. IMD must be provided between MMS(SR)-related AE and surrounding AE storage.

V4.E5.23.2.4. ILD must be provided between MMS(SR) and surrounding AE-related manned operations.

V4.E5.23.2.5. IBD or PTRD must be provided, as appropriate, to personnel not associated with AE operations.

V4.E5.24. BLAHAs AND AHAs. To fulfill their missions, certain units must keep their basic load ammunition in armored vehicles, trucks, trailers, and structures or on pads. This involves an acceptance of greater risks to unit personnel, facilities, and equipment than permitted by other parts of this volume. The following apply to BLAHAs and AHAs:

V4.E5.24.1. Storage Compatibility. Storage compatibility requirements of section V1.E6.4. do not apply.

V4.E5.24.2. NEWQD Computations. NEWQD computations must be in accordance with paragraph V1.E7.2.3.

V4.E5.24.3. Explosives Limits

V4.E5.24.3.1. The maximum NEWQD at any BLAHA or AHA cell storing mixed compatibility must not exceed 8,818 lbs [4,000 kg]. A BLAHA or AHA may have multiple 8,818-lb [4,000-kg] cells, provided the cells are separated from each other by the applicable distances (D1, D2, and D3) given in Table V4.E5.T11.

V4.E5.24.3.2. When the NEWQD of a BLAHA or AHA cell exceeds 8,818 lbs [4,000 kg], the QD computations for the site must be in accordance with Volume 3 of this manual, the HD mixing rules must be in accordance with Enclosure 7 of Volume 1, and the explosives compatibility storage criteria must be in accordance with Enclosure 6 of Volume 1.

V4.E5.24.4. QD Computations

V4.E5.24.4.1. The total NEWQD of AE in each cell is used for computation of QD provided the required distances of Table V4.E5.T11. are met, to prevent prompt propagation between cells. If the 8,818 lbs [4,000 kg] NEWQD limit or required separation distances are not met, then the entire BLAHA/AHA is considered one site and paragraph V4.E5.24.3.2. applies.

V4.E5.24.4.2. Table V4.E5.T11. provides the QD requirements for BLAHAs and AHAs.

Table V4.E5.T11. QD Requirements for Armored and Non-armored Vehicles

From ➡ To ⬇	Heavy Armored	Light Armored	Non-Armored
Heavy Armored (IMD Exposure)	IMD Not Required	IMD Not Required	IMD Not Required
Light Armored (IMD Exposure)	IMD Not Required	D1 from Table V4.E5.T12.	D1 from Table V4.E5.T12.
Non-Armored (IMD Exposure)	IMD Not Required	D3 from Table V4.E5.T12.[a]	D3 from Table V4.E5.T12.[a]
PTRD Exposure	D6 from Table V4.E5.T12.	D4 from Table V4.E5.T12.	D4 from Table V4.E5.T12.
IBD Exposure	D6 from Table V4.E5.T12.	D5 from Table V4.E5.T12.	D5 from Table V4.E5.T12.
a	D1 distance can be applied if a barricade is provided between PES and ES. Refer to Table V4.E5.T12. footnotes regarding the need for a barricade.		

V4.E5.24.4.3. Use Table V4.E5.T12. to determine the applicable QD for heavy, light, and non-armored vehicles, as described in paragraph V4.E5.24.5. Intraline requirements are given in Footnote a of Table V4.E5.T12.

V4.E5.24.5. AE Loaded Vehicles. For the purposes of BLAHA criteria, combat vehicles are treated as heavy armored, light armored, or non-armored.

V4.E5.24.5.1. Heavy Armored Vehicles (e.g., M1 Abrams Tank).

V4.E5.24.5.1.1. A heavy armored vehicle is expected to contain the fragments from an internal explosion involving the munitions stored within it, so QD is based on blast impulse only. It is also considered well protected against the explosion effects from an external explosion.

V4.E5.24.5.1.2. For the reasons above, a heavy armored vehicle has no IMD and requires no separation from other heavy, light armored, or non-armored vehicles. However, the hatches of a heavy armored vehicle are required to be closed, otherwise the vehicle must be treated as light armored.

V4.E5.24.5.1.3. All munitions must be contained within the on-board storage compartments, otherwise the heavy armored vehicle must be treated as non-armored as a PES.

Table V4.E5.T12. QD for BLAHAs and AHAs[a]

NEWQD	D1[b]	D2[c]	D3[d]	D4[e]	D5[f]	D6[g]
(lbs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
[kg]	[m]	[m]	[m]	[m]	[m]	[m]
10	4	13	26	284	474	66
4.5	1.3	3.9	7.9	86.6	144.4	20
15	5	15	30	303	506	66
6.8	1.5	4.5	9	92.5	154.2	20
20	5	16	33	317	529	66
9.1	1.6	5	9.9	96.7	161.1	20
30	6	19	37	336	561	66
13.6	1.9	5.7	11.4	102.5	170.9	20
50	7	22	44	361	601	66
22.7	2.2	6.7	13.5	109.9	183.2	20
70	8	25	49	377	628	66
31.8	2.5	7.5	15.1	114.8	191.3	20
100	9	28	56	395	658	66
45.4	2.8	8.5	17	120.2	200.4	20
110	10	28	57	417	695	66
49.9	2.9	8.8	17.5	127	211.7	20
150	11	32	64	489	815	81
68	3.2	9.7	19.4	149.1	248.5	24.6
180	11	34	68	532	886	92
81.6	3.4	10.3	20.6	162	270	27.9

REFERENCES

Table V4.E5.T12. QD for BLAHAs and AHAs,[a] Continued

NEWQD	D1[b]	D2[c]	D3[d]	D4[e]	D5[f]	D6[g]
(lbs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
[kg]	[m]	[m]	[m]	[m]	[m]	[m]
200	12	35	70	532	886	98
90.7	3.5	10.7	21.4	162	270	30
300	13	40	80	532	886	130
136.1	4.1	12.2	24.5	162	270	39.6
331	14	41	83	532	886	139
150	4.2	12.6	25.3	162	270	42.3
500	16	48	95	532	886	
226.8	4.8	14.5	29	162	270	
700	18	53	107	532	886	
317.5	5.4	16.2	32.5	162	270	
1,000	20	60	120	532	886	
453.6	6.1	18.3	36.6	162	270	
1,500	23	69	137	532	886	
680.4	6.9	20.9	41.9	162	270	
2,000	25	76	151	532	886	
907.2	7.6	23	46.1	162	270	
3,000	29	87	173	532	886	
1,360.80	8.8	26.4	52.7	162	270	
5,000	34	103	205	532	886	
2,268.00	10.4	31.3	62.5	162	270	
5,500.00	35	106	212	532	886	
2,494.80	10.7	32.3	64.5	162	270	
7,000	38	115	229	612	1,021	
3,175.20	11.6	35	69.9	183.6	306	
8,818	41	124	248	687	1146	
4,000	12.5	37.6	75.5	206.1	343.4	

a   BLAHA and AHA ILD for other than heavy armored vehicles is determined in accordance with paragraph V3.E3.1.4. For heavy armored vehicles, ILD is the lesser of the computed value using K18 [K_m 7.14] or the D6 column in this table.

b	D1 is used for:
	    1. Non-armored vehicle (PES) to non-armored vehicle (ES), when an adequate barricade in accordance with section V2.E5.4. is located between them.
	    2. Light armored vehicle (PES) to non-armored vehicle (ES), when an adequate barricade in accordance with section V2.E5.4. is located between them.
	    3. Light armored or non-armored vehicle (PES) to light armored vehicle (ES), no barricade required.
	    4. Determining D1 and NEWQD for D1:
	<u>English EQNs (NEWQD in lbs, D1 in ft)</u>
	
	$D1 = 2*NEWQD^{1/3}$ EQN V4.E5.T12-1
	
	$NEWQD = (D1/2)^3$ with a maximum of 8,818 lbs EQN V4.E5.T12-2
	
	Metric EQNs (NEWQD in kg, D1 in m)
	$D1 = 0.79*NEWQD^{1/3}$ *EQN V4.E5.T12-3*
	$NEWQD = (D1/0.79)^3$ with a maximum of 4,000 kg *EQN V4.E5.T12-4*

c	D2 is used for:
	    1. Non-armored or light armored vehicles to the side or rear of an undefined ECM.
	    2. Determining D2 and NEWQD for D2:
	<u>English EQNs (NEWQD in lbs, D2 in ft)</u>
	
	$D2 = 6*NEWQD^{1/3}$ EQN V4.E5.T12-5
	
	$NEWQD = (D2/6)^3$ with a maximum of 8,818 lbs EQN V4.E5.T12-6
	
	Metric EQNs (NEWQD in kg, D2 in m)
	$D2 = 2.38*NEWQD^{1/3}$ *EQN V4.E5.T12-7*
	$NEWQD = (D2/2.38)^3$ with a maximum of 4,000 kg *EQN V4.E5.T12-8*

d	D3 is used for:
	    1. Non-armored vehicles to non-armored vehicles without an adequate barricade.
	    2. Light armored vehicles to non-armored vehicles without an adequate barricade at the non-armored vehicles.
	    3. Non-armored vehicles, light armored vehicles, to the front of undefined ECM when no barricade is present at the ES.
	    4. Determining D3 and NEWQD for D3:
	<u>English EQNs (NEWQD in lbs, D3 in ft)</u>
	
	$D3 = 12*NEWQD^{1/3}$ EQN V4.E5.T12-9
	
	$NEWQD = (D3/12)^3$ with a maximum of 8,818 lbs EQN V4.E5.T12-10
	
	Metric EQNs (NEWQD in kg, D3 in m)
	$D3 = 4.76*NEWQD^{1/3}$ *EQN V4.E5.T12-11*
	$NEWQD = (D3/4.76)^3$ with a maximum of 4,000 kg *EQN V4.E5.T12-12*

e	D4 is used for:
	    1. PTRD for a BLAHA or AHA PES that cannot stop primary fragments but will generate debris (e.g., open or light weight structure, ISO container, non-armored or light armor vehicle).
	    2. D4 = 60%*D5

f	D5 is used for:
	1. IBD for a BLAHA or AHA PES that cannot stop primary fragments but will generate debris (e.g., open or light weight structure, ISO container, non-armored or light armor vehicle).
	2. Determining D5 and NEWQD for D5:

English EQNs (NEWQD in lbs, D5 in ft)

NEWQD $\leq$ 180 lbs	Use equations from Footnote c, Table V3.E3.T2.	
180 lbs < NEWQD $\leq$ 5,500 lbs:	D5 = 886 ft	
5,500 lbs < NEWQD $\leq$ 8,818 lbs:	D5 = 12.2*NEWQD$^{1/2}$	EQN V4.E5.T12-13
D5 < 886 ft:	Use equations from Footnote d, Table V3.E3.T2.	
886 ft $\leq$ D5 $\leq$ 1,146 ft:	NEWQD = (D5/12.2)^2 with a maximum of 8,818 lbs	EQN V4.E5.T12-14

Metric EQNs (NEWQD in kg, D5 in m)

NEWQD $\leq$ 81.65 kg	*Use equations from Footnote c, Table V3.E3.T2.*	
81.65 kg $\leq$ NEWQD $\leq$ 2,495 kg:	*D5 = 270 m*	
2,495 kg < NEWQD $\leq$ 4,000 kg:	*D5 = 5.43*NEWQD$^{1/2}$*	*EQN V4.E5.T12-15*
D5 < 270 m:	*Use equations from Footnote d, Table V3.E3.T2.*	
270 m $\leq$ D5 $\leq$ 343.4 m:	*NEWQD = (D5/5.43)^2 with a maximum of 4,000 kg*	*EQN V4.E5.T12-16*

g	D6 is used for:
	1. Determining the IBD and PTRD from heavy armored vehicles. When NEWQD exceeds 331 lbs [150 kg] the IBD and PTRD specified in Volume 3 of this manual apply.
	2. Determining D6 and NEWQD for D6:

English EQNs (NEWQD in lbs, D6 in ft)

NEWQD $\leq$ 110 lbs:	D6 = 66 ft	
110 lbs < NEWQD $\leq$ 331 lbs:	D6 = -4.49 + 0.487*(NEWQD$^{1/3}$) + 2.928*(NEWQD$^{1/3}$)	EQN V4.E5.T12-17
D6 < 66 ft:	NEWQD = 0 lbs	
66 ft $\leq$ D6 $\leq$ 138 ft:	NEWQD = (0.0833 + [1.5421 + 0.3416*D6]$^{1/2}$)^3	EQN V4.E5.T12-18

Metric EQNs (NEWQD in kg, D6 in m)

NEWQD < 50 kg:	*D6 = 20 m*	
50 kg $\leq$ NEWQD $\leq$ 150 kg:	*D6 = -1.37 + 0.193*(NEWQD$^{1/3}$) + 1.512*(NEWQD$^{1/3}$)*	*EQN V4.E5.T12-19*
D4 < 20 m:	*NEWQD = 0 kg*	
20 m $\leq$ NEWQD $\leq$ 42.3 m:	*NEWDQ = (0.0640 + [0.9108 + 0.6615*D6]$^{1/2}$)^3*	*EQN V4.E5.T12-20*

V4.E5.24.5.2. Light Armored Vehicles (e.g., M109 Howitzer, FAASV, M113 Mortar Tracks, M2/M3 Bradley Fighting Vehicle, MRAP)

V4.E5.24.5.2.1. A light armored vehicle is not expected to contain the explosion effects from an internal explosion involving the munitions stored within it, and the munitions and vehicle will generate fragments. It is expected that the vehicle's structure or armor will either stop primary fragments or significantly reduce fragment velocities from an external munitions explosion. Consequently, QD for a light armored vehicle is based on blast, fragments, and vehicle debris.

V4.E5.24.5.2.2. A light armored vehicle does provide protection from an external blast and fragments and debris.

V4.E5.24.5.2.3. A light armored vehicle is treated as a barricaded ES and as an unbarricaded PES.

V4.E5.24.5.2.4. The hatches and ramps are required to be closed, otherwise the vehicle must be treated as non-armored.

V4.E5.24.5.2.5. All munitions must be contained within the light armored vehicle (e.g., no external carry munitions) for it to be considered as a barricaded ES, otherwise the vehicle must be treated as non-armored.

V4.E5.24.5.3. Non-armored Vehicles (e.g., HUMVEE, Trailer). Non-armored vehicles provide no protection from an internal or external explosion.

V4.E5.25. PARKING LOTS. Parking lots for privately owned vehicles (POVs) belonging to personnel employed or stationed at PESs. A minimum distance of 100 ft [30.5 m] is required from PESs to protect PESs from vehicle fires. The minimum 100 ft [30.5 m] separation may be reduced to 50 ft [15.2 m] provided the PESs are of non-combustible construction, and sufficient measures are in place between POV parking spaces and PESs to prevent a parked vehicle from rolling to within 50 ft [15.2 m] of PESs (e.g., sloping grade, curbs, vehicle barriers, drainage features). Access for emergency vehicles must be provided. The provisions of this paragraph do not negate the need to comply with applicable security requirements for POV access to or parking in explosives areas. (See DoDM 5100.76 for applicable security requirements.)