TABLE C9.T34. Scaled IBD for Airblast without Mitigating Devices[1,2]

NEWQD (lbs) *[kg]*	$R(\theta)/(D_{HYD}/V_E^{1/2.8})$ Horizontal Angle from Centerline Axis (Degrees)					
	0	30	60	90	120	180
1,000	1,545	1,290	895	621	452	273
453.6	*432.8*	*361.4*	*250.7*	*173.9*	*126.6*	*76.4*
1,500	1,786	1,491	1,034	718	522	315
680.4	*500.2*	*417.7*	*289.7*	*201.0*	*146.3*	*88.3*
2,000	1,979	1,653	1,146	795	579	349
907.2	*554.3*	*462.9*	*321.1*	*222.8*	*162.1*	*97.9*
3,000	2,287	1,910	1,325	919	669	404
1,361	*640.7*	*535.0*	*371.1*	*257.5*	*187.4*	*113.1*
5,000	2,745	2,292	1,590	1,103	803	485
2,268	*768.9*	*642.1*	*445.4*	*309.0*	*224.9*	*135.8*
7,000	3,096	2,585	1,793	1,244	905	547
3,175	*867.1*	*724.1*	*502.2*	*348.5*	*253.6*	*153.1*
10,000	3,516	2,936	2,037	1,413	1,028	621
4,536	*984.9*	*822.5*	*570.5*	*395.8*	*288.0*	*173.9*
15,000	4,064	3,394	2,354	1,633	1,188	718
6,804	*1,138.4*	*950.6*	*659.4*	*457.5*	*332.9*	*201.0*
20,000	4,504	3,761	2,609	1,810	1,317	795
9,072	*1,261.5*	*1,053.5*	*730.7*	*507.0*	*368.9*	*222.8*
30,000	5,206	4,347	3,015	2,092	1,522	919
13,608	*1,458.1*	*1,217.6*	*844.6*	*586.0*	*426.4*	*257.5*
50,000	6,247	5,217	3,619	2,511	1,827	1,103
22,680	*1,749.9*	*1,461.3*	*1,013.6*	*703.3*	*511.7*	*309.0*
70,000	7,045	5,883	4,081	2,831	2,060	1,244
31,751	*1,973.4*	*1,647.9*	*1,143.0*	*793.1*	*577.1*	*348.5*
100,000	8,002	6,683	4,635	3,216	2,340	1,413
45,359	*2,241.5*	*1,871.8*	*1,298.3*	*900.8*	*655.5*	*395.8*
150,000	9,249	7,724	5,357	3,717	2,705	1,633
68,039	*2,837.8*	*2,369.8*	*1,643.7*	*1,140.5*	*829.9*	*501.1*
200,000	11,977	10,002	6,937	4,813	3,502	2,115
90,718	*3,354.9*	*2,801.6*	*1,943.2*	*1,348.3*	*981.1*	*592.4*
300,000	14,550	12,150	8,427	5,848	4,255	2,569
136,077	*4,071.9*	*3,400.4*	*2,358.5*	*1,636.5*	*1,190.8*	*719.0*
500,000	17,462	14,582	10,114	7,018	5,106	3,083
226,795	*4,886.9*	*4,081.0*	*2,830.5*	*1,964.0*	*1,429.1*	*862.9*
700,000	19,691	16,444	11,406	7,914	5,759	3,477
317,513	*5,510.9*	*4,602.1*	*3,192.0*	*2,214.8*	*1,611.6*	*973.1*
1,000,000	22,367	18,678	12,955	8,989	6,541	3,949
453,590	*6,259.5*	*5,227.3*	*3,625.6*	*2,515.7*	*1,830.5*	*1,105.3*

Notes for Table C9.T34

1. IBD for airblast without airblast mitigating devices:

$$R(\theta)/(D_{HYD}/V_E^{1/1.4}) = 149.3*\{W^{0.5}/[p_{SO}(1+(\theta/56)^2)]\}^{1/1.4} \quad \textbf{[EQN C9.T34-1]}$$

where: $p_{SO} = 1.2$ psi $\quad W \leq 100{,}000$ lbs

$p_{SO} = 44.57* W^{-0.314}$ psi $\quad 100{,}000 < W \leq 250{,}000$ lbs **[EQN C9.T34-2]**

$p_{SO} = 0.9$ psi $\quad W > 250{,}000$ lbs

$$R(\theta)/(D_{HYD}/V_E^{1/1.4}) = 149.3*\{W^{0.5}/[p_{SO}(1+(\theta/56)^2)]\}^{1/1.4} \quad \textbf{[EQN C9.T34-3]}$$

where: $p_{SO} = 8.27\ kPa \quad W \leq 43{,}590\ kg$

$p_{SO} = 239.759* W^{-0.314}\ kPa \quad 43{,}590 < W \leq 113{,}397.5\ kg$ **[EQN C9.T34-4]**

$p_{SO} = 6.21\ kPa \quad W > 113{,}397.5\ kg$

2. For IBD reductions with mitigating devices, see C5.2.3.3.

C9.8. FACILITIES SITING CRITERIA

This section establishes criteria for siting AE and non-AE facilities with respect to PES.

C9.8.1. Administration and Industrial Areas and Auxiliary Facilities.

C9.8.1.1. Administration and industrial areas shall be separated from a PES by IBD.

C9.8.1.2. 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.

C9.8.2. Classification Yard.

C9.8.2.1. For protection of the classification yard from a PES, separation distances shall be at least the applicable IMD.

C9.8.2.2. Specific QD separation is not required from the classification yard to ES when the classification yard is used exclusively for:

C9.8.2.2.1. Receiving, dispatching, classifying, and switching of cars.

C9.8.2.2.2. Interchanging of trucks, trailers, or railcars between the common carrier and the DoD activity.

C9.8.2.2.3. Conducting external inspection of motor vehicles or railcars, or opening of free rolling doors of railcars for the purpose of removing documents and making a visual inspection of the cargo.

C9.8.2.3. Specific QD separation applies if the classification yard is used for any other purpose.

C9.8.3. Areas for Burning AE. Use the QD formula described in subparagraph C2.2.1.3. and the requirements in subparagraphs C9.8.3.1. through C9.8.3.3. to determine safe locations for burning AE.

C9.8.3.1. Use K24 [9.52] in the QD formula to determine the minimum safe distance for either personnel burning AE or those conducting unrelated AE operations.

C9.8.3.2. Use K40 [15.87] in the QD formula to determine the safe distance for persons not performing AE operations. However, if the NEWQD of burn material is more than 450 lbs [204 kg], the minimum safe distance shall be at least 1,250 ft [381 m]. If the NEWQD of burn material is $\leq$ 450 lbs [204 kg], use the minimum HFD given in Table C9.T2.

C9.8.3.3. Locate burning grounds at ILD from other PES.

C9.8.4. Areas Used for Intentional Detonations.

C9.8.4.1. General.

C9.8.4.1.1. Protective structures for personnel or measures to suppress blast or fragment effects may be used to reduce the below required withdrawal distances.

C9.8.4.1.2. Control sites for intentional detonations for AE disposals, live-fire demonstrations and EOD non-emergency operations must be at ILD from other PES, based on the PES's NEWQD.

C9.8.4.2. The minimum separation distances between areas used for intentional detonation (excluding hands-on training) and non-essential personnel are determined by application of the criteria given below. If the minimum separation distance requirements for previously approved DDESB sitings or those prescribed in this section cannot be met, then personnel shall be provided the protection specified in paragraph C4.3.2.

C9.8.4.2.1. For non-fragmenting AE, use $d = 328W^{1/3}$ but not less than 1,250 ft [$d = 130.1Q^{1/3}$, but not less than 381 m]. If known, maximum debris throw distance, with a safety factor determined by the DoD Component, may be used to replace the 1,250 ft [381 m] minimum distance.

C9.8.4.2.2. For fragmenting AE use the larger of the two distances below:

C9.8.4.2.2.1. The distance determined from the equation $d = 328W^{1/3}$ but not less than 1,250 ft. [$d = 130.1Q^{1/3}$ but not less than 381 m].

C9.8.4.2.2.2. The distances given in Table C9.T35., based on the diameter of the AE being destroyed. A calculated or measured maximum fragment throw distance (including the interaction effects for stacks of items or single items, whichever applies), with a safety factor determined by the DoD Component, may be used to replace these distances. Calculated case fragment maximum throw distances for selected munitions are given in Table C9.T36. (NOTE: The calculated case fragment throw distances in Tables C9.T35. and C9.T36. are for individual items. These throw distances do not consider "rogue" fragments that are produced by sections of nose plugs, base plates, or lugs, and they do not directly apply to stacks of munitions. In addition, shaped charge jets or slugs from directed energy munitions can travel significantly greater distances than case fragments; therefore, these munitions require specific analysis.)

C9.8.4.2.2.2.1. "Rogue" fragments can travel significantly greater distances (> 10,000 ft [3,048 m]) than those shown in Tables C9.T35. and C9.T36. Care must be taken either to properly orient the munition (e.g., lugs or strongbacks and nose or tail plate sections oriented away from personnel locations), or to minimize or eliminate the hazard of rogue fragments (e.g., sand bagging the munition prior to detonation).

C9.8.4.2.2.2.2. For multiple munitions' detonation, the preferred approach is:

C9.8.4.2.2.2.2.1. Place the munitions in a single layer with their sides touching such that their axis is horizontal.

C9.8.4.2.2.2.2.2. Place the munitions so that the nose of each munition is pointing in the same direction.

C9.8.4.2.2.2.2.3. Orient the munitions so that lugs or strongbacks and nose or tail plate sections are facing away from areas to be protected.

C9.8.4.2.2.2.2.4. Initiate the stack detonation so that all munitions detonate simultaneously.

C9.8.4.2.2.2.2.5. Use the following when the procedures outlined in subparagraphs C9.8.4.1.2.2.2.1. through C9.8.4.1.2.2.2.4. cannot be met:

C9.8.4.2.2.2.2.5.1. If the orientation of the potential rogue fragments can be controlled, then the ranges given in Tables C9.T35. and C9.T36. shall be increased by 20 percent to account for the interaction effects.

C9.8.4.2.2.2.2.5.2. If the orientation of potential rogue fragments cannot be controlled, fragment ranges must be evaluated on a case-by-case basis.

C9.8.4.2.2.2.2.5.3. If detonations involve stacks of mixed munitions, evaluate the distance for each munition separately using the procedures in subparagraph C9.8.4.2.2.2. and select the largest distance.

TABLE C9.T35. DEFAULT MAXIMUM CASE FRAGMENT DISTANCES FOR INTENTIONAL DETONATIONS

DIAMETER (in) *[mm]*	MAXIMUM FRAGMENT DISTANCE (feet) *[m]*
<1.5	1250
<38	*381.0*
1.5	1266
38	*384.9*
2.0	1626
51	*497.1*
2.5	1905
64	*580.7*
3.0	2133
76	*649.3*
3.5	2326
89	*709.5*
4.0	2493
102	*761.4*
4.5	2641
114	*803.9*
5.0	2772
127	*845.0*
5.5	2892
140	*882.2*
6.0	3000
152	*913.6*
6.5	3101
165	*944.8*
7.0	3193
178	*973.8*
7.5	3400
190	*1033.8*
8.0	3593
203	*1094.3*
8.5	3775
216	*1151.0*
9.0	3946
229	*1204.4*
9.5	4108
241	*1251.1*
10.0	4262
254	*1299.1*

TABLE C9.T35. DEFAULT MAXIMUM CASE FRAGMENT DISTANCES FOR INTENTIONAL DETONATIONS (continued)

DIAMETER (in) *[mm]*	MAXIMUM FRAGMENT DISTANCE (feet) *[m]*
10.5	4408
267	*1344.7*
11.0	4548
279	*1384.9*
11.5	4681
292	*1426.5*
12.0	4809
305	*1466.3*
12.5	4931
318	*1504.4*
13.0	5049
330	*1538.3*
13.5	5162
343	*1573.6*
14.0	5271
356	*1607.6*
14.5	5376
368	*1637.9*
15.0	5478
381	*1669.6*
15.5	5576
394	*1700.3*
16.0	5671
406	*1727.7*
16.5	5763
419	*1756.5*
17.0	5853
432	*1784.4*
17.5	5940
444	*1809.4*
18.0	6024
457	*1835.8*
18.5	6106
470	*1861.4*
19.0	6186
483	*1886.4*
19.5	6264
495	*1908.8*
20.0	6340
508	*1932.5*
> 20	Use equations in Notes 2 & 3
> 508	*Use equations in Notes 2 & 3*

NOTES for Table C9.T35

1. These calculated fragment throw distances are for individual munitions and do not apply to stacks. They also do not address "rogue" (non-case) fragments that can be produced from sections of nose plugs, base plates or lugs. Rogue fragments can travel to significantly greater distances (i.e., > 10,000 ft [3,048 m]) than those shown. Care must be taken to properly orient the munition or take other measures to minimize rogue fragment hazards.

2. Maximum Fragment Distance (MFD) in ft, Diameter in inches; ln is natural logarithm.

MFD = 759 + 1251*[ln(Diameter)	Diameter $\leq$ 7 in;	**[EQN C9.T35-1]**
Diameter = exp[(MFD/1251) - 0.61];	Range $\leq$ 3193 ft;	**[EQN C9.T35-2]**

MFD in m, Diameter mm ; ln is natural logarithm.

MFD = -1002.08 + 381.305[ln(Diameter)];*	*Diameter $\leq$ 178 mm;*	**[EQN C9.T35-3]**
Diameter = exp[(MFD/381.305) + 2.628];	*Range $\leq$ 973.2 m;*	**[EQN C9.T35-4]**

3. MFD in ft, Diameter in inches; ln is natural logarithm.

MFD = -2641 + 2998*[ln(Diameter)];	Diameter > 7 in;	**[EQN C9.T35-5]**
Diameter = exp[(MFD/2998) + 0.88];	Range > 3193 ft;	**[EQN C9.T35-6]**

MFD in m, Diameter in mm; ln is natural logarithm.

MFD = -3760.859 + 913.79[ln(Diameter)];*	*Diameter > 178 mm;*	**[EQN C9.T35-7]**
Diameter = exp[(MFD/913.79) + 4.1157];	*Range > 973.2 m;*	**[EQN C9.T35-8]**

4. Use of equations given in Notes (2) and (3) to determine other Diameter/MFD combinations is allowed.

5. See subparagraph C9.8.4.2.2.2. for ranges associated with multiple munitions detonation.

TABLE C9.T36. MAXIMUM CASE FRAGMENT DISTANCES FOR SELECTED SINGLE ITEM DETONATIONS

MUNITION	MAXIMUM FRAGMENT THROW DISTANCE (CASE FRAGMENTS) (ft) [m]
20 mm projectile	320 [97.5]
25 mm projectile	760 [231.6]
37 mm projectile	980 [298.7]
40 mm projectile	1100 [335.3]
40 mm grenade	345 [105.2]
M229, 2.75" rocket	1375 [419.1]
M48, 75-mm projectile	1700 [518.2]
105-mm projectile	1940 [591.3]
5"/38 projectile	2205 [672.1]
5"/54 projectile	2307 [703.2]
155-mm projectile	2580 [786.4]
M437, 175-mm projectile	2705 [824.5]
M106, 8-in projectile	3290 [1002.8]
16"/50 projectile	5640 [1719.1]
M49A3, 60-mm mortar	1080 [329.2]
M374, 81-mm mortar	1235 [376.4]
M3A1, 4.2 -in mortar	1620 [493.8]
M64A1 500-lb bomb	2500 [762.0]
MK 81, 250-lb bomb	2855 [870.2]
MK 82, 500-lb bomb	3180 [969.3]
MK 83, 1000-lb bomb	3290 [1002.8]
MK 84, 2000-lb bomb	3880 [1182.6]
BLU-109 bomb	4890 [1490.5]

Notes for Table C9.T36.

1. These calculated case fragment throw distances are for individual items and do not apply to detonations involving multiple munitions. See subparagraph C9.8.4.2.2.2. for application to multiple munitions' detonation. In addition, shaped charge jets or slugs from directed energy munitions can travel significantly greater distances than case fragments; therefore, these munitions require specific analysis.

2. These calculated fragment throw distances are for individual munitions and do not apply to stacks. They also do not address "rogue" (non-case) fragments that can be produced from sections of nose plugs, base plates or lugs. Rogue fragments can travel to significantly greater distances (i.e., > 10,000 ft [3,048 m]) than those shown. Care must be taken to properly orient the munition or take other measures to minimize rogue fragment hazards.

C9.8.4.3. EOD Operations.

C9.8.4.3.1. EOD operational responses require the application of public withdrawal distances to all non-essential personnel per Table C8.T4.

C9.8.4.3.2. EOD operations or demonstrations conducted on ranges require minimum separation distances (see subparagraph C9.8.4.2.) for non-essential personnel.

C9.8.4.3.3. EOD training operations, or operations involving demolition of AE, do not require minimum separation distances for essential personnel. The on-site DoD authority shall determine adequate protection for essential personnel.

C9.8.4.3.4. EOD Proficiency Training Ranges. EOD proficiency-training ranges are limited to a maximum of 5 lbs [2.27 kg] of demolition explosives (e.g., bare charges or items without a fragment hazard).

C9.8.4.3.4.1. Facilities that require IBD, PTRD and ILD protection must be located at the following minimum distances from the destruction point:

C9.8.4.3.4.1.1. If the destruction point is at least 500 ft [152.4 m] from these facilities, a 5 lbs [2.27 kg] NEWQD limit applies.

C9.8.4.3.4.1.2. If the destruction point is less than 500 ft [152.4 m], but 300 ft [91.4 m] or more from these facilities, a 2.5-lb [1.13 kg] NEWQD limit applies.

C9.8.4.3.4.1.3. If the destruction point is less than 300 ft [91.4 m], but 200 ft [61 m] or more from these facilities, a 1.25-lb [0.57 kg] NEWQD limit applies.

C9.8.4.3.4.2. Barricading of Destruction Point. If the EOD Proficiency Training Range provides the 500-foot protection distance specified in subparagraph C9.8.4.3.4.1.1., then no barricading of the destruction point is required. If the EOD Proficiency Training Range provides less than 500 feet protection distance, then the range's destruction point shall be constructed to control ejection of debris by:

C9.8.4.3.4.2.1. Constructing a barricade with two entrances, which surrounds the destruction point, that is the equivalent of at least two side-to-side sandbags, is at least six ft [1.83 m] high, and is constructed within about 10 ft [3.05 m] of the destruction point.

C9.8.4.3.4.2.2. Locating the barricade entrances at 180 degrees separation. These entrances shall be barricaded, as above, to effectively block all debris.

C9.8.4.3.4.3. EOD proficiency training ranges used with other than bare charges or non-fragment producing items shall meet the requirements of subparagraph C9.8.4.1.

C9.8.4.3.4.4. EOD proficiency training ranges on which explosively operated tool kits are used on inert AE only require 100 ft [30.5 m] separation distance between the destruction point and facilities that require IBD, PTRD and ILD protection. The site shall be barricaded per subparagraph C9.8.4.3.4.2. above.

C9.8.4.4. Live-fire Demonstrations and Disposal Operations.

C9.8.4.4.1. The appropriate DoD authority shall determine, on a case-by-case basis:

C9.8.4.4.1.1. Essential personnel required for the live-fire demonstrations or disposal operations.

C9.8.4.4.1.2. Other range safety considerations (e.g., personnel withdrawal distances and acceptable exposures).

C9.8.5. Inert Storage. The DoD Components shall 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 shall determine what constitutes "directly related." The following apply to inert storage:

C9.8.5.1. Locations for inert storage shall 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.

C9.8.5.2. Site plans meeting the conditions above are not required to be submitted to the DDESB for review and approval (see paragraph C5.6.9.).

C9.8.5.3. Inert storage that will be accessed by personnel not related to the explosives mission shall be sited per subparagraphs C9.4.1.1.4.7. and C9.4.1.1.6.9. (based on blast only.) Minimum fragment distances do not apply (see subparagraphs C9.4.1.2.1.3.4.).

C9.8.6. Interchange Yards.

C9.8.6.1. Truck, trailer, or railcar interchange yards are not subject to QD requirements, when used exclusively:

C9.8.6.1.1. For the interchange of vehicles or railcars containing AE between the commercial carrier and DoD activities.

C9.8.6.1.2. To conduct external inspection of the trucks, trailers, or railcars containing AE.

C9.8.6.1.3. To conduct visual inspection of the external condition of the cargo in vehicles (e.g., trucks, trailers, and railcars) that passed the external inspection.

C9.8.6.2. Truck, trailer, or railcar interchange used, at any time, for any purpose other than the above are subject to applicable Q-D tables. (See C9.3.1.7.).

C9.8.7. Inter-DoD Component Support and Tactical Facilities.

C9.8.7.1. General.

C9.8.7.1.1. The separation distances in subparagraph C9.8.7.2. shall apply between facilities of one DoD Component to those of another DoD Component regardless of the location of the boundaries.

C9.8.7.1.2. Other safety criteria (e.g., toxicity, noise, radiation, flight trajectory, etc.) may require greater distances. In these situations, the predominant hazard criteria shall apply.

C9.8.7.2. The following minimum QD relationships apply:

C9.8.7.2.1. AE storage facilities shall be separated by IMD.

C9.8.7.2.2. AE storage or operating locations of one DoD Component shall be separated from AE operating locations of another DoD Component by IBD. (See subparagraph C9.8.7.2.3. below for an exception to this criterion.)

C9.8.7.2.3. Explosive operations that present a similar degree of hazard or involve joint or support operations shall be separated by ILD.

C9.8.7.2.4. AE storage or operating locations of one DoD Component shall 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.

C9.8.8. Detached Loading Docks. Detached loading docks that normally service multiple facilities shall be sited on the basis of use.

C9.8.8.1. When servicing magazines, they must be separated from magazines by IMD.

C9.8.8.2. When servicing operating buildings, they must be separated from the operating buildings by ILD.

C9.8.9. Holding Yards for Railcars and Trucks Containing AE.

C9.8.9.1. Railcar-groups containing AE shall be separated from each other by AGM distance in a rail holding yard. For example:

C9.8.9.1.1. If the railcar holding yard is formed by two parallel ladder tracks connected by diagonal spurs, the parallel tracks and the diagonal spurs shall be separated by AGM distance for the quantities of AE involved.

C9.8.9.1.2. 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 shall be separated by AGM distance for the quantities of AE involved.

C9.8.9.2. Truck-groups containing AE in holding yards shall be separated from each other by AGM distance.

C9.8.9.3. Both railcar and truck holding yards containing AE shall be separated from other facilities by the applicable IBD, PTRD, ILD or IMD.

C9.8.9.4. In addition to the temporary parking of railcars, trucks, or trailers containing AE, holding yards may also be used to interchange truck, trailers or railcars between the commercial carrier and the DoD activity, and to conduct visual inspections.

C9.8.10. Inspection Stations for Railcars and Trucks Containing AE.

C9.8.10.1. Inspection stations for railcars and trucks containing AE that are used exclusively for the activities below 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:

C9.8.10.1.1. External visual inspection of the railcars or motor vehicles.

C9.8.10.1.2. Visual inspection of the external condition of the cargo packaging in vehicles that have passed the external inspection indicated in subparagraph C9.8.10.1.1.

C9.8.10.1.3. Interchange of trucks, trailers, or railcars between the common carrier and the DoD activity.

C9.8.10.2. Inspection stations used for any other purpose shall comply with applicable QD criteria.

C9.8.11. Holding Areas for Suspect Railcars or Trucks Containing AE. Railcars or trucks that are suspected of being in a hazardous condition shall be separated (isolated) from other PES or ES by the applicable QD before any other action.

C9.8.12. 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 as indicated below. (NOTE: The below operations shall be conducted on installations under U.S. control, when possible, to limit exposures to the public.) Allowable operations are:

C9.8.12.1. Roll-on or roll-off (RORO) operations (not involving lifting), which meet the following requirements:

C9.8.12.1.1. The total NEWQD present shall not exceed 50,000 lbs.

C9.8.12.1.2. All AE present (e.g., in trailers, railcars, barges, ships) must be associated only with the RORO operation being conducted.

C9.8.12.1.3. RORO operations shall not exceed 24 hours following arrival of AE, including AE staged at a transshipment point.

C9.8.12.1.4. RORO operations shall be located as remote as practicable from populated areas, in order to minimize exposure of unrelated personnel.

C9.8.12.2. Off-installation military vans/International Standardization Organization (MILVAN/ISO) container inter- or intra-modal transfers (involving highway and rail modes only) where containers are not stored or other operations performed.

C9.8.13. Secure Holding Area. An area designated for the temporary parking of commercial carriers' motor vehicles transporting DoD-owned Arms, Ammunition, and Explosives (AAE), classified (SECRET or CONFIDENTIAL) materials, and Controlled Cryptographic Items (CCI). There are two types of secure holding areas and the criteria for each are provided below. (NOTE: 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 Standard imposes no requirement for installations to have such areas. The term Secure Holding Area is applicable to areas (CONUS, Hawaii, Alaska, and Puerto Rico) governed by DoD 4500.9-R, reference (aa))

C9.8.13.1. Secure Explosives Holding Area. Site as a holding yard per paragraph C9.8.9.

C9.8.13.2. Secure Non-explosives Holding Area. No siting required if located outside all QD arcs. If located within a QD arc, site as an administrative parking lot per subparagraph C9.4.1.1.4.6. The holding of HD 1.4S materials, without regard to QD, is permitted at this location.

C9.8.14. Storage Tanks for Hazardous Materials.

C9.8.14.1. Unprotected, aboveground bulk storage tanks shall be separated from PES by IBD per Table C9.T1. A dike system satisfying reference (s) is required. Aboveground storage tanks that are provided protection against rupture or collapse from blast and fragment hazards may bc sited at distances less than Table C9.T1. when supported by testing or analysis.

C9.8.14.2. 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:

C9.8.14.2.1. The losses are accepted by the DoD Component.

C9.8.14.2.2. The tanks are sited.

C9.8.14.2.3. Spill containment is provided so other exposures are not endangered.

C9.8.14.3. 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:

C9.8.14.3.1. A dike system meeting the requirements of reference (t) is provided.

C9.8.14.3.2. 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.

C9.8.14.4. A service tank supporting a single PES shall be separated from that PES by the applicable NFPA fire protection distance. The distance from this service tank to any other PES shall be the larger of the required distance between the two PES or the applicable NFPA fire protection distance.

C9.8.14.5. Buried tanks and buried pipelines shall be separated from all PES 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 [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.

C9.8.14.6. Small quantities of POL or other hazardous materials used for operational purposes require no specific separation distance for explosives safety; however, operating procedures shall be implemented to limit adverse environmental impacts in the event of an accidental explosion.

C9.8.14.7. For underground AE facilities, it is not practical to specify QD criteria that cover all tank storage configurations. The DoD Component shall assess each configuration per section C9.7 to ensure that equivalent protection of subparagraphs C9.8.14.1. through C9.8.14.6. is provided.

C9.8.15. Storage Tanks for Water.

C9.8.15.1. Unprotected aboveground water storage tanks shall meet the siting requirements of subparagraph C9.8.14.1. if loss of the tank is unacceptable to the DoD Component. Buried tanks and associated components of like value shall meet the siting requirements of subparagraph C9.8.14.5. Aboveground storage tanks that are provided protection against rupture or collapse from blast and fragment hazards may be sited at distances less than Table C9.T1. when supported by testing or analysis. No dike is required.

C9.8.15.2. QD criteria do not apply to water storage tanks and associated components if loss is acceptable to the DoD Component.

C9.8.16. Underground Tanks or Pipelines for Non-Hazardous Materials. See subparagraph C9.8.14.5.

C9.8.17. Temporary Construction or Maintenance Operations. Construction and maintenance personnel who are temporarily near a PES to perform their job shall be provided the maximum practicable protection from the effects of an explosion if one occurs at a PES. The DoD Component shall determine the minimum practicable separation distance from PES for such personnel and shall 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 shall be maintained until construction or maintenance operations are completed.

C9.8.18. Military Working Dog (MWD) Explosives Search Training. Training of MWD 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 shall:

C9.8.18.1. Be conducted by personnel meeting DoD Component qualifications.

C9.8.18.2. Be conducted in facilities that meet the requirements of this Standard.

C9.8.18.3. Store explosives in facilities that meet the requirements of this Standard.

C9.8.18.4. Provide non-essential personnel:

C9.8.18.4.1. $40W^{1/3}$ [$15.87Q^{1/3}$] separation distance from the training site if more than 15 lbs [6.8 kg] NEWQD are being used for the exercise.

C9.8.18.4.2. 100 ft [30.5 m] separation distance from the training site for NEWQD $\leq$ 15 lbs [6.8 kg].

C9.8.18.5. Minimize the number of samples and the quantity of explosives for each sample. The DoD Component shall determine the total quantity of explosives permitted during an exercise considering:

C9.8.18.5.1. The value and importance of the exposed facilities.

C9.8.18.5.2. The exercise operating conditions.

C9.8.18.5.3. The available separation distance for non-essential personnel.

C9.8.18.6. Separate samples a sufficient distance apart to prevent an explosion from propagating from one sample to another.

C9.8.18.7. Not use any initiating devices or initiating explosives.

C9.8.18.8. Not place explosives near any heat or spark producing items (e.g., bare electrical wiring, radiators, electric heaters, heating vents, etc.).

C9.8.18.9. Not place explosives in metal containers or other means of confinement that could produce fragments in the event of an accidental explosion.

C9.8.19. Demilitarization Processing Equipment and Operations for Expended .50-Caliber and Smaller Cartridge Casings.

C9.8.19.1. A demilitarization operation for processing expended .50-caliber and smaller cartridge cases can be treated as a non-explosive operation provided:

C9.8.19.1.1. Cartridge casings to be processed are screened prior to processing. (NOTE: Screening is intended to ensure that only .50-caliber and smaller are processed, and to remove unused .50-caliber and smaller cartridges.)

C9.8.19.1.2. 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.

C9.8.19.1.3. Demilitarization processing equipment is operated within the manufacturer's specifications and restricted only to the processing of expended .50-caliber and smaller cartridge casings.

C9.8.19.1.4. Demilitarization processing equipment is inspected and maintained to ensure safe operation.

C9.8.19.2. DoD Components shall:

C9.8.19.2.1. Approve the use of specific demilitarization processing equipment.

C9.8.19.2.2. Establish and implement procedures for:

C9.8.19.2.2.1. Screening and segregating the material to be processed.

C9.8.19.2.2.2. Operating, inspecting, and maintaining the demilitarization processing equipment to ensure safe operation.

C9.8.19.2.2.3. Dispositioning of processed material.

C9.8.19.3. Explosives Safety Siting.

C9.8.19.3.1. Demilitarization processing operation locations meeting subparagraphs C9.8.19.1. and C9.8.19.2., and located outside of IBD from all PES, do not require submission of a site plan to the DDESB (see paragraph C5.6.10.).

C9.8.19.3.2. Locations used for demilitarization processing operations that are located within IBD arcs:

C9.8.19.3.2.1. Require submission of a site plan to the DDESB.

C9.8.19.3.2.2. Shall be sited at ILD, except from the PES to which it is integral.

C9.8.20. Conveyance Loading and Unloading at a Magazine. A conveyance (e.g., truck, trailer, railcar, ISO or MILVAN 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/apron in front of the magazine, or within the established boundaries of an aboveground magazine. Detached ramps or loading docks that normally service multiple facilities will be sited in accordance with paragraph C9.8.8.

C10. CHAPTER 10

CONTINGENCIES, COMBAT OPERATIONS, MILITARY OPERATIONS OTHER THAN WAR (MOOTW), AND ASSOCIATED TRAINING

C10.1. GENERAL

C10.1.1. This Chapter provides the minimum criteria for contingencies, combat operations, military operations other than war (MOOTW), and associated training. Full compliance with other chapters of this Standard may not be possible during such operations. The DoD Components may establish implementing regulations that are more protective than this Standard. In situations involving combined or joint operations, the Commanders of the Combatant Commands or the U.S. Commander of a Joint Task Force (JTF) shall designate the DoD Component's explosives safety criteria to be used.

C10.1.2. The provisions of this Chapter only apply to:

C10.1.2.1. Those DoD AE activities located outside the U.S.

C10.1.2.2. The Commanders of the Combatant Commands, the U.S. Commanders of JTF, or the DoD Component Commanders in the management of these DoD AE activities. When necessary, commanders may delegate certain explosive safety responsibilities to designated subordinate commanders to ensure appropriate controls.

C10.1.2.3. Contingency, combat, and MOOTW training, regardless of location, when specifically authorized by applicable DoD Component headquarters or Combatant Commander. Prior to approval of this training, a risk analysis that thoroughly assesses asset preservation and identifies the risk associated with the training shall be conducted. QD separations provided for asset preservation shall be used for training, except where chapter 9 permits lesser distances to be used.

C10.1.3. This Chapter provides optional criteria and risk management tools not available elsewhere in this Standard. These optional criteria provide greater protection (asset preservation distance) for assets deemed sufficiently critical to warrant the greater protection, and, in some circumstances, provide lesser protection (minimum separation distance) for those assets for which the mission requirements out weigh the increased risk to those assets.

C10.1.3.1. Asset Preservation Distance. At this distance from the PES, assets at the ES are expected to be usable and mission capability is maintained following an incident. This separation distance should prevent propagation between PES. (See subparagraphs C2.2.5.5. and C2.2.5.6. for expected consequences for these separation distances.)

C10.1.3.2. Minimum Separation Distance. At this distance from the PES, mission capability will likely be impaired or delayed. This separation distance should prevent prompt propagation; however, late time propagation between PES is possible. (See subparagraphs C2.2.5.2., C2.2.5.3., and C2.2.5.4. for expected consequences for these separation distances.)

C10.2. RISK MANAGEMENT

Consistent with operational requirements, it is DoD policy to manage risks associated with AE (See section C1.2). Exceptions to this Chapter's criteria are where equivalent protection is provided or where a risk analysis is performed, as follows:

C10.2.1. Equivalent Protection. Analysis determining that protective construction or other specialized safety features provides a level of protection equivalent to the separation distances required by this Standard.

C10.2.2. Risk Analysis. Analysis determining that an acceptable level of safety is provided. Risk analysis is a systematic procedure consisting of the following four steps:

C10.2.2.1. An event analysis to identify and describe possible events such as the location, type of occurrence, probability of occurrence, and quantity of explosives.

C10.2.2.2. An effects analysis of the effects of the possible events to persons in the surroundings such as blast pressure, fragmentation, and thermal hazards.

C10.2.2.3. An exposure analysis of the places, protection and time history of exposed personnel in the hazardous areas.

C10.2.2.4. A risk calculation.

C10.2.3. Risk Management Control. The action a commander takes to minimize acceptable risk. Such actions shall include:

C10.2.3.1. Development, implementation, and enforcement of applicable control measures used to eliminate the hazard or reduce its risk.

C10.2.3.2. Continuous evaluation of the effectiveness of the implemented control measures.

C10.3. SITE PLAN PROCESS

C10.3.1. Site Approval. All explosives locations falling within the scope of this Chapter shall be approved by the applicable commander or by the DDESB as outlined below. Site plan packages shall be submitted:

C10.3.1.1. For AE locations such as the following:

C10.3.1.1.1. Storage Locations.

C10.3.1.1.2. Holding areas (e.g., basic load ammunition holding areas (BLAHA), flight line holding areas, port and railhead holding areas, and marshalling areas, etc.).

C10.3.1.1.3. Handling and operating locations (e.g., HAS, ports, AE maintenance, repair, and renovation areas and sling out areas, etc.).

C10.3.1.1.4. Forward arming and refueling points (FARP).

C10.3.1.1.5. Combat aircraft parking area (CAPA) and cargo aircraft parking areas.

C10.3.1.1.6. Static missile batteries.

C10.3.1.1.7. Locations used for the treatment or disposal (e.g., open burn or open detonation) of munitions. Exceptions are those locations used in an emergency response, for burning excess propellant resulting from munitions use during training, and those involved in direct combat operations.

C10.3.1.2. Non-AE related ES within QD arcs.

C10.3.2. Documentation requirements. The operational situation and the type and duration of the AE operations conducted at the site or facility determine the type of documentation required for a site approval. The following categories of operations apply:

C10.3.2.1. Permanent.

C10.3.2.1.1. Definition. Those AE related facilities where operations are expected to continue for more than 12 months.

C10.3.2.1.2. Documentation Requirement. A DDESB approved site plan for such locations must be obtained once the Commander of the Combatant Commands or DoD Component headquarters, as applicable, determines operations shall require the facilities' use to continue beyond 12 months.

C10.3.2.2 Recurrent.

C10.3.2.2.1. Definition. Those AE related facilities where operations are expected to occur on a periodic basis regardless of the duration of the operation. These locations may be sited using compensatory actions, such as facility evacuation or change-of-use, to minimize the risks associated with AE operations.

C10.3.2.2.2. Documentation Requirement. These locations must have a DDESB (or appropriate level of command when applicable) approved site plan before commencing operations.

C10.3.2.3. Temporary.

C10.3.2.3.1. Definition. Those AE related facilities where operations are not expected to continue for more than 12 months and are not recurrent, or for which advanced planning and approval are impractical.

C10.3.2.3.2. Documentation Requirement. A plan for the specific scenario shall be approved by the applicable commander. The plan shall include the following:

C10.3.2.3.2.1. A risk assessment for the proposed operation. This assessment shall weigh the need for the facility against the potential effects of a mishap (e.g., mission impact, loss of resources, turnaround times, etc.).

C10.3.2.3.2.2. Schedule for the cessation of explosives operations or submittal of a site plan if the operations exceed 12 months.

C10.3.2.4. Contingency, Combat, and MOOTW Training.

C10.3.2.4.1. Definition. Those operations that simulate real world combat environments using live AE to achieve training goals.

C10.3.2.4.2. Documentation Requirement. Facilities or areas for training activities shall have a DDESB approved site plan for permanent or recurrent operations, or a risk analysis approved by the applicable commander for temporary operations.

C10.3.3. Site Plan Packages. See section C5.4. for the requirements with the following additions:

C10.3.3.1. In the absence of suitable maps or drawings, information (e.g., sketches, photographs, or other information) may be provided.

C10.3.3.2. An explanation of any deviations from pertinent safety standard caused by local conditions.

C10.3.3.3. A copy of the risk analysis performed by the DoD Component, if one was performed, to demonstrate equivalent protection.

C10.3.4. Approval Authority for Waivers and Exemptions. The Commander of the Combatant Commands, the U.S. Commander of JTF, or the DoD Component Commander may, for strategic and other compelling reasons, authorize waivers to the explosives safety standards contained herein for the planning or conduct of contingencies, combat operations and MOOTW. All waivers shall be coordinated with the host nation, as required, and consistent with international agreements.

C10.3.4.1. Requests for waivers and exemptions to QD criteria shall be IAW DoD Component directives. When joint operations are being conducted from a single base or location, waivers and exemptions that affect another DoD Component must be coordinated between affected DoD Components.

C10.3.4.2. Requests for waivers and exemptions to QD criteria shall contain the following:

C10.3.4.2.1. A risk analysis for the proposed operation weighing the need to conduct the operation and violate the standards against the potential effect of a mishap (e.g., mission impact, loss of resources, turnaround times, etc.).

C10.3.4.2.2. A timeline listing milestones which shall eliminate the need for the waiver or exemption.

C10.4. QD CRITERIA FOR CONTINGENCIES, COMBAT OPERATIONS, MOOTW AND ASSOCIATED TRAINING

QD criteria are provided for specific types of locations below:

C10.4.1. BLAHA.

C10.4.1.1. General. To fulfill their missions, certain units must keep their basic load ammunition in armored vehicles, trucks, trailers, structures, or on pads. This involves acceptance of greater risks to unit personnel, facilities, and equipment than permitted by other chapters of this Standard. The concept of BLAHA storage may also be used to provide QD separations during mobile operations. A Basic Load Storage Area (BLSA) is a location containing multiple BLAHA.

C10.4.1.2. Mixing of Basic Load Ammunition. Storage compatibility requirements of chapter 3 do not apply to BLAHA facilities.

C10.4.1.2.1. NEWQD for use with BLAHA QD criteria shall be determined as follows:

C10.4.1.2.1.1. The sum of the weights of all energetic compositions contained in munitions hazard classified as HD 1.1 or 1.5 shall be used.

C10.4.1.2.1.2. The sum of the explosive weight of all HD 1.2 AE shall be used. The propellant weight of a HD 1.2 item (if present) may be disregarded.

C10.4.1.2.1.3. The weights of energetic compositions hazard classified as HD 1.3 may be disregarded. However, if the site only contains HD 1.3 items, the criteria contained in paragraph C9.4.3. apply.

C10.4.1.2.1.4. The weights of energetic compositions classified as HD1.4 may be disregarded.

C10.4.1.2.1.5. The explosive weight of HD 1.6 shall be computed as follows:

C10.4.1.2.1.5.1. When HD 1.6 is stored alone or with HD 1.4 AE, the QD criteria of paragraph C9.4.3. apply.

C10.4.1.2.1.5.2. When HD 1.6 is stored with AE classified as HD 1.1, HD 1.2 or HD 1.5, add the explosives weight of the HD 1.6 items into the NEWQD calculations.

C10.4.1.2.1.5.3. When HD 1.6 is stored with AE classified as HD 1.3 add the explosives weights of HD1.3 and HD 1.6. The QD criteria in paragraph C9.4.3. apply.

C10.4.1.2.2. Explosives Limits.

C10.4.1.2.2.1. The maximum NEWQD at any BLAHA in a BLSA storing mixed compatibility must not exceed 8,818 lbs [4,000 kg]. A BLSA may have multiple 8,818-lb [4,000 kg] BLAHA, provided the BLAHA are separated from each other by the applicable distances (D1, D2 and D3) given in Table C10.T1.

C10.4.1.2.2.2. When the NEWQD of a BLSA or a BLAHA exceeds 8,818 lbs [4,000 kg], the QD computations and HD mixing rules for the site shall be IAW chapter 9 and the explosives compatibility storage criteria shall be IAW chapter 3.

C10.4.1.2.3. QD Computations.

C10.4.1.2.3.1. The total NEWQD of AE in each site shall be used for computation of QD provided the required distances (Table C10.T1.) necessary to prevent propagation separate these sites. If the separation distances are not met, the entire BLSA shall be considered one site and subparagraph C10.4.1.2.2.2. applies.

C10.4.1.2.3.2. The IMD requirements of chapter 9 apply when using 3-bar or 7-bar ECM.

C10.4.1.2.3.3. Table C10.T1. contains the QD separation for BLAHA and BLSA.

C10.4.1.2.3.4. Heavy armored vehicles are expected to contain most of the blast and fragments from an internal explosion and are well protected from an external explosion. For this reason there is no required separation from heavy armor PES to light or non-armored ES. Additionally, heavy armor ES require no separation from other sites. The hatches of heavy armored vehicles must be kept closed to be considered as heavy armor vehicles; otherwise, they are considered as light armor vehicles. Use Table C10.T2. to determine the applicable QD for heavy, light and non- armored vehicles.

TABLE C10.T1. QD for BLAHA and BLSA

NEW (lbs) [kg]	D1[1] (ft) [m]	D2[2] (ft) [m]	D3[3] (ft) [m]	D4[4] (ft) [m]	D5[5] (ft) [m]	D6[6] (ft) [m]
10	4	13	26	591	886	66
4.5	*1.3*	*3.9*	*7.9*	*180*	*270*	*20*
15	5	15	30	591	886	66
6.8	*1.5*	*4.5*	*9.0*	*180*	*270*	*20*
20	5	16	33	591	886	66
9.1	*1.7*	*5.0*	*9.9*	*180*	*270*	*20*
30	6	19	37	591	886	66
13.6	*1.9*	*5.7*	*11.4*	*180*	*270*	*20*
50	7	22	44	591	886	66
22.7	*2.2*	*6.7*	*13.5*	*180*	*270*	*20*
70	8	25	49	591	886	66
31.8	*2.5*	*7.5*	*15.1*	*180*	*270*	*20*
100	9	28	56	591	886	66
45.4	*2.8*	*8.5*	*17.0*	*180*	*270*	*20*
150	11	32	64	591	886	81
68.0	*3.2*	*9.7*	*19.4*	*180*	*270*	*24.6*
200	12	35	70	591	886	99
90.7	*3.6*	*10.7*	*21.4*	*180*	*270*	*30.0*
300	13	40	80	591	886	130
136.1	*4.1*	*12.2*	*24.5*	*180*	*270*	*39.6*
500	16	48	95	591	886	
226.8	*4.8*	*14.5*	*29.0*	*180*	*270*	
700	18	53	107	591	886	
317.5	*5.4*	*16.2*	*32.5*	*180*	*270*	
1,000	20	60	120	591	886	
453.6	*6.1*	*18.3*	*36.6*	*180*	*270*	
1,500	23	69	137	591	886	
680.4	*7.0*	*20.9*	*41.9*	*180*	*270*	
2,000	25	76	151	591	886	
907.2	*7.7*	*23.0*	*46.1*	*180*	*270*	
3,000	29	87	173	591	886	
1,360.8	*8.8*	*26.4*	*52.8*	*180*	*270*	
5,000	34	103	205	591	886	
2,268.0	*10.4*	*31.3*	*62.5*	*180*	*270*	
7,000	38	115	230	669	1021	
3,175.1	*11.7*	*35.0*	*70.0*	*204.0*	*306.0*	
8,818	41	124	248	751	1146	
4,000	*12.6*	*37.8*	*75.6*	*229.0*	*343.4*	

Notes for Table C10.T1.

1. D1 is used for:

a. Side-to-side, side-to-rear and rear-to-rear exposures between undefined ECM, provided the earth cover complies with subparagraph C5.2.1.3. and the explosives are stored at least 3 ft [1 m] from the end of the ECM.

b. Non-armored vehicle (PES) to non-armored vehicle (ES) when an adequate barricade IAW section C5.3. is located between them.

c. Light armored vehicle (PES) to non-armored vehicle (ES) when an adequate barricade IAW section C5.3. is located between them.

d. Light armor or non-armored vehicle (PES) to light armored vehicle (ES) when an adequate barricade IAW section C5.3. is located between them.

e. Determining D1 and NEWQD for D1 (NEWQD in lbs, D1 in ft):

$D1 = 2*NEWQD^{1/3}$ **[EQN C10.T1-1]**

$NEWQD = (D1/2)^3$ (8,818 lbs maximum) **[EQN C10.T1-2]**

f. *Determining D1 and NEWQD for D1 (NEWQD in kg, D1 in m)*

$D1 = 0.79 * NEWQD^{1/3}$ ***[EQN C10.T1-3]***

$NEWQD = (D1/0.79)^3$ *(4,000 kg maximum)* ***[EQN C10.T1-4]***

2. D2 is used for:

a. Front-to-front exposures involving undefined ECM when there is an adequate barricade (section C5.3.) at the ES.

b. Non-armored or light armored vehicles to the side or rear of an undefined ECM.

c. Determining D2 and NEWQD for D2 (NEWQD in lbs, D2 in ft):

$D2 = 6*NEWQD^{1/3}$ **[EQN C10.T1-5]**

$NEWQD = (D2/6)^3$ (8,818 lbs maximum) **[EQN C10.T1-6]**

d. *Determining D2 and NEWQD for D2 (NEWQD in kg, D2 in m)*

$D2 = 2.38 * NEWQD^{1/3}$ ***[EQN C10.T1-7]***

$NEWQD = (D2/2.38)^3$ *(4,000 kg maximum)* ***[EQN C10.T1-8]***

3. D3 is used for:

a. Non-armored vehicles to non-armored vehicles without an adequate barricade.

b. Light armored vehicles to non-armored vehicles without an adequate barricade at the non-armored vehicles.

c. Undefined ECM to undefined ECM when positioned front-to-front and no barricade is present.

d. Non-armored vehicles, light armored vehicles or undefined ECM to the front of undefined ECM when no barricade is present at the ES.

e. Determining D3 and NEWQD for D3 (NEWQD in lbs, D3 in ft):

$D3 = 12*NEWQD^{1/3}$ **[EQN C10.T1-9]**

$NEWQD = (D3/12)^3$ (8,818 lbs maximum) **[EQN C10.T1-10]**

f. *Determining D3 and NEWQD for D3 (NEWQD in kg, D3 in m)*

$D3 = 4.76 * NEWQD^{1/3}$ ***[EQN C10.T1-11]***

$NEWQD = (D3/2.38)^3$ *(4,000 kg maximum)* ***[EQN C10.T1-12]***

4. D4 is used for PTRD from non-armored and light armored vehicles.

a. Determining D4 and NEWQD for D4 (NEWQD in lbs, D4 in ft):

NEWQD ≤ 5,500 lbs	D4 = 591 ft.	
5,500 lbs < NEWQD ≤ 8818 lbs	$D4 = 8*NEWQD^{1/2}$	**[EQN C10.T1-13]**
D4 < 591 ft	NEWQD = 0 lbs	
591 ft ≤ D4 ≤ 751 ft	$NEWQD = (D4/8)^2$ (8,818 lbs maximum)	**[EQN C10.T1-14]**

b. *Determining D4 and NEWQD for D4 (NEWQD in kg, D4 in m)*

NEWQD ≤ 2,495 kg	*D4 = 180 m*	
2,495 kg < NEWQD ≤ 4000 KG	$D4 = 3.62 * NEWQD^{1/2}$	***[EQN C10.T1-15]***
D4 < 180 m	*NEWQD = 0 kg*	
180 m ≤ D4 ≤ 229 m	$NEWQD = (D4/3.62)^2$ *(4,000 kg maximum)*	***[EQN C10.T1-16]***

5. D5 is the IBD from non-armored and light armored vehicles.

a. Determining D5 and NEWQD for D5 (NEWQD in lbs, D5 in ft):

NEWQD ≤ 5,500 lbs	D5 = 886 ft.	
5,500 lbs < NEWQD ≤ 8818 lbs	$D5 = 12.2*NEWQD^{1/2}$	**[EQN C10.T1-17]**
D5 < 886 ft	NEWQD = 0 lbs	
886 ft ≤ D5 ≤ 1146 ft	$NEWQD = (D5/12.2)^2$ (8,818 lbs maximum)	**[EQN C10.T1-18]**

b. *Determining D5 and NEWQD for D5 (NEWQD in kg, D5 in m)*

NEWQD ≤ 2,495 kg	*D5 = 270 m*	
2,495 kg < NEWQD ≤ 4000 KG	$D5 = 5.43 * NEWQD^{1/2}$	***[EQN C10.T1-19]***
D5 < 270 m	*NEWQD = 0 kg*	
270 m ≤ D5 ≤ 343.4 m	$NEWQD = (D5/5.43)^2$ *(4,000 kg maximum)*	***[EQN C10.T1-20]***

6. D6 is used to determine the IBD and PTRD from heavy armor vehicles. When NEWQD exceeds 331 lb (*150 kg*) the IBD and PTRD specified in chapter 9 apply.

a. Determining D6 and NEWQD for D6 (NEWQD in lbs, D6 in ft):

NEWQD ≤ 110 lbs	D6 = 66 ft	
110 lbs < NEWQD ≤ 331 lbs	$D6 = -4.49 + 0.487*(NEWQD^{1/3}) + 2.928*(NEWQD^{1/3})^2$	**[EQN C10.T1-21]**
D6 < 66 ft	NEWQD = 0 lbs	
66 ft ≤ D6 ≤ 138 ft	$NEWQD = (0.0833 + [1.5421 + 0.3416*D6]^{1/2})^3$	**[EQN C10.T1-22]**

b. *Determining D6 and NEWQD for D6 (NEWQD in kg, D6 in m)*

NEWQD < 50 kg	*D6 = 20 m*	
50 ≤ NEWQD ≤ 150 kg	$D6 = -1.37 + 0.193*(NEWQD^{1/3}) + 1.512*(NEWQD^{1/3})^2$	***[EQN C10.T1-23]***
D4 < 20 m	*NEWQD = 0 kg*	
20 m ≤ NEWQD ≤ 42.3 m	$NEWDQ = (0.0640 + [0.9108 + 0.6615*D6]^{1/2})^3$	***[EQN C10.T1-24]***

TABLE C10.T2. QD Requirements for Armored Vehicles [1]

TO ES	EXPOSURE	FROM PES		
		HEAVY	LIGHT	NON-ARMORED
HEAVY	IMD	N/R	N/R	N/R
LIGHT	IMD	N/R	D1 from C10.T1	D1 from C10.T1
NON-ARMORED	IMD	N/R	D3 from C10.T1	D3 from C10.T1
	IBD	D6 from C10.T1	D5 from C10.T1	D5 from C10.T1
	PTRD	D6 from C10.T1	D4 from C10.T1	D4 from C10.T1

Notes for Table C10.T2.

1. Application of D1 and D2 distances above may require the use of a barricade between PES and ES. Refer to Table C10.T1. notes regarding the need for a barricade.
2. N/R = No IMD required
3. Use $d = 24W^{1/3}$ [$9.52\ W^{1/3}$] **[EQN C10.T2-1] [EQN C10.T2-2]** or $d = 30W^{1/3}$ [$11.90\ W^{1/3}$] **[EQN C10.T2-3] [EQN C10.T2-4]** instead of D1 and D3 for asset preservation.

C10.4.2. Ports. The following criteria shall apply to ports where DoD AE are loaded or unloaded.

C10.4.2.1. Required Separations.

C10.4.2.1.1. Explosives Piers.

C10.4.2.1.1.1. AGM IMD (K11[4.36]) shall be maintained between explosives piers.

C10.4.2.1.1.2. ILD (K18 [7.14]) shall be maintained from an explosives pier to a non-explosives pier used for the handling of military cargo.

C10.4.2.1.1.3. AGM IMD (K11 [4.36]) shall be maintained to AE holding areas based on the NEWQD at the pier.

C10.4.2.1.1.4. Marshalling Yards shall be located at PTRD from explosives piers.

C10.4.2.1.1.5. Railheads used for long-term storage or as a transfer depot shall be sited at AGM IMD (K11 [4.36]) from an explosives pier based on the NEWQD at the pier.

C10.4.2.1.2. Explosives anchorages. The criteria of chapter 9 apply with the following exceptions:

C10.4.2.1.2.1. ILD (K18 [7.14]) shall be provided between the explosives loading or unloading section of the anchorage and the loaded ship section of the explosives anchorage (see Figure C9.F10.).

C10.4.2.1.2.2. An explosives anchorage shall be located at K40 [15.87] from all piers. However, where necessary for security or navigational reasons, this distance may be reduced to ILD (K18 [7.14]) when the piers are only used for DoD operations. PTRD may be applied for asset preservation. A separation distance of K40 [15.87] shall be maintained to all non-DoD related piers.

C10.4.2.1.2.3. ILD (K18 [7.14]) is permitted between an explosives anchorage and a non-explosives DoD related anchorage. K40 [15.87] shall be maintained between an explosives anchorage and a non-explosives, non-DoD related anchorage.

C10.4.2.1.3. AE Facilities.

C10.4.2.1.3.1. AE holding Areas. These holding areas are used in support of AE loading and un-loading of ships. Typically, AE being held at these locations are only present for a short time. The NEWQD associated with the AE holding area shall be based on all AE present at the site. The following apply to AE holding areas:

C10.4.2.1.3.1.1. ILD (K18 [7.14]) shall be maintained to both explosives and non-explosives piers based on the NEWQD present at the AE holding areas.

C10.4.2.1.3.1.2. PTRD shall be maintained to an explosives or non-explosives Marshalling Yard.

C10.4.2.1.3.1.3. Railheads used for AE holding areas storage or as a transfer depot shall be sited at AGM IMD (K11 [4.36]) from an AE holding areas based on the NEWQD at the AE holding areas.

C10.4.2.1.3.2. Marshalling Yards. PTRD shall be maintained between marshalling yards and explosives piers or AE holding areas. The location of the marshalling yard will typically be governed by the NEWQD at the other PES. When operational necessity dictates, marshalling yards may be separated by ILD (K18 [7.14]) to any nearby manned explosives operations and AGM IMD (K11 [4.36]) to any nearby unmanned explosives storage operations.

C10.4.2.1.3.3. Loading Docks. Loading docks shall be sited at IMD (K11 [4.36]) from all ES.

C10.4.2.1.3.4. Classification Yards. Use criteria provided in paragraph C9.8.2.

C10.4.2.1.3.5. Railheads. Based on its use, a railhead shall be sited as a classification yard, AE holding area or a loading dock.

C10.4.3. Field Storage and Handling Areas. These areas shall be sited IAW Table C10.T3. Use separation distances from the applicable QD tables in chapter 9 for the HD and NEWQD of the AE involved with the PES. AE will be segregated IAW chapter 3 by storage CG. The clear zone surrounding the field storage and handling areas is bounded by the applicable IBD. No unrelated, occupied structures are permitted within this zone.

C10.4.3.1. These areas may consist of all or some of the following explosives locations:

C10.4.3.1.1. Field Storage Sections. These sections are used to store AE. Field storage sections are used for dispersing AE in multiple, widely-separated storage sections to prevent the loss of any one section from causing the loss of other sections thereby seriously degrading the mission. AE may be stored in existing structures, caves, and tunnels as prescribed in chapter 9. The construction and use of barricades and revetments shall be IAW chapter 5.

C10.4.3.1.2. AE Staging Area. These areas are normally used for temporary holding of outgoing AE and for ready access to CALA.

C10.4.3.1.3. Captured Enemy Ammunition Area. A separate area shall be provided for the storage of captured enemy AE. Captured enemy AE that cannot be identified shall be treated as HD 1.1.

C10.4.3.1.4. AE Operations Area. An area used for operations such as minor maintenance and repair of AE or their containers, surveillance, segregation, or weapons assembly.

C10.4.3.1.5. AE Destruction Area. An area used for disposal of AE. It may consist of a burning area, a demolition area, or both.

C10.4.3.1.6. Sling-out Area. An area used for moving AE by rotary-wing aircraft.

C10.4.3.2. These areas may consist of all or some of the following non-explosives locations:

C10.4.3.2.1. Administration and Billeting Areas. Inhabited locations not directly related to the daily operations of the field storage and handling areas.

C10.4.3.2.2. Manned Support Facilities. Facilities directly supporting AE operations (e.g., field offices and AE support equipment maintenance facilities).

C10.4.3.2.3. Unmanned Support Facilities. Unmanned locations supporting AE operations (e.g., forklift charging stations, dunnage storage, and buildings that store inert materials). A minimum 50 ft [15.2 m] separation distance shall be maintained from these locations to any PES.

C10.4.3.3. Modular Storage. A barricaded area comprised of a series of connected cells with hard surface storage pads separated from each other by barricades (see C5.T3.).

C10.4.3.4. Commercial Intermodal Containers (CIC). Containers used for transporting AE may be used for AE storage and shall be sited as AGM.

TABLE C10.T3. QD for Field Storage and Handling Areas

	FROM					
TO	Storage Sections	AE Staging Area	Captured Enemy Ammunition Area	AE Operations Area	Sling Out Area Area	AE Destruction Area
Storage Sections	IMD Note 1	IMD Note 1	PTRD[2] PTRD[2]	IMD Note 1	IMD Note 1	Note 4
AE Staging Area	IMD Note 1	IMD Note 1	PTRD[2] PTRD[2]	IMD Note 1	IMD Note 1	Note 4
Captured Enemy Ammunition Area	IMD Note 1	IMD Note 1	IMD PTRD[2]	IMD Note 1	IMD Note 1	Note 4
AE Operations Area	IMD Note 1	IMD Note 1	PTRD[2] PTRD[2]	IMD Note 1	IMD Note 1	Note 4
Sling-Out Area	N/R Note 1	N/R Note 1	PTRD[2] PTRD[2]	IMD Note 1	IMD Note 1	Note 4
Administrative and Billeting Area	IBD[3] IBD[3]	IBD[3] IBD[3]	IBD[3] IBD[3]	IBD[3] IBD[3]	IBD[3] IBD[3]	Note 4
Boundaries	IBD[3] IBD[3]	IBD[3] IBD[3]	IBD[3] IBD[3]	IBD[3] IBD[3]	IBD[3] IBD[3]	Note 4
Manned Non-Explosive Support Facility	ILD Note 1	ILD Note 1	IBD[3] IBD[3]	ILD Note 1	ILD Note 1	Note 4
Unmanned Non-Explosive Support Facility	N/R Note 1	N/R Note 1	PTRD[2] PTRD[2]	N/R Note 1	N/R Note 1	Note 4
AE Destruction Area	Note 4	Note 4	Note 4	Note 4	Note 4	Note 4

Notes for Table C10.T3.

N/R = Not Required

1. The distance criteria in the upper half of each row are the minimum separation distances required per chapter 9. The distance criterion in the lower half of each row is the asset preservation distance. For HD 1.1 material, use $d = 24W^{1/3}$ [$9.52\ W^{1/3}$] **[EQN C10.T3-1] [EQN C10.T3-2]** or $d = 30W^{1/3}$ [$11.90\ W^{1/3}$] **[EQN C10.T3-3] [EQN C10.T3-4]]**. For HD 1.2, 1.3, or 1.4 apply PTRD from chapter 9.
2. PTRD includes minimum fragment distance.
3. IBD includes minimum fragment distance.
4. IAW paragraphs C9.8.3. and C9.8.4.

C10.4.4. FARP. Storing AE and fuel at the same location is inherently hazardous and should be avoided when possible. If it is necessary to refuel and rearm aircraft at the same location, all precautions must be made to minimize the hazards involved in these operations. Armament pads shall contain the minimum amount of AE to conduct efficient operations. For example, where armament pads support only one aircraft, that pad shall be restricted to the amount of ammunition necessary to rearm that aircraft.

C10.4.4.1. Required Separations.

C10.4.4.1.1. Use K24 [9.52] for asset preservation between FARP and other ES.

C10.4.4.1.2. FARPs shall be separated by IBD from all non-associated inhabited buildings.

C10.4.4.1.3. AE ready storage (i.e., AE staged to support the next load) shall be separated by AGM IMD from the armament pads with only armament pads considered as the PES. Ready AE storage structures and locations shall be separated from other ready AE storage structures and locations by AGM IMD.

C10.4.4.1.4. Build-up locations shall be separated by AGM IMD from all other explosives storage and operations with only the build-up locations considered as the PES.

C10.4.4.1.5. Distances prescribed by the owning DoD Component shall separate other support structures and sites.

C10.4.4.1.6. AE shall be separated from operational fuel supplies by at least 100 ft [30.5 m]. Fuel supplies shall be diked or placed downhill from AE.

C10.4.5. Airfield Operations. Special consideration must be given to phased plans where the peacetime operation and positioning of aircraft transitions to contingency operations with increased quantities and use of AE. Exposures given adequate protection under the peacetime phase may be at greater risk during the contingency phase. Commanders must consider these changes when approving these plans. The proper use of such features as barricades or earth-filled, steel-bin-type barricades (ARMCO revetment or equivalent (see section C5.3.)) can decrease the magnitude of a potential event and increase the explosives capacity of limited areas.

C10.4.5.1. Airfield QD Criteria for PES. Table C10.T4. provides criteria for airfield PES.

C10.4.5.2. Airfield QD Criteria for ES.

C10.4.5.2.1. Runways, Taxiways and Aircraft.

C10.4.5.2.1.1. For military use only, use Table C10.T4.

C10.4.5.2.1.2. For joint use, use criteria in Table C9.T24.

C10.4.5.2.2 Combat Aircraft Support Facilities.

C10.4.5.2.2.1. Unhardened combat aircraft support facilities shall be separated from AE storage and operating facilities by K30 [11.9]. For asset preservation, apply incremental K40 [15.87] to K50 [19.84] based on the NEWQD.

C10.4.5.2.2.2. If these functions are located in a HAS, separation may be reduced to K18 [7.14] to the sides or rear of the HAS.

C10.4.5.2.2.3. Other hardened facility sitings require DDESB approval.

C10.4.5.2.2.4. When operational necessity dictates, separation distances less than K18 [7.14] may be approved for ES; however, it must be demonstrated that protection equivalent to K18 [7.14] is being provided.

C10.4.6. Static Missile Battery Separation. To ensure optimal effectiveness, offensive and defensive missile batteries many times must be deployed in a static (non-mobile role) in the proximity of other AE operations such as field storage or flight lines. The following criteria apply to deployed static missile batteries and associated support functions:

C10.4.6.1. IMD (K11 [4.36]) shall be maintained between missile launchers, reloads and other AE storage locations to include parked AE loaded aircraft.

C10.4.6.2. Missile batteries deployed within the IBD of AE storage areas may be sited at K18 [7.14] to manned functions considered related to area AE operations. Likewise, missile batteries deployed in the clear zones of flight line operations may be sited at K18 [7.14] to manned flight line facilities.

C10.4.6.3. Those functions solely providing support to static missile units, such as motor pools, may be sited at K18 [7.14] to batteries and other AE activities when the missile battery is located in these areas. For asset preservation, use PTRD.

C10.4.6.4. No separation is required between missile batteries and the security force structures exclusively supporting them.

C10.4.7. Emergency Destruction. When it becomes necessary to destroy stores of AE to prevent them from falling to the enemy, care must be taken to ensure that assets otherwise not in danger of falling to the enemy are not destroyed by blast or fragments. The DoD Components shall develop specific guidance for the implementation of and training for emergency destruction of munitions. Normal disposal operations shall be conducted IAW paragraphs C9.8.3. and C9.8.4.

C10.4.8. Separation From Fuel.

C10.4.8.1. Operational Storage. Quantities up to 500 gal. [1,893 l] shall be separated from each PES by at least 50 ft. [15.24 m]. Quantities between 500 to 5,000 gal. [1,893 to 18,927 l] shall be separated from each PES by at least 100 ft. [30.5 m]. Fuel should be located downhill and diked to contain a possible fuel spill.

C10.4.8.2. Bulk Fuel Storage. For more than 5,000 gal. [18,927 l] apply paragraph C9.8.14.

C10.4.9. Roll-on or Roll-off AE Operations. A documented risk assessment, (e.g., Safety Assessment for Explosives Risk (SAFER)), must be used when chapter 9 criteria cannot be met. The risk assessments, performed and accepted IAW DoD Component criteria, must consider explosive effects, explosives limits, site location, operation scheduling, potential secondary hazards (e.g., fuel tanks, chemical), and surrounding personnel and exposures. Risk reduction or mitigation measures, identified from the risk assessment, must be incorporated into the RORO operational procedures.

TABLE C10.T4. QD for Contingency, Combat, and MOOTW Airfields

TO ES	FROM AIRFIELD PES	
	MINIMUM SEPARATION DISTANCE	ASSET PRESERVATION DISTANCE
Manned functions not related to the combat mission	IBD	IBD
Base boundaries without an easement unless manifestly unsuitable	IBD	IBD
Crew support and billeting areas	IBD	IBD
Central airfield support facilities	ILD	Note 1
Functions related to the explosives mission (manned)	ILD	Notes 1,2
Flight line fire and rescue services	ILD	Note 1
Manned munitions operating locations (assembly, maintenance, refurbishment, etc)	ILD	Note 1
To any other explosives loaded aircraft or CAPA	IMD	Notes 1,2
Flight line Munitions HA	IMD	Notes 1,2
Military use runways and taxiways	D=4.5*NEWQD$^{1/3}$ [*D=1.79*NEWQD$^{1/3}$*]	Notes 1,2

Notes for Table C10.T4.

1. For HD 1.1 material, use d =24W$^{1/3}$ [9.52 W$^{1/3}$] **[EQN C10.T4-1] [EQN C10.T4-2]** or d=30W$^{1/3}$ [11.90 W$^{1/3}$] **[EQN C10.T4-3] [EQN C10.T4-4]**]. For HD 1.2, 1.3, or 1.4 apply PTRD from chapter 9.
2. For aircraft, asset preservation distances may not provide protection from fragments. To protect against low-angle, high-energy fragments, aircraft should be barricaded.

C11. CHAPTER 11
TOXIC CHEMICAL MUNITIONS AND AGENTS

C11.1. SCOPE AND APPLICABILITY

C11.1.1. This Chapter sets forth standards for protecting workers and the general public from the harmful effects of toxic chemical munitions and agents associated with research, testing, training, preservation and maintenance operations, storage, and demilitarization at laboratories, manufacturing plants and depots as well as other DoD Component agent operations, exclusive of combat training and operations. They apply to:

C11.1.1.1. Blister Agents (examples include, but are not limited to):

C11.1.1.1.1. H/HD - 2,2' dichlorodiethyl sulfide,

C11.1.1.1.2. H/HT - 60% HD and 40% 2,2' dichloroethylthiodiethyl ether,

C11.1.1.1.3. L - dichloro (2-chlorovinyl) arsine;

C11.1.1.2. Nerve agents (examples include, but are not limited to)

C11.1.1.2.1. GB - isopropyl methylphosphonofluoridate,

C11.1.1.2.2. GA -dimethylaminoethoxy-cyanophosphine oxide,

C11.1.1.2.3. VX - 0-ethyl S-[2-(diisopropylamino) ethyl] methylphosphonothioate,

C11.1.1.2.4. GD-pinacolyl methylphosphonofluoridate,

C11.1.1.2.5. Mixtures of these agents.

C11.1.2. Toxic chemical munitions may present additional hazards of blast, fragments, and thermal effects. Standards relating to these explosives hazards are addressed in other Chapters.

C11.1.3. This Standard does not apply to the immediate disposal of toxic chemical munitions or decontamination of toxic chemical agents during an emergency when the delay will cause a greater danger to human life or health.

C11.1.4. The DoD Components are responsible for developing implementing instructions and safety procedures for logistical movements, training, and field operations.

C11.1.5. The requirements of MIL-STD-882 (reference (ab)) shall be followed.

C11.2. SITING CRITERIA

C11.2.1. Hazard Distance Calculations (See Public Exclusion Distance). Hazard distance calculations shall conform with reference (q). DDESB approved software (e.g. D2PC (reference (ac)) that implements the methodology of reference (s) may be used to perform these calculations. The calculated hazard distance is based on the greater of the MCE or the toxic chemical agent MCE and is bounded by the one percent lethality arc for a toxic chemical agent source containing a dose of more than:

C11.2.1.1. 10.0 mg-min/m^3 of GB

C11.2.1.2. 4.3 mg-min/m^3 of VX

C11.2.1.3. 150.0 mg-min/m^3 mustards, and

C11.2.1.4. 0.1 mg for inhalation-deposition of VX.

C11.2.2. Positive means shall be taken to ensure that unprotected personnel do not enter hazard zones and shall include written procedures that must be reviewed and updated, as necessary. However, positive control of an area, which ensures personnel can evacuate or be protected before exposure in the case of an accident, may be developed instead of absolute exclusion. Details of such control procedures shall be included in the site and general construction plans.

C11.3. WORKPLACE AIRBORNE EXPOSURE LEVELS (AEL)

The Army Surgeon General establishes the maximum permissible concentrations (AEL) listed in Table C11.T1. AEL are time-weighted averages (TWA) or ceiling values that define the permissible limits of exposure for unprotected personnel.

TABLE C11.T1. Airborne Exposure Limits

	Chemical Agents (mg/m^3)				
	GD	GA/GB	VX	H,HD,HT	L (Note 1)
Unmasked Agent Worker					
8-hour TWA in any work shift	3×10^{-5}	1×10^{-4}	1×10^{-5}	3×10^{-3} (Note 2)	3×10^{-3} (Note 2)
Non-agent Worker and General Population					
72-hour TWA	3×10^{-6}	3×10^{-6}	3×10^{-6}	1×10^{-4} (Note 3)	3×10^{-3} (Note 2)
Ceiling Value (Note 4)	3×10^{-5}	1×10^{-4}	1×10^{-5}	3×10^{-3} (Note 2)	3×10^{-3} (Note 2)
Source Emission Limit					
1-hour TWA	1×10^{-4}	3×10^{-4}	3×10^{-4}	3×10^{-2}	3×10^{-2}

Notes for Table C11.T1.

1. All concentrations measured as Lewisite.
2. This value also represents the technologically feasible real time detection limit. HT is measured as HD.

3. It is recommended that this level of detection (using a 12-hour sampling time) be demonstrated and used at all sites where mustard shall be transported and destroyed.
4. The concentration of chemical agent that may not be exceeded for any period of time. Practically, it may be an average value over the minimum time to detect the specified concentration.

C11.4. TOXIC CHEMCAL AGENT HAZARD ANALYSES, MEASUREMENTS, AND EXPOSURE CONTROLS

C11.4.1. Hazard Analyses.

C11.4.1.1. Hazard analyses shall be conducted for all new operations involving toxic chemical agents or when there is a change in existing production, process, or control measures that may result in an increase in airborne or contact concentrations of toxic chemical agents. Hazard analyses shall be retained for 40 years.

C11.4.1.2. If hazard analyses indicate that an operation may expose personnel to toxic chemical agents above the AEL, control measures shall be instituted and procedures shall be established so that the actual exposure is measured.

C11.4.2. Measurements.

C11.4.2.1. Devices for sampling and analyzing workplace air shall measure and alarm within 10 minutes when toxic chemical agents are present in excess of the 8 hour TWA concentrations.

C11.4.2.2. When the interior of reservoirs, pipes and such systems are sampled, the volume of the item or system being sampled as well as the volume of the sample must be recorded and associated with the measured concentrations.

C11.4.2.3. Decontaminating solutions shall not be analyzed for residual toxic chemical agent for the purpose of certifying a level of decontamination. Suspected toxic chemical agents shall be extracted from samples with suitable solvents where analyses are required. Air may be an appropriate solvent for volatile agents.

C11.4.3. Exposure Control.

C11.4.3.1. When exhaust systems are used to control exposure, measurements of system effectiveness such as static pressure shall be made at the start of each operation and at least every 3 months.

C11.4.3.2. Before beginning toxic chemical agent operations, the hazard zone associated with those operations shall be under positive control in accordance with paragraph C11.2.2.

C11.4.3.3. If personnel exposures will equal or exceed the applicable AEL, personnel shall be protected by personnel protective equipment (PPE) specifically approved by the Army Surgeon General or as indicated in Table C11.T2.

C11.4.3.4. Procedures shall be developed to address hazards involved in maintenance and repair operations.

Table C11.T2. PPE[1] And Employee Exposure Potential[2]

Occupational Scenario	Toxic Chemical Agents (mg/m^3)				
	GD	GA/GB	VX	H,HD, & HT	L
1. Unmasked agent worker					
A full facepiece, chemical canister, air purifying protective mask will be on hand for escape. (The M9, M17 or M40 series masks are acceptable for that purpose. Other masks certified as equivalent may be used.) (Note 5)	3×10^{-5} (Note 3)	1×10^{-4} (Note 3)	1×10^{-5} (Note 3)	3×10^{-3} (Note 4)	3×10^{-3} (Note 4)
2. Masked personnel in routine operations					
a. A NIOSH approved pressure demand full facepiece SCBA or supplied air respirator with escape air cylinder may be used. b. Alternatively, a full facepiece, chemical canister, air purifying protective mask is acceptable for that purpose (i.e., M9, M17, or M40 series or other certified equivalent.) (Note 5)	$>3 \times 10^{-5}$ to 6×10^{-2}	$>1 \times 10^{-4}$ to 2×10^{-1}	$>1 \times 10^{-5}$ to 2×10^{-2}	3×10^{-3}	3×10^{-3}
3. Personnel conducting emergency operations or operations in unknown but potentially high agent concentrations					
a. NIOSH approved pressure demand full facepiece SCBA with protective ensemble. (Notes 7 & 8) b. During emergencies, the best available respiratory protection and personnel ensemble will be used. If protection in 3a above is not available, use of a full facepiece, chemical canister, air purifying protective mask with hood is acceptable. Only the M9 or M40 series masks are acceptable. (Notes 7 & 8)	$>6 \times 10^{-2}$	$>2 \times 10^{-1}$	$>2 \times 10^{-2}$	$>3 \times 10^{-3}$ (Note 6)	$>3 \times 10^{-3}$ (Note 6)

Notes for Table C11.T2.

1. Qualitatively fit all workers required to use respiratory protective devices. Quantitative fit testing may be performed using surrogate masks.
2. Employee exposure potential is based on an 8-hour TWA measurement. All values on this table are 8 hour TWA unless otherwise noted. The TWA is the concentration to which workers may be repeatedly exposed, for a normal 8-hour workday and 40-hour workweek, day after day, without adverse effects. TWA permit excursions above the limit provided they are compensated by equivalent excursions below the limit during the workday. Excursions above the TWA should be controlled even where the 8-hour TWA is within recommended limits.

3. Determined by required continuous air monitoring.
4. This represents ceiling value determined by continuous real time monitoring (with alarm) at the 0.003 mg/m^3 level of detection. Respiratory protection must be immediately available in case concentration rises above 0.003 mg/m^3. Engineering and work practice controls shall be used to limit employee exposure potential to the extent practical.
5. Air-purifying masks may not be used in oxygen deficient atmospheres.
6. Because agents H and L are potential carcinogens, the highest level of respiratory and dermal protection shall be provided to all workers exposed. An air-purifying protective mask is not suitable for this purpose.
7. Examples of such protective ensembles include toxicologic agent protective ensemble, self-contained (TAPES) and the demilitarization protective ensemble (DPE).
8. For emergency masked escape, a full facepiece, chemical canister, air-purifying protective mask (DoD Component-certified masks) is acceptable.

C11.5. MEDICAL SURVEILLANCE

Before being assigned to toxic chemical agent duties and on an annual basis thereafter, health assessments shall be provided for each employee to establish a baseline health record. Annual assessments shall be used to determine deviations from the baseline.

C11.6. WORKER PPE

C11.6.1. Positive engineering and administrative controls shall be incorporated in all operations involving toxic chemical agents to preclude or minimize the need for PPE.

C11.6.2. A respiratory protection program shall be established in conformance with DoD Instruction 6055.1 and DoD Instruction 6055.5 (references (ad) and (ae)) for approved respiratory requirements. The wearer's face shall be clean-shaven to the extent that there is no interference of any facial hair growth with the sealing surfaces of the protective mask. Personnel with beards shall be denied access to agent storage and operating areas, unless suitable emergency egress respirator(s) can be provided.

C11.6.3. Personnel shall use PPE recommended by the hazard analysis. (See Table C11.T2.).

C11.7. ADMINISTRATIVE AND WORK PRACTICE CONTROLS

C11.7.1. Containment.

C11.7.1.1. Containment is the principal control measure for prevention of exposure of personnel to toxic chemical agents.

C11.7.1.1.1. Total containment is required for those operations involving toxic chemical munitions that contain explosive components when the operation may subject the explosive components to a potential initiating stimulus. Total containment requires the equipment or facility to be a DDESB approved design capable of containing all the reaction gases, detectable toxic chemical agents, and fragments from the largest explosion or detonation that could occur without causing equipment or facility rupture or leakage. Operations requiring total containment include, but are not limited to:

C11.7.1.1.1.1. Toxic chemical munition cutting, sawing, milling, drilling, punching, or shearing operations that require the machine tool to remove or displace metal before or after contact with the explosives.

C11.7.1.1.1.2. Operations in which the toxic chemical munition arming and functioning environments can be duplicated by the equipment or process.

C11.7.1.1.1.3. Disassembly of armed or possibly-armed toxic chemical munitions.

C11.7.1.1.1.4. Disassembly of explosive components from toxic chemical munitions that requires application of significantly greater leverage or torque than that required for assembly.

C11.7.1.1.2. Vapor containment is required for those operations involving toxic chemical agents without explosives components and for those operations involving toxic chemical munitions containing explosive components that do not subject the explosive components to a potential initiating stimulus. Vapor containment requires the equipment or facility to be a DDESB approved design capable of containing non-explosion releases of toxic chemical agents. Operations requiring vapor containment include, but are not limited to:

C11.7.1.1.2.1. Toxic chemical munitions punching, drilling, or sawing operations for removal of toxic chemical agents.

C11.7.1.1.2.2. Burster-well removal.

C11.7.1.1.2.3. Transfer of toxic chemical agents from bulk storage tanks, containers, or toxic chemical munitions into holding tanks, chemical detoxification reactors, incinerators, or similar processing equipment (e.g., may be found in a production, demilitarization, or disposal line).

C11.7.1.1.2.4. Research, Development, Test, and Evaluation (RDT&E) Chamber operations.

C11.7.1.2. Containment is not required for operations associated with field storage and maintenance activities (e.g., shipping, storage, receiving, re-warehousing, minor maintenance, surveillance inspection, repair, and encapsulation).

C11.7.2. Training and Information. Anyone who works with toxic chemical munitions and agents (e.g., agent workers, firefighters, medical, and security personnel) shall receive training to enable them to work safely and to understand the significance of toxic chemical agent exposures. This training shall include, but is not limited to, information on sources of exposure, adverse health effects, practices and controls used to limit exposures, environmental issues, medical monitoring procedures, and employee responsibilities in health protection programs.

C11.7.3. Record Keeping. Record keeping pertaining to exposure determination and measurement, mechanical ventilation, employee training, medical surveillance, and access to records shall be consistent with reference (ae).

C11.7.4. Labeling and Posting of Hazards.

C11.7.4.1. Signs and labels to warn personnel of hazards of toxic chemical agents are required for:

C11.7.4.1.1. Work areas.

C11.7.4.1.2. Contaminated clothing and equipment.

C11.7.4.1.3. Identification of restricted-use areas.

C11.7.4.2. When items or materials are contaminated or suspected of being contaminated with toxic chemical agents, they shall be marked as follows:

C11.7.4.2.1. The applicable Supplemental Chemical Hazard Symbol (Figure C8.F3.) with a single "X" indicates the items or materials have been partially decontaminated of the indicated toxic chemical agent. Further decontamination processes are required before the item is moved or any maintenance or repair is performed without the use of PPE.

C11.7.4.2.2. The applicable Supplemental Chemical Hazard Symbol (Figure C8.F3.) with "XXX" indicates that the items or materials have been decontaminated. Tests or monitoring shall be conducted in accordance with DoD Component requirements to verify that concentrations do not exceed the AEL for an Unmasked Agent Worker in Table C11.T1.

C11.7.4.2.3. The applicable Supplemental Chemical Hazard Symbol (Figure C8.F3.) with "XXXXX" indicates that the items or materials have been completely decontaminated and may be released for general use or sold to the general public. Items or materials are completely decontaminated when they have been subjected to procedures that are known to completely degrade the toxic chemical agent molecule, or when analyses, approved by the DDESB, have shown that the total quantity of toxic chemical agent is less than the minimal health effects dosage as determined by the Office of the Surgeon General of the Army.

C11.7.4.3. When facilities or rooms are contaminated or suspected of being contaminated with toxic chemical agents, they shall be marked as follows (excluding magazines which use the Supplemental Chemical Hazard Symbols shown in Figure C8.F3.):

C11.7.4.3.1. 5R - No Agent Hazard. A Supplemental Chemical Hazard Symbol (Figure C8.F3.) with "RRRRR" indicates that all previously contaminated surfaces are decontaminated and analyzed to demonstrate the absence of residual toxic chemical agents and air sampling indicates toxic chemical agent vapor concentration is less than the 8-hour TWA for Unmasked Agent Worker (Table C11.T1.). The air is sampled at a temperature of 70 F [21.1° C] or greater, with the facility's ventilation system operating.

C11.7.4.3.2. 4R - Controlled Agent Vapor Hazard. A Supplemental Chemical Hazard Symbol (Figure C8.F3.) with four "Rs" indicates that all previously contaminated surfaces are decontaminated using locally approved procedures and air sampling indicates toxic chemical agent vapor concentration is less than the 8-hour TWA for Unmasked Agent Worker (Table C11.T1.). The air is sampled at a temperature of 70 F [21.1° C] or greater, with the facility's ventilation system operating.

C11.7.4.3.3. 3R - Contained Agent Hazard. A Supplemental Chemical Hazard Symbol (Figure C8.F3.) with three "Rs" indicates that any toxic chemical agents are in containers or packaging which, if left undisturbed, will prevent agent vapor or contact hazards.

C11.7.4.3.4. 2R - Agent Vapor Hazard. A Supplemental Chemical Hazard Symbol (Figure C8.F3.) with two "Rs" indicates that any toxic chemical agents are in containers or packaging which, if left undisturbed, prevent contact hazards.

C11.7.4.3.5. lR - Agent Hazard. A Supplemental Chemical Hazard Symbol (Figure C8.F3.) with one "R" indicates the possibility of toxic chemical agent contact or vapor hazards, or agents in a single container or packaging which may leak. This includes rooms being used for operations that may cause agents to be released from engineering controls due to accidental causes.

C11.7.5. Emergencies.

C11.7.5.1. In case of an accidental release of a toxic chemical agent that may result in personnel exposure, all nonessential and unprotected personnel shall evacuate immediately. Contaminated areas shall be decontaminated to applicable Table C11.T1. AELs before normal operations are resumed.

C11.7.5.2. Special medical surveillance shall be started within 24 hours for all personnel present in the potentially affected area at the time of the emergency.

C11.7.5.3. The DoD Component shall maintain up-to-date Chemical Accident and Incident Control plans and conduct practice exercises of these plans at least annually.

C11.7.6. Toxic Chemical Agent Decontamination.

C11.7.6.1. When toxic chemical agents are spilled, or released, immediate action shall be taken to contain the spill and clean up the agent in the immediate area of the spill.

C11.7.6.2. Before leaving contaminated work areas, the external surfaces of the PPE shall be decontaminated.

C11.7.6.3. When PPE becomes contaminated with toxic chemical agents, the outside layer of clothing shall be removed and decontaminated as soon as possible.

C11.7.6.4. PPE that has been worn in known contaminated areas (toxic chemical agent detected) shall be decontaminated and monitored before reuse. Because mustard penetrates into many protective materials with time, reuse of any PPE that has been contaminated with liquid mustard is not permitted. PPE that has been worn in potentially contaminated areas (when no agent leakage has been visually observed or detected by use of field detection equipment) shall be monitored before being moved to areas accessible to non-agent workers.

C11.7.6.5. Monitoring of protective clothing and equipment shall include containerization at 70 F [21.1° C] or higher for at least 4 hours, with subsequent analysis of a portion of the interior atmosphere of the container for the toxic chemical agent. The volume of the container, as well as the sample volume must be noted.

C11.7.6.6. PPE found to emit toxic chemical agent concentrations above the XXX level after decontamination shall not be reused. They shall be disposed of in accordance with DoD Component guidance and in compliance with all Federal, state and local requirements.

C11.7.6.7. Before toxic chemical agent disposal systems are converted to different agents, piping, tanks, etc., of the disposal systems shall be decontaminated to XXX. Walls and floors of process areas shall be decontaminated to ensure the absence of contact hazards.

C11.7.7. Recertification of Protective Clothing. After decontamination, clothing that has been determined to be XXX may be laundered, visually examined, and re-certified by the DoD Component for use. Other PPE, such as boots and gloves, shall be tested, laundered, and re-certified for use in the same manner.

C11.7.8. Transportation of Items or Materials Contaminated with Toxic Chemical Agents. Items or materials contaminated with toxic chemical agents may be transported from one location to another. They shall be encapsulated within an agent tight barrier. In addition, the following items or materials shall be overpacked in compatibly lined drums or provided with other suitably tested containment before being transported:

C11.7.8.1. Potentially contaminated with liquid toxic chemical agent.

C11.7.8.2 Failing a XXX determination.

C11.7.8.3. Suspected of offering hazards due to skin exposure to a toxic chemical agent.

C11.7.9. Transportation of Toxic Chemical Munitions and Bulk Agents . The requirements established by AR 740-32/OPNAVINST 8070.1B/AFR 136-4/MCO 4030.25B (reference (af)) shall be met.

C11.8. ENGINEERING DESIGN GUIDANCE FOR FACILITIES

The chemical handling and maintenance areas associated with industrial operations shall be isolated from the main facility and shall be operated at a negative pressure with respect to the main facility area. The agent handling rooms shall be equipped with local exhaust ventilation which may be cascaded to more contaminated areas and exhausted out of a common exhaust stack. All air leaving the facility shall be filtered through redundant filter banks or other DDESB approved decontamination methods. The flow of air (negative pressures) shall go from less hazardous areas to more hazardous areas.

C11.8.1. Air Ventilation Systems. Air ventilation systems shall be designed and periodically tested to ensure that control of toxic chemical agent-contaminated exhaust shall not exceed Source Emission Limits of Table C11.T1.

C11.8.1.1. Filters or scrubbers for exhaust air shall be designed and approved for the MCE of the operations involved.

C11.8.1.2. Redundant filters shall be used when filter breakthrough of the toxic chemical agent is expected. Filters shall be changed when agent breaks through the filter that is just upstream of the last filter.

C11.8.1.3. All exhaust equipment shall have backup blowers that automatically engage if the main blower fails.

C11.8.1.4. Filter systems shall be fitted with the means to measure the pressure drop across the filters.

C11.8.1.5. Exhaust hoods and glove boxes shall be designed to contain toxic chemical agents so that concentrations specified in Table C11.T1. for Unmasked Agent Worker are not exceeded outside engineering controls. The design of these items shall permit airflow adjustments sufficient to maintain the required protection level when laboratory equipment is in place.

C11.8.1.5.1. Catch basins and traps or spill trays of sufficient capacity to contain the quantity of toxic chemical agent involved shall be provided within hoods and glove boxes.

C11.8.1.5.2. Glove boxes shall be used when the hazards analysis indicates that toxic chemical agent aerosols or dusts may be present during an operation.

C11.8.1.6. Special design features shall be used when exposed explosives are involved to segregate explosives from air ventilation systems.

C11.8.2. Mechanical and Utilities Design for Facilities.

C11.8.2.1. The design parameters shall consider equipment and process layout, makeup airflow, and operational positions with regard to maintaining flow balance and cross currents. The system shall maintain negative pressure in operating areas in relation to hallways, offices, and other non-toxic chemical agent areas.

C11.8.2.2. Working surfaces, walls, floors, and ceilings within a facility likely to be contaminated shall be constructed of agent resistant materials. Flooring material shall cover wall surfaces to a height of 6 in [15.2 cm].

C11.8.2.3. Access to non-toxic chemical agent areas (e.g., utilities, mechanical rooms, etc.) shall be accomplished without entry into toxic chemical agent areas.

C11.8.2.4. Electrical systems shall be equipped with a backup power source designed to start automatically and supply sufficient power to support critical functions in the event of power outage.

C11.8.2.5. Safety showers and eyewash fountains shall be readily accessible and tested.

C11.8.2.6. Water outlets in a toxic chemical agent operational facility shall be fitted with backflow devices.

C11.8.2.7. Dedicated liquid waste systems shall be designed to collect and hold potentially toxic chemical agent-contaminated effluent produced by the activity until disposal in accordance with applicable laws. Vents or other openings in the waste system shall be fitted with approved toxic chemical agent filters or connected/exhausted to facility toxic chemical agent air filtration system.

C11.8.2.8. Decontamination facilities of sufficient capacity to catch and contain liquid effluents shall be provided for toxic chemical agent operations. Adequate decontamination solution shall be available for immediate use on personnel or on facilities.

C11.8.2.9. When operations require work assignments to be conducted at exposure levels above or potentially above the AEL for Unmasked Agent Worker (Table C11.T1.), change facilities with showers shall be provided.

C11.8.3. General Design Considerations.

C11.8.3.1. Facility Alarms and Monitors for Engineering Systems. Each toxic chemical agent facility shall have a master alarm and control panel that will permit functional verification of the exhaust blowers and air handlers. Visual and audible alert alarms shall be keyed to this master alarm panel to indicate failures.

C11.8.3.2. Fire Detection and Protection. Fire detection and protection systems for production and maintenance facilities shall comply with the requirements and guidelines published in ARLCD-CR-80049 (reference (ag).)

C11.8.3.3. Bulk Storage Tanks. Impermeable dikes to hold at least 110 percent of the tank capacity plus the required volume of decontaminant solution shall be placed around all bulk agent tanks, reactors, and mixers. However, a system designed to pump the toxic chemical agent from the dikes to a vessel designed to accommodate the decontamination will satisfy this requirement that the dike contain sufficient volume for the decontaminating solutions.

C11.8.3.4. Isolation of Facility Functions. Toxic chemical agent facilities shall be designed to isolate unrelated activities by physical barriers or approved engineering controls. Design criteria shall prevent explosives from entering drain lines and sumps containing toxic chemical agents.

C11.8.3.5. Monitoring. Air monitoring stations shall be established around toxic chemical agent operational areas and storage areas to determine if Table C11.T1. AEL are exceeded. In laboratory environments this requirement is met by routine area monitors and stack sampling.

C11.8.3.5.1. Monitoring analyses conducted for the purpose of demonstrating compliance with AEL shall be based on DoD Component certified reference materials.

C11.8.3.5.2. Monitoring analyses conducted for the purpose demonstrating compliance with AEL shall be conducted under quality assurance plans that address the following issues:

C11.8.3.5.2.1. Production, characterization, and storage of DoD Component certified reference materials.

C11.8.3.5.2.2. Documentation of precision, accuracy and quantification limits of analytical methodology.

C11.8.3.5.2.3. External oversight of laboratory results.

C12. CHAPTER 12

REAL PROPERTY CONTAMINATED WITH AMMUNITION, EXPLOSIVES OR CHEMICAL AGENTS

C12.1. SCOPE.

This Chapter contains particular guidance and procedures necessary to provide protection to personnel as a result of DoD ammunition, explosives or chemical agent contamination of real property currently and formerly owned, leased or used by the DoD. This includes manufacturing areas including pads, pits, basins, ponds, streams, burial sites and other locations incident to such operations. This requires identification and control measures that are in addition to, not substitutes for, those generally applicable to DoD real-property management. Contamination as used in this Chapter refers in all cases to contamination with ammunition, explosives or chemical agents.

C12.2. GUIDANCE

C12.2.1. Every means possible shall be used to protect members of the general public from exposure to hazards from contaminated real property currently or formerly under DoD ownership or control.

C12.2.2. Permanent contamination of real property by final disposal of AE or chemical agents is prohibited. This prohibition extends to disposal by land burial; by discharge onto watersheds or into sewers, streams, lakes or waterways. This does not preclude burial to control fragments during authorized destruction by detonation when procedures are authorized by the DoD Component concerned, and compliance with applicable statutes and regulations relative to environmental safeguards is ensured.

C12.2.3. Real property that is known to be contaminated with AE or chemical agents must be remediated with the most appropriate technology to ensure protection of the public consistent with the proposed end use of the property.

C12.3. PROCEDURES

C12.3.1. Identification and Control (Active Installations).

C12.3.1.1. Permanent records shall be created and maintained for each installation, ammunition plant, depot, laboratory, range, and ammunition holding areas to identify clearly all contaminated areas. These records shall indicate known and suspect areas, positively identify contamination by nomenclature, hazard, quantity, exact locations, and dud rates. All decontamination efforts shall be similarly detailed. If the installation is deactivated, the decontamination records shall be transferred to the office designated by the DoD Component concerned to ensure permanent retention.

C12.3.1.2. All contaminated locations shall be placarded appropriately with permanent signs that prohibit entrance of unauthorized personnel. The DoD Component

concerned shall ensure periodically that such signs are restored and maintained in a legible condition.

C12.3.1.3. Active firing ranges, demolition grounds, and explosives test areas shall be assumed to be contaminated with unexploded ordnance (UXO) explosive material and shall be controlled accordingly. Access to these areas shall be controlled by the DoD Component.

C12.3.2. Land Disposal (Active Installations).

C12.3.2.1. The plans for leasing, transferring, excessing, disposing and/or remediating DoD real property when AE or chemical agents contamination exists or is suspected to exist, shall be submitted to DDESB for review and approval of explosives safety aspects.

C12.3.2.2. The land disposal submission shall state the intended end use of the property, the nature and extent of on and off post contamination, location of the contaminated land, any improvements that may have been made, proposed detection and degree of decontamination and the extent to which the property may be used safely without further decontamination.

C12.3.2.3. When accountability and control of real property contaminated with ammunition and explosives are transferred among the DoD Components, the action shall be accompanied by the permanent record of contamination.

C12.3.2.4. AE or chemical agents shall be removed until an acceptable level of protection is reached. Identification of degree and extent of contamination, assessment of potential for migration of contamination, and implementation of steps to halt such migration are necessary to accomplish proper cleanup. In addition, AE contamination shall be removed to appropriate depths in limited areas where the user activity warrants it. Transfer records shall detail past AE contamination and decontamination efforts; provide requisite residual contamination information; and advise the user not to excavate or drill in residual contamination area without a metal detection survey. This information shall be enclosed along with the report of excess. This information shall also be entered in the permanent land records of the civil jurisdiction in which the property is located.

C12.3.2.5. Limited use land transfers may be arranged with other federal agencies for compatible use of contaminated real property such as wildlife refuges, safety zones for federal power facilities, or other purposes not requiring entry except for personnel authorized by the DoD Component concerned. These land transfers shall include all restrictions and prohibitions concerning use of the real property to ensure appropriate protection of both operating personnel and the general public.

C12.3.3. Remediation of Formerly Used Defense Sites (FUDS).

C12.3.3.1. The DoD Component responsible for the remediation of the FUDS shall develop procedures to safely remediate those sites contaminated with ammunition, explosives or chemical agents. These procedures shall be provided DDESB for review and approval. Priority shall be given to the remediation of sites with contamination that poses an immediate public risk. Identification of the degree and extent of contamination, assessment of potential for migration of contamination, and implementation of steps to halt such migration shall complement efforts to clean up FUDS.

C12.3.3.2. Plans for the remediation of FUDS must be submitted to the DDESB for coordination (with regard to explosives and chemical agent safety). These plans should present the type of contaminations that are suspected to exist at the site, the techniques that will be used for the identification of the contamination, a risk assessment, and the measures that will be taken to minimize the risk to workers and the public during the contamination assessment, cleanup and disposal phases. The DDESB shall be notified if significant hazards arise during any of the above phases and require actions beyond the DDESB-approved FUDS procedures or actions beyond the specific FUDS remediation plan initially submitted for coordination by the DDESB.

C12.3.4. Remediation Methods and Use Restrictions.

C12.3.4.1. Remediation Planning. The depth to which UXO remediation is necessary depends on the projected end use of the land and the extent of human exposure.

C12.3.4.1.1. Information concerning the remediation and notification that additional cleanup is necessary before further and/or different use shall be included in applicable land disposal documents.

C12.3.4.1.2. The intended end use may be defined in congressional legislation or the end user which can be any combination of Federal, State, local and private entities.

C12.3.4.1.3. The land's projected end use must be changed in those cases where UXO detection systems are not sensitive enough or funds are not available to remove UXO to the remediation depth.

C12.3.4.1.4. Documents about the remediation depth to which UXO was removed and the process by which that depth was determined must be included in the land disposal documents.

C12.3.4.2. Remediation Process. Remediation involves removing UXO from the specific parcel of land being transferred. This process includes several steps:

C12.3.4.2.1. Determine the land end use. The end use may be provided externally or may be DoD-recommended. Within a parcel of land, there may be multiple uses, such as wildlife refuge, livestock grazing, public highway and picnic area.

C12.3.4.2.2. Determine the boundaries of the area(s) to be researched and remediated.

C12.3.4.2.3. Determine known or suspected UXO by type.

C12.3.4.2.4. Define the locations of UXO and the remediation depth(s).

C12.3.4.2.5. Remove or neutralize UXO.

C12.3.4.2.6. Document the process.

C12.3.4.2.7. Make provisions for continued DoD surveillance of areas where UXO is above the frost line yet located below the remediation depth. (NOTE: The CoE is responsible for actions involving land returned to the public domain.) Such UXO can be expected to eventually migrate to the surface and additional remediation will be required.

C12.3.4.3. Site-specific Remediation Depth Determination. The preferred method to determine the remediation depths is to use site-specific information. The following information is needed for site-specific determination:

C12.3.4.3.1. Characterize the site including the boundaries, types of ordnance, and soil characteristics. This is done through searching historical documents, interviews and on-site investigation, as appropriate.

C12.3.4.3.2. Provide the estimated depth at which UXO may be present based on available records, technical data, and/or on-site investigation, as appropriate. A method for predicting penetration path length, using empirical equations, is found in chapter 6 of Unified Facilities Code (UFC) 3-340-01 (reference (ah)). In addition, a projectile penetration software code called PENCURV (reference (ai)) can be used to estimate penetration depths.

C12.3.4.3.3. Using UXO depth estimate(s), establish remediation depths for the site-specific conditions.

C12.3.4.4. The approved remediation plan may be modified based on actual conditions encountered during the remediation. For example, should UXO be consistently found at less than the predicted depths, the remediation depth may be reduced. The modification(s) shall be documented, forwarded to DDESB for approval, and included in the land disposal agreements.

C12.3.4.5. **Assessment Depth.** When site specific planning described in subparagraph C12.3.4.3., above, is not possible, the assessment depths provided in Table C12.T1. shall be used for interim planning.

C12.3.4.6. Land disposal agreements must include notice that there could be increased risks to operations and public safety if violations of the end use were to occur.

C12.3.5. **Termination of Use of Facilities Storing AE.** Each storage facility no longer used to store AE must undergo a process to ensure that AE and any visible explosives residues are removed within 180 days from the last use of the storage facility. Those procedures help ensure that no threats to human health or the environment remain when the unit is no longer to be used to store AE. Ammunition storage units (ASUs) that have been used to store waste military munitions must also comply with the closure procedures in section C14.6. Those procedures shall include the following:

C12.3.5.1. Emptying the storage facility of all AE and related materials.

C12.3.5.2. Cleaning the storage facility, as required, to remove any visible explosives residue.

C12.3.5.3. Visually inspecting the storage facility for the presence of remaining AE or visible explosives residue by a knowledgeable individual that the installation or responsible activity commander appoints.

C12.3.5.4. Removing from the storage facility all fire and chemical hazard symbols and marking the storage facility as empty.

Table C12.T1. Assessment Depths

Planned End Use	Depth
Unrestricted	
Commercial/Residential/ Utility/Subsurface Recreational	
Construction Activity	10 Ft *[3.05m]
Public Access	
Farming/Agriculture/Surface	4 Ft
Recreation/Vehicle Parking/Surface	[1.22 m]
Supply Storage	
Limited Public Access	
Livestock Grazing/Wildlife Preserve	1 Ft
	[0.30 m]
Not Yet Determined	Surface
Like Use	
(Remediation shall be consistent with DoD regulations concerning routine maintenance of impact areas).	

(Assessment planning at construction sites for any projected end use requires looking at the possibility of UXO presence 4 ft [1.22 m] below planned excavation depths).

C12.3.5.5. Securing the storage facility to prevent inadvertent use or access.

C12.3.5.6. Notifying the applicable emergency response and regulatory authorities of the change in the storage facility's use.

C12.3.5.7. Recording the date the storage facility was inspected, the name and position of the inspector, and the results in permanent real estate records.

C12.4. MINERAL EXPLORATION AND EXTRACTION

C12.4.1. AE Facilities.

C12.4.1.1. Mineral exploration and drilling activities are to be separated from AE operating and storage facilities by public traffic route explosives safety distances provided there is to be no occupancy of the site by personnel when the exploration or drilling is completed, and by inhabited building explosives safety distances if occupancy is to continue when exploration or drilling is completed. If chemical agents or munitions are present, public exclusion distances must be maintained to the exploration or drilling activities. Examples of exploration activities are seismic or other geophysical tests.

Examples of drilling activities are those for exploration or extraction of oil, gas, and geothermal energy.

C12.4.1.2. Mining activities are to be separated from AE operating and storage facilities by IBD. If chemical agents or munitions are present, public exclusion distances must be maintained to the mining activities. Examples of mining activities are strip, shaft, open pit and placer mining, which normally require the presence of operating personnel.

C12.4.2. Contaminated Lands. Exploration, drilling, and mining are prohibited on the surface of AE or chemical agent contaminated lands. Exploration and extraction is permitted by directional (slant) drilling at a depth greater than 50 feet [15.2 m] beneath the AE contaminated land surface or by shaft mining at a depth greater than 100 feet [30.5 m] beneath such land surface.

C12.4.3. Safety Review of Exploration and Extraction Plans. DoD Component plans for mineral exploration and extraction on land that is in proximity to AE facilities or land that is contaminated or suspected to be contaminated with AE shall be forwarded to the DDESB for safety review and approval. Submission shall include information necessary for explosives safety evaluation consistent with paragraph C12.3.2., above. Relationships with other PES should be included.

C13. CHAPTER 13
ACCIDENT NOTIFICATION AND REPORTING REQUIREMENTS

C13.1. SCOPE

C13.1.1. Enclosure 5 to DoD Instruction 6055.7 (reference (aj), identifies the accidents that shall be reported to the DDESB. Accident notifications and reports shall be prepared in accordance with implementing regulations to reference (aj). This reporting requirement has been assigned Report Control Symbol (RCS) DD-AT&L(AR)1020 in accordance with reference (b).

C13.1.2. This Chapter sets forth the minimum data that shall be included in accident notifications and reports submitted to the DDESB. Submit any missing data in subsequent reports.

C13.1.3. Accidents reported to the DDESB need not be reported separately to the Assistant Deputy Under Secretary of Defense (Environment, Safety & Occupational Health) (ADUSD(ESOH)) under the special reporting requirements of enclosure 3 to reference (aj).

C13.1.4. Regardless of format, accident notifications and reports that are prepared in compliance with DoD Component criteria may be used to satisfy these requirements when they contain similar data.

C13.2. SECURITY CLASSIFICATION

Accident notifications and reports should be unclassified when possible to ease dissemination of safety information to the DoD Components, industry, and allied governments.

C13.3. ACCIDENT NOTIFICATION REQUIREMENTS

The DoD Component shall provide the following data as soon as practical:

C13.3.1. Name and location of the reporting activity.

C13.3.2. Location of accident (activity, city, installation, building number or designation, road names, or similar information).

C13.3.3. Item nomenclature or description (e.g., Mk, Mod, FSC, NIN, DODAC, NALC or ANFO).

C13.3.4. Quantity involved (number of items and NEWQD).

C13.3.5. Day, date, and local time of initial significant event and when discovered.

C13.3.6. Narrative of the event (include type of operation involved).

C13.3.7. Number of fatalities (military, DoD civilian, or other civilian).

C13.3.8. Number of persons injured (military, DoD civilian, or other civilian).

C13.3.9. Description of material damage (government or non-government).

C13.3.10. Immediate action taken or planned (corrective, investigative, or EOD assistance).

C13.3.11. Details of any chemical agent hazard or contamination, if applicable.

C13.3.12. Is there news media attention (yes or no)?

C13.4. ACCIDENT REPORTS

In addition to the Accident Notification data, the following accident reporting data, as applicable, shall be provided to the DDESB. Chemical agent accidents shall also require the inclusion of the data specified in section C13.5., below.

C13.4.1. Event Circumstances. Type of operation or transportation mode engaged in at time of the accident (include reference to applicable standing operating procedure or regulatory document).

C13.4.1.1. Description of accident.

C13.4.1.2. Quantity, type, lot number, configuration, and packaging of AE or chemical agents involved in accident.

C13.4.1.3. Type of reaction or reactions.

C13.4.1.3.1. Single reaction, such as detonation, deflagration, fire, release, or activation.

C13.4.1.3.2. Multiple reaction, such as detonation and fire.

C13.4.1.3.3. Communication of reactions, such as fire-caused fire, fire-caused detonation, and detonation-caused detonation, and the time between events.

C13.4.1.4. Possible or known causes.

C13.4.2. Event Effects. A copy of aerial and ground photographs taken of the accident site shall be submitted to the DDESB as soon as possible after the occurrence. When applicable, include photographs (color, whenever possible), maps, charts, and overlays, showing or listing the following data:

C13.4.2.1. Number of persons killed or injured (military, DoD civilian, or other civilian). Indicate cause of fatalities and injuries, and location of affected persons with respect to the accident origin.

C13.4.2.2. Property damage at the accident origin (government or non-government).

C13.4.2.3. Area containing property with complete destruction (more than 75 percent).

C13.4.2.4. Area containing property damage beyond economical repair (50 to 75 percent).

C13.4.2.5. Area containing repairable property damage (1 to 49 percent). Indicate event origin, and a description of the damage and its cause.

C13.4.2.6. Radii of glass breakage. When possible, include type and dimensions of glass broken at farthest point.

C13.4.2.7. Locations and dimensions of craters.

C13.4.2.8. When direct propagation has occurred, identify distances from the accident origin and whether propagation resulted from blast, fragments, or firebrands.

C13.4.2.9. Approximate number, size, and location of hazardous fragments and debris.

C13.4.2.10. Effect on production, operation, mission or other activity.

C13.4.3. Factors Contributing to or Limiting Event Effects. When applicable, describe the influence of the following factors on the accident:

C13.4.3.1. Environmental and meteorological conditions (e.g., lightning, cloud cover, wind direction and velocity, temperature, relative humidity, EMR, and electrostatic buildup or discharge).

C13.4.3.2. Topography (e.g., hills, forests, and lakes).

C13.4.3.3. Structural features at the accident origin (e.g., exterior and interior walls and bulkheads, roofs and overheads, doors and hatches, cells or magazines, earth cover, and barricades).

C13.4.3.4. Safety features, other than structural, at the accident origin (e.g., remote controls, sprinkler or deluge systems, detectors, alarms, blast traps, and suppressive shielding).

C13.4.4. Structures. When applicable, provide position, orientation, and type of construction of all structures, damaged or not, located within the maximum radius of damage or the applicable QD, whichever is greater.

C13.4.5. Vessels, Vehicles, and Mobile Equipment. When applicable, provide their location within the maximum radius of damage, or the applicable QD requirement, whichever is greater.

C13.4.6. Personnel. When applicable, provide their location within the maximum radius of damage, or the applicable QD requirements, whichever is greater.

C13.4.7. AE and Chemical Agents. When applicable, provide the location, type, configuration, and amounts of AE and chemical agents in adjacent locations and describe the protection provided by structures at adjacent locations. This information is required out to the maximum radius of damage to any AE or chemical agents, or the applicable IMD or ILD requirements, whichever is greater.

C13.4.8. Provide analyses, conclusions, and recommendations.

C13.5. CHEMICAL AGENT ACCIDENTS

In addition to the data required by section C13.4., for AE accidents, each chemical agent accident report shall contain the following information.

C13.5.1. Personnel.

C13.5.1.1. Chemical agent safety training received.

C13.5.1.2. The availability, type, and use of protective equipment.

C13.5.1.3. A description of the emergency measures taken or performed at the scene of the accident.

C13.5.1.4. A summary of applicable medical data.

C13.5.1.5. A diagram showing locations where injuries occurred and indicates the distance and direction from the agent source.

C13.5.2. Accident Area. In addition to the environmental and meteorological data required at the accident site by subparagraph C13.4.3.1., provide the following:

C13.5.2.1. Facility filter types and the facility ventilation and air turnover rates.

C13.5.2.2. Rate and manner of agent release and any other data used to determine the downwind hazard.

C13.5.2.3. Status and disposition of any chemical agent remaining at the accident site.

C13.5.2.4. Details of any remaining chemical agent hazard and contamination, if applicable.

C14. CHAPTER 14
SPECIAL STORAGE PROCEDURES FOR WASTE MILITARY MUNITIONS

C14.1. SCOPE AND APPLICABILITY

C14.1.1. The Environmental Protection Agency (EPA) promulgated the Munitions Rule (MR) (62 FR 6621) (reference (ak)) to define when chemical and conventional military munitions become hazardous waste and to provide for the safe storage and transportation of such waste. The MR sets forth two approaches for the storage of waste military munitions:

C14.1.1.1. A conditional exemption (CE) from certain "Resource Conservation and Recovery Act (RCRA)" (reference (al)) requirements.

C14.1.1.2. A new RCRA storage unit standard (i.e., Subpart EE, of Parts 264 and 265 of 40 CFR (reference (am))).

C14.1.2. This Chapter establishes additional requirements for storage of waste military munitions in the U.S., territories, and possessions.

C14.2. WAIVERS AND EXEMPTIONS

C14.2.1. CE Storage. Waivers and exemptions from this Standard are not authorized for AE storage facilities (hereafter designated as an ASU) storing CE waste military munitions.

C14.2.2. RCRA Storage. Waivers and exemptions from this Standard shall only be available to DoD Components storing waste munitions under RCRA unit standards (e.g., Subpart EE of Part 264 of 40 CFR, (reference (am))). The approval authority for these waivers and exemptions is the Assistant Secretary of the Military Department responsible for safety, environment and installations. That authority may not be delegated.

C14.3. REQUIREMENTS FOR STORAGE OF WASTE MILITARY MUNITIONS UNDER CE

C14.3.1. The DoD Components shall ensure that waste military munitions stored under CE comply with 40 CFR Section 266.205(a) (reference (am)). (NOTE: The MR established CE does not apply to toxic chemical agents or toxic chemical munitions.)

C14.3.2. The DoD Components shall ensure that installations and responsible activities:

C14.3.2.1. Maintain records of stored waste military munitions for a minimum of 3 years from the date they were last stored. The records must be distinguished by type. A separate record or line item is required for each type of munition in any mixed lot of munitions received for storage. The record shall include the following:

C14.3.2.1.1. The type of waste military munitions stored by standard nomenclature, Lot Number, Federal Supply Class (FSC), National Stock Number (NSN), Department of Defense Ammunition Code (DoDAC), and condition code.

C14.3.2.1.2. The quantity stored.

C14.3.2.1.3. The date identified as "waste."

C14.3.2.1.4. The date they left storage.

C14.3.2.1.5. The storage location or locations (e.g., building number or storage pad, and grid coordinates) where they were stored.

C14.3.2.1.6. The means (e.g., destroyed, demilitarized, and shipped) and date of disposition.

C14.3.2.1.7. When applicable, the sending and receiving sites for those waste military munitions received from or shipped to off-site sources.

C14.3.2.2. Physically separate (e.g., on a separate pallet or shelf; etc.) waste military munitions from non-waste military munitions when both are stored in the same ASU.

C14.3.2.3. Clearly mark the physically separated waste military munitions to ensure proper identification.

C14.3.2.4. Store waste military munitions under CE in ASU that comply (without waiver or exemption) with the provisions of this Standard. Each ASU storing waste military munitions or explosives under CE must be included in a DDESB-approved explosives safety site plan that the installation keeps on file. Those portions of the site plan addressing ASU storing waste military munitions under CE shall be made available to applicable Federal or State environmental regulatory authorities on request.

C14.3.2.5. Have SOP or plans (see section C8.6.) that provide safety, security, and environmental protection. Those plans shall be coordinated with the applicable Federal, State, and local emergency response authorities (e.g., law enforcement, fire departments, and hospitals; etc.) and any established LEPC.

C14.3.3. Loss of CE.

C14.3.3.1. The un-permitted or uncontrolled detonation, release, discharge, or migration (e.g., loss or theft, or as a result of fire or explosion; etc.) of waste military munitions out of any ASU that might endanger human health or the environment shall result in the immediate loss of CE for those waste military munitions. Incidents of that nature and the loss of CE require reporting under section C14.5.

C14.3.3.2. The applicable Federal or State environmental regulatory authorities may withdraw CE based on review or inspection of the installation's or responsible activity's compliance with the requirements for storage of waste military munitions under CE. The DoD Components may, at any time, restrict an activity from using CE. Additionally, the DDESB or the DoD Component, upon discovery of a condition that could warrant loss of CE, shall report the condition to the applicable DoD Component and to the commander of the installation or responsible activity.

C14.3.3.3. If CE is lost the waste military munitions are subject to other RCRA hazardous waste regulations. The installation or responsible activities must obtain any required RCRA permits because of the loss of CE.

C14.3.3.4. Installations and responsible activities may apply for reinstatement of CE under 40 CFR Section 266.205(c) (reference (am)).

C14.4. OTHER STORAGE STANDARDS

C14.4.1. The DoD Components shall forward to the Chairman, DDESB, a copy of their implementing standards or regulations pertaining to the storage of waste military munitions.

C14.4.2. Many States regulate waste management activities, including the storage of waste military munitions. If such State regulations conflict with DDESB or DoD Components' explosives safety standards, the affected Component shall attempt to resolve the conflict. For those issues that cannot be resolved, the DoD Components shall notify the Chairman, DDESB, through their Board member, of any irreconcilable conflict of State law, regulation, or directive with those or other DoD or Military Component explosives safety standards. The Chairman, DDESB, shall review the law, regulation, or directive for any potential impact on explosives safety and shall assist the DoD Component, in coordination with the Deputy Under Secretary of Defense (Installations & Environment) (DUSD(I&E)), in resolving such regulatory conflicts. Nothing in this section shall affect the DoD Components' right to seek review of the State law, regulation, or directive in a court of competent jurisdiction.

C14.5. UN-PERMITTED AND UNCONTROLLED LOSS REPORTING

In addition to other applicable reporting requirements, installations and responsible activities shall notify their chain of command, the DDESB Chairman (through the DoD Component channels), the applicable Federal or State environmental regulatory authority, and established local committees, as follows:

C14.5.1. Telephonically or, in the case of the DoD Component and the DDESB, electronically (by e-mail message or facsimile and using the format specified in chapter 13) within 24 hours from the time the installation or responsible activity becomes aware of any un-permitted or uncontrolled detonation, release, discharge, or migration of waste military munitions out of any ASU (e.g., loss or theft, or as a result of fire or explosion; etc.) that may endanger human health or the environment; and

C14.5.2. In writing, if the initial report was telephonic, within 5 days from the time the installation or responsible activity becomes aware of any un-permitted or uncontrolled detonation, release, discharge, or migration of waste military munitions out of any ASU (e.g., loss or theft, or as a result of fire or explosion; etc.) that may endanger human health or the environment. Follow-up reports to the DoD Component and the DDESB are required only when pertinent information, which was not previously reported, becomes known. Such reports, to include a report of investigation, shall comply with the requirements of chapter 13.

C14.6. CLOSURE OF FACILITIES STORING WASTE MILITARY MUNITIONS UNDER CE

C14.6.1. In addition to the explosives safety requirements of chapter 12:

C14.6.1.1. When an ASU that stored waste military munitions under CE is permanently taken out of service for the storage of non-waste and waste military munitions, installations, and responsible activities shall ensure that such ASU are applicably closed.

C14.6.1.2. Installations or responsible activities must notify the applicable Federal or State environmental regulatory authorities in writing at least 45 days before the closure activities begin. Initiation of those closure procedures should occur within 180 days after the date the decision is made to permanently stop using the ASU for the storage of military munitions.

C14.6.1.3. On completion of closure activities, a "Certification of Closure," signed by the installation or responsible activity commander, or other equivalent level authority, and by an independent (i.e., an individual not assigned within the commander's or equivalent-level authority's chain of command) registered professional engineer must be submitted to the applicable Federal or State environmental regulatory authorities within 90 days of completing the closure activities.

C14.6.1.4. The Certificate of Closure must state, at a minimum, that each of the explosives safety requirements in paragraph C12.3.5. have been met and that waste military munitions and residues are removed in such a manner as to protect the public and the environment consistent with the planned use of the ASU and of the property.

C14.6.1.5. If closure certification cannot be rendered, the installation or responsible activity must contact the applicable Federal or State environmental regulatory authorities to determine the applicable course of action.

C14.6.2. Discontinuance of Use for the Storage of Waste Military Munitions. When an ASU that stored waste military munitions under CE is permanently taken out of service for the storage of waste military munitions, but is to continue in service for the storage of non-waste military munitions, installations and responsible activities shall ensure that waste military munitions and residues are removed.

C14.7. CLOSURE OF FACILITIES STORING WASTE MILITARY MUNITIONS UNDER RCRA.

In addition to those explosives safety requirements in paragraph C12.3.5., closure procedures for those sites operating under existing RCRA (Subpart EE of Parts 264 and 265 of 40 CFR, reference (am)) permits shall follow the closure requirements stipulated in the respective permit.

AP1. APPENDIX 1

GLOSSARY

AP1.1.1. Aboveground Magazine (AGM). Any open area, vehicle, or any aboveground structure not meeting the requirements of an ECM that is used for explosives storage.

AP1.1.2. Aboveground Structure/Site (AGS). Any aboveground, non-earth-covered structure and/or site.

AP1.1.3. Acceptor/Donor. A total quantity of stored AE may be subdivided into separate storage units in order to reduce the MCE. The separation distances between separate storage units, with or without an intervening barrier, need to be sufficient (i.e. IMD) ensuring that propagation between units does not occur. The storage unit that reacts initially is termed the donor and nearby units, which may be endangered, are termed acceptors.

AP1.1.4. Action Level. One-half of the exposure limit for a chemical agent averaged over an 8-hour work shift.

AP1.1.5. Active Installation. A military installation that is currently in service and being regularly used for military activities.

AP1.1.6. Administration Area. The area containing administrative buildings that support the installation as a whole, excluding those offices located near and directly serving AE storage and operating areas.

AP1.1.7. AE Aircraft Cargo Area. Any area specifically designated for:

AP1.1.7.1. Aircraft loading or unloading of transportation configured AE.

AP1.1.7.2. Parking aircraft loaded with transportation configured AE.

AP1.1.8. AE Area. An area specifically designated and set aside from other portions of an installation for the development, manufacture, testing, maintenance, storage, or handling of AE.

AP1.1.9. AE Facility. Any structure or location containing AE. (NOTE: formerly called explosives facility).

AP1.1.10. Airborne Exposure Level (AEL). Time weighted averages or ceiling values that define the permissible limits of toxic chemical agent exposure for unprotected personnel.

AP1.1.11. Aircraft Passenger Transport Operations. Passenger transport operations are defined for the purposes of QD as follows: Passenger transport traffic involving military dependents and civilians other than those employed by or working directly for the DoD Components. The following are not considered passenger transport operations:

AP1.1.11.1. Infrequent flights of base and command administrative aircraft that may, on occasion, provide some space available travel to authorized personnel.

AP1.1.11.2. Travel of direct hire appropriated funds personnel employed by any DoD Component.

AP1.1.11.3. Travel of such personnel as contractor and technical representatives traveling to or from direct support assignments at DoD installations.

AP1.1.12. Ammunition and Explosives (AE). Includes, but is not necessarily limited to, all items of U.S.-titled (i.e., owned by the U.S. Government through the DoD Components) ammunition; propellants, liquid and solid; pyrotechnics; high explosives; guided missiles; warheads; devices; devices, and chemical agent substances and components presenting real or potential hazards to life, property and the environment. Excluded are wholly inert items and nuclear warheads and devices, except for considerations of storage and stowage compatibility, blast, fire, and non-nuclear fragment hazards associated with the explosives.

AP1.1.13. Ammunition Storage Unit (ASU). All types of explosives storage magazines; e.g., open storage areas, sheds, bunkers, ECM and AGM.

AP1.1.14. Anchorages.

AP1.1.14.1. Scuttling Site. A designated area of water for positioning a ship for its flooding or sinking under emergency situations.

AP1.1.14.2. Explosives Anchorage. A designated area of water used for AE loading and unloading of vessels and for anchoring vessels carrying a cargo of AE.

AP1.1.15. Auxiliary Building. Any building, e.g., power plant, change house, paint and solvent locker, and similar facilities, related to or maintained and operated to serve an operating building, line, plant, or pier area. AE is not present in an auxiliary building.

AP1.1.16. Barge Units. See Ship or Barge Units.

AP1.1.17. Barge Piers. Piers and wharves used exclusively for loading and/or unloading explosives on barges or utility craft.

AP1.1.18. Barricade. An intervening natural or artificial barrier of such type, size, and construction that limits the effect of an explosion on nearby buildings or exposures in a prescribed manner.

AP1.1.19. Barricaded Open Storage Module. A series of connected, barricaded cells with hard surface storage pads.

AP1.1.20. Blast Impulse. The area under the positive phase of the overpressure-time curve.

AP1.1.21. Blast Overpressure. The pressure above ambient in a shock wave.

AP1.1.22. Bonding. A physical and electrical connection between a metal object and the LPS. This produces electrical continuity between LPS and the object and minimizes electro-magnetic potential differences. Bonding is done to prevent side-flash. Methods of bonding include mechanical, compression and thermal types.

AP1.1.23. Breakroom. A room in an operating building or a separate facility used by personnel to take breaks and eat meals.

AP1.1.24. Bunker Suit. Apparel that consists of trousers or overalls tucked into a pair of boots; it is designed for dressing quickly when answering an alarm.

AP1.1.25. Burning Reaction. The energetic material ignites and burns non-propulsively. The case may open, melt or weaken sufficiently to rupture non-violently, allowing mild release of combustion gases. Debris primarily remains within the area of the reaction. The debris is not expected to cause fatal wounds to personnel or be a hazardous fragment beyond 50 ft [15.2 m].

AP1.1.26. Catenary LPS. An LPS consisting of one or more overhead wires suspended from poles connected to a grounding system via down conductors. The objective is to intercept lightning flashes and provide a zone of protection.

AP1.1.27. Cavern Storage Site. A natural or manmade cavern adapted for the storage of AE.

AP1.1.28. Ceiling Value. The concentration of chemical agent that may not be exceeded for any period of time.

AP1.1.29. Chamber Storage Site. An excavated chamber or series of excavated chambers especially suited to the storage of AE. A cavern may be subdivided or otherwise structurally modified for use as a chamber storage site.

AP1.1.30. Classification Yard. A railroad yard used for receiving, dispatching, classifying, and switching of cars.

AP1.1.31. Closure Block. A protective construction feature designed to seal the entrance tunnel to an underground storage chamber in the event of an explosion within the chamber.

AP1.1.32. Cluster Bomb/Dispenser Unit (CBU). Usually subsets of non-robust AE that are designed to carry and dispense sub-munitions.

AP1.1.33. Cold Iron. The status of a ship that has shut down its main power plant and is dependent on shore power. A ship in cold iron is not capable of providing immediate propulsion.

AP1.1.34. Combat Aircraft Parking Area (CAPA). Any area specifically designated for:

AP1.1.34.1. Aircraft loading or unloading of combat-configured munitions.

AP1.1.34.2. Parking aircraft loaded with combat-configured munitions.

AP1.1.35. Combustible Construction. Construction that uses materials that readily ignite and burn when exposed to fire (i.e. wood frame structures are an example of combustible construction).

AP1.1.36. Compatibility. AE are considered compatible if they may be stored or transported together without significantly increasing either the probability of an accident or, for a given quantity, the magnitude of the effects of such an accident.

AP1.1.37. Compatibility Group (CG). Letter designation assigned to AE to indicate what may be shipped and transported together without significantly increasing either the probability of an accident or, for a given quantity, the magnitude of the effects of such an accident.

AP1.1.38. Conditional Exemption (CE). An exemption from the regulatory definition of hazardous waste (and therefore from compliance with specific environmental requirements pertaining to the storage of hazardous waste) conditioned on compliance with certain criteria requirements, as in 40 CFR Section 266.205 (reference (am)).

AP1.1.39. Conductor. A LPS component designed to transfer the current of a lightning flash to the earth electrode system. Conductors are usually heavy metallic cables. However, metallic building structural members (e.g., steel I-beams) can also function as conductors.

AP1.1.40. Connected-Chamber Storage Site. A chamber storage site consisting of two or more chambers connected by ducts or passageways. Such chambers may be at the ends of branch tunnels off a main passageway.

AP1.1.41. Constriction. Constrictions are short lengths of tunnel whose cross-sectional areas are reduced to one-half or less of the normal tunnel cross-section. Constrictions reduce the airblast effects passing through them. To be effective, constrictions should be placed within five tunnel diameters of the tunnel exit or to the entrances of storage chambers.

AP1.1.42. Container. A package designed to protect AE from hazardous environments during transportation and storage.

AP1.1.43. Counterpoise. A type of an earth electrode system consisting of conductor cables buried around the structure to be protected. Generally, a counterpoise will have more surface area contacting the earth than ground rod systems.

AP1.1.44 Debris. Any solid particle thrown by an explosion or other strong energetic reaction. For aboveground explosions, debris refers to secondary fragments. For explosions in underground facilities, debris refers to both primary and secondary fragments.

AP1.1.45. Debris Trap. A protective construction feature in an underground facility designed to capture fragments and debris from an explosion within the facility.

AP1.1.46. Definitive Drawing. A design (e.g., a control bunker, a 3- or 7-bar ECM, a missile test cell, or a barricade) that has been documented by a DoD Component on numbered drawings approved by the DDESB. The purpose of a definitive drawing is to provide a standard design to insure consistency in construction. Upon approval by the DDESB, it is not necessary to for the definitive drawing to be reviewed again if the design has not been changed.

AP1.1.47. Deflagration Reaction. Ignition and rapid burning of the confined energetic materials builds up high local pressures leading to non-violent pressure release as a result of a low strength case or venting through case closures (e.g., loading ports or fuze wells). The case may rupture but does not fragment; closure covers might be expelled, and unburned and burning energetic materials might be thrown about and spread the fire. Propulsion may launch an unsecured test item, causing an additional hazard. No blast or significant fragmentation damage to the surroundings is expected, only heat and smoke damage from the burning explosive substances.

AP1.1.48. Detonation Reaction. A supersonic decomposition reaction propagates through the energetic materials and produces an intense shock in the surrounding medium and very rapid plastic deformation of metallic cases, followed by extensive fragmentation. All energetic materials will be consumed. Effects will include: large ground craters for items on or close to the ground; holing, plastic flow damage, and fragmentation of adjacent metal structures; and blast overpressure damage to nearby structures.

AP1.1.49. Dividing Wall. A wall designed to prevent, control, or delay propagation of a reaction involving AE on opposite sides of the wall.

AP1.1.50 DoD Explosives Operations/Storage: Explosives operations conducted by the Department of Defense, or other Federal Agency, under DoD oversight, procedure, or control and in accordance with the explosives safety standards of this Standard. This term is applicable

only to Department of Defense and Federal explosives operations, and to non-DoD commercial enterprises directly supporting the Department of Defense and Federal explosives contractual efforts.

AP1.1.51. Donor/Acceptor. See Acceptor/Donor.

AP1.1.52. Down Conductor. See Conductor.

AP1.1.53. Dunnage. Inert material associated with the packaging, containerization, blocking and bracing of AE.

AP1.1.54. Earth-Covered Magazine (ECM). An aboveground, earth covered structure that meets soil cover depth and slope requirements of this Standard. ECM have three possible strength designations (7-bar, 3-bar, or Undefined). The strength of an ECM's headwall and door determines its designation.

AP1.1.55. Earth Electrode System. A LPS component used for transferring current from a lightning flash to the earth. The earth electrode system (e.g., ground rods, counterpoise, buried metal plates, or Ufer grounds) is connected to down conductors and is in direct contact with the earth.

AP1.1.56. Electromagnetic Environment (EME). The resulting product of the power and time distribution, within various frequency ranges, and includes the radiated and conducted electromagnetic emission levels that may be encountered. It is the totality of electromagnetic energy, from man made and natural sources, to which a platform/system, or subsystem/equipment will be exposed within any domain, that is, land, air, space, and sea, while performing its intended mission throughout its operational life cycle (in the case of munitions, during its stockpile-to-safe separation sequence). When defined, the EME will be for a particular time and place. Specific equipment characteristics, such as operating frequencies, emitter power levels, and receiver sensitivity, operational factors such as distances between items and force structure, and frequency coordination all contribute to the EME. In addition, transient emissions and their associated rise and fall times such as from EMP, lightning, and p-static also contribute. (MIL-HDBK-237, reference (an)).

AP1.1.57. Electromagnetic Environmental Effects (E3). The impact of EME on the operational capability of military forces, equipment, systems, and platforms. It encompasses all electromagnetic disciplines, including electromagnetic compatibility (EMC) / electromagnetic interference (EMI); electromagnetic vulnerability (EMV); electromagnetic pulse (EMP); electronic protection (EP); hazards of electromagnetic radiation to personnel (HERP), military munitions--ordnance (HERO), and volatile materials such as fuel (HERF); and the natural phenomena effects of lightning and precipitation static (p-static). (MIL-HDBK 240, reference (ao)).

AP1.1.58. Electro-Explosive Device (EED). An explosive or pyrotechnic component that initiates an explosive, burning, electrical, or mechanical train and is activated by the application of electrical energy. (JP 1-02, reference (ap)).

AP1.1.59. Electrically Initiated Device (EID). An EID is a single unit, device, or subassembly that uses electrical energy to produce an explosive, pyrotechnic, thermal, or mechanical output. Examples include: electro explosive devices (such as hot bridge wire, semiconductor bridge,

carbon bridge, and conductive composition), exploding foil initiators, laser initiators, burn wires, and fusible links. (See reference (ao))

AP1.1.60. Electromagnetic Radiation (EMR). Radiation made up of oscillating electric and magnetic fields and propagated with the speed of light. Includes gamma radiation, X-rays, ultraviolet, visible, and infrared radiation, and radar and radio waves. (See reference (ap))

AP1.1.61. Emergency Withdrawal Distance. The distance personnel are evacuated to from an ES during an explosive accident or incident.

AP1.1.62. Emission Control (EMCON). The selective and controlled use of electromagnetic, acoustic, or other emitters to optimize command and control capabilities while minimizing, for operations security: a. detection by enemy sensors; b. mutual interference among friendly systems; and/or c. enemy interference with the ability to execute a military deception plan. (See reference (ap))

AP1.1.63 Energetic Liquid. A liquid, slurry, or gel, consisting of, or containing an explosive, oxidizer, fuel, or combination of the above, that may undergo, contribute to, or cause rapid exothermic decomposition, deflagration or detonation.

AP1.1.64. Engineering Controls. The management of facility operations using engineering principles (e.g., facility design, operation sequencing, equipment selection, or process limitations).

AP1.1.65. Essential Personnel. Individuals, as identified by the DoD Component, associated with an AE operation.

AP1.1.66. Exemption. See Waiver.

AP1.1.67. Expansion Chamber. A protective construction feature in an underground storage facility designed to reduce the overpressure exiting the facility by increasing the total volume of the tunnel chamber complex. It may also function as an operating area within the underground facility or as a debris trap.

AP1.1.68. Explosive. A substance or a mixture of substances that is capable by chemical reaction of producing gas at such temperature, pressure and speed as to cause damage to the surroundings. The term explosive includes all substances variously known as high explosives and propellants, together with igniter, primer, initiation and pyrotechnic (e.g., illuminant, smoke, delay, decoy, flare and incendiary compositions.

AP1.1.69. Explosive Accident. Accidents resulting in damage or injury from:

AP1.1.69.1. An explosion or functioning of explosive materials or devices (except as a result of enemy action).

AP1.1.69.2. Inadvertent actuation, jettisoning, and releasing or launching explosive devices.

AP1.1.69.3. Impacts of ordnance off-range.

AP1.1.70. Explosion Reaction. Ignition and rapid burning of the confined energetic materials builds up high local pressures leading to breakup of the confining structure. Metal cases are fragmented (e.g., brittle fracture) into large pieces that are often thrown long distances. Unreacted or burning energetic materials are also thrown about. Fire and smoke hazards will

exist. Air shocks are produced that can cause damage to nearby structures. The blast and high velocity fragments can cause minor ground craters and damage (e.g., breakup, tearing, gouging) to adjacent metal plates. Blast pressures are lower than for a detonation reaction.

AP1.1.71. Explosive Equivalent. The weight of a standard explosive, usually taken as TNT, required to produce a selected shockwave parameter of equal magnitude at a specific location to that produced by a unit weight of the explosive in question.

AP1.1.72. Exposed Site (ES). A location exposed to the potential hazardous effects (e.g., blast, fragments, debris, or heat flux) from an explosion at a potential explosion site (PES).

AP1.1.73. Extremely Insensitive Detonating Substance (EIDS). A substance which, although capable of sustaining a detonation, has demonstrated through tests that it is so insensitive that there is a very low probability of accidental initiation.

AP1.1.74. Forward Arming and Refueling Point (FARP). A temporary facility, organized, equipped and deployed to provide fuel and AE necessary to support aviation maneuver units in combat. The FARP permits combat aircraft to rapidly refuel and rearm and is normally located in the main battle area closer to the area of operation than the aviation unit's combat service area.

AP1.1.75. Faraday cage. A LPS where the area to be protected is enclosed by a heavy metal screen (similar to a birdcage) or continuous metallic structure with no un-bonded metallic penetrations. Lightning current flows on the exterior of the structure, not through its interior.

AP1.1.76. Faraday-like shield. A LPS that is not an ideal Faraday Cage, but is formed by a contiguous conductive matrix that is properly bonded and grounded (e.g., electrically continuous steel arches and reinforcing bars of concrete end-walls and floors of steel arch magazines, reinforcing bars of ECM, or the metal shell of pre-fabricated "portable" magazines and metal buildings).

AP1.1.77. Firebrand. A projected hot fragment or burning energetic material or debris whose thermal energy is transferred to the surroundings.

AP1.1.78. Formerly Used Defense Site (FUDS). Properties previously owned, leased, or otherwise possessed by the U.S. and under the jurisdiction of the Secretary of Defense; or manufacturing facilities for which real property accountability rested with the Department of Defense but operation was performed by contractors (government owned-contractor operated) and later the facilities were legally disposed.

AP1.1.79. Fragmentation. Fracture of AE confining cases and structures as the result of an initiation.

AP1.1.80. Fragmenting AE. Items that have cases that are designed to fragment (e.g., naturally fragmenting warheads, continuous rod warheads, items with scored cases and items that contain pre-formed fragments).

AP1.1.81. Frost Line. The depth to which frost will penetrate soil (region dependent).

AP1.1.82. General public. Persons not associated with a DoD installation's mission or operations (e.g., visitors, guests of personnel assigned to the installation, or persons not employed or contracted by the Department of Defense or the installation).

AP1.1.83. Grounding. The method used for providing an electrical path to the earth or to the earth electrode system. Good grounding is a function of: the earth itself; temperature and moisture condition; an ionizing medium such as naturally occurring salts; or the volume of the earth electrode.

AP1.1.84. Ground Shock. Coupling of energy to the ground as a result of an AE reaction. Localized movement of the ground or structures in the vicinity will occur.

AP1.1.85. Hardened Aircraft Shelter (HAS). Defined as being one of the following structure types addressed by this Standard:

AP1.1.85.1. TAB VEE. 24 ft [7.3 m] radius semicircular arch; 48 ft [14.7 m] wide by 100.8 ft [30.7 m] long; and prow shaped front closure, vertically hinged, recessed door. Considered as First Generation HAS.

AP1.1.85.2. First Generation (TAB VEE Modified). 24-ft [7.3 m] radius semicircular arch; 48 ft wide [14.7 m] by 100.8 ft [30.7 m] long; and prow shaped front closure, laterally opening, external flush door.

AP1.1.85.3. Second Generation. 29.4 ft [9.0 m] double-radius, pseudo-elliptical arch; 82 ft [25 m] wide by 124 ft [37.8 m] long; and vertical reinforced concrete panel, laterally opening, sliding, external flush door.

AP1.1.85.4. Third Generation. 27.4 ft [8.4 m] double-radius, pseudo-elliptical arch; 70.8 ft [21.6 m] wide by 120 ft [36.6 m] long; and vertical reinforced concrete panel, laterally opening, sliding, external flush door. A personnel door is located out one side and is protected by a barricade.

AP1.1.86. Hazard Classification. Process by which hazardous materials are assigned to one of the nine U.N. recognized classes of dangerous goods.

AP1.1.87. Hazard Division (HD). One of six divisions designating the predominant hazard within UN Class 1, Explosives.

AP1.1.88. Hazards of Electromagnetic Radiation to Ordnance (HERO) - Situations in which transmitting equipment (for example, radios, radar, electronic countermeasures, electronic counter-countermeasures, ground penetrating radar, etc.) or other electromagnetic emitting devices can generate radiation of sufficient magnitude to: induce or otherwise couple electromagnetic energy sufficient to exceed specified safety and/or reliability margins in electrically initiated devices (EID) contained within ordnance, or cause radiation-induced damage or degradation of performance in military munitions containing EID. (See reference (ao))

AP1.1.89. Hazardous Fragment or Debris. Fragments or debris having an impact energy of 58 ft-lb [79 J] or greater.

AP1.1.90. Hazardous Fragment Density. An areal number density of hazardous fragments or debris exceeding one per 600 ft^2 [55.7 m^2].

AP1.1.91. Headwall. An ECM's front wall. It is a critical feature that is directly associated with the strength designation assigned to an ECM.

AP1.1.92. Heavy Armor. Main battle tanks or other vehicles that are expected to contain fragments and reduce blast overpressure generated from an internal explosion of its AE stores.

AP1.1.93. HE Equivalent. See Explosive Equivalent.

AP1.1.94. High Explosives (HE). An explosive substance designed to function by detonation (e.g., main charge, booster or primary explosives).

AP1.1.95. High Performance Magazine (HPM). An earth-bermed, 2-story, box-shaped structure with internal non-propagation walls designed to reduce the MCE.

AP1.1.96. High Pressure Closure. See Closure Block.

AP1.1.97. Holding Yard. A temporary holding location for railcars, trucks, trailers or shipping containers before storage or transportation.

AP1.1.98. Hybrid Propellants. A propellant charge using a combination of physically separated solid and liquid (or gelled) substances as fuel and oxidizer.

AP1.1.99. Hygroscopic. A tendency of material to absorb moisture from its surroundings.

AP1.1.100. Hypergolic. A property of various combinations of chemicals to self ignite upon contact with each other without a spark or other external initiation source.

AP1.1.101. Inhabited Buildings. Structures, other than AE-related buildings, occupied by personnel or the general public, both within and outside DoD establishments (e.g., schools, churches, residences, quarters, Service clubs, aircraft passenger terminals, stores, shops, factories, hospitals, theaters, mess halls, post offices, or post exchanges).

AP1.1.102. Inhabited Building Distance (IBD). Distance to be maintained between a PES and an inhabited building.

AP1.1.103. Inspection Station. A designated location at which trucks and railcars containing AE are inspected.

AP1.1.104. Installation-Related Personnel. Military personnel (to include family members), DoD employees, DoD contractor personnel, and other personnel having either a direct operational (military or other Federal personnel undergoing training at an installation) or logistical support (e.g., vendors) relationship with installation activities.

AP1.1.105. Integral Air Terminal LPS. A LPS that has strike termination devices mounted on the structure to be protected. The strike termination devices are connected to the earth electrode system via down conductors.

AP1.1.106. Interchange Yard. An area on a DoD installation set aside for exchanging railroad cars or vehicles with a common carrier.

AP1.1.107. Intermagazine Distance (IMD). Distance to be maintained between two AE storage locations.

AP1.1.108. Intraline Distance (ILD). The distance to be maintained between any two AE related buildings or sites within an AE related operating line.

AP1.1.109. Joint DoD - Non-DoD Use Runway/Taxiway. A runway or taxiway serving both DoD and commercial aircraft. A runway or taxiway serving solely the Department of Defense, DoD chartered, or Non-DoD aircraft on DoD authorized business is not joint use.

AP1.1.110. Joint Hazard Classification System (JHCS). A data base containing hazard classification and safety data for DoD AE.

AP1.1.111. Joint Storage. AE storage in a facility that includes both DoD-titled and non-DoD-titled AE. In other than ownership, the stored AE items are similar.

AP1.1.112. K Factor. The factor in the formula $D=KW^{1/3}$ used in QD determinations where D represents distance in ft and W is the NEW in lb. The K factor is a constant and represents the degree of protection that is provided.

AP1.1.113. Launch Pad. The load-bearing base, apron, or platform upon which a rocket, missile, or space vehicle and its launcher rest prior to launch.

AP1.1.114. Liquid Propellant. Energetic liquids used for propulsion or operating power for missiles, rockets, AE and other related devices.

AP1.1.115. Loading Density (w). Quantity of explosive per unit volume expressed as lbs/ft^3 $[kg/m^3]$.

AP1.1.116. Loading Docks. Facilities, structures, or paved areas used for transferring AE between modes of transportation.

AP1.1.117. Lunchroom. Facilities where meals may be distributed by food service personnel or brought by operating personnel for consumption. It may serve more than one PES.

AP1.1.118. Magazine. Any building or structure used exclusively for the storage of AE.

AP1.1.119. Marshalling Yard. A designated area near a port facility where a unit or activity consolidates their equipment and prepares for movement.

AP1.1.120. Mass Explosion. Explosion that affects almost the entire quantity of AE virtually instantaneously.

AP1.1.121. Mast LPS. A LPS consisting of one or more poles with a strike termination device connected to an earth electrode system by down conductors. Its purpose is to intercept lightning flashes and provide a zone of protection.

AP1.1.122. Maximum Credible Event (MCE). In hazards evaluation, the MCE from a hypothesized accidental explosion, fire, or toxic chemical agent release (with explosives contribution) is the worst single event that is likely to occur from a given quantity and disposition of AE. The event must be realistic with a reasonable probability of occurrence considering the explosion propagation, burning rate characteristics, and physical protection given to the items involved. The MCE evaluated on this basis may then be used as a basis for effects calculations and casualty predictions.

AP1.1.123. Military Munitions. All ammunition products and components produced or used by or for the U.S. Department of Defense, or the U.S. Armed Services for national defense and security, including military munitions under the control of the Department of Defense, the U.S. Coast Guard, the U.S. DoE, and the National Guard personnel. The term "military munitions" includes confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and

riot control agents, smokes, and incendiaries used by the DoD Components, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof. "Military munitions" do not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components thereof. However, that term does include non-nuclear components of nuclear devices, managed under the DoE's nuclear weapons program, after all required sanitizing operations under the Atomic Energy Act of 1954 (42 CFR Section 2011 et seq. (reference (aq)), as amended, have been completed (40 CFR Section 260.10, reference (am)).

AP1.1.124. **Mitigation.** A feature that reduces, limits or controls the consequences of an AE reaction.

AP1.1.125. **Module.** See barricaded open storage module.

AP1.1.126. **Navigable Streams.** Those parts of streams, channels, or canals capable of being used in their ordinary or maintained condition as highways of commerce over which trade and travel are, or may be, conducted in the customary modes. Streams that are not capable of navigation by barges, tugboats, and other large vessels are not included, unless they are used extensively and regularly for the operation of pleasure boats.

AP1.1.127. **Net Explosive Quantity (NEQ).** NEW expressed in kg.

AP1.1.128. **Net Explosive Weight (NEW).** The total weight of all HE and all propellants expressed in pounds (lbs).

AP1.1.129. **Net Explosive Weight for QD (NEWQD).** The total quantity, expressed in pounds [kilograms], of high explosives equivalency in each item or round to be used when applying QD criteria or other standards. The NEWQD is equal to the NEW unless hazard classification testing has shown that a lower weight is appropriate for QD purposes. (NOTE: If the NEWQD is less than the NEW, the reason is usually that propellant or other substances do not contribute as much to the blast effect as the same amount of high explosive would.)

AP1.1.130. **Nitrogen Padding (or Blanket).** The nitrogen filled void or ullage of a closed container used to prevent oxidation or to avoid formation of a flammable mixture, or a nitrogen atmosphere in or around an operation or piece of equipment.

AP1.1.131. **Non-combustible Construction**. Construction that uses materials that do not readily ignite and burn when exposed to fire (i.e. concrete, masonry, and metal structures are examples of non-combustible construction).

AP11..132. **Non-DoD Components.** Any entity (Government, private, or corporate) that is not a part of the Department of Defense.

AP1.1.133. **Non-DoD Explosives Operations/Storage**: Non-DoD explosives operations/storage conducted on DoD property, but not under DoD oversight. (See DoD Explosives Operations/Storage)

AP1.1.134. **Non-Essential Personnel.** Individuals, as identified by the DoD Component, not associated with an AE operation.

AP1.1.135. Non-Robust Munitions. Those HD 1.1 and HD 1.2 AE that are not members of one of the following groups: Robust Munitions or Fragmenting Munitions (e.g., air-to-air missile warheads, CBU type munitions, and SD Sensitive). Examples of Non-Robust Munitions include torpedoes and underwater mines.

AP1.1.136. Operating Building. Any structure, except a magazine, in which operations associated with AE are conducted (e.g., manufacturing, processing, handling, loading, or assembling).

AP1.1.137. Operating Line. A group of buildings, facilities, or related workstations so arranged as to permit performance of the consecutive steps of operations associated with AE (e.g., manufacture, loading, assembly, modification, or maintenance).

AP1.1.138. Operational Shield. A barrier constructed at a particular location or around a particular machine or operating station to protect personnel, material, or equipment from the effects of a localized fire or explosion.

AP1.1.139. Ordnance. Explosives, chemicals, pyrotechnics, and similar stores (e.g., bombs, guns and ammunition, flares, smoke, or napalm).

AP1.1.140. Packaging, Inner and Outer. Material used to surround and protect substances and articles during transportation and storage. They are generally made of lightweight materials such as fiberboard or fiberglass.

AP1.1.141. Passenger Railroad. Any steam, diesel, electric, or other railroad that carries passengers for hire.

AP1.1.142. Pier. A landing place or platform built into the water, perpendicular or oblique to the shore, for the berthing of vessels.

AP1.1.143. Portal Barricade. A barricade placed in front of an entrance into an underground storage facility. Its function is to reflect that portion of the shock wave moving directly outward from the entrance, thereby, reducing the pressures along the extended tunnel axis and increasing the pressures in the opposite direction. The result is a more circular IBD area centered at the portal.

AP1.1.144. Potential Explosion Site (PES). The location of a quantity of AE that will create a blast, fragment, thermal, or debris hazard in the event of an accidental explosion of its contents.

AP1.1.145. Primary fragment. A fragment from material in intimate contact with reacting AE.

AP1.1.146. Prohibited Area. A designated area at airfields, seadromes, or heliports where AE facilities are prohibited.

AP1.1.147. Propagation. Transfer of a reaction between AE.

AP1.1.148. Public Exclusion Distance. The calculated distance from the toxic chemical agent source at which no more than 10.0, 4.3, and 150 milligrams per minute per cubic meter is present for GB, VX, and mustard, respectively, or the explosives safety IBD, whichever is greater.

AP1.1.149. Public Traffic Route (PTR). Any public street, road, highway, navigable stream, or passenger railroad, including roads on a military reservation used routinely by the general public for through traffic.

AP1.1.150. Public Traffic Route Distance (PTRD). Distance to be maintained between a PES and a PTR exposure.

AP1.1.151. Quantity-Distance (QD). The quantity of explosive material and distance separation relationships that provide defined levels of protection. The relationships are based on levels of risk considered acceptable for specific exposures and are tabulated in applicable QD tables. These separation distances do not provide absolute safety or protection. Greater distances than those in the QD tables should be used if practical.

AP1.1.152. Ready Ammunition Storage. A location where AE is stored for near term tactical or training use.

AP1.1.153. Real Property. Lands, buildings, structures, utilities systems, improvements and appurtenances thereto. Includes equipment attached to and made part of buildings and structures (such as heating systems) but not moveable equipment (such as plant equipment)

AP1.1.154. Risk. The product of the probability or frequency that an accident will occur within a certain time and the accident's consequences to people, property or the environment.

AP1.1.155. Robust Munitions. AE that meet two of the following criteria:

AP1.1.155.1. Have a ratio of the explosive weight to empty case weight less than 1.

AP1.1.155.2. Have a nominal wall thickness of at least 0.4 in [10 mm].

AP1.1.155.3. Have a case thickness/$NEW^{1/3} > 0.05$ $in/lb^{1/3}$. [0.165 $cm/kg^{1/3}$].

Examples of Robust Munitions include 20 mm, 25 mm, and 30 mm cartridges, GP bombs, artillery projectiles, and penetrator warheads.

AP1.1.156. Rock Strength. Designations (e.g., strong, moderately strong or weak rock) providing a general classification of rock types.

AP1.1.157. Roll-on or Roll-off (RORO). An AE operation that involves the movement, without lifting, of AE-laden semi-trailers, railcars, or similar wheeled conveyances into or from a transporter (e.g., a barge, a ship, a railcar or aircraft), such that the conveyances remain in a transportation mode through a transshipment point.

AP1.1.158. Runway. Any surface on land designated for aircraft takeoff and landing operations, or a designated lane of water for takeoff and landing operations of seaplanes.

AP1.1.159. Secondary Fragment. Fragments produced by the impact of primary fragments or airblast into surrounding structures, AE or earth.

AP1.1.160. Secretarial Exemptions or Certifications. A written authorization granted by the Service Secretary for strategic or other compelling reasons that permits long-term noncompliance with a mandatory requirement of DoD explosives safety criteria.

AP1.1.161. Secure Explosives Holding Area. An area designated for the temporary parking of commercial carriers' motor vehicles transporting DoD-owned AA&E. (See Part 205 of reference (aa)).

AP1.1.I.162. **Secure Non-explosives Holding Area**. An area designated for the temporary parking of commercial carriers' motor vehicles transporting Categorized DoD Arms, classified (SECRET or CONFIDENTIAL) materials, and CCI. (See Part 205 of reference (aa)).

AP1.1.163. **Sensitivity Group (SG).** A category used to describe the susceptibility of HD 1.1 and HD 1.2 AE to sympathetic detonation (SD). The SG are: Robust, Non-Robust, Fragmenting, CBU weapons, and SD Sensitive.

AP1.1.164. **Service Magazine.** A building of an operating line used for the intermediate storage of AE.

AP1.1.165. **Shared Launch Facility.** Any space or orbital launch facility supporting both DoD and non-DoD launch services and operations, as determined by the DoD Component involved or by mutual agreement when multiple DoD Components are involved.

AP1.1.166. **Ship or Barge Units.** Combination of AE ships (including submarines at berth), barges or piers/wharves not separated by required IMD.

AP1.1.167. **Sideflash.** The phenomenon where lightning current will arc through a non-conductive medium in order to attach to other objects. An electrical spark caused by differences of potential that occurs between conductive metal bodies or between such metal bodies and a component of the LPS or earth electrode system.

AP1.1.168. **Single-Chamber Storage Site.** An excavated chamber with its own access to the natural ground surface that is not connected to any other storage chamber.

AP1.1.169. **Source Emission Limits.** The amount of toxic chemical agent that may be released at a particular point that allows for natural dilution, ventilation, and meteorological conditions.

AP1.1.170. **Spall.** The material broken loose from any surface of an acceptor chamber or cell by a shock wave transmitted through the wall. Spall is also used to describe this process.

AP1.1.171. **Standoff distance.** Minimum separation distance between a wall or barrier and the edge a stack of AE.

AP1.1.172. **Static Missile Battery.** Deployed ground-based missiles meant to be employed in a non-mobile mission for offensive or defensive purposes.

AP1.1.173. **Static Test Stand.** Locations where liquid energetic engines or solid propellant motors are tested in place.

AP1.1.1.174. **Strike Termination Device or System.** A component or feature of a LPS intended to intercept lightning strikes. They may include overhead wires or grids, air terminals, or a building's grounded structural elements.

AP1.1.175. **Support Facilities.** Facilities that support AE operations (e.g., field offices, AE support equipment maintenance, forklift charging stations, dunnage storage, or inert storage buildings).

AP1.1.176. **Surge Suppression/Protection.** The attenuation, suppression or diversion of lightning induced electrical energy to ground.

AP1.1.177. Suspect Truck and Railcar Holding Areas. A designated location for placing motor vehicles or railcars either containing AE that are suspected of being in a hazardous condition or motor vehicles or railcars that may be in a condition that is hazardous to the AE.

AP1.1.178. Sympathetic Detonation (SD). The detonation of AE produced by the detonation of adjacent AE.

AP1.1.179. Tactical Facilities. Prepared locations with an assigned combat mission (e.g., missile launch facilities, alert aircraft parking areas, or fixed gun positions).

AP1.1.180. Taxiway. Any surface designated as such in the basic airfield clearance criteria specified by a DoD Component publication or Federal Aviation Regulation (reference (aa)).

AP1.1.181. Toxic Chemical Agent. A substance intended for military use with lethal or incapacitating effects on personnel through its chemical properties. Excluded from toxic chemical agents for purposes of this Standard are riot control agents, chemical herbicides, smoke- and flame-producing items, and individual dissociated components of toxic chemical agent munitions.

AP1.1.182. Toxic Chemical Agent Accident. Any unintentional or uncontrolled release of a toxic chemical agent when, as follows:

AP1.1.182.1. Reportable damage occurs to property from contamination, or costs are incurred for decontamination.

AP1.1.182.2. Individuals exhibit physiological symptoms of toxic chemical agent exposure.

AP1.1.182.3. The toxic chemical agent quantity released to the atmosphere is such that a serious potential for exposure is created by exceeding the applicable AEL for unprotected workers or the general public or property.

AP1.1.183. Toxic Chemical Agent MCE. The hypothesized maximum quantity of toxic chemical agent that could be accidentally released from AE without explosive contribution, bulk container, or process as a result of a single unintended, unplanned, or accidental occurrence. It must be realistic with a reasonable probability of occurrence.

AP1.1.184. Toxic Chemical Munitions. AE that through its chemical properties, produces lethal or other damaging effects to human beings, except that such term does not include riot control agents, chemical herbicides, smoke and other obscuration materials (40 CFR Section 266.201 and 50 USC Section 1521 (j) (1)) (references (am) and (ar)).

AP1.1.185. Ufer Ground. An earth electrode system that consists of solid conductors encased along the bottom of a concrete foundation footing or floor and is in direct contact with earth.

AP1.1.186. Underground Storage Facility. Underground Storage Facilities may consist of a single chamber or a series of connected chambers and other protective construction features. The chambers may be either excavated or natural geological cavities.

AP1.1.187. Unexploded Ordnance (UXO). Explosive ordnance which has been primed, fuzed, armed or otherwise prepared for action, and which has been fired, dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installations,

personnel or material and remains unexploded either by malfunction or design or for any other cause.

AP1.1.188. **Unit Risk.** The risk to personnel or facilities that is associated with debris, fragment or blast hazards that is the result of the detonation of a single round of AE.

AP1.1.189. **United States (U.S).** The States, the District of Columbia, the Commonwealth of Puerto Rico, the U.S. Virgin Islands, Guam, American Samoa; and the Commonwealth of The Northern Mariana Islands, Johnston Atoll, Kingman Reef, Midway Island, Nassau Island, Palmyra Island, Wake Island and any other territory or possession over which the United States has jurisdiction, and associated navigable waters, contiguous zones, and ocean waters of which the natural resources are under the exclusive management authority of the United States.

AP1.1.190. **Vulnerable Construction.** Buildings of vulnerable construction (e.g., schools, high-rise buildings, restaurants, large warehouse-type retail stores) are of three main types:

AP1.1.190.1. Buildings of curtain wall construction that have four stories or more and are constructed with external non-load bearing panels on a separate sub-frame that are supported off the structural frame or floors for the full height of the building.

AP1.1.190.2. Buildings of largely glass construction that have four stories or more and have at least 50 percent of their wall areas glazed.

AP1.1.190.3. The third type of vulnerable construction is impracticable to define precisely. This covers any large building that employs non load-bearing cladding panels. Definition of this type of construction cannot be more precise because of the variation in types of modern structures

AP1.1.191. **Waiver or Exemption.** A written authorization granted by the proper authority within a DoD Component for strategic or other compelling reasons that permits deviation from a mandatory requirement of DoD explosives safety criteria.

AP1.1.192. **Waste Military Munition.** Military munitions are waste when they are solid or hazardous waste under the regulations (42 U.S.C. 9601, et seq., reference (as)) implementing the Resource Conservation and Recovery Act (RCRA) Subpart EE of Part 264 of 40 CFR, reference (am), or defined as a waste under a DoD Component's written procedures. Waste military munitions are defined in Section 266.202 of 40 CFR, reference (am).

NOTE: Decisions about whether specific munitions are or are not waste should be made with reference to Section 260.10 and Sections 266.200 through 266.206 of 40 CFR, reference (am).

AP1.192.1 An unused military munition is a solid waste when any of the following occurs:

AP1.192.1.1. The munition is abandoned by being disposed of, burned, detonated (except during intended use), incinerated, or treated before disposal;

AP1.192.1.2. The munition is removed from storage in a military magazine or other storage area for the purpose of being disposed of, burned, or incinerated, or treated prior to disposal;

AP1.192.1.3. The munition is deteriorated or damaged (e.g., the integrity of the munition is compromised by cracks, leaks, or other damage) to the point that it cannot be put into serviceable condition, and cannot reasonably be recycled or used for other purposes; or,

AP1.192.1.4. An authorized military official has declared the munition a solid waste.

NOTE: Declaration by an "authorized military official" that munitions are waste (Section 266.202(b)(4) of 40 CFR, reference (am)) has a very limited meaning and applicability. The only example is a declaration by the Army in 1984 that M55 rockets are waste. The Environmental Protection Agency expects that such a declaration would be in writing. A decision that munitions are unserviceable, or that they are to be transferred into a demilitarization account does not, by itself, constitute a decision that the munitions are solid waste.

AP1.1.192.2. A used or fired military munition is a solid waste, if as follows:

AP1.1.192.2.1. When transported off range or from the site of use, where the site of use is not a range, for the purposes of storage, reclamation, treatment, disposal, or treatment before disposal; or,

AP1.1.192.2.2. If recovered, collected, and then disposed of by burial, or land filling either on or off a range.

AP1.1.192.3. For the RCRA (Section 1004(27) of reference (am)), a used or fired military munition is a solid waste, and, therefore, is potentially subject to RCRA corrective action authorities under Section 3004(u) and 3004(v), and 3008 (h) of reference (am), or, imminent and substantial endangerment authorities under Section 7003, of reference (am) if the munition lands off-range and is not promptly rendered safe and/or retrieved. Any imminent and substantial threats associated with any remaining material must be addressed. If remedial action is not possible, the operator of the range must maintain a record of the event for as long as any threat remains. The record must include the type of munition and its location (to the extent the location is known). (For further clarification see 40 CFR Section 266.202 of reference (am) under "Definition of Solid Waste.")

AP1.1.193. Wharf. A landing place or platform built into the water or along the shore for the berthing of vessels.

AP1.1.194. Wharf Yard. An AE area close to a pier or wharf where railcars or trucks are temporarily held in support of pier or wharf operations.

AP1.1.195. Wingwall. A wall located on either side of an ECM's headwall. It may slope to the ground or may join a wingwall from an adjacent ECM. It may be monolithic (of single construction) or separated by expansion joints from the headwall. The purpose of a wingwall is to retain the earth fill along the side slope of an ECM.

AP1.1.196. With its own means of initiation. An AE item with its normal initiating device, such as a detonator or detonating fuze, assembled to it or packed with it, and this device is considered to present a significant risk during storage and transport, but not one great enough to be unacceptable.

AP1.1.197. **Without its own means of initiation.** An AE item without its normal initiating device assembled to it or packed with it. The term also applies to an AE item packed with its initiating device, provided the device is packed so as to eliminate the risk of causing detonation of the AE item in the event of accidental functioning of the initiating device. In addition, the term applies to an AE item assembled with its initiating device provided there are protective features such that the initiating device is very unlikely to cause detonation of the AE item under conditions that are associated with storage and transport. For hazard classification purposes, a means of initiation that possesses two independent effective protective features is not considered to present a significant risk of causing the detonation of an AE item under conditions associated with storage and transport.

AP1.1.198. **Zone of protection.** The space beneath the LPS that is substantially immune to direct lightning.

AP2. APPENDIX 2

EQUATIONS USED

(Metric equations highlighted)

Equation Number	Equation
CHAPTER 5	
C5.T1-1	$D = 1.1W^{1/3}$
C5.T1-2	$D = 0.44Q^{1/3}$
C5.T1-3	$W = D^3/1.33$
C5.T1-4	$Q = D^3/0.083$
C5.2-1	$y(\%) = 50\log_{10}(16.02w)$
C5.2-2	$y(\%) = 50\log_{10}(10w)$
C5.2-3	$D_{cd} = 2.5W^{1/3}$
C5.2-4	$D_{cd} = .99Q^{1/3}$
C5.2-5	$D_{cd} = 5.0W^{1/3}$
C5.2-6	$D_{cd} = 1.98Q^{1/3}$
C5.2-7	$D_{cd} = 3.5W^{1/3}$
C5.2-8	$D_{cd} = 1.39Q^{1/3}$
C5.2-9	$D_{cp} = 1.5W^{1/3}$
C5.2-10	$D_{cp} = 0.59Q^{1/3}$
C5.2-11	$D_{cp} = 0.75W^{1/3}$
C5.2-12	$D_{cp} = 0.30Q^{1/3}$
C5.2-13	$Cc = 2.5W^{1/3}$
C5.2-14	$Cc = .99Q^{1/3}$
C5.T2-1	$D_{cd} = 2.5W^{1/3}$
C5.T2-2	$D_{cd} = 0.99Q^{1/3}$
C5.T2-3	W=Dcd3/15.625
C5.T2-4	$Q = D_{cd}^3/0.97$
C5.T2-5	$D_{cd} = 5W^{1/3}$
C5.T2-6	$D_{cd} = 1.98Q^{1/3}$
C5.T2-7	$W = D_{cd}^3/125$
C5.T2-8	$Q = D_{cd}^3/7.762$
C5.T2-9	$D_{cd} = 3.5W^{1/3}$
C5.T2-10	$D_{cd} = 1.39Q^{1/3}$
C5.T2-11	$W = D_{cd}^3/42.875$
C5.T2-12	$Q = D_{cd}^3/2.686$

C5.T2-13	$D_{cd} = 1.5W^{1/3}$
C5.T2-14	$D_{cd} = 0.60Q^{1/3}$
C5.T2-15	$W = D_{cd}^3/3.375$
C5.T2-16	$Q = D_{cd}^3/0.216$
C5.T2-17	$D_{cd} = 0.75W^{1/3}$
C5.T2-18	$D_{cd} = 0.30Q^{1/3}$
C5.T2-19	$W = D_{cd}^3/0.422$
C5.T2-20	$Q = D_{cd}^3/0.027$

CHAPTER 9

C9.4-1	loading density = NEWQD (lbs)/internal volume (ft^3)
C9.4-2	loading density = NEWQD (kg)/internal volume (m^3)
C9.4-3	$d=40W^{1/3}$
C9.4-4	$d=15.87Q^{1/3}$
C9.T1-1	$d = 35NEWQD^{1/3}$
C9.T1-2	$d = 35NEWQD^{1/3}$
C9.T1-3	$d = 0.3955NEWQD^{0.7227}$
C9.T1-4	$d = 50NEWQD^{1/3}$
C9.T1-5	$d = 13.88NEWQD^{1/3}$
C9.T1-6	$d = 13.88NEWQD^{1/3}$
C9.T1-7	$d = 0.2134NEWQD^{0.7227}$
C9.T1-8	$d = 19.84NEWQD^{1/3}$
C9.T1-9	$NEWQD = d^3/42,875$
C9.T1-10	$NEWQD = d^3/42,875$
C9.T1-11	$NEWQD = 3.60935d^{1.3837}$
C9.T1-12	$NEWQD = d^3/125,000$
C9.T1-13	$NEWQD = d^3/2,674.04$
C9.T1-14	$NEWQD = d^3/2,674.04$
C9.T1-15	$NEWQD = 8.4761d^{1.3837}$
C9.T1-16	$NEWQD = d^3/7,809.53$
C9.T1-17	$d = 25NEWQD^{1/3}$
C9.T1-18	$d = 0.004125NEWQD^{1.0898}$
C9.T1-19	$d = 50NEWQD^{1/3}$
C9.T1-20	$d = 9.92NEWQD^{1/3}$
C9.T1-21	$d = 0.002976NEWQD^{1.0898}$
C9.T1-22	$d = 19.84*NEWQD^{1/3}$
C9.T1-23	$NEWQD = d^3/15,625$

C9.T1-24	$NEWQD = 154.2006d^{0.91760}$
C9.T1-25	$NEWQD = d^3/125{,}000$
C9.T1-26	$NEWQD = d^3/976.19$
C9.T1-27	$NEWQD = 208.0623d^{0.91760}$
C9.T1-28	$NEWQD = d^3/7{,}809.53$
C9.T1-29	$d = 40NEWQD^{1/3}$
C9.T1-30	$d = 2.42NEWQD^{0.577}$
C9.T1-31	$d = 50NEWQD^{1/3}$
C9.T1-32	$d = 15.87NEWQD^{1/3}$
C9.T1-33	$d = 1.1640NEWQD^{0.577}$
C9.T1-34	$d = 19.84NEWQD^{1/3}$
C9.T1-35	$NEWQD = d^3/64{,}000$
C9.T1-36	$NEWQD = 0.2162d^{1.7331}$
C9.T1-37	$NEWQD = d^3/125{,}000$
C9.T1-38	$NEWQD = d^3/3{,}989.42$
C9.T1-39	$NEWQD = 0.7686d^{1.7331}$
C9.T1-40	$NEWQD = d^3/7{,}809.53$
C9.T2-1	HFD = 291.3 + [79.2 x ln(NEWQD)
C9.T2-2	HFD = -1133.9 + [389 x ln(NEWQD)
C9.T2-3	HFD = 107.87 + [24.14 x ln(NEWQD)
C9.T2-4	HFD = -251.87 + [118.56 x ln(NEWQD)
C9.T2-5	NEWQD = exp [(HFD/79.2) - 3.678]
C9.T2-6	NEWQD = exp [(HFD/389) + 2.914]
C9.T2-7	NEWQD = exp [(HFD/24.14) – 4.4685]
C9.T2-8	NEWQD = exp [(HFD/118.56) + 2.1244]
C9.T2-9	HFD = HFD = -1133.9 + [389 x ln(NEWQD)]
C9.T2-10	HFD = HFD = -251.87 + [118.56 x ln(NEWQD)]
C9.T2-11	NEWQD = exp[(HFD/389) + 2.914]
C9.T2-12	NEWQD = exp[(HFD/118.56) + 2.2144]
C9.T4-1	$d = 10*NEWQD^{1/3}$
C9.T4-2	$d = (13.659 - 1.6479 \times 10^{-5}*NEWQD + 1.4358 \times 10^{-11}*NEWQD^2)*NEWQD^{1/3}$
C9.T4-3	$NEWQD = d^3/1000$
C9.T4-4	$NEWQD = 1.50138 \times 10^8 - 6.73914 \times 10^5*d + 1002.9*d^2 - 0.4938*d^3$
C9.T4-5	$d = 3.97*NEWQD^{1/3}$
C9.T4-6	$d = (5.419 - 1.4410 \times 10^{-5}*NEWQD + 2.7684 \times 10^{-11}*NEWQD^2)*NEWQD^{1/3}$
C9.T4-7	$NEWQD = d^3/62.429$
C9.T4-8	$NEWQD = 6.80924 \times 10^7 - 1.002764 \times 10^6*d + 4895.93*d^2 - 7.90884*d^3$

C9.T4-9	$d = 7*NEWQD^{1/3}$
C9.T4-10	$d = (1.0848 + 1.986 \times 10^{-5}*NEWQD)*NEWQD^{1/3}$
C9.T4-11	$d = 9*NEWQD^{1/3}$
C9.T4-12	$NEWQD = d^3/343$
C9.T4-13	NEWQD = 57,424 + 515.89*d]
C9.T4-14	$NEWQD = d^3/729$
C9.T4-15	$d = 2.78*NEWQD^{1/3}$
C9.T4-16	$d = (0.4303 + 1.7369 \times 10^{-5}*NEWQD)*NEWQD^{1/3}$
C9.T4-17	$d = 3.57*NEWQD^{1/3}$
C9.T4-18	$NEWQD = d^3/21.413$
C9.T4-19	NEWQD = 26,048 + 767.73*d
C9.T4-20	$NEWQD = d^3/45.511$
C9.T4-21	$d = 6*NEWQD^{1/3}$
C9.T4-22	$d = (-3.059 + 3.0228 \times 10^{-5}*NEWQD)*NEWQD^{1/3}$
C9.T4-23	$d = 9*NEWQD^{1/3}$
C9.T4-24	$NEWQD = d^3/216$
C9.T4-25	NEWQD = 148,160 + 379.7*d
C9.T4-26	$NEWQD = d^3/729$
C9.T4-27	$d = 2.38*NEWQD^{1/3}$
C9.T4-28	$d = (-1.2135 + 2.6437 \times 10^{-5}*NEWQD)*NEWQD^{1/3}$
C9.T4-29	$d = 3.57*NEWQD^{1/3}$
C9.T4-30	$NEWQD = d^3/13.485$
C9.T4-31	NEWQD = 67,206 + 565.05*d
C9.T4-32	$NEWQD = d^3/45.511$
C9.T4-33	$d = 18*NEWQD^{1/3}$
C9.T4-34	$NEWQD = d^3/5,832$
C9.T4-35	$d = 7.14*NEWQD^{1/3}$
C9.T4-36	$NEWQD = d^3/364.086$
C9.T4-37	$d = 16*NEWQD^{1/3}$
C9.T4-38	$d = (9.9683 + 2.0135 \times 10^{-5}*NEWQD)*NEWQD^{1/3}$
C9.T4-39	$d = 18*NEWQD^{1/3}$
C9.T4-40	$NEWQD = d^3/4,096$
C9.T4-41	NEWQD = -118,180 + 390.35*d
C9.T4-42	$NEWQD = d^3/5,832$
C9.T4-43	$d = 6.35*NEWQD^{1/3}$
C9.T4-44	$d = (3.9544 + 1.76097 \times 10^{-5} *NEWQD)*NEWQD^{1/3}$
C9.T4-45	$d = 7.14*NEWQD^{1/3}$

C9.T11-1 $IBD = 101.649 - [15.934 \times (\ln(\text{Number of items} \times NEWQD))] + [5.173 \times (\ln(\text{Number of items} \times NEWQD))^2]$,

C9.T11-2 $IBD = 28.127 - [2.364 \times (\ln(\text{Number of items} \times NEWQD))] + [1.577 \times (\ln(\text{Number of items} \times NEWQD))^2]$

C9.T11-3 $\text{Number of items} \times NEWQD = \exp[1.5401 + (-17.278 + 0.1933 \times IBD)^{1/2}]$

C9.T11-4 $\text{Number of items} \times NEWQD = \exp[0.7495 + (-17.274 + 0.6341 \times IBD)^{1/2}]$

C9.T13-1 $d_{IBD,PTRD} = \exp[2.47 + 0.2368*(\ln(NEWQD)) + 0.00384*(\ln(NEWQD))^2]$

C9.T13-2 $d_{IBD,PTRD} = \exp[7.2297 - 0.5984*(\ln(NEWQD)) + 0.04046*(\ln(NEWQD))^2]$

C9.T13-3 $d_{IBD,PTRD} = 8*NEWQD^{1/3}$

C9.T13-4 $d_{IBD,PTRD} = \exp[1.4715 + 0.2429*(\ln(NEWQD)) + 0.00384*(\ln(NEWQD))^2]$

C9.T13-5 $d_{IBD,PTRD} = \exp[5.5938 - 0.5344*(\ln(NEWQD)) + 0.04046*(\ln(NEWQD))^2]$

C9.T13-6 $d_{IBD,PTRD} = 3.17*NEWQD^{1/3}$

C9.T13-7 $NEWQD = \exp[-30.833 + (307.465 + 260.417*(\ln(d_{IBD,PTRD})))^{1/2}]$

C9.T13-8 $NEWQD = \exp[7.395 + (-124.002 + 24.716*(\ln(d_{IBD,PTRD})))^{1/2}]$

C9.T13-9 $NEWQD = d_{IBD,PTRD}^3/512$

C9.T13-10 $NEWQD = \exp[-31.628 + (617.102 + 260.417*(\ln(d_{IBD,PTRD})))^{1/2}]$

C9.T13-11 $NEWQD = \exp[6.604 + (-94.642 + 24.716*(\ln(d_{IBD,PTRD})))^{1/2}]$

C9.T13-12 $NEWQD = d_{IBD,PTRD}^3/131.964$

C9.T13-13 $d_{IMD,ILD} = \exp[2.0325 + 0.2488*(\ln(NEWQD)) + 0.00313*(\ln(NEWQD))^2]$

C9.T13-14 $d_{IMD,ILD} = \exp[4.338 - 0.1695*(\ln(NEWQD)) + 0.0221*(\ln(NEWQD))^2]$

C9.T13-15 $d_{IMD,ILD} = 5*NEWQD^{1/3}$

C9.T13-16 $d_{IMD,ILD} = \exp[1.0431 + 0.2537*(\ln(NEWQD)) + 0.00313*(\ln(NEWQD))^2]$

C9.T13-17 $d_{IMD,ILD} = \exp[3.0297 - 0.1346*(\ln(NEWQD)) + 0.0221*(\ln(NEWQD))^2]$

C9.T13-18 $d_{IMD,ILD} = 1.98*NEWQD^{1/3}$

C9.T13-19 $NEWQD = \exp[-39.744 + (930.257 + 319.49*(\ln(d_{IMD,ILD})))^{1/2}]$

C9.T13-20 $NEWQD = \exp[3.834 + (-181.58 + 45.249*(\ln(d_{IMD,ILD})))^{1/2}]$

C9.T13-21 $NEWQD = d_{IMD,ILD}^3/125$

C9.T13-22 $NEWQD = \exp[-40.527 + (1309.19 + 319.49*(\ln(d_{IMD,ILD})))^{1/2}]$

C9.T13-23 $NEWQD = \exp[3.045 + (-127.817 + 45.249*(\ln(d_{IMD,ILD})))^{1/2}]$

C9.T13-24 $NEWQD = d_{IMD,ILD}^3/7.804$

C9.T15-1 $D_{IBD,PTRD} = 40W^{1/3}$

C9.T15-2 $D_{IBD,PTRD} = 15.87Q^{1/3}$

C9.T15-3 $D_{IMD,ILD} = 18W^{1/3}$

C9.T15-4 $D_{IMD,ILD} = 7.14Q^{1/3}$

C9.T15-5 $D_{IBD,PTRD} = 8W^{1/3}$

C9.T15-6 $NEWQD = D_{IBD,PTRD}^3/512$

C9.T15-7 $D_{IBD,PTRD} = 3.17Q^{1/3}$

C9.T4-46	$NEWQD = d^3/255.709$
C9.T4-47	$NEWQD = -53{,}605 + 580.89*d$
C9.T4-48	$NEWQD = d^3/364.086$
C9.T4-49	$d = 12*NEWQD^{1/3}$
C9.T4-50	$d = (11.521 + 1.9918 \times 10^{-6}*NEWQD + 2.0947 \times 10^{-11}* NEWQD^2)* NEWQD^{1/3}$
C9.T4-51	$d = (1.9389+ 4.0227 \times 10^{-5}*NEWQD)* NEWQD^{1/3}$
C9.T4-52	$d = 18*NEWQD^{1/3}$
C9.T4-53	$NEWQD = d^3/1{,}728$
C9.T4-54	$NEWQD = -193{,}080+526.83*d$
C9.T4-55	$NEWQD = 60{,}778 + 255.83*d$
C9.T4-56	$NEWQD = d^3/5{,}832$
C9.T4-57	$d = 4.76*NEWQD^{1/3}$
C9.T4-58	$d = (4.5704 + 1.7420 \times 10^{-6}*NEWQD + 4.0389 \times 10^{-11}* NEWQD^2)* NEWQD^{1/3}$
C9.T4-59	$d = (0.7692+ 3.5182 \times 10^{-5}*NEWQD)* NEWQD^{1/3}$
C9.T4-60	$d = 7.14*NEWQD^{1/3}$
C9.T4-61	$NEWQD = d^3/107.877$
C9.T4-62	$NEWQD = -87{,}578 + 784.00*d$
C9.T4-63	$NEWQD = 27{,}568 + 380.7*d$
C9.T4-64	$NEWQD = d^3/364.086$
C9.T5-1	$d = 9*NEWQD^{1/3}$
C9.T5-2	$d = 3.57*NEWQD^{1/3}$
C9.T5-3	$NEWQD = d^3/729$
C9.T5-4	$NEWQD = d^3/45.511$
C9.T5-5	$d = 18*NEWQD^{1/3}$
C9.T5-6	$d = 7.14*NEWQD^{1/}$
C9.T5-7	$NEWQD = d^3/5{,}832$
C9.T5-8	$NEWQD = d^3/364.086$
C9.T9-1	$IBD = -735.186 + [237.559 \times (\ln(\text{Number of items} \times NEWQD))] - [4.274 \times (\ln(\text{Number of items} \times NEWQD))^2]$
C9.T9-2	$IBD = -167.648 + [70.345 \times (\ln(\text{Number of items} \times NEWQD))] - [1.303 \times (\ln(\text{Number of items} \times NEWQD))^2]$
C9.T9-3	$\text{Number of items} \times NEWQD = \exp[27.791 - (600.392 - 0.234 \times IBD)^{1/2}]$
C9.T9-4	$\text{Number of items} \times NEWQD = \exp[27.000 - (600.287 - 0.768 \times IBD)^{1/2}]$
C9.T10-1	$\text{Hazardous debris distance} = -1133.9 + [389 \times \ln(MCE)]$
C9.T10-2	$HFD = -251.87 + [118.56 \times \ln(MCE)]$
C9.T10-3	$MCE = \exp[(\text{Hazardous Debris Distance}/389) + 2.914]$
C9.T10-4	$MCE = \exp[(\text{Hazardous Debris Distance}/118.56) + 2.1244]$

C9.T15-8	$NEWQD = D_{IBD,PTRD}^3/31.86$
C9.T15-9	$D_{IMD, ILD} = 5W^{/3}$
C9.T15-10	$NEWQD = D_{IMD, ILD}^3/125$
C9.T15-11	$D_{IMD, ILD} = 1.98Q^{1/3}$
C9.T15-12	$NEWQD = D_{IMD, ILD}^3/7.76$
C9.T17-1	lbs of energetic liquids = gallons X density of energetic liquids (lbs/gal)
C9.T17-2	kg of energetic liquids = liters X density of energetic liquids (kg/liter)
C9.T17-3	1 lb/gal = 8.345 kg/liter
C9.T17-4	1 kg/liter = 0.1198 lb/gal
C9.T20-1	$Distance = 149.3*W^{(-0.41+0.059*\ln(W))}$
C9.T20-2	$Distance = 24*W^{1/3}$
C9.T20-3	$Distance = 34.2*W^{(-0.317+0.059*\ln(W))}$
C9.T20-4	$Distance = 9.52*W^{1/3}$
C9.T20-5	$W = \exp[-134.286 + 71.998*(\ln(Distance)) - 12.363*(\ln(Distance))^2 + 0.7229*(\ln(Distance))^3]$
C9.T20-6	$W = \exp[-65.774 + 45.6823*(\ln(Distance)) - 9.7864*(\ln(Distance))^2 + 0.7229*(\ln(Distance))^3]$
C9-T22-1	$Unprotected\ Distance = 28*W^{1/3}$
C9.T22-2	$Unprotected\ Distance = 11.11*W^{1/3}$
C9-T22-3	$W = (Unprotected\ Distance/28)^3$
C9.T22-4	$W = (Unprotected\ Distance/11.11)^3$
C9-T22-5	$Protected\ Distance = -154.1 + 72.89*[\ln(W)] - 6.675*[\ln(W)]^2 + 0.369*[\ln(W)]^3$
C9.T22-6	$Protected\ Distance = -30.62 + 19.211*[\ln(W)] - 1.7678*[\ln(W)]^2 + 0.1124*[\ln(W)]^3$
C9-T22-7	$W = \exp[311.367 - 215.761*(\ln(protected\ distance)) + 55.1828*(\ln(protected\ distance))^2 - 6.1099*(\ln(protected\ distance))^3 + 0.25343*(\ln(protected\ distance))^4]$
C9.T22-8	$W = \exp[122.38 - 108.8094*(\ln(protected\ distance)) + 35.5517*(\ln(protected\ distance))^2 - 4.9055*(\ln(protected\ distance))^3 + 0.25343*(\ln(protected\ distance))^4]$
C9.T23-1	$D = 30W^{1/3}$
C9.T23-2	$D = 11.90Q^{1/3}$
C9.T23-3	$NEWQD = D^3/27,000$
C9.T23-4	NEWQD = D3/1,685.2
C9.T25-1	$d=2W^{1/3}$
C9.T25-2	$d=0.79Q^{1/3}$
C9.7-1	$D_{ig} = 5.8W^{1/3}$

C9.7-2 $D_{ig} = 2.30Q^{1/3}$

C9.7-3 $D_{ig} = 12.5f_gW^{4/9}$

C9.7-4 $D_{ig} = 5.41f_gQ^{4/9}$

C9.7-5 $D_{ig} = 11.1f_gW^{4/9}$

C9.7-6 $D_{ig} = 4.81f_gQ^{4/9}$

C9.7-7 $D_{ig} = 2.1f_gW^{4/9}$

C9.7-8 $D_{ig} = 0.91f_gQ^{4/9}$

C9.7-9 $f_g = 0.267w^{0.3}$

C9.7-10 $f_g = 0.11604w^{0.3}$

C9.7-11 $D_{id} = f_d*f_c*W^{0.4}$

C9.7-12 $D_{id} = f_d*f_c*Q^{0.41}$

C9.7-13 $f_d = 0.6w^{0.18}$

C9.7-14 $f_d = 0.3615\ w^{0.18}$

C9.7-15 $R = 149.3*D_{HYD}*((W/V_E)^{0.5}/p_{SO})^{1/1.4}$

C9.7-16 $R = 220.191*D_{HYD}*((W/V_E)^{0.5}/p_{SO})^{1/1.4}$

C9.7-17 $R(\theta) = R(\theta=0)/(1 + (\theta/56)^2)^{1/1.4}$

C9.7-18 $P_{SO} = 44.57*W^{-0.314}$

C9.7-19 $P_{SO} = 239.753*W^{-0.314}$

C9.7-20 $R = 131.1*D_{HYD}*(W/V_E)^{1/2.8}$

C9.7-21 $R = 48.683*D_{HYD}*(W/V_E)^{1/2.8}$

C9.7-22 $R = 9.91*D_{HYD}*W^{0.581}/V_E^{0.357}$

C9.7-23 $R = 4.395*D_{HYD}*W^{0.581}/V_E^{0.357}$

C9.7-24 $R = 161.0*D_{HYD}*(W/V_E)^{1/2.8}$

C9.7-25 $R = 59.787*D_{HYD}*(W/V_E)^{1/2.8}$

C9.T31-1 $f_c = 8.0178 - 0.1239*C + 27.1578*C^2 - 40.1461*C^3 + 21.9018*C^4 - 5.3529*C^5 + 0.4948*C^6$

C9.T31-2 $f_c = 10.8116 - 25.0685*C + 113.9591*C^2 - 168.1092*C^3 + 107.1033*C^4 - 31.5032*C^5 + 3.5251*C^6$

C9.T31-3 $f_c = 3.3794 - 0.1316*C + 72.7376*C^2 - 271.0478*C^3 + 372.7526*C^4 - 229.651*C^5 + 53.5115*C^6$

C9.T31-4 $f_c = 4.5570 - 26.6351*C + 305.2201*C^2 - 1134.995*C^3 + 1822.82*C^4 - 1351.556*C^5 + 381.2317*C^6$

C9.T32-1 $R(\theta)/R = [1+(\theta/56)^2]^{(-1/1.4)}$

C9.T34-1 $R(\theta)/(D_{HYD}/V_E^{1/1.4}) = 149.3*\{W^{0.5}/[p_{SO}(1+(\theta/56)^2)]\}^{1/1.4}$

C9.T34-2 $p_{SO} = 44.57*\ W^{-0.314}$

C9.T34-3 $R(\theta)/(D_{HYD}/V_E^{1/1.4}) = 149.3*\{W^{0.5}/[p_{SO}(1+(\theta/56)^2)]\}^{1/1.4}$

C9.T34-4 $p_{SO} = 239.759*\ W^{-0.314}$

C9.T35-1	MFR = 759 + 1251*[ln(Diameter)]
C9.T35-2	Diameter = exp[(MFR/1251) - 0.61]
C9.T35-3	MFR = -1002.08 + 381.305*[ln(Diameter)]
C9.T35-4	Diameter = exp[(MFR/381.305) + 2.628]
C9.T35-5	MFR = -2641 + 2998*[ln(Diameter)]
C9.T35-6	Diameter = exp[(MFR/2998) + 0.88]
C9.T35-7	MFR = -3760.859 + 913.79*[ln(Diameter)]
C9.T35-8	Diameter = exp[(MFR/913.79) + 4.1157]

CHAPTER 10

C10.T1-1	$D1 = 2*NEWQD^{1/3}$
C10.T1-2	$NEWQD = (D1/2)^3$
C10.T1-3	$D1 = 0.79 * NEWQD^{1/3}$
C10.T1-4	$NEWQD = (D1/0.79)^3$
C10.T1-5	$D2 = 6*NEWQD^{1/3}$
C10.T1-6	$NEWQD = (D2/6)^3$
C10.T1-7	$D2 = 2.38 * NEWQD^{1/3}$
C10.T1-8	$NEWQD = (D2/2.38)^3$
C10.T1-9	$D3 = 12*NEWQD^{1/3}$
C10.T1-10	$NEWQD = (D3/12)^3$
C10.T1-11	$D3 = 4.76 * NEWQD^{1/3}$
C10.T1-12	$NEWQD = (D3/2.38)^3$
C10.T1-13	$D4 = 8*NEWQD^{1/2}$
C10.T1-14	$NEWQD = (D4/8)^2$
C10.T1-15	$D4 = 3.62 * NEWQD^{1/2}$
C10.T1-16	$NEWQD = (D4/3.62)^2$
C10.T1-17	$D5 = 12.2*NEWQD^{1/2}$
C10.T1-18	$NEWQD = (D5/12.2)^2$
C10.T1-19	$D5 = 5.43 * NEWQD^{1/2}$
C10.T1-20	$NEWQD = (D5/5.43)^2$
C10.T1-21	$D6 = -4.49 + 0.487*(NEWQD^{1/3}) + 2.928*(NEWQD^{1/3})^2$
C10.T1-22	$NEWQD = (0.0833 + [1.5421 + 0.3416*D6]^{1/2})^3$
C10.T1-23	$D6 = -1.37 + 0.193*(NEWQD^{1/3}) + 1.512*(NEWQD^{1/3})^2$
C10.T1-24	$NEWQD = (0.0640 + [0.9108 + 0.6615*D6]^{1/2})^3$
C10.T2-1	$d = 24W^{1/3}$
C10.T2-2	$d = 9.52\ W^{1/3}$
C10.T2-3	$d=30W^{1/3}$

C10.T2-4	$d = 11.90\ W^{1/3}$
C10.T3-1	$d = 24W^{1/3}$
C10.T3-2	$d = 9.52\ W^{1/3}$
C10.T3-3	$d=30W^{1/3}$
C10.T3-4	$d = 11.90\ W^{1/3}$
C10.T4-1	$d = 24W^{1/3}$
C10.T4-2	$d = 9.52\ W^{1/3}$
C10.T4-3	$d=30W^{1/3}$
C10.T4-4	$d = 11.90\ W^{1/3}$

Jeanine Derby/R3/USDAFS
03/20/2008 11:27 AM

To "Dick Shuman" <shumans2@cox.net>
cc Beverley A Everson/R3/USDAFS@FSNOTES
bcc
Subject Re: Rosemont EIS Open House March 18, 2007 in Green Valley

Every comment that we receive on Rosemont becomes part of the record. Thank you for yours in the past. Because we were delayed in announcing meetings due to a delay in Federal Register announcing the Notice of Intent, I have agreed to extend the scoping period until May 19. We will check to assure that your mailing address is on the mailing list.

Jeanine Derby, Forest Supervisor
Coronado National Forest
phone: 520 388-8306
FAX: 520 388-8305
"Dick Shuman" <shumans2@cox.net>

"Dick Shuman"
<shumans2@cox.net>
03/18/2008 04:30 PM

To "Derby, Jeanine" <jderby@fs.fed.us>, "Everson, Beverly" <beverson@fs.fed.us>, "Campbell, Andrea" <awcampbell@fs.fed.us>
cc
Subject Rosemont EIS Open House March 18, 2007 in Green Valley

Jeanine Derby, Forest Supervisor
Coronado National Forest

I am upset about two aspects of subject open house in Green Valley
1. The short notice appearing in the Arizona Star (6 days).
2. I was not notified directly. I understood that I was on your notification list of any public notices or information.

I have the following question.
Will the two documents I submitted to you need to be resubmitted? Are they part of the comment record?
These are the letters I submitted on November 12 and December 30, 2007 under the subject of File Code 2810 Rosemont Plan of Operation.

In my letter of November 12, I requested that Rosemont be requested to make a comprehensive hydrological study of our aquifer to determine the exact impact that Rosemont pumping will have on our community. Has Rosemont been requested to do this?

Respectfully,
Dick Shuman, PE
Casa Paloma I Homeowners, Inc.
Environmental Coordinator
Ph: (520) 648-0445 Email shumans2@cox.net

Pjbonthron@aol.com
03/26/2008 02:18 PM

To beverson@fs.fed.us
cc
bcc
Subject Letter Re Rosemont mine

Attached is a letter regarding the Rosemont mine. We will also send you a hard copy in the mail tomorrow.

Gunnar and Peggy Bonthron

 Forest Service Letter.doc

GUNNAR & PEGGY BONTHRON
421 NORTH MOUNTAIN BROOK DRIVE
GREEN VALLEY, ARIZONA 85614
520-399-1886

March 27, 2008

Beverly Everson
USDA Forest Service
Coronado National Forest
300 West Congress Street
Tucson, Arizona 85701

Subject: Proposed Rosemont Mine

Dear Ms. Everson:

We have been following the proposed Rosemont Mine efforts and attending your recent public meetings. We wanted to attend these meetings and move around the crowds so we could hear first-hand input from the various communities. I am sure you found out, as we did, that there is strong opposition for this large mine being allowed in this area. People here are so stressed that our government, and your government agency, would allow such a thing like this to happen based upon the looming water shortage we are facing here. Many people that we spoke with said, "The Forest Service has already made up their mind to allow this mine to operate, these meetings are only window-dressing." We truly hope that this is not the case.

We hope you will take the time to read this entire letter and have a better understanding of the facts and what Green Valley/Sahuarita may be facing in just a few years as it relates to our water shortage.

As you well know, we have been in a drought situation for the past 10 years in Arizona. In many areas, more groundwater is being pumped than being replaced. This holds especially true in the Green Valley area. We have been in an overdraft situation for many years. For FY 2006, we had an overdraft of 40,000 AF. We have not received the figures for 2007, but it will be more than that because of the massive groundwater pumping by the copper mine, the pecan grove and golf courses. All are demanding more water due to higher temperatures in the summer and less rainfall. This is not a fantasy, but real facts. Note: When Sierra Vista had an annual overdraft of just over 4,000 AF, everyone got into a panic and wanted to address the issue, and did. Green Valley area has

an overdraft of over 40,000 AF annually, and no one seems to really care. There has been a lot of talk, but no sound action. Every day/month/year that goes by, only compounds the severity of the groundwater crisis. Government agencies and politicians perceive that we are all over 65 and maybe have less than 10-12 years, so why bother. Then a new group of retirees will move to town and we can continue to fool them for a while longer.

In 1998 when the Malcolm Pirnie Report was published, everyone knew (DWR, Pima County, copper mine, pecan grove) if we did not begin some type of groundwater recharge, the area was going to be in trouble. The proposed CAP pipeline was presented that would extend from Pima Mine Road to the Canoa Ranch area. Phelps Dodge and FICO (pecan grove) decided it was cheaper to pump groundwater, rather than do the right thing and they forfeited the offer of 23,000 AF of CAP water annually. Also, they did not want to assist financially with the extension of the pipeline. It is not up to the taxpayers to pay this bill, as the copper mine and pecan grove pump 85% of our groundwater from this basin. Everyone has gone along their merry way, hoping no one would find out the truth, just pumping and pumping our groundwater. They had the wells and grandfathered rights and no one could touch them. The politicians are afraid to do the right thing, as the lobbyist are very powerful and votes are more important than taking care of the people of Green Valley.

Over the past 25 months, there have been several groups here in Green Valley working together trying to determine just what are we facing, as the government agencies and politicians have completely let us down. The statistics on our looming water crisis in this basin are absolutely frightening.

First, we will address the Sierrita Mine (Phelps Dodge). From 1987 to 2006, this mine has pumped over 505,000 AF of groundwater from the old Canoa Ranch area. That equates to 23 million gallons per day. As we all know, there has been no means of recharge in the area except what small amount flows down the Santa Cruz River and rainfall. You just cannot pump that much groundwater, and not replenish it, without there being serious subsidence. Well guess what, that has started to happen. In the Canoa Verde and Canoa Azul area of Canoa Ranch, there are approximately eight homes, plus one swimming pool, that has faced serious foundation problems. It is only a matter of time before that whole area sinks maybe 4 to 9 feet. Further, that area has many golf courses, and they pump 600,000 gallons per day/per golf course.

Now, let's look at the area where the Rosemont mine will be pumping. In that area, well owners are already facing declines in the water levels. We

personally met a gentleman that lives off of Sahuarita Road where his well has dropped 60 feet in the past five years. In the next year, he will have to drill another well to the tune of over $14,000 to secure a water supply (and for how long). You people must factor in the human consequences of what this new mine will create for all the well owners in that area.

Groundwater in this area flows from the Nogales area towards Marana. We already have less water coming down the Santa Cruz River (helps to recharge the Canoa area). Now if the new copper mine begins to draw down the groundwater in the Sahuarita area, it could possibly deplete the water in the Green Valley area even further. As that water level goes down, the Green Valley water would begin to flow towards Sahuarita at a faster rate. Groundwater knows no boundaries, there are no gates down there to tell it to stay here. So as the Green Valley area is receiving less water from the south, so could we further lose our groundwater faster to the north if the Sahuarita table begins to decline. And, it will. The only thing we do not know is when, but it will be sooner, rather than later. In possibly less than 10 years, how do you tell people 75 years of age and older that they have to go and get bottled water. Many are crippled and some with no means of transportation. Further, maybe they can only flush their toilets for two hours a day when the water is turned on. What do we do when the small water companies in Green Valley close their doors (there are six water companies here) because they cannot afford to drill deeper or dig new wells (not knowing how long that water will last). I have personally seen this happen, and believe me it is not a pretty picture. It cost the State of California and a County millions and millions to correct a problem that could have been prevented.

The National Environmental Policy Act, Section 101, Paragraph B pertains to Rosemont's activities of transporting groundwater away from Sahuarita that would interfere with the natural balance of the environments ability to maintain critical water levels for the overall development and welfare of the community. Rosemont's transportation of groundwater from Sahuarita, which is already suffering from groundwater depletion and subsidence, may cause a risk to health and safety of the residents with undesirable consequences to the community (wells drying up and property becoming worthless) and Rosemont's transportation of our groundwater could dramatically affect future growth in the community.

IF YOU APPROVE FOR THE ROSEMONT MINE TO GO INTO PRODUCTION, THEY SHOULD ONLY BE ALLOWED TO USE **CAP WATER (NO GROUNDWATER).** REMEMBER, THIS IS A FOREIGN COMPANY THAT WILL BE REMOVING OUR PRECIOUS METAL TO BE SHIPPED OVERSEAS. WHY IN THE WORLD WOULD WE ALLOW THEM

(FOREIGN ENTITY) TO DESTROY OUR GROUNDWATER BASIN. WHAT ABOUT THE POSSIBILITY OF DISPLACING AROUND 50,000 RESIDENTS IF OUR WATER SUPPLY ERODES. PLUS THE HOMES IN THIS BASIN WOULD BECOME WORTHLESS.

If you want proof of our groundwater overdraft in this basin, contact the Department of Water Resources, Pima County Flood Control and the Pima County Board of Supervisors.

We have been hoping that our State government would step in and see the urgency of this matter. The State of Arizona is at a crossroads. If the State wants mining, then they must stop residential growth. You cannot have it both ways. With the threat of less CAP water and the drought continuing for maybe 15 years, proper planning must begin today, not years from now for a sustainable water supply. It is totally unfair to lure retirees into this area, knowing our water dilemma, and where they (retirees) may lose their home and have a financial disaster, just because of powerful lobbyist, a very outdated mining law that most politicians are afraid to address because of the money for their war chest.

The Federal government has an obligation to make a sound decision. You must look at the facts and what is happening to our groundwater basin. This just cannot be ignored.

We are going to contact 20/20, Dateline, Lou Dobbs and all media outlets to try and get this story told to the entire United States. We must protect our retirees and stop others from coming here and possibly losing a lot of their retirement money. The State of Arizona should be ashamed of itself for issuing the 100 Year Guaranteed Water Certificates. Politicians, and government officials, need to start being accountable. We will not sit here and just let our community be destroyed because of greed. We will not rest until this matter is presented to the country and large media outlets. The worst part of this is that the damage will be done by a foreign company and the copper going to another country. We are also distributing this letter to our politicians so they cannot use the excuse, when there is an emergency, that they did not know there was a problem or no one informed them of this groundwater overdraft.

Should you care to meet with us, we have all of the hard data to confirm what we are saying.

Gunnar and Peggy Bonthron
Concerned citizens of Green Valley and
representing over 700 couples

COPIES TO:
Governor Janet Napolitano
Senator Jon Kyl
Senator John McCain
Senator Tim Bee
Congresswoman Gabrielle Gifford
Congressman Raul Grijalva
Arizona Corporation Commission
Pima County Board of Supervisors
Department of Water Resources
Green Valley Recreation
Green Valley Community Coordinating Council
All Media Outlets

Mailroom R3 Coronado
Sent by: Karina Montez

03/21/2008 08:27 AM

To Beverley A Everson/R3/USDAFS@FSNOTES
cc
bcc
Subject Re: Fw: (OC): Rosemont Copper Project

Karen Terney

Karen Terney
03/19/2008 09:39 AM

To: mailroom_r3_coronado@fs.fed.us
cc:
Subject: Fw: (OC): Rosemont Copper Project

The trailing email was sent to the Washington Office.

Karen Terney - Writer/Editor
Ecosystem Management Coordination
202-205-1732
fax 202-205-1012

<tucsonhere@msn.com>

<tucsonhere@msn.com>

03/18/2008 10:10 PM
Please respond to tucsonhere

To: mailroom_wo@fs.fed.us
cc:
Subject: (OC): Rosemont Copper Project

Below is the result of your feedback form. It was submitted on:
Tuesday, March 18th, 2008 at 10:10pm.

From: Robert Miggins <tucsonhere@msn.com>
subject: Rosemont Copper Project
comment: I support and concur with those comments and concerns of Representative Gabrielle Giffords; Member of the U.S. Congress as written in her letter to Mr. Corbin Newman; Regional Forester U.S. Forest Service Region 3. Please Re-consider the negative impact of the Rosemont Copper Project in the Santa Rita Mountains.

---------- Submission Details ----------
Remote Address: 64.215.172.230
HTTP User Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.8.1.12) Gecko/20080201 Firefox/2.0.0.12

"Peter Ott"
<pott@shc.arizona.edu>
03/19/2008 10:09 AM

To <beverson@fs.fed.us>
cc
bcc
Subject Rosemont paying people to support the mine

I attended last night's (3/18) US forest service meeting on the Rosemont mine project
I am against this mine and have stated so in several occasions

It was appalling to see that Rosemont bussed people in, after having treated them to a dinner, made them sign petitions in support of the mine and make them wear Rosemont badges I spoke to several of these individuals they clearly had no idea of the issues at hand and simply enjoyed an evening of "wining and dining".

I would expect a US government agency to disallow such obvious manipulation of the hearing process.

Peter Ott, M.D., FACC

Director of Electrophysiology Laboratory and Arrhythmia Services
at University of Arizona Health Sciences Center, Sarver Heart Center

Phone: 520-626-6358
Fax: 520-626-4333
Physician line: 520-694-5868

"Mikey Block"
<mikey@mikeyblock.com>
03/19/2008 04:01 PM

To <beverson@fs.fed.us>
cc
bcc
Subject Augusta Resources "Rosemont Mine", Pima County, AZ

Dear Ms. Everson,

Please see my attached letter.

Thank you.

Sally Reichardt

E-mail: bsrsvn@azwildblue.com Rosemont Mine letter.doc

March 18, 2008

Coronado National Forest
Beverly Everson
300 West Congress Street
Tucson, Arizona
85701

Re: Augusta Resources proposed "Rosemont Mine"

Dear Ms. Everson,

I write to you, as a native Tucsonan, who is currently living in Sonoita and who is extremely concerned about the proposed Rosemont Mine. As a child, our family had very little money so we found camping on Mt. Lemmon to be a very inexpensive family vacation. I always thought that our National forests were for the enjoyment of the taxpayers. Apparently, I am wrong. The Coronado National Forest will become a dumping site of waste rock and tailings. Hundreds of acres paid for and enjoyed by American taxpayers will be destroyed by a foreign registered company scheduled to ship the majority of the mined copper outside of the United States.

I continue to hear, as I did throughout my entire childhood, how precious our water supply is; so precious that we had peak hours that we shouldn't water during. I now read, in Augusta's Rosemont Mine feasibility study that "Water quantities are limited and environmentally sensitive in the region of the Rosemont mine". Further, the study says: "fresh water makeup is 4.8 million gallons per day". Wow! It seems to me that the wells in the surrounding areas/towns will quickly run dry. Their study goes on to say "Property for other well locations are currently being acquired for the other 2,000 gpm requirement".

The study also states that "State Route 83 can be used to gain access to the plant road" and "This system of interstates and highway will allow for quick access to the site". I beg to differ. It will be far from "quick" access. Hwy. 83, as you know, is a two lane road with several windy areas. One such curve has one of the highest accident rates and, I believe, *the* highest rate in the State for motorcycles. We already have 18 wheelers using Hwy. 83 as a detour route because the bridge on I-10 to the East of Hwy. 83 is too short. We currently have many wide loads which require us to pull off to the side of the road and "wait". Last week, I had to pull over for four separate wide loads and that was just between Rosemont Junction & I-10. Several of our highway patrol cars are involved with these wide loads. Augusta said for the first two (or thereabouts) years, they will be running wide loads every 10 minutes. Nobody will be able to use this section of Hwy. 83. It will make travel impossible. The school busses will not be able to get the kids to school. The Patagonia-Sonoita Scenic (2nd oldest in Arizona) Hwy. sign will need to be taken down. Nobody, including bicyclists, motorcyclists and tourists will be able to travel from Tucson to the wineries, Tombstone, Parker Lake, Patagonia Lake or Patagonia, via Hwy. 83, thus, hurting tourism and the revenues of small businesses.

This mine, if built, will be seen from many miles away and their tailings will actually be located in the backyard of an existing neighborhood on Coronado National Forest property. Additionally, per their feasibility study, the mine will be "working two 12-hour shifts per day, seven days per week, 52 weeks per year". Property values in Sonoita, Patagonia and all of the surrounding areas, for hundreds of miles will plummet.

Add to the above, that this mine will only employ 327 people and a mine life of 18.2 years. It's no wonder that the Board of Supervisors voted to oppose this project. Not to mention that there's no guarantee, of course, that the mine won't go belly up in two years like some recent mines in the U.S. have. The proposed mine property contains many very, very old Oak trees and is one of the most pristine lands we have. If anyone believes that the mine can put this land back to anything close to what it is now, they are just dead wrong. It's impossible. The proposed mining site will destroy this area forever.

Contrary to what Augusta would have you believe, there is huge opposition to this mine. I urge you to consider the destruction of the Santa Ritas and Coronado National Forest by this open pit copper mine, as a travesty of the public trust and to reject the Rosemont Copper proposal.

Sincerely,

Sally Reichardt

E-mail: bsrsvn@azwildblue.com

Jeanine Derby/R3/USDAFS
03/20/2008 10:35 AM

To Beverley A Everson/R3/USDAFS@FSNOTES
cc
bcc
Subject Fw: Rosemount Mine

Jeanine Derby, Forest Supervisor
Coronado National Forest
phone: 520 388-8306
FAX: 520 388-8305
----- Forwarded by Jeanine Derby/R3/USDAFS on 03/20/2008 10:35 AM -----

"Richard Salzetti"
<Rsalzetti@cox.net>
03/20/2008 10:24 AM

To <jderby@fs.fed.us>
cc
Subject Rosemount Mine

As a resident of the area where the mine will be developed if approved I would like to go on record to highlight a few items that need to be considered. First, where is the water going to come from that will be used by the mine if approved. If it is form wells in the area surrounding the mine what impact will that have on the water residents in the draw from wells in the same general area. If a replacement source of water is not brought in by the mine for the duration of the mining operation the approval should not occur. Perhaps you are not aware but we do have a growing water shortage in the area and drawing out more water than what is replaced is not a good idea. Perhaps your home may suffer the consequences of either no water or a major reduction of water usage due to the mine using available water. Think about that possibility for perhaps yourself and other residents in that area. Second, ALL COMMUNITIES AND WATER COMPANIES AFFECTED BY THE DRAW DOWN OF WATER BY THE MINE SHOULD BE INVOLVED IN THE DECISION AS ALL WILL BE EFFECTED IN SOME WAY. Last item, The mine has developed local advertising on the merits of the mine and one is they will provide money to develop or create or help create areas to preserve the natural habitat of a area. It seems to me they could do that by not destroying land that is now in it"s natural state and it would create more good will than developing a mine and then trying to pacify residents by giving a dollar or two to create a park or a few acres of natural growth land that is already in its natural state. Thank You Richard Salzetti

Mailroom R3 Coronado
Sent by: Karina Montez

03/17/2008 08:33 AM

To Beverley A Everson/R3/USDAFS@FSNOTES
cc
bcc
Subject Re: (no subject)

Perfectbil@cs.com

Perfectbil@cs.com
03/15/2008 11:15 AM

To: mailroom_r3_coronado@fs.fed.us
cc:
Subject: (no subject)

Hello,

I wish to state my opposition to any approval of mining for the Rosemont Mine in the Santa Rita Mountains, whether now or at any other time. There may be some short term benefits economically, though even this is somewhat questionable given the eventual costs of reclamation and potential pollution. The loss of beauty in the short term, as well as use of the land for recreation, and the destruction of the land for an unforseeable long-term are easily enough to outweigh any short-term gain.

Sincerely,

William Pritchard
8912 n. Camino Coronado
Tucson, Az. 85704

Mailroom R3 Coronado
Sent by: Karina Montez

03/17/2008 08:33 AM

To Beverley A Everson/R3/USDAFS@FSNOTES
cc
bcc
Subject Re: (no subject)

Perfectbil@cs.com

Perfectbil@cs.com
03/15/2008 11:15 AM

To: mailroom_r3_coronado@fs.fed.us
cc:
Subject: (no subject)

Hello,

I wish to state my opposition to any approval of mining for the Rosemont Mine in the Santa Rita Mountains, whether now or at any other time. There may be some short term benefits economically, though even this is somewhat questionable given the eventual costs of reclamation and potential pollution. The loss of beauty in the short term, as well as use of the land for recreation, and the destruction of the land for an unforseeable long-term are easily enough to outweigh any short-term gain.

Sincerely,

William Pritchard
8912 n. Camino Coronado
Tucson, Az. 85704