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	Engineer and Design ESTABLISHING A TEMPORARY OPEN BURN AND OPEN DETONATION SITE FOR CONVENTIONAL ORDNANCE AND EXPLOSIVES PROJECTS	
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US Army Corps of Engineers®

ENGINEERING AND DESIGN

ESTABLISHING A TEMPORARY OPEN BURN AND OPEN DETONATION SITE FOR CONVENTIONAL ORDNANCE AND EXPLOSIVES PROJECTS

ENGINEER PAMPHLET

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1. Purpose. This pamphlet provides U.S. Army Corps of Engineers (USACE) personnel and their contractors with general guidance for establishing and utilizing a temporary Open Burn (OB) and/or Open Detonation (OD) site for the destruction of small quantities of Ordnance and Explosives (OE) in support of OE project operations. The establishment of permanent, large-scale OB or OD areas for the destruction of OE is not covered in this pamphlet. The guidance provided in this pamphlet has been compiled from many different Department of Defense (DOD) and Department of the Army (DA) sources and is to be used in the establishment and use of a temporary OB/OD site whenever site-specific conditions allow.

2. Applicability. This pamphlet applies to all Headquarters, USACE (HQUSACE) elements and all USACE commands having responsibility for conventional OE response activities.

3. References. Required and related publications are listed in Appendix A.

4. Distribution. Approved for public release, distribution is unlimited.

5. Explanation of Abbreviations and Terms. Abbreviations and special terms used in this pamphlet are explained in the glossary at Appendix B.

FOR THE COMMANDER:

RUSSELL L. FUHRMAN
Major General, USA
Chief of Staff

4 Appendices
(See Table of Contents)

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CHAPTER 1
INTRODUCTION

1-1. Policy.

a. General. The policy of the USACE is to produce products and services that fully meet the customer's expectations of quality, timeliness and cost effectiveness, within the bounds of legal responsibility. An acceptable level of quality does not imply perfection; however, there should be no compromise of functional, health, or safety requirements. Adherence to the principles outlined in ER 1110-1-12, Quality Management, will contribute to achieving this goal. Procedures must be formulated to ensure harmony with the USACE Strategic Vision and shall be executed in concert with activities presented in other USACE guidance.

b. Prohibition from Burial**.** Destruction of OE will be accomplished by burning or detonation only. Burying of OE or dumping it into waste places, pits, wells, marshes, shallow streams, deep sea, or inland waterways is absolutely prohibited. This policy does not include burial to control fragments during authorized destruction operations by detonation when in compliance with applicable statutes and regulations.

1-2. Organization of Document**.** This document is organized into specific topic areas likely to be encountered during the establishment and use of a temporary OB or OD site. As the predominant method of destruction of OE items is open detonation, this method of destruction will be given primacy in this document. Within those topic areas, where there are significant differences between OB and OD operations, the OB-specific details will be covered in a separate sub-section after the OD discussion. Appendix C contains a checklist that can be used in setting up an OB/OD site.

1-3. Responsibilities**.**

a. General. It is the responsibility of all USACE personnel involved with the OE program to safely execute OE projects in accordance with (IAW) ER 385-1-92. All USACE organizations will ensure that all personnel involved with on-site activities at OE sites are familiar with and have access to the approved Work Plan and Site Safety and Health Plan (SSHP) that have been prepared for the site activities to be conducted. In addition, each organization will ensure that all personnel have received appropriate training, medical surveillance, and personal protection equipment (PPE) required by the SSHP, contract specifications, Occupational Safety and Health Administration (OSHA) Standards, and DA and USACE regulations.

b. USACE Commands. Responsibilities of USACE elements for executing OE projects are delineated in ER 1110-1-8153.

c. Contractors. Contractors will be responsible for setting up, operating, dismantling, and documenting OB/OD areas IAW the guidelines set forth in this pamphlet.

CHAPTER 2
ENVIRONMENTAL COMPLIANCE

2-1. Policy.

a. Environmental laws and regulations implemented by Federal, state, and local governments should be considered prior to conducting OB/OD operations. Vigilance should be constantly exercised to ensure that any applicable changes in Federal, state, or local regulations are incorporated.

b. A temporary facility established to perform OB/OD operations is exempt from the permitting requirements established in the Resource Conservation and Recovery Act (RCRA) if the action is being conducted as a CERCLA response action on-site. There could be substantive requirements that must be considered. Office of Counsel should be consulted to determine the applicable laws and regulations on a site-specific basis.

c. Storage and disposition of wastes generated from OB/OD operations will be in compliance with RCRA and associated Federal, state, and local regulations.

2-2. Operations.

a. As an administrative requirement rather than a regulatory requirement, a closure plan for the OB/OD area will be prepared as part of the Work Plan submittal. The closure plan will document the type, number, and locations of the environmental samples that will be collected from the OB/OD area.

b. Prior to constructing the OB/OD area, environmental samples of the proposed area should be collected and analyzed at an off-site laboratory to determine if there is any pre-existing environmental contamination (e.g., explosives, metals, etc.) at the site. Reference EM 200-1-3 for sampling methods. Upon completion of the OB/OD operations, the OB/OD site will be dismantled and environmental samples should again be collected and analyzed to determine whether the OB/OD operations have caused any contamination. The results of the pre- and post-environmental sampling will be documented and submitted to the CO upon completion of the project.

CHAPTER 3
SITE SELECTION

3-1. General.

a. When selecting a site for a temporary OB/OD area, the district Office of Counsel should be consulted to determine the applicable Federal and state environmental laws and regulations. The OB/OD site must not be located in any sensitive environmental areas (e.g., wetlands, floodplains, or threatened endangered species habitats).

b. There are three distance aspects of a detonation that must be considered when siting an OB/OD area. These include the distance that fragments will be thrown, the overpressure effects, and the noise that is generated during an OE detonation. In general, the site selected for the destruction of OE will be located at the maximum practicable distance from all explosives storage areas, temporary holding magazines, inhabited buildings, public traffic routes, and operating buildings, unless engineering controls, pits, or similar aids are used to limit the range of fragments and debris. Where possible, natural barricades will be used between the OB/OD site and public areas, roads, and other field operations.

c. OB/OD sites must also be sited in relation to the direction of prevailing winds so that any sparks that are generated from the OB/OD operations will not be blown to an area where explosives are stored or where fires are likely to start. Disposal by open burning will not be undertaken when wind velocity exceeds 15 mph. Dry grass, leaves, and other extraneous combustible material in amounts sufficient to spread fire will be removed from a 61-meter (200-foot) radius from the point of destruction. The grounds shall be of well-packed earth and will be free from loose stones and deep cracks in which explosives might lodge. Explosive materials will not be burned or detonated on concrete mats. When destroying explosives by burning, the possibility that the mass of explosives may detonate must be recognized (see paragraph 2-7 for additional special siting considerations to be used in siting an OB area).

d. The design and construction of the temporary OB/OD site will take into consideration the live and dead loads that will be experienced in the area, the local soil and hydrostatic pressures, and any rain or snow loads that may be encountered. The temporary OB/OD site will not be located directly on rock strata.

e. OB/OD areas will be located in areas that provide adequate lighting and visibility.

f. OB/OD areas will not be sited near overhead power lines or near any underground utilities.

3-2. Topography. When determining potential locations for a temporary OB/OD area, maps of the local area will be reviewed prior to the site visit to locate areas that have topography preferential for locating an OB/OD area (e.g., sites remote from public areas, hillsides located between potential OB/OD area and public areas, etc.). After the map reconnaissance has been performed and potential sites have been selected, a site walk over will be conducted to determine the best potential area.

3-3. Criteria for OB/OD Area Site Layout. The following discussion introduces the general distance criteria to consider for siting a temporary OB/OD area. These distance criteria have been developed to ensure that OB/OD operations can be safely conducted.

a. Personnel Separation Distance (PSD) Criteria.

(1) The minimum separation distances required between OB/OD operations and personnel have been established in order to provide a degree of safety when establishing a temporary OB/OD area. The safe separation distance for all personnel will be the greater of the overpressure distance or the appropriate fragment range as determined by the maximum fragment range or mitigated fragment range, but never less than 61 meters (200 feet). Table 3-1 presents the default separation distances, as detailed in Chapter 5, Paragraph 5-7.c of DA Pam 385-64.

TABLE 3-1
Default Personnel Separation Distances From Aboveground Detonations[1]

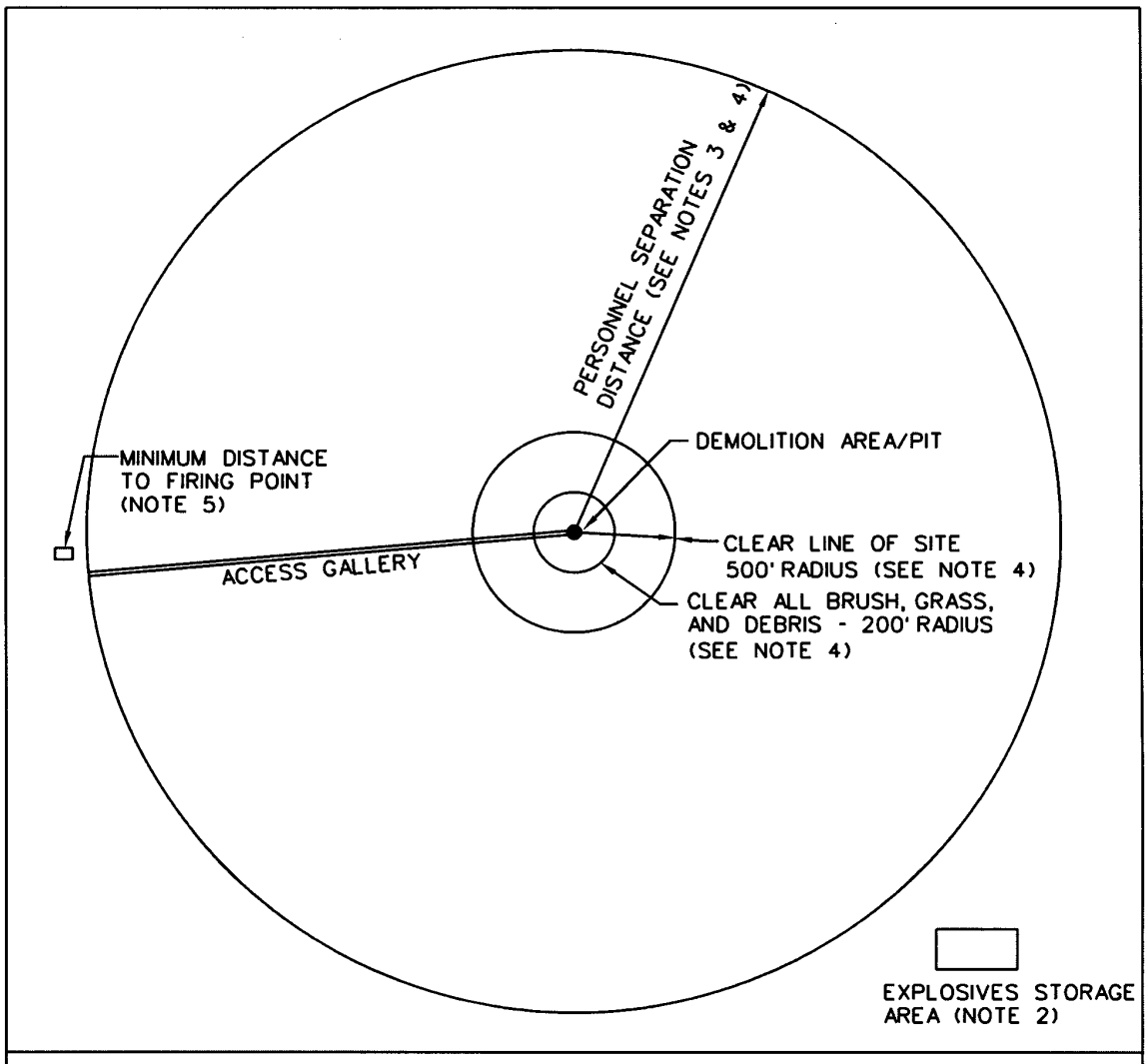
	Blast Overpressure Distance Meters (Feet)	Fragment/ Debris Distance Meters (Feet)
Non-fragmenting Explosive Material	$D = 130Q^{1/3}$, where Q in kg.[2] ($D = 328W^{1/3}$, where W in lb.)[3]	381 (1,250)
Bombs and Projectiles of Diameter Less Than 127 mm (5 Inches)	$D = 130Q^{1/3}$, where Q in kg. ($D = 328W^{1/3}$, where W in lb.)	762 (2,500)
Bombs and Projectiles With a Diameter of 127 mm (5 Inches) or More	$D = 130Q^{1/3}$, where Q in kg. ($D = 328W^{1/3}$, where W in lb.)	1219 (4,000)
All Other Ammunition	$D = 130Q^{1/3}$, where Q in kg. ($D = 328W^{1/3}$, where W in lb.)	762 (2,500)

[1] From DA Pam 385-64, Table 5-7
[2] Q is the Net Explosive Quantity (NEQ)
[3] W is the Net Explosive Weight (NEW)

(2) If known, maximum debris throw ranges with a applicable safety factor may be used to replace the default personnel separation distances. Contact the OE Mandatory Center of Expertise (MCX) for calculation of the maximum fragmentation distance. The personnel separation distance is the maximum of this fragmentation distance, the blast overpressure distance from Table 3-1, or 61-meters (200-feet).

(3) Multiple rounds may be demolished by a single detonation (consolidated shot) using the procedures detailed in Appendix D. The personnel separation distance for a consolidated shot is calculated as shown in Appendix D.

b. Figure 3-1 provides a general layout and distance guidelines for a temporary OD area using the default personnel separation distance guidelines. The guidelines portrayed in this figure are covered in greater detail in the following paragraphs.



NOTES:
1. Net explosives weight and type of UXO being destroyed will also impact distances.
2. See DoD 6055.9-STD for siting criteria of explosives storage sites.
3. Guards must be posted when performing operation or signs posted at radius warning against entering area (see paragraph 3.3.h).
4. All radii (including PSD) will be measured from outermost limits of demolition area/pit(s).
5. See Table 3-1.

FIGURE 3-1: TEMPORARY OD AREA DISTANCE REQUIREMENTS

c. The center of the OB/OD site typically consists of a central detonation area or pit, or in the case of an OB operation, a central burning tray or burning pit. For an OD site, all combustible materials and loose stones must be cleared within a 61-meter (200-foot) radius of the center of the site.

d. Engineering controls and/or protective structures for personnel or other measures to suppress the blast and/or fragment effects may be used to reduce the required separation distance. Engineering controls will be determined on a site-specific, munition-specific basis. The designs for engineering controls must be included in the Explosives Safety Submission (ESS) and submitted to the OE MCX for review and approval. Figures 3-2 and 3-3 provide general examples of engineering controls that can be constructed where the minimum safe fragmentation distance requirement cannot be met. Tables 3-2.A and 3-2.B may be used to determine the required personnel separation distances due to overpressure when using burial as an engineering control.

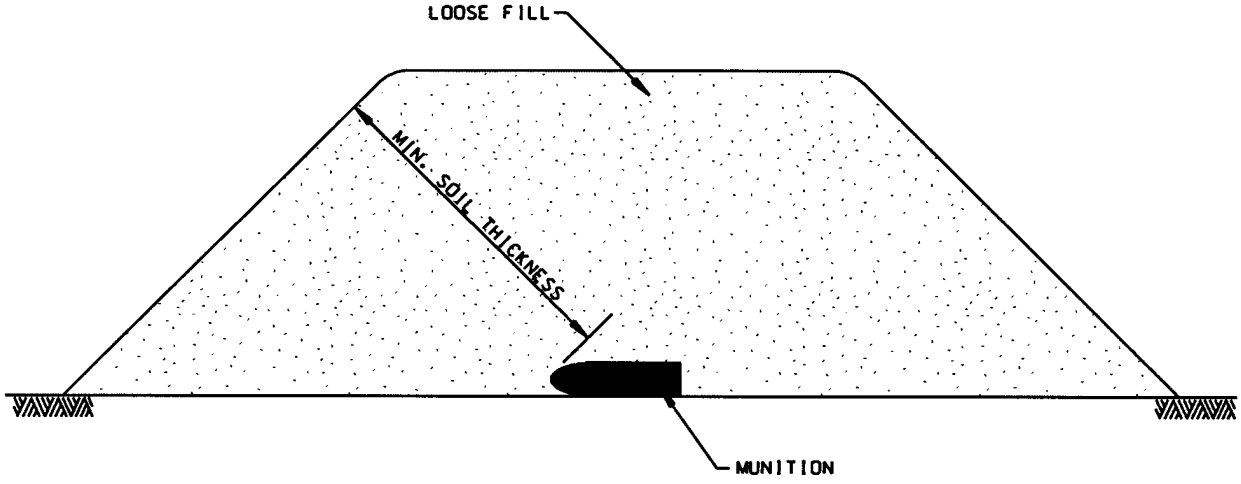


FIGURE 3-2: CROSS-SECTION OF ENGINEERING CONTROL (TAMPED EARTH) FOR INTENTIONAL DETONATION

FIGURE 3-3: SIDE VIEW – SANDBAG ENCLOSURE

e. Distance Criteria for Personnel Protective Shelters. Generally, personnel protective shelters are not used at temporary OB/OD sites; however, if personnel protective shelters are built, they will be located as far from the OD area as possible. All plans for proposed personnel protective shelters will be designed IAW DOD 6055.9-STD and Army TM 5-1300, and reviewed and approved by the OE MCX.

f. Distance Criteria for an Explosives Storage Area or Donor Explosives. The explosives storage area or donor explosives will be located outside the PSD with a separation distance IAW DOD 6055.9-STD. The actual distance to the explosives storage area will be determined by the quantity of materials being held in the explosives storage area, the amount of material being destroyed in the OD area during a single destruction event, and the type of munitions being destroyed.

g. When a temporary OB/OD site is established near radar or radio transmission facilities or near electrical energy sources where testing has shown that radio frequency (RF) energy or stray electrical current may present a hazard to electrical blasting, an approved non-electrical initiation system will be employed. The distances prescribed in Table 3-3, Table 3-4, and Table 3-5 will be used as a guide in the selection of an OB/OD site when using electric detonation in the vicinity of radar and other microwave transmissions.

h. Roadblocks must be established at the fragmentation zone perimeter of the OB/OD site. In addition, an adequate number of guards must be posted at the fragmentation zone perimeter to ensure that unauthorized personnel do not accidentally enter the PSD. A means of communication will be maintained between all site personnel conducting the OB/OD operations. Prior to the start of operations, the PSD will be searched for unauthorized personnel. Guards will then be posted to prevent entry into the OB/OD area. The guards will be posted at a distance to afford them protection from the explosive effects of the OB/OD operations.

3-4. Noise. The noise criteria that must be followed during OB/OD operations are presented in Tables 5.10 and Table 5.11 of DA PAM 385-64. Local regulators should be contacted during the planning process to determine whether there are any noise ordinances that could impact the proposed OB/OD operation.

3-5. OB Site Specific Requirements. In addition to paragraphs 3-1 through 3-6 above, the following present requirements that must be adhered to during OB operations.

a. The OB site will consist of a completely cleared square area or pad, measuring a minimum of 92 meters by 92 meters (300 feet by 300 feet). The pad will be completely cleared so that a flat bed of only sand or dirt remains. The area around the OB area will be free of all combustible material (brush, grass, debris, and leaves) for a distance of 15 meters (50 feet) beyond the square pad in all directions. Figure 3-4 presents the general distance guidelines for an OB area. In the event that these minimum distances cannot be met, engineering controls, pits, or other similar aids may be used to decrease these distance requirements.

b. Pit or trench burning is normally used when the material to be burned may detonate or become propulsive. Figure 3-5 illustrates a typical burning trench. Figure 3-5 is an example of an OE burning trench that can be used at an OB area where the minimum safe distance requirements for surface burning cannot be met.

TABLE 3-2.A
Required Blast Overpressure Protection Distance for Personnel for Detonating Ammunition for the Purpose of Explosive Ordnance Disposal (Metric)

NEQ (kg.)	Burial Depth in Meters							
	0	0.30	0.61	0.91	1.22	1.52	3.05	4.57
	Distance Required in Meters							
0.45	100	24.1	4.9	4.9	4.9	4.9	4.9	4.9
2.27	171	79.6	31.7	12.5	8.5	8.5	8.5	8.5
4.54	215	121	58.2	28.0	13.4	10.7	10.7	10.7
9.07	271	141	99.4	55.5	31.1	17.4	13.7	13.7
13.6	311	173	112	79.2	47.9	28.7	15.5	15.5
18.1	342	198	134	100	63.4	39.9	17.1	17.1
22.7	368	220	153	106	77.7	50.3	18.3	18.3
45.4	464	300	225	169	126	99.4	23.2	23.2
68.0	531	357	278	216	168	130	32.0	26.5
90.7	585	403	321	255	203	161	46.0	29.3
113	630	442	357	289	234	189	60.4	31.4
136	669	476	390	319	262	214	74.1	33.5
159	705	507	419	347	287	237	87.8	35.4
181	737	535	446	372	310	259	101	36.9
204	766	561	471	395	332	279	114	40.8
227	793	585	494	417	353	298	127	46.9
454	1000	767	671	586	513	449	230	110
680	1145	895	796	708	630	561	312	169
907	1260	998	897	807	725	652	383	225
1134	1357	1084	983	890	807	731	447	272
1361	1442	1161	1058	964	879	801	504	317
1814	1587	1291	1187	1091	1002	921	604	397
2268	1710	1401	1296	1198	1108	1025	693	468
2722	1817	1498	1392	1293	1201	1116	772	534
3175	1912	1585	1477	1378	1284	1198	844	595
3629	2000	1663	1556	1455	1361	1273	911	652
4082	2080	1736	1628	1526	1431	1342	973	705
4536	2154	1803	1695	1593	1497	1406	1031	756

NOTES FOR TABLE 3-2.A:

1. This table is derived from DA PAM 385-64.
2. This table provides distances for protection from blast overpressure only.
3. The 0 meter column distances are for above ground or open pit detonations and are based on the formula $D = 130Q^{1/3}$ (D in meters, Q in kg.). The columns 0.30 meter through 4.57 meter are for buried detonations and are generated from the program EARTHEX. These distances assume the use of alluvium soil, a silty material which is the lightest soil type. They also assume "base weather conditions," meaning low winds and high clouds. In lieu of this table, EARTHEX is recommended for soil types other than alluvium (heavier soils may allow smaller distances), for atmospheric conditions such as low stable clouds (which may increase distances), and for interpolation between table values. EARTHEX, an IBM compatible program, is available from the U.S. Army Technical Center for Explosives Safety, ATTN: SMCAC-ES, Savanna, IL 61074-9639.

TABLE 3-2.B
Required Blast Overpressure Protection Distance for Personnel for Detonating Ammunition for the Purpose of Explosive Ordnance Disposal (English)

NEW (lbs)	Burial Depth in Feet							
	0	1	2	3	4	5	10	15
	Distance Required in Feet							
1	328	79	16	16	16	16	16	16
5	561	261	104	41	28	28	28	28
10	707	398	191	92	44	35	35	35
20	890	464	326	182	102	57	45	45
30	1019	566	368	260	157	94	51	51
40	1122	650	439	329	208	131	56	56
50	1208	721	501	349	255	165	60	60
100	1522	984	737	553	414	326	76	76
150	1743	1171	911	708	550	428	105	87
200	1918	1322	1052	837	665	529	151	96
250	2066	1450	1172	948	767	620	198	103
300	2196	1562	1279	1047	858	702	243	110
350	2312	1663	1375	1137	941	778	288	116
400	2417	1755	1463	1220	1018	849	332	121
450	2514	1839	1545	1297	1089	915	375	134
500	2603	1918	1620	1369	1157	977	417	154
1000	3280	2515	2200	1924	1683	1472	754	360
1500	3755	2936	2612	2324	2067	1839	1025	556
2000	4133	3273	2943	2646	2380	2140	1258	739
2500	4452	3558	3224	2921	2647	2398	1465	894
3000	4731	3808	3471	3163	2883	2627	1652	1039
4000	5207	4236	3893	3578	3289	3023	1983	1301
5000	5609	4598	4251	3931	3635	3362	2273	1537
6000	5960	4915	4566	4241	3940	3660	2533	1752
7000	6274	5199	4847	4520	4214	3929	2769	1952
8000	6560	5457	5104	4773	4464	4175	2988	2138
9000	6823	5695	5340	5007	4695	4402	3191	2313
10000	7067	5916	5560	5225	4910	4614	3382	2479

NOTES FOR TABLE 3-2.B:

1. This table is derived from DA PAM 385-64.
2. This table provides distances for protection from blast overpressure only.
3. The 0 foot column distances are for above ground or open pit detonations and are based on the formula $D = 328W^{1/3}$ (D in feet, W in lbs.). The columns 1 foot through 15 feet are for buried detonations and are generated from the program EARTHEX. These distances assume the use of alluvium soil, a silty material which is the lightest soil type. They also assume "base weather conditions," meaning low winds and high clouds. In lieu of this table, EARTHEX is recommended for soil types other than alluvium (heavier soils may allow smaller distances), for atmospheric conditions such as low stable clouds (which may increase distances), and for interpolation between table values. EARTHEX, an IBM compatible program, is available from the U.S. Army Technical Center for Explosives Safety, ATTN: SMCAC-ES, Savanna, IL 61074-9639.

TABLE 3-3
Minimum Safe Distances Between RF Transmitters and Electric Blasting Operations[1]

Transmitter Power (watts)	Minimum Safe Distance in Meters (Feet)			
	Commercial AM Broadcast Transmitters		HF Transmitters Other Than AM Broadcast	
100	228.6	(750)	228.6	(750)
500	228.6	(750)	518.2	(1,700)
1,000	228.6	(750)	731.5	(2,400)
4,000	228.6	(750)	1,463.0	(4,800)
5,000	259.1	(850)	1,676.4	(5,500)
10,000	396.2	(1,300)	2,316.5	(7,600)
25,000	609.6	(2,000)	3,657.6	(12,000)
50,000[2]	853.4	(2,800)	5,181.6	(17,000)
100,000	1,188.7	(3,900)	7,315.2	(24,000)
500,000[3]	2,682.2	(8,800)	16,764.0	(55,000)

[1] From TM 9-1300-214.
[2] Present maximum power of US broadcast transmitters in Commercial AM Broadcast Frequency Range (0.535 to 1.605 MHz).
[3] Present maximum for international broadcast.

TABLE 3-4
Minimum Safe Distances Between TV and FM Broadcasting Transmitters And Electric Blasting Operations[1]

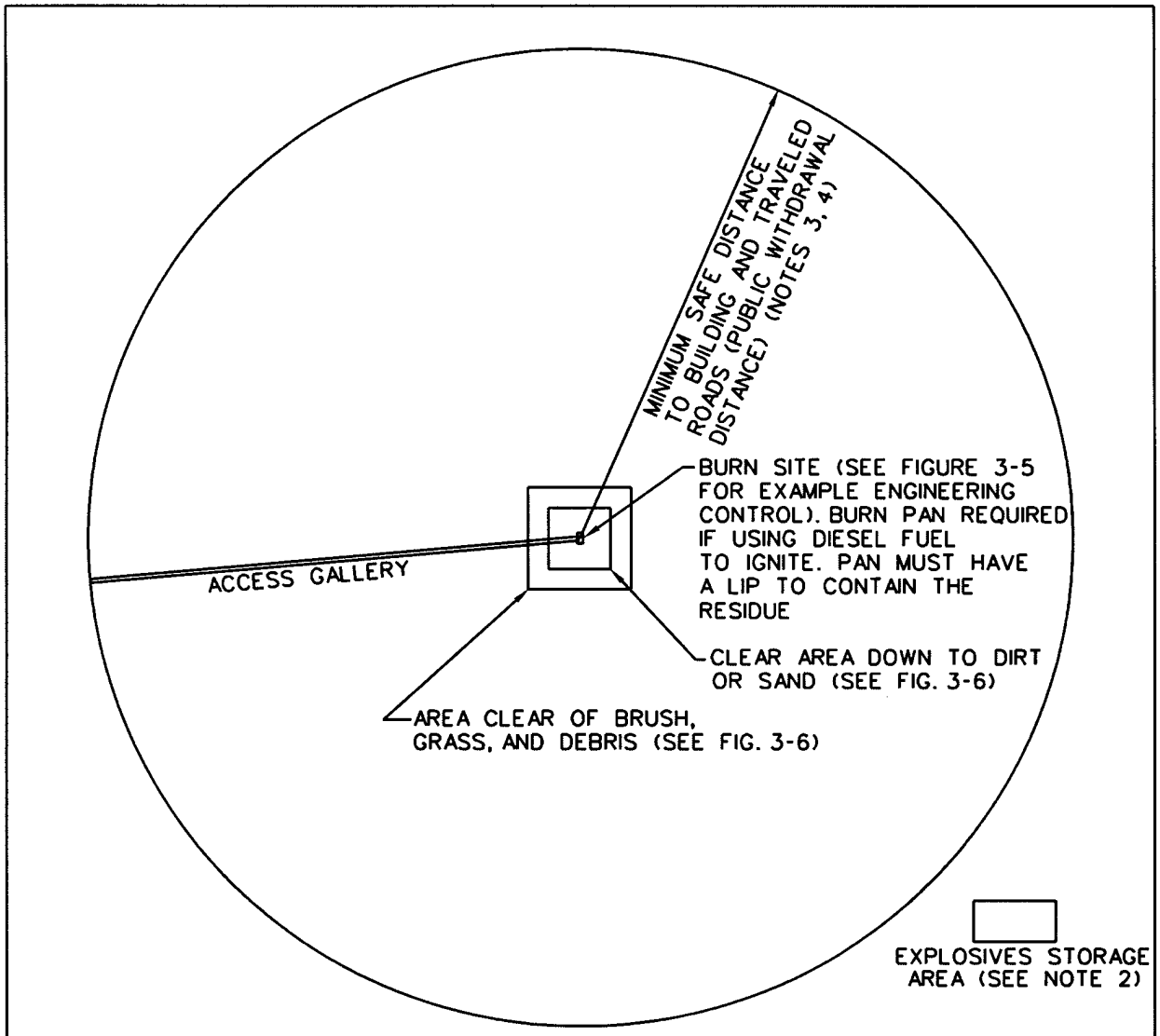
Effective Radiative Power (watts)	Minimum Safe Distances in Meters (Feet)					
	Channels 2 to 6 and FM		Channels 7 to 13		UHF	
Up to 1,000	304.8	(1,000)	228.6	(750)	182.9	(600)
10,000	548.6	(1,800)	396.2	(1,300)	182.9	(600)
100,000[2]	975.4	(3,200)	701.0	(2,300)	335.3	(1,100)
316,000[3]	1,310.6	(4,300)	914.4	(3,000)	442.0	(1,450)
1,000,000	1,767.8	(5,800)	1,219.2	(4,000)	610.0	(2,000)
5,000,000[4]	2,743.2	(9,000)	1,889.8	(6,200)	914.4	(3,000)
10,000,000	3,109.0	(10,200)	2,255.5	(7,400)	1,066.8	(3,500)
100,000,000					1,828.8	(6,000)

[1] From TM 9-1300-214.
[2] Present maximum power, channels 2 to 6 and FM.
[3] Present maximum power, channels 7 to 13.
[4] Present maximum power, channels 14 to 83.

TABLE 3-5
Minimum Safe Distances Between Mobile RF Transmitters
and Electric Blasting Operations[1]

Transmitter Power Watts	Minimum Safe Distance in Meters (Feet)									
	MF 1.6 - 3.4 MHz Industrial		HF 28-29.7 MHz Amateur		VHF 35 - 36 MHz Pub. Use 42 - 44 MHz Pub. Use 50 - 54 MHz Amateur		VHF 144 - 148 MHz Amateur, 150.8 - 161.5 MHz Public Use		UHF 450 - 460 MHz Public Use	
5[2]										
10	12.2	(40)	30.5	(100)	12.2	(40)	4.6	(15)	3.0	(10)
50	27.4	(90)	67.0	(220)	27.4	(90)	10.7	(35)	6.1	(20)
100	38.1	(125)	94.5	(310)	39.6	(130)	15.2	(50)	9.1	(30)
180[3]							19.8	(65)	12.2	(40)
250	61.0	(200)	149.4	(490)	62.5	(205)	22.9	(75)	13.7	(45)
500[4]					88.4	(290)				
600[5]	91.4	(300)	231.6	(760)	96.0	(315)	35.0	(115)	21.3	(70)
1,000[6]	122.0	(400)	298.7	(980)	125.0	(410)	45.7	(150)	27.4	(90)
10,000[7]	381.0	(1,250)			396.2	(1,3000)				

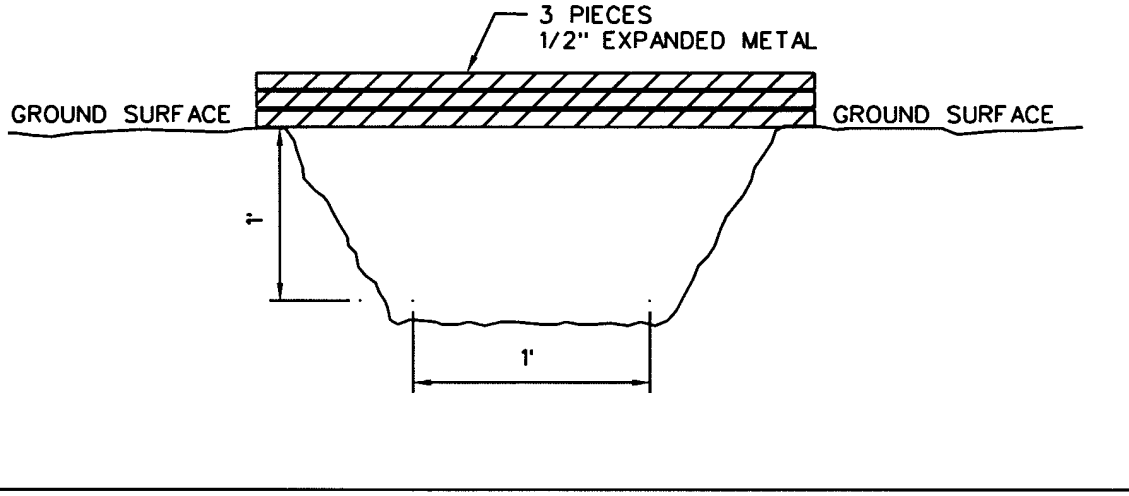
[1] From TM 9-1300-214.
[2] Citizens band radio (walkie-talkie) (26.96 to 27.23 MHz) - Minimum safe distance - five feet.
[3] Maximum power for 2-way mobile units in VHF (150.8 to 161.6 MHz range) and for 2-way mobile and fixed station units in UHF (450 to 460 MHz range).
[4] Maximum power for major VHF 2-way mobile and fixed station units in 35 to 44 MHz range.
[5] Maximum power for 2-way fixed station units in VHF (150.8 to 161.6 MHz range).
[6] Maximum power for amateur radio mobile units.
[7] Maximum power for some base stations in 42 to 44 MHz band and 1.6 to 1.8 MHz band.



NOTES:

1. Distances can be adjusted based on Net Explosive Weight being destroyed.
2. See DoD 6055.9-STD for siting criteria of explosives storage area.
3. Guards must be posted when performing operation or signs posted at radius warning against entering area (see paragraph 3.3.h).

FIGURE 3-4: TEMPORARY OB AREA DISTANCE REQUIREMENTS



NOTES:
1. Length of trough dependent on type of munitions being burned.
2. Distances shown in Figure 3-4 may be reduced using subsurface burning procedure shown.

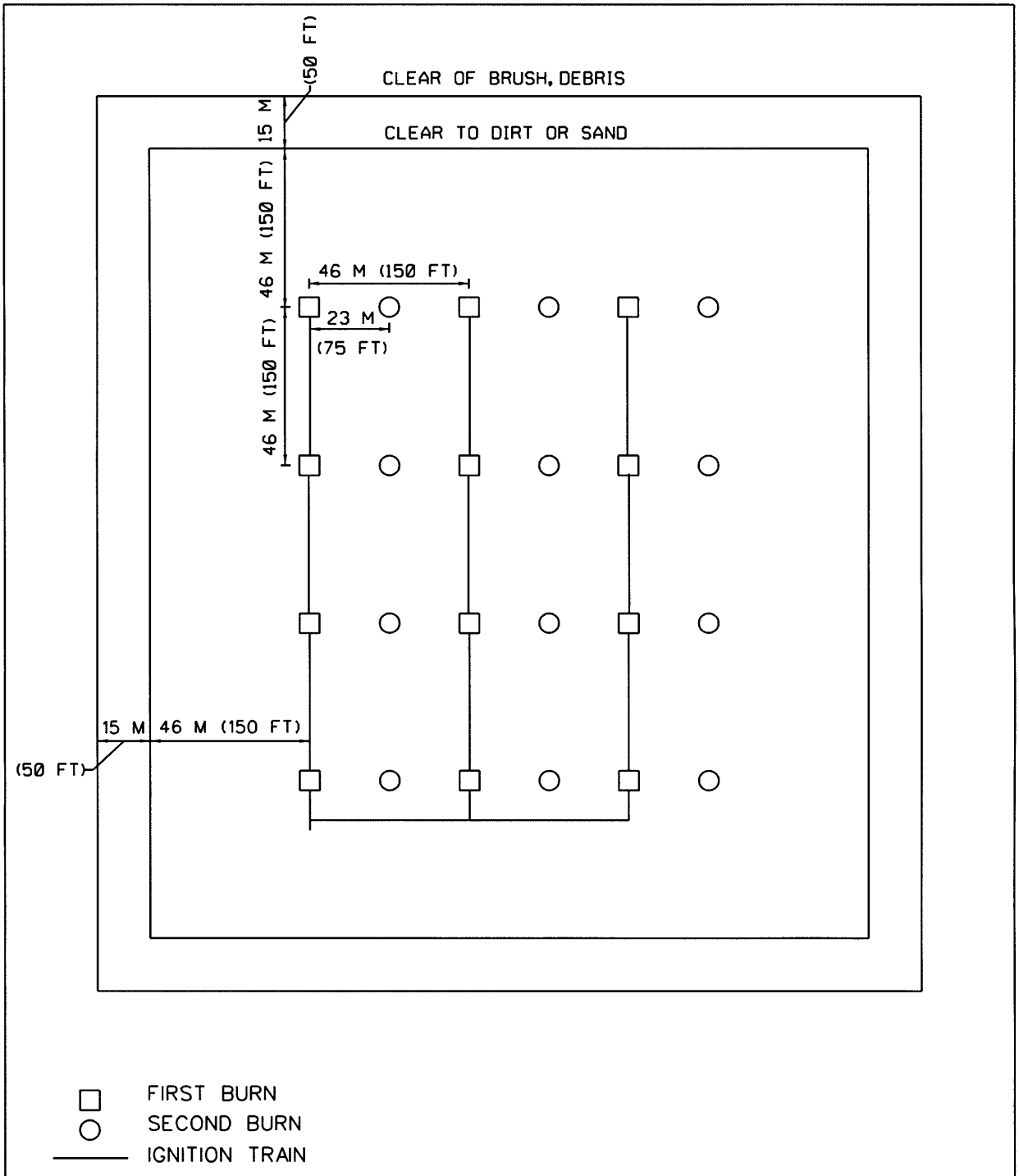
FIGURE 3-5: EXAMPLE OE BURNING TRENCH

c. Burning pans/pads will be constructed IAW DA PAM 385-64 and other applicable explosives safety regulations. All burning pans/pads will have at least a four-inch bed of sand over a burning pan for the burning of items other than propellants. Upon removal from the pan, the sand must be tested to determine if it is listed or characteristic of a hazardous waste, and then handled, packaged and treated or disposed of accordingly.

d. All burning sites will have a means of collecting and evaluating whether or not the remnants are hazardous waste. Proper disposal will then be arranged accordingly.

e. When using more than one burn area, parallel beds of explosives prepared for burning will be separated by not less than 46 meters (150 feet). In repeated burning operations, care must be taken to guard against material being ignited from smoldering residue or from heat retained in the ground. Burnings will not be repeated on previously burned-over plots for 24 hours unless the burning area has been thoroughly soaked with water and an inspection of the plot by competent personnel has been made to assure the safety of personnel during a subsequent burning operation. Figure 3-6 presents a diagram of the distances required between multiple burning pad areas.

f. Burning sites will be selected to ensure that the items to be burned are unconfined, and spread evenly over the burning site, so that the depth of the material being burned will not exceed three inches. In addition, OB sites will be constructed so that the distance between each active burning site will be sufficient to prevent a burning ember from landing on an adjoining site.



NOTES:
1. From TM 60A-1-1-31
2. When more than one pad of explosives is prepared, the pads may be connected with a continuous ignition train as shown above.
3. The distance between successive burns shall be a minimum of 23 meters (75 feet).

FIGURE 3-6: TYPICAL SURFACE BURNING AREA

3-6. Available Facilities. If an OB/OD area has already been established at a site, the Standing Operating Procedures (SOPs) developed for the use of that site will be reviewed and incorporated into the new Work Plan, SSHP, and ESS.

CHAPTER 4
SAFETY CONSIDERATIONS

4-1. Safety Precautions.

a. OB/OD operations will be conducted IAW ER 385-1-92, all other applicable DA and USACE safety regulations, and applicable Federal, state, and local safety laws and regulations.

b. OE operations will not be conducted until a complete Work Plan and SSHP for the operation involved is prepared and approved by the OE Design Center. The health and safety plans will be based upon limiting the exposure to a minimum number of personnel, for a minimum time, to the minimum amount of OE, consistent with safe and efficient operations.

c. Plan for, provide, and know the measures to be taken in the event of an accident. Emergency procedures that are to be used in the event of an accident should be thoroughly covered in the project SSHP.

d. Only qualified UXO personnel will be involved in conducting OB/OD operations. Non-UXO trained personnel may be used to perform OB/OD support activities (e.g., soil sampling, trenching, etc.) when supervised by an UXO-qualified individual. All personnel engaged in OE disposal operations will be thoroughly trained in explosive safety and be capable of recognizing hazardous explosive situations.

e. OD operations always produce dangerous overpressures and various types of fragments, depending on the type of explosives being detonated. Consider OE which have been exposed to fire and detonation as extremely hazardous. Chemical and physical changes may have occurred to the contents that render OE much more sensitive than it was in its original state.

f. Open air burning or detonation of munitions, explosives and pyrotechnics for the purpose of destruction is prohibited between sunset and dawn.

g. Medical and First Aid Requirements. Prior to the start of work, arrangements will be made for medical facilities and personnel to provide prompt attention to the injured and for consultation on occupational safety and health matters.

(1) Communication and transportation to effectively care for injured workers will be provided.

(2) The telephone numbers of physicians, hospitals, or ambulances will be conspicuously posted (at the minimum, these numbers will be posted at the on-site project office telephones).

(3) When any part of the body may be exposed to toxic or corrosive materials, drenching and/or flushing facilities will be provided in the work area for immediate use.

(4) A first aid kit will be present during all OB/OD operations. The contents of the first aid kit will, at a minimum, include those items required to handle burns and puncture wounds.

h. Lightning Suppression. All explosive storage areas will be equipped with a lightning suppression system that meets the guidelines of Chapter 7 of DOD 6055.9-STD.

i. OB Specific Requirements.

(1) When destroying explosives by burning, the possibility that the mass may detonate must be recognized and appropriate protective barriers or distance separation should be used for the protection of personnel and property.

(2) Personnel engaged in OB operations will be provided with flame resistant clothing.

(3) Disposal by open burning will not be undertaken when wind velocity exceeds 15 mph.

4-2. Physical Security.

a. Physical security requirements for OB/OD operations are governed by applicable Federal, state, and local regulations. The physical security requirements will, at a minimum, meet the requirements specified in ATFP 5400.7.

b. A physical security survey will be conducted by the contractor prior to construction of an explosives storage area. This survey will determine the fencing and lighting requirements that will be necessary for the explosives storage area.

c. The number of entrances and exits to the OB/OD area will be limited to the fewest number practicable to limit access to the area. Unauthorized persons will not be permitted to enter the OB/OD area during operations. Authorized persons must enter and leave the OB/OD area at the designated points. The OB/OD area will be separated from administrative, residential, and other public areas by as much distance as possible.

d. All personnel entering the OB/OD area must be briefed by the Site Safety and Health Officer on the hazards present at the site and the safety protocols in force at the site. The same protocols will be used for entry of personnel into the project exclusion zone. Prior to the start of operations, the exclusion zone will be searched for unauthorized personnel. An adequate number of guards will then be posted to prevent unauthorized entry into the disposal area. The guards will be posted at a distance to afford protection from blast and fragments. A means of communication will be maintained between all site personnel during the conduct of the operations to ensure that unauthorized personnel do not stray into the area. All entrances to the OB/OD area will also be guarded during the conduct of the operation to ensure unauthorized personnel do not enter the area. The exclusion zone will again be checked for any unauthorized personnel at the end of each day's operation. The topography of the OB/OD area will be used to the maximum extent practicable to ensure the safety and security of the OB/OD operation.

e. A warning sign will be posted at each entrance to the OB/OD area to warn the public to stay out of the site. The warning signs will be designed and maintained IAW the following specifications:

(1) The design of warning signs must consider the wording, size, and color. The wording of the sign must be concise, legible, easily understood, and positive. In those cases where the OB/OD site is sited in an area with a bilingual population, the sign wording must also be bilingual with the common second language of the local population. The size of the sign is determined by its purpose, location, quantity of wording, and distance from which it should be legible. The color of the sign is dependent on the sign's function.

(2) Signs must be kept in good condition, clean, well illuminated and legible. Signs shall be made of metal, plastic, or durable weather resistant materials.

(3) Danger signs will be used on an OB/OD site. The danger sign will have a white background with a black rectangle in the top portion. Inside the black rectangle will be a red oval containing the word "DANGER" in white letters. The size of this part of the sign will vary proportionally with the overall dimensions of the sign. Figure 4-1 is an example of a danger placard. Table 4-1 presents danger sign dimensions. The sign wording will be located in the remaining portion of the sign. The wording will be in black letters on the white background. The wording must convey all necessary information, but be kept as brief as possible. Phosphorescent or retroreflective paint will be used in locations where night visibility is required.

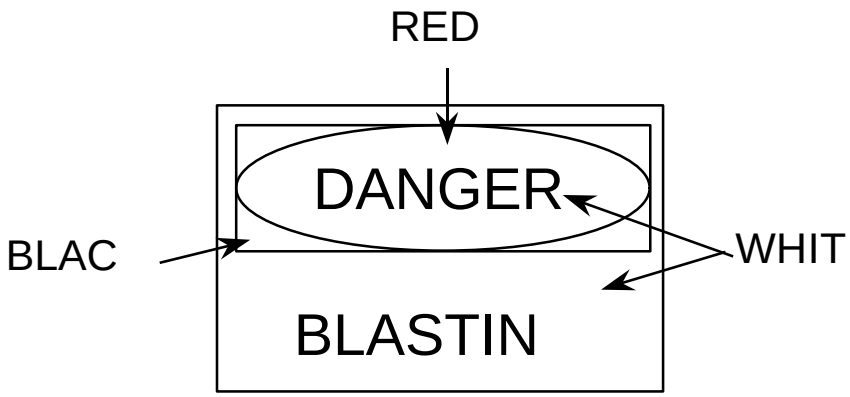


FIGURE 4-1: Example Warning Sign

TABLE 4-1

Danger Sign Dimensions (inches)[1]

Sign Size	Black Rectangular Panel	Red Oval	Word "Danger"	Maximum Message Space
Horizontal Pattern				
7 x 10	3 1/4 x 9 3/8	2 7/8 x 8 1/2	1 7/16	1 3/4 x 9 3/8
10 x 14	4 3/8 x 13 3/8	4 1/8 x 11 7/8	2 1/6	4 1/4 x 13 3/8
14 x 20	6 1/2 x 19 3/8	5 3/4 x 17	1 7/8	6 1/4 x 19 3/8
20 x 28	9 1/4 x 27 3/8	8 1/4 x 23 7/8	4 1/8	9 1/8 x 27 3/8
Upright Pattern				
10 x 7	2 3/8 x 6 3/8	2 1/8 x 5 7/8	1 1/18	6 3/8 x 6 3/8
14 x 10	3 1/4 x 9 3/8	2 7/8 x 8 1/2	1 7/18	9 1/2 x 9 3/8
20 x 14	4 5/8 x 13 3/8	4 1/8 x 11 7/8	2 1/16	14 x 13 3/8
28 x 20	6 1/2 x 19 3/8	5 3/4 x 17	1 7/8	10 1/4 x 19 3/8

[1] From AR 385-30.

4-3. Personnel/Training Requirements.

a. Only UXO-qualified personnel will conduct OB/OD operations.

b. Personnel employed at the OB/OD area will be thoroughly trained regarding the nature of the materials handled, the hazards involved, and the precautions necessary. The danger of using unapproved, improvised methods and other deviations must be thoroughly instilled in the minds of the employees. It is essential that thorough training and vigilant supervision be provided during all OB/OD operations.

c. All personnel performing on-site work activities, wherein they may be exposed to hazards resulting from OB/OD operations, will have completed applicable training in compliance with 29 CFR 1910, 29 CFR 1926, ER 385-1-92, and EM385-1-1. Although OSHA regulations at 29 CFR 1910.120 and 29 CFR 1926.65 permit varying levels of training based on employee responsibility and exposure potential, it is the policy of USACE to require that all personnel engaged in OB/OD operations obtain training IAW ER 385-1-92.

d. First Aid and CPR Training.

(1) When a medical facility or physician is not accessible within five minutes of the work site, at least two employees on each shift will be qualified to administer first aid and CPR.

(2) Employees designated as responsible for rendering first aid or medical assistance will be:

(a) included in their employer's blood-borne pathogen program IAW 29 CFR 1910.1030;

(b) instructed in the sources, hazards, and avoidance of blood-borne pathogens; and

(c) provided, use, and maintain personal protective equipment when appropriate for rendering first aid or other medical assistance to prevent contact with blood or other potentially infectious materials.

4-4. Material Awaiting Destruction. Material awaiting destruction will be stored in an explosives storage magazine that meets the criteria of ATFP 5400.7 and sited in accordance with DoD 6055.9-STD.

4-5. Emergency Equipment.

a. Before the start of OB/OD operations an Emergency Response Plan, which complies with 29 CFR 1910.120(l), 29 CFR 1926.65(l) will be developed and implemented. The Emergency Response Plan will address, at a minimum, the following areas:

(1) pre-emergency planning and procedures for reporting incidents to appropriate government agencies for potential chemical exposures, personal injuries, fires/explosions, environmental spills and releases, and discovery of radioactive materials;

(2) personnel roles, lines of authority, and communications;

(3) posted instructions and list of emergency contacts, including the following: physician/nearby medical facility, fire and police departments, ambulance service, Federal/state/local environmental agencies, CO, or approving authority for in-house activities;

(4) emergency recognition and prevention;

(5) site topography, layout, and prevailing weather conditions;

(6) criteria and procedures for site evacuation (emergency alerting procedures/employee alarm system, emergency personal protective equipment (PPE), safe distances, place of refuge, evacuation routes, site security, and control);

(7) specific procedures for decontamination and medical treatment of injured personnel;

(8) route maps to nearest pre-notified medical facility;

(9) criteria for initiating community alert program, contacts, and responsibilities; and

(10) critique of emergency responses and follow-up.

b. Local fire/police/rescue authorities having jurisdiction and nearby medical facilities that will be utilized for emergency treatment of injured personnel will be contacted before the start of OB/OD operations in order to notify them of upcoming site activities and potential emergency situations, to ascertain their response capabilities, and to obtain a response commitment.

c. The following items, as appropriate, will be immediately available for on-site use during the conduct of OB/OD operations:

(1) first aid equipment and supplies approved by the consulting physician;

(2) fire extinguishers; and

(3) emergency eyewashes/showers (as necessary).

d. First Aid Kits. Unless otherwise specified, first aid kits will be 16-unit first aid kits. First aid kits will comply with 29 CFR 1910.151 and 1926.50, be constructed of weatherproof containers, and be easily accessible to all workers with each item maintained in a sterile condition. The contents of the first aid kits will be checked by the employer prior to their use and at least weekly when work is in progress to ensure that expended items are replaced.

e. During OB/OD operations, a designated emergency vehicle will be provided in the area in case of an accident or other emergency.

4-6. Communications.

a. The OB/OD area will be serviced with telephones or two-way radio communications. If available, a permanent structure serviced with electricity and hard-wire communications will be used.

b. The use of electro-explosive devices (EED) susceptible to electromagnetic radiation (EMR) devices in the radio frequency (RF) range, that is, radio, radar, and television transmitters, has become almost universal. Some ordnance is particularly susceptible to EMR/RF emission. A knowledge of ordnance that is normally unsafe in the presence of EMR/RF is important so that preventive steps can be taken if the ordnance item is encountered in a suspected EMR/RF environment. The presence of antennas, communication, and RADAR devices should be noted during the initial site visit or during the preliminary assessment. When potential EMR hazards exist, the site will be electronically surveyed for EMR/RF emissions and the appropriate actions taken. Minimum safe distances from EMR/RF sources are listed in Tables 3-2, 3-3, and 3-4 of this EP.

4-7. Fire Prevention Planning.

a. Fire Prevention Plan. A fire prevention plan will be prepared as part of the SSHP. This plan will, at a minimum, include the following items.

(1) The fire prevention plan will specifically cover the explosives storage area and any temporary storage magazine used on site and will be coordinated with the local fire department. Placarding of the explosives storage area and any temporary magazines will be IAW Federal, state, and local regulations.

(2) The fire prevention plan will show the fire lanes providing access to all critical areas. These fire lanes will be maintained free of obstruction.

(3) The fire prevention plan will state that all vehicles, equipment, materials, and supplies will not be placed so that access to fire hydrants or other fire fighting equipment is obstructed.

(4) The fire prevention plan will be coordinated with the local fire department during the plan preparation phase of a project. During this coordination the capabilities of the local fire department must be determined, particularly the local fire department's capabilities to battle ordnance-related fires.

(5) The fire prevention plan will discuss how fire-fighting capabilities will be readily available to extinguish brush or grass fires.

(6) The fire prevention plan will designate the location of smoking areas at the site. Smoking may take place only in the specifically designated and posted "Smoking Locations". Smoking will be prohibited in all areas where flammable, combustible, or oxidizing materials are stored. "NO SMOKING OR OPEN FLAME" signs will be posted in all prohibited areas.

(7) The fire prevention plan will designate that all sources of ignition will be prohibited within 15 meters (50 feet) of operations with a potential fire hazard. The potential fire hazard area will be conspicuously and legibly posted with a sign stating "NO SMOKING OR OPEN FLAME".

b. Ensure that the fire prevention plan is read and understood by all personnel working on the site. Also ensure that each person knows what to do in case of fire within the work area. The person in charge should instruct all personnel on the existing fire plan to aid fire fighting crews and to prevent the loss of life and property in case of an accident.

c. Only OE-trained fire fighters will assist in fires involving ammunition and explosives. If the practical need for their doing so can be anticipated, the local fire fighters will receive advance instruction in ammunition and explosives fire fighting procedures.

d. OB Specific Requirements.

(1) OB areas will be established in coordination with the local authorities and with the agency responsible for monitoring fire potential at the location of the proposed OB area.

(2) OB operations will be conducted in compliance with all applicable Federal, state, and local regulations and guidelines.

(3) A sufficient force necessary to patrol and control the burning operations will be maintained until the last embers have been extinguished.

4-8. Airspace Clearance. The proposed site for the OB/OD operation must not conflict with any existing or proposed airways. Written clearance for the proposed OB/OD site will be obtained from the appropriate local Federal Aviation Administration administrator.

4-9. Personnel Protection.

a. Hazard Assessment. When setting up an OB/OD area, a hazard assessment will be performed to determine the hazards that will be associated with performing OB/OD operations in the area. Based on this assessment, engineering design criteria for the OB/OD area will be developed for use in the selection of appropriate equipment, shielding, engineering controls, and protective clothing for personnel. The hazard assessment will include the following factors, as appropriate:

(1) initiation sensitivity;

(2) quantity of materials to be destroyed;

(3) heat output;

(4) rate of burning;

(5) potential ignition and initiation sources;

(6) protection capabilities of shields, the types of clothing to be worn, protection systems; and

(7) the physiological effects of hot vapors and combustion products on exposed personnel.

b. Personal Protective Equipment.

(1) PPE Plan. A PPE Plan will be developed as part of the SSHP. The PPE Plan will address:

(a) PPE selection based on site-specific hazards;

(b) the use and limitations of PPE;

(c) OB/OD activity duration;

(d) the maintenance and storage of PPE;

(e) the decontamination and disposal of PPE;

(f) PPE training and fitting;

(g) equipment donning and doffing procedures;

(h) procedures for inspecting equipment before, during, and after use;

(i) an evaluation of the effectiveness of the PPE program; and

(j) medical considerations, including work limitations due to temperature extremes.

(2) PPE selected to be used on a site will be based on the performance characteristics of the equipment relative to:

(a) the requirements and limitations of the site;

(b) the task specific conditions and duration of the operation; and

(c) the hazards and potential hazards identified at the site.

c. Personnel working in an OB/OD area will have ample time to exit the exclusion zone prior to detonation.

d. OB/OD operations will be discontinued and personnel moved to a safe area during the approach or progress of a thunderstorm or dust storm. Controls will be established to prevent the accidental discharge of electric blasting caps from extraneous electricity.

e. Personnel working with OE will only wear outer and undergarments made of 100 percent cotton material in order to minimize the static that can be generated by other fabrics. Materials of 100 percent polyester, nylon, silk, or wool are highly static-producing and are therefore prohibited when performing OB/OD operations. Any person handling a UXO suspected of containing EEDs will ground himself/herself prior to touching the UXO. See DA PAM 385-64, Paragraph 6-10.a.(4) for additional information on non-static producing attire.

f. When working with munitions, personnel are required to observe the following precautions:

(1) do not carry fire or spark-producing devices into ammunition or explosives work areas unless authorized in writing;

(2) do not smoke, except in authorized area. After smoking, ensure that burning tobacco is completely extinguished;

(3) do not have fires for heating or cooking, except in authorized areas;

(4) do not allow accumulation of litter, packing material, dunnage, dry leaves, grass, etc. within fire-break areas;

(5) pick up any debris within storage area;

(6) do not accumulate oily rags or other material subject to spontaneous ignition, except in a covered metal box. Have such material collected daily and removed from the area;

(7) do not conduct OB/OD operations without the OE Design Center approved Work Plan and SSHP in place and under proper supervision;

(8) use only permissible lighting in the temporary magazines and explosive storage areas;

(9) do not become careless by reason of familiarity with ammunition; and

(10) personnel will never work alone during OB/OD operations. Warning signs or roadblocks will restrict entry to the area. One person, available in an emergency, should observe from a safe distance while another person performs the operation.

g. Personnel will wear clothing suitable for the weather and work conditions: the minimum for field work will be short sleeved shirt, long trousers, and leather or other protective work shoes or boots.

h. For all activities in which USACE or contractor personnel or official visitors are potentially exposed to foot hazards, the applicable position/activity hazard analysis, accident prevention plan, or project SSHP will include an analysis of and prescribe specific protective measures to be taken for reducing foot hazards.

i. Personnel will be provided with eye and face protection equipment when operations present potential eye or face injury from physical, chemical, or radiation agents.

j. OB Specific Requirements. Personnel engaged in OB activities will be provided with fire resistant clothing. Until authorized flame-resistant clothing is available, clothing may be flame-proofed by immersion in an approved flame-proofing solution. Effective flame-proofing solutions are: (1) a 15 percent aqueous solution of diammonium phosphate or ammonium sulfamate or (2) a solution of 2 pounds of ammonium sulfate, 4 pounds of ammonium chloride and 3 gallons of water. These are minimum effective percentages; stronger solutions may be used without effect on wearing life of the clothing. During operations, the number of people in the area exposed to the hazard should be kept to a minimum, but no fewer than two.

4-10. Toxic Hazards of Certain Explosives and Munitions. Many explosives, because of their chemical structures, are somewhat toxic. When munitions are destroyed, careful attention must be paid to the toxic nature of some of the munitions as the toxic effects of munition destruction can vary from mild dermatitis or a headache to serious damage to internal organs. All personnel should remain outside the PSD until all smoke and fumes dissipate.

CHAPTER 5
SITE OPERATIONS

5-1. Plan Requirements.

a. OB/OD operations will not take place without an approved Work Plan, ESS, and SSHP. The plans prepared for these operations will be reviewed for compliance with Federal, state, and local laws and regulations involving destruction of OE. Plans that are not in continuous use and have not been used within the previous six months will be reviewed prior to the start of any OB/OD operations.

b. All personnel working within the personnel separation distance will comply with the requirements of the Work Plan, SSHP, and ESS.

5-2. Maps. Furnish the following maps.

a. Site map. Furnish an overall map of the site showing the following:

(1) The OE areas.

(2) The location of any magazines to be used for the storage of demolition explosives and/or recovered OE.

(3) The location of any planned or established demolition areas to be used to destroy recovered OE.

b. Quantity-Distance (Q-D) Maps. The Q-D map and the site map may be shown on the same map. Scaled maps, 1-inch equals not more than 400 feet are preferred. A smaller scale is acceptable if distances can be accurately shown. Provide Q-D map(s) for the following areas (it is possible that more than one map will be needed to show everything in sufficient detail).

(1) Each OE area to be cleared.

(2) The location of magazines for the storage of demolition explosives and/or recovered OE.

(3) Areas planned or established for the intentional detonation or burning of OE will have a PSD associated with them. Show each area and the PSD around it (an example is shown in figure 5-1). Identify every inhabited building, occupied area, and public (those not supporting the clearance operation) exposure inside the PSD. Describe measures to be taken to eliminate/mitigate risk for exposures within the PSD/PWD (example: evacuation of inhabited buildings, blocking off public highways).

c. Encroaching Q-D's. Some project sites are too small to locate the OB/OD areas so that their PSDs do not encroach on other OE areas (work area, other OB area, or other OD area/pit). Figure 5-2 shows an example of such a case. As shown, the PSD for the OB area

encroaches on the work area. Before OB work can begin, work must stop in this part of the work area and any personnel not directly involved with the OB work must be evacuated from the PSD for the OB area. Similarly, the PSD for the OB area encroaches on the OD area/pit and the PSD for the OD area encroaches on the OB area. In this case, work may not be done in the OB area and the OD area/pit simultaneously. When a PSD encroaches on another OE area, the Work Plan and the ESS must include standard operating procedures for protecting personnel while the work is accomplished in the area with the encroaching PSD.

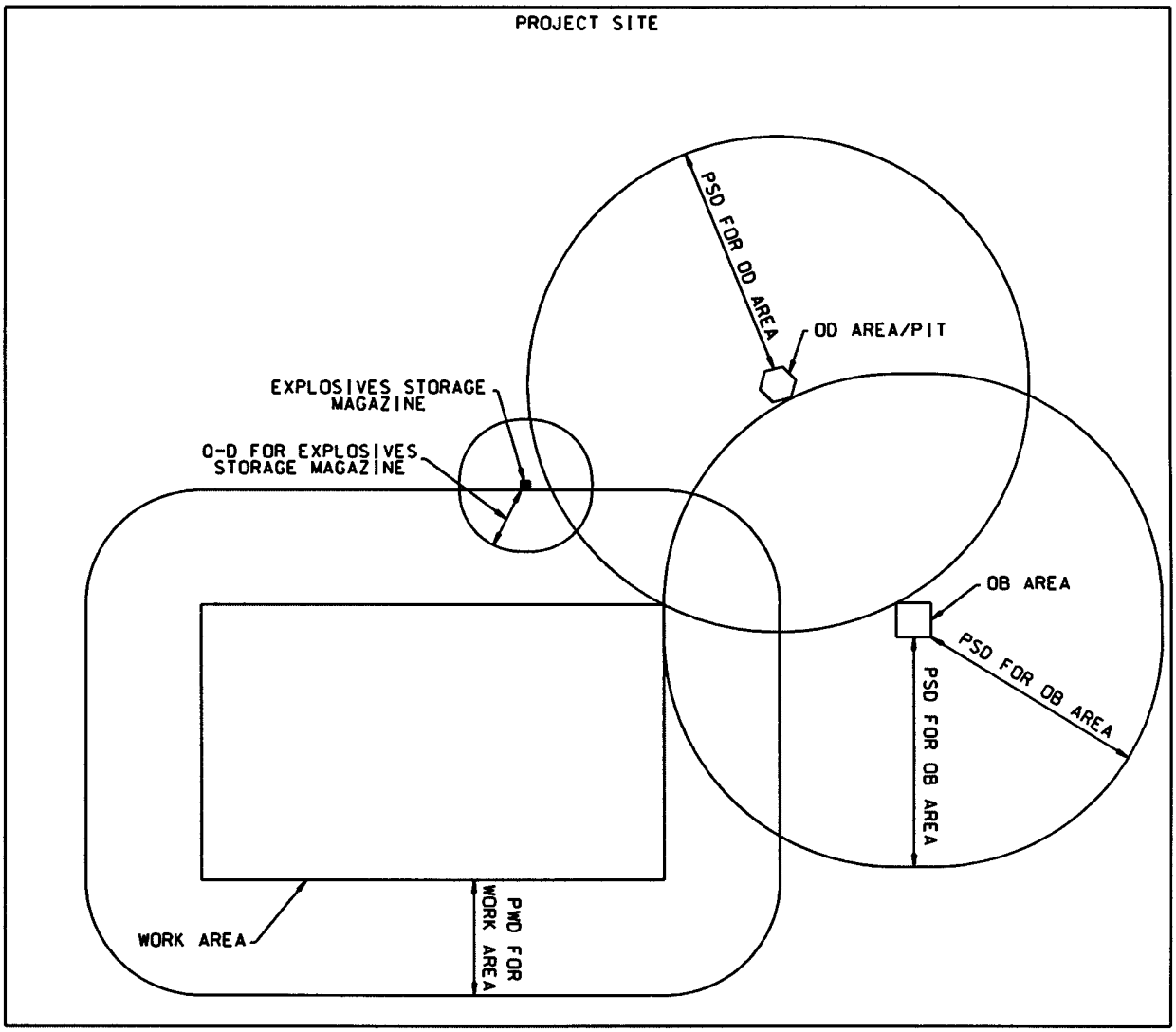


FIGURE 5-1: SAMPLE OF A Q-D MAP FOR A PROJECT SITE

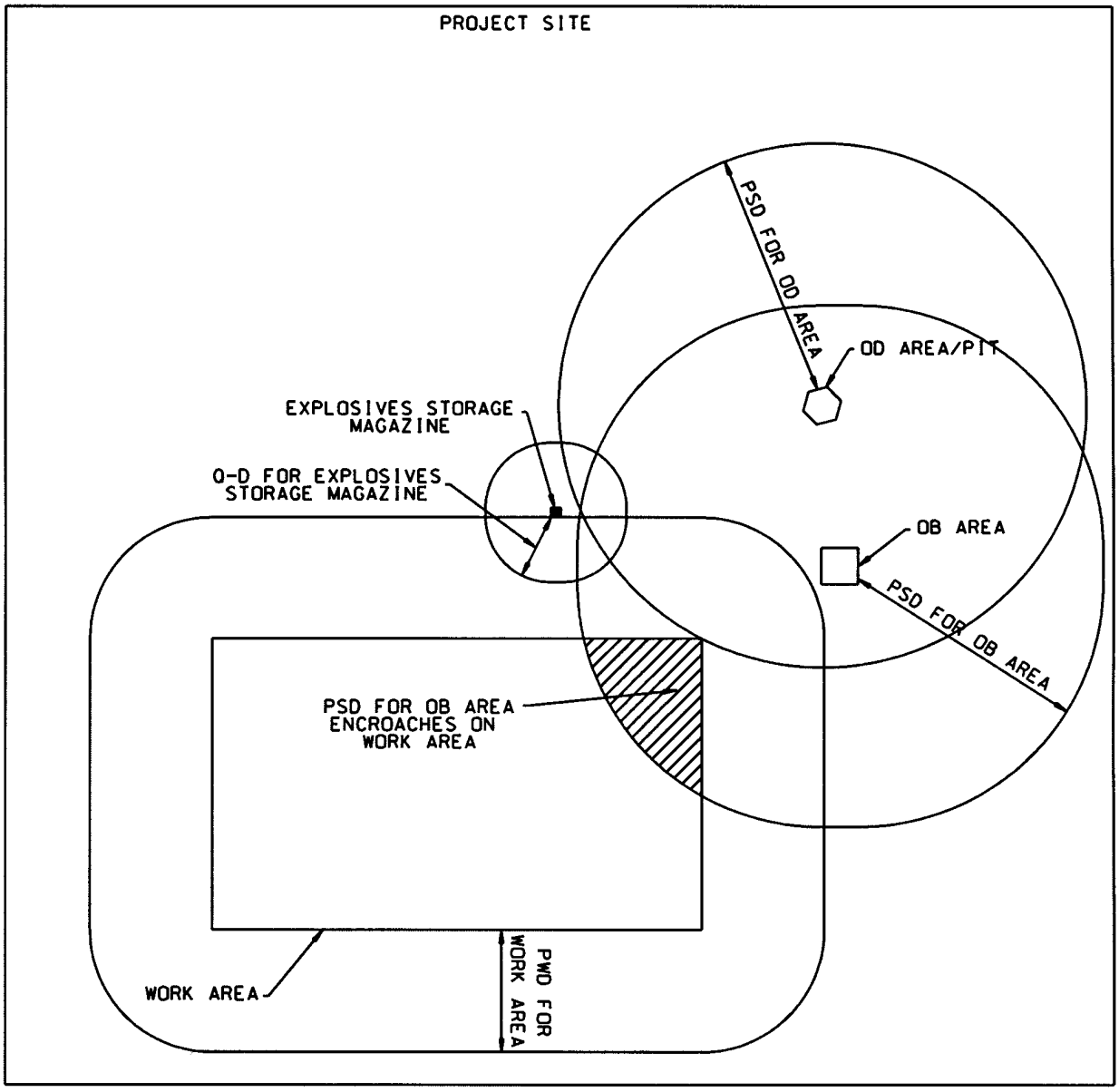


FIGURE 5-2: SAMPLE OF A Q-D MAP FOR A PROJECT SITE WITH ENCROACHING PSD

5-3. Separation Distance Requirements.

a. While ordnance is being prepared for OB/OD operations, only personnel necessary for the OB/OD operation will be allowed within the PSD area. Prior to burning or detonation, all personnel will withdraw from the PSD area. When non-essential personnel must enter the PSD area, all OB/OD operations will cease.

b. When non-essential personnel must enter the PSD area, the following must be accomplished:

(1) The individual must receive a safety briefing before entering the OB/OD PSD area.

(2) All OB/OD operations must cease.

(3) The individual(s) must be escorted by a UXO-qualified individual at all times while in the OB/OD PSD area.

5-4. Hours of Operation. OB/OD operations are prohibited between sunset and dawn.

5-5. Weather Restrictions. OB/OD operations will not be conducted in inclement weather. Weather conditions affect both the location and timing of OB/OD operations. The optimum wind speed for an OB/OD operation is 4 to 15 mph, because winds at these speeds tend not to change direction and, as a result, dissipate smoke relatively rapidly. OB/OD operations are never conducted during sand, snow, or electrical storms strong enough to produce static electricity, which might cause premature detonation.

5-6. OB Specific Requirements.

a. Open burning of explosives and smokeless powder or chemical decomposition of explosives will not be accomplished without prior approval of the CO.

b. Anticipate a high order detonation when burning pyrotechnics or incendiary-loaded UXO. Safety measures for personnel and property must be based upon this possibility.

c. Disposal by open burning will not be undertaken when wind velocity exceeds 15 mph.

5-7. Maintenance of Grounds.

a. For OD operations, all dry grass, leaves, and other flammable materials within a radius of 61 meters (200 feet) from the point of destruction will be removed.

b. The OB/OD area will be kept clean and orderly at all times.

c. Explosive items, hazardous materials, inert OE scrap, and wood, paper, and combustible packaging materials will not be mixed. Each of these categories will be carefully controlled and placed in separate, approved, and properly marked containers. The containers will be placed outside of the OB/OD area, except for containers required at the work location during operations. Working location containers will be emptied as needed but at least once during each 8-hour shift.

d. The above listed items will be removed to proper disposal areas at frequent intervals and prior to leaving at the end of the duty day or shift. When isolated collection points are used, time and quantity limits, which comply with environmental regulations, will be set up to ensure

timely movement of the material to the disposal area. Materials should not be "stored" in the disposal area, but disposed of as soon as possible after arrival.

e. Hazardous wastes, if any, will be disposed of in authorized facilities. Disposal operations of hazardous wastes generated during OB/OD operations will be covered in the Work Plan and SSHP.

f. OB Specific Requirements. For OB areas all dry grass, leaves, and other flammable material will be removed for a distance of 15 meters (50 feet) from the OB area. Burning will not be repeated on previously burned-over plots for 24 hours unless the burning area has been soaked thoroughly with water and an inspection by competent personnel has been made to ensure the safety of personnel during subsequent burning operations. The use of concrete mats for burning or detonation is not permitted.

5-8. Servicing/Close-out of Destruction Site.

a. Prior to beginning OB/OD operations, coordination with local environmental regulators should be made in order to establish the nature and extent of any OB/OD area sampling and decontamination requirements. These requirements will be documented in a closure plan developed specifically for the OB/OD area prior to the start of OB/OD operations.

b. Trucks transporting explosive material to burning or demolition grounds will meet the requirements of Chapter 6 of TM 9-1300-206. No more than two persons will ride in the cab.

c. When materials being processed at destruction sites are to be handled by gasoline or diesel powered forklift truck, the requirements of Appendix C of TM 9-1300-206 will be observed.

d. Containers for explosive material will have covers, preferably self-closing. Explosive material includes scrap powder, initiating or sensitive explosives, sweepings from open explosives areas, and rags contaminated with these explosives.

(1) Receptacles should have enough liquid, normally water or oil, to cover the scraps or rags if this does not add to the hazard.

(2) Number 10 mineral oil is useful for covering white phosphorous, pyrotechnic, tracer, flare, and similar mixtures. If water is used to cover such materials, scrap should be put in so it is immediately immersed to reduce the production of dangerous gases.

e. During closure of the OB/OD area, the contractor must remove and decontaminate all waste residues, contaminated containment areas, contaminated subsoils, and all contaminated structures and equipment, and manage them as hazardous waste IAW the requirements of the closure plan.

f. After dismantling the OB/OD area, confirmation samples will be collected from the area IAW the requirements of the Closure Plan prepared for the site. Any residual contamination will be addressed under a follow-on Hazardous, Toxic, and Radioactive Waste (HTRW) investigation.

5-9. Documentation Requirements. Records shall be kept of all OB/OD operations. These records shall include at a minimum the types and numbers of all ordnance destroyed, the method of destruction (i.e. burning or detonation), and the disposition of the scrap.

5-10. Mishap Reporting and Investigation Requirements. The following information provides general guidelines to be followed for reporting mishaps involving ammunition and explosives. See AR 385-40, with USACE Supplement 1, and EM 385-1-1 for additional details on mishap reporting requirements.

a. Reporting Criteria. All mishaps will be investigated by the contractor and reported to the CO and Government Safety Officer or to the government authority cited in the statement of work. See EM 385-1-1 for accident reporting and recordkeeping requirements. Any accident will be reported on ENG FORM 3394, “Accident Investigation Report”.

b. Mishap Scene. In the event of a mishap, the contractor will implement emergency procedures and secure the scene of the mishap to keep unauthorized persons away from the mishap scene for their protection and to preserve the evidence for the mishap investigation.

APPENDIX A
REFERENCES

Section I
Required Publications

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, Public Law (PL) 96-510, 94 Stat 2767, 42 USC 9601

Resource Conservation and Recovery Act (RCRA) of 1976,
PL 94-580, 90 Stat 2796, 42 USC 6901, et seq., as amended

29 CFR 1910.120
OSHA Hazardous Waste Operations and Emergency Response

40 CFR Part 260, et al
U.S. Environmental Protection Agency (EPA) Military Munitions Rule

40 CFR Part 300
EPA National Oil and Hazardous Substance Pollution Contingency Plan

DOD 6055.9-STD
Ammunition and Explosives Safety Standards

AR 385-40, with USACE Supplement 1
Accident Reporting and Records

AR 385-64
U.S. Army Explosives Safety Program

DA Pam 385-64
Ammunition and Explosives Safety Standards

TM 5-1300
Structures to Resist the Effects of Accidental Explosions

TM 9-1300-206
Ammunition and Explosives Standards

TM 9-1300-214
Military Explosives

TM 9-1300-277
General Instructions for Demilitarization/ Disposal of Conventional Munitions

TM 9-1375-213-12
Operator's and Organizational Maintenance Manual; Demolition Materials

TM 60A-1-1-31
General Information on EOD Disposal Procedures

ER 385-1-92
Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities

ER 1110-1-12
Quality Management

ER 1110-1-8153
Ordnance and Explosives Response

EM 200-1-3
Requirements for the Preparation of Sampling and Analytical Plans

EM-385-1-1
U.S. Army Corps of Engineers Safety and Health Requirements Manual

ATFP 5400.7
ATF - Explosives Law and Regulations

"TRAJ - A Two Dimensional Trajectory Program for Personal Computers", Minutes of the Twenty-Fourth Explosives Safety Seminar, August 1990, pp. 1853-1879, Montanaro, P.E.

EARTHEX Computer Program - U.S. Army Technical Center for Explosives Safety

Section II
Related Publications
A related publication is merely a source of additional information. The user does not have to read it to understand this regulation.

AR 75-15
Responsibilities and Procedures for Explosive Ordnance Disposal

DA PAM 75-5
List of Storage and Outloading Drawings for Ammunition

DALO-SMA Memorandum
Interim Policy for DOD Implementation of the EPA Military Munitions Rule

FM 9-15
Explosive Ordnance Disposal Service and Unit Operations

FM 21-16
Unexploded Ordnance (UXO) Procedures

TM 5-855-1
Fundamentals of Protective Design for Conventional Weapons

TM 9-1300-250
Ammunition Maintenance

TB 5-890-1
Ordnance and Explosive Waste Engineering

NAVSEA OP5; Volume 1
Ammunition and Explosives Ashore; Safety Regulations for Handling, Storing, Production, Renovation, and Shipping

NAVSEA SWO 60-AA-MMA-010
Demolition Materials

EPA/625/R-93/013
Approaches for the Remediation of Federal Facility Sites Contaminated with Explosive or Radioactive Wastes

APPENDIX B
GLOSSARY

Section I
Abbreviations

CFR
Code of Federal Regulations

CO
Contracting Officer

DA
Department of the Army

DOD
Department of Defense

DDESB
Department of Defense Explosives Safety Board

EED
Electro-explosive Device

EMR
Electromagnetic Radiation

ES
Exposed Site

ESS
Explosives Safety Submission

FOA
Field Operating Activity

HQUSACE
Headquarters, U.S. Army Corps of Engineers

HTRW
Hazardous, Toxic, and Radioactive Waste

MSC
Major Subordinate Command

NEW
Net Explosive Weight

NEQ
Net Explosive Quantity

OB
Open Burn

OD
Open Detonation

OE
Ordnance and Explosives

OE MCX
Ordnance and Explosives Mandatory Center of Expertise

OSHA
Occupational Safety and Health Administration

PES
Potential Explosion Site

PPE
Personal Protective Equipment

PSD
Personnel Separation Distance

PWD
Public Withdrawal Distance

Q-D
Quantity-Distance

RCRA
Resource Conservation and Recovery Act

RF
Radio Frequency

SOP
Standing Operating Procedure

SSHP
Site Safety and Health Plan

USACE
U.S. Army Corps of Engineers

USAESCH
U.S. Army Engineering and Support Center, Huntsville

UXO
Unexploded Ordnance

Section II
Terms

Aboveground Magazines
Any type of magazine above grade other than standard or nonstandard earth-covered types of magazines.

Ammunition and Explosives
Includes (but is not necessarily limited to) all items of ammunition; propellants, liquid and solid; high and low explosives; guided missiles; warheads; devices; pyrotechnics; chemical agents; and components and substances associated therewith, presenting real or potential hazards to life and property.

Blast Overpressure
The pressure, exceeding the ambient pressure, manifested in the shock wave of an explosion.

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

Controlling Authority
The headquarters of the DOD Component concerned.

Detonation
A violent chemical reaction within a chemical compound or mechanical mixture evolving heat and pressure. A detonation is a reaction which proceeds through the reacted material toward the unreacted material at a supersonic velocity. The result of the chemical reaction is exertion of extremely high pressure on the surrounding medium forming a propagating shock wave that originally is of supersonic velocity. A detonation, when the material is located on or near the surface of the ground, is characterized normally by a crater.

Engineering Controls
Regulation of facility operations through the use of prudent engineering principles, such as facility design, operation sequencing, equipment selection, and process limitations.

Explosion
A chemical reaction of any chemical compound or mechanical mixture that, when initiated, undergoes a very rapid combustion or decomposition releasing large volumes of highly heated gases that exert pressure on the surrounding medium. Also, a mechanical reaction in which failure of the container causes the sudden release of pressure from within a pressure vessel, for example, pressure rupture of a steam boiler. Depending on the rate of energy release, an explosion can be categorized as a deflagration, a detonation, or pressure rupture.

Exposed Site (ES)
A location exposed to the potential hazardous effects (blasts, fragments, debris, and heat flux) from an explosion at a potential explosion site (PES). The distance to a PES and the level of protection required for an ES determine the quantity of ammunition or explosives permitted in a PES.

Fragmentation
The breaking up of the confining material of a chemical compound or mechanical mixture when an explosion takes place. Fragments may be complete items, subassemblies, pieces thereof, or pieces of equipment or buildings containing the items.

Hazardous Fragment
A hazardous fragment is one having an impact energy of 58 ft-lb or greater.

Hazardous Fragment Density
A density of hazardous fragments exceeding one per 600 sq. ft.

Inhabited Buildings
Buildings or structures, other than operating buildings occupied in whole or in part by human beings, both within and outside DOD establishments. They include but are not limited to schools, churches, residences (quarters), service clubs, aircraft passenger terminals, stores, shops, factories, hospitals, theaters, mess halls, post offices, and post exchanges.

Magazine
Any building or structure, except an operating building, used for the storage of ammunition and explosives.

Net Explosive Quantity (NEQ)
Net explosive quantity expressed in kilograms.

Net Explosive Weight (NEW)
Net explosive weight expressed in pounds.

Non-DOD Components
Any entity (government, private, or corporate) that is not a part of the Department of Defense.

Ordnance and Explosives (OE)
OE consists of either: (1) Ammunition, ammunition components, chemical warfare material or explosives that have been abandoned, lost, discarded, buried, fired, or expelled from demolition pits or burning pads (such ammunition, ammunition components and explosives are no longer under accountable record control of any DOD organization or activity) or (2) Explosive Soil: Explosive soil refers to mixtures of explosives in soil, sand, clay, or other solid media at concentrations such that the mixture itself is explosive.

Unexploded Ordnance (UXO)
Military munitions that have been primed, fuzed, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected or placed in such a manner as to constitute a hazard to operation, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause.

UXO Personnel
Contractor or government personnel who have completed specialized military training in Explosives Ordnance Disposal (EOD) methods and have satisfactorily performed the EOD function while serving in the military. Various grades and contract positions are established based on skills and experience. Check with the OE MCX for current ratings.

APPENDIX C
OB/OD CHECKLIST

SITE SELECTION (OB/OD AREAS)		PARAGRAPH
	Determine the direction of the prevailing winds and ensure that they are not directed toward the Explosive Storage Area or temporary holding magazine.	3-1.c
	Dry grass, leaves, and other extraneous combustibles must be removed from a 61-meter (200-foot) radius of the OD site.	3-1.c
	Ensure no public utility lines are located in or near the OB/OD area. If utilities cannot be avoided, contact the owners of the utility to develop the necessary protective measures.	3-1.f
	Take advantage of the topography (e.g., slopes, hills, etc.) when locating OB/OD area to ensure public areas are shielded from OB/OD operations, whenever possible.	3-2
	If personnel protective structures will be built, all plans must be design reviewed and approved by the OE MCX.	3-3.e
	Ensure the temporary Explosives Storage Area or donor explosives will be located outside the exclusion zone.	3-3.f
	Ensure radio frequency energy or stray electrical current is not present in the area.	3-3.g
	Establish roadblocks at all entrances and exits to the OB/OD area at the fragmentation zone distance.	3-3.h
	Ensure that a sufficient distance has been allowed between the OB/OD area and all public places. Calculate the anticipated overpressure hazards using the equation $D=328W^{1/3}$, where W is the NEW in pounds of ordnance to be destroyed and D is the distance in feet that must be maintained from the OB/OD area place to reduce the overpressure hazards.	3-3.a
	Ensure that personnel have protection from fragmentation hazards generated during OB/OD operations.	3-3.a, Table 3-1
	Determine noise requirements for the OB/OD operation.	3-4
SITE SELECTION (OB - SPECIFIC REQUIREMENTS)		**PARAGRAPH**
	Ensure an area of 92 meters by 92 meters (300 feet by 300 feet) is completely cleared in each direction from the OB area.	3-5.a
	Ensure that dry grass, brush, debris, and leaves are cleared for a distance of 153 meters (500 feet) in all directions.	3-5.a
	Ensure that the distance between multiple burning sites will be sufficient to prevent a burning ember landing on an adjacent site (a minimum of 46 meters (150 feet) distance is required).	3-5.e

OB/OD CHECKLIST

AVAILABLE FACILITIES		**PARAGRAPH**
	Ensure that SOP's are incorporated into the work plan and health and safety plan.	3-6
SAFETY PRECAUTIONS		**PARAGRAPH**
	Minimize the number of personnel engaged in OB/OD operations. In no case, however, shall OB/OD operations be conducted by one individual. Plan for, provide, and know the measures to be taken in the event of an accident.	4-1
	Ensure that an approved SSHP has been read by all personnel and is available onsite.	4-1.b
	Only UXO-qualified personnel shall be involved in conducting OB/OD operations.	4-1.d
	Ensure that a first aid kit is available onsite and that arrangements have been made with local medical facilities in the event personnel are injured.	4-1.g(4), 4-5.d
	Ensure that all Explosives Storage Areas and temporary holding magazines are equipped with lightning suppression systems.	4-1.h
SAFETY PRECAUTIONS - (OB SPECIFIC REQUIREMENTS)		**PARAGRAPH**
	When conducting OB operations, ensure personnel are provided with flame resistant clothing.	4-1.i(2), 4-9.j
PHYSICAL SECURITY		**PARAGRAPH**
	Ensure that all Explosives Storage Areas and temporary holding magazines meet the physical security requirements.	4-2.a
	Conduct a physical security survey of the area before setting up the Explosive Storage Area to determine the physical security requirements.	4-2.b
PHYSICAL SECURITY (CONT'D)		**PARAGRAPH**
	The number of entrances and exits to the OB/OD area will be limited to the fewest number practicable to limit access to the area.	4-2.c
	The OB/OD area shall have guards posted around the fragmentation zone perimeter and at all entrances and exits to the OB/OD area during the conduct of OB/OD operations.	4-2.d
	The OB/OD area will be placarded at each entrance to ensure that unauthorized personnel do not enter the area.	4-2.e

OB/OD CHECKLIST

	PERSONNEL TRAINING	PARAGRAPH
	All personnel conducting OB/OD operations shall be UXO-certified and meet all other USACE training requirements.	4-3.a &b
	All personnel conducting OB/OD operations shall have completed the applicable training IAW 29 CFR 1910, 29 CFR 1926, ER 385-1-92, EM 385-1-1, and OE MCX specific requirements.	4-3.c
	At least two employees within each shift shall be certified to administer first aid and CPR if a medical facility or physician is not accessible within five minutes of a site.	4-3.d(1)
	MATERIAL AWAITING DESTRUCTION	**PARAGRAPH**
	Ensure that all material to be destroyed is stored in an Explosives Storage Area that has been constructed IAW ATFP 5400.7.	4-4
	EMERGENCY EQUIPMENT	**PARAGRAPH**
	Prepare an Emergency Response Plan as part of the Work Plan submittal.	4-5.a
	Ensure local fire, police, medical, and rescue authorities have been notified of the proposed OB/OD operation.	4-5.b
	Ensure fire extinguishers are available onsite.	4-5.c
	Ensure emergency eyewashes/showers are available, as necessary.	4-5.c
	Ensure a first aid kit is available onsite.	4-5.d
	COMMUNICATIONS	**PARAGRAPH**
	Ensure the OB/OD area is serviced by either telephone or two-way radio communication.	4-6.a
	FIRE PREVENTION PLANNING	**PARAGRAPH**
	A Fire Prevention Plan will be prepared as part of the SSHP.	4-7.a
	AIRSPACE CLEARANCE	**PARAGRAPH**
	Contact the local FAA administrator to ensure that the proposed OB/OD area does not interfere with any existing or proposed airways.	4-8

OB/OD CHECKLIST

	PERSONNEL PROTECTION	**PARAGRAPH**
	Conduct a hazard assessment prior to setting up the OB/OD area to determine the hazards and personnel protection that will be necessary to conduct OB/OD operations at a particular site.	4-9.a
	Ensure that a Personal Protective Equipment Plan has been developed as a part of the SSHP.	4-9.b
	TOXIC HAZARDS OF CERTAIN EXPLOSIVES	**PARAGRAPH**
	Be aware of the toxic hazards of certain explosives and munitions and take safe-guards to prevent personnel exposure during OB/OD operations.	4-10
	ENVIRONMENTAL COMPLIANCE	**PARAGRAPH**
	A Closure Plan for the OB/OD area will be prepared as part of the Work Plan submittal.	2-2.a
	Environmental samples of the proposed OB/OD area must be obtained to determine if there is any pre-existing environmental contamination at the site.	2-2.b
	SITE OPERATIONS	**PARAGRAPH**
	Ensure all OB/OD operations are conducted IAW the USAESCH-approved Work Plan, SSHP, and SOP's developed for the site.	5-1.a
	Minimize the number of personnel conducting OB/OD operations.	5-3
	OB/OD operations will only be conducted during daylight hours.	5-4
	Ensure weather conditions are favorable for the conduct of OB/OD operations.	5-5
	MAINTENANCE OF GROUNDS	**PARAGRAPH**
	The OB/OD area will be kept clean and orderly at all times.	5-7.b
	CLOSE-OUT OF OB/OD AREA	**PARAGRAPH**
	When dismantling the OB/OD area ensure that all environmental sampling and cleanup requirements have been performed IAW the requirements of the Closure Plan.	5-8.e
	MISHAP REPORTING	**PARAGRAPH**
	Submit a telephonic or written report to the CO and Government Safety Officer on all reportable accidents IAW EM 385-1-1 and USACE Supplement 1 to AR 385-40.	5-10

APPENDIX D
CONSOLIDATED SHOTS

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
2461 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22331-0600

OCT 27 1998

DDESB-KO

MEMORANDUM FOR DIRECTOR US ARMY TECHNICAL CENTER FOR EXPLOSIVES SAFETY (ATTENTION: SIOAC-ES)

SUBJECT: Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives Sites

References: (a) Memorandum from SIOAC-ESL to Chairman DDESB (ATTN: DDESB-KO), 14 September 1998, SAB

(b) M. Crull and Wayne Shaw, US Army Corps of Engineers, Huntsville, "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites" (August 1998)

The subject procedures forwarded by reference (a) and defined in reference (b) have been reviewed with respect to explosives safety criteria. Based on the information furnished, the procedures proposed in reference (b) for the demolition of consolidated ordnance at OE sites are approved.

Point of contact is Dr. Chester E. Canada, DDESB-KT2 (PH: 703-325-1369, FAX: 703-325-6227, E-MAIL: canadce@hqda.army.mil).

for DANIEL T. TOMPKINS
Colonel, USAF
Chairman

CONSOLIDATED SHOTS

Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites

August 1998

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Reviewed by: _____ 8/27/98
Chief, Structural Branch — Date

Reviewed by: _____ 8/27/98
Chief, Civil-Structures Division — Date

Reviewed by: _____ 8/27/98
Chief, OE Center of Expertise — Date

Reviewed by: _____ 8/31/98
Chief, Ordnance & Explosives Team — Date

Reviewed by: _____ 8/28/98
Chief, OE Safety — Date

CONSOLIDATED SHOTS

D1.0 Introduction

The U.S. Army Engineering and Support Center, Huntsville (USAESCH) includes the Ordnance and Explosives Center of Expertise (OE-CX). Part of the OE-CX mission is development of procedures for removal and destruction of munitions found on OE sites. Standard procedures are to destroy the munitions by detonation on site. This includes both single round detonation in-place and multiple round detonation (or consolidated shots) at a pre-determined location. The procedures for multiple round detonation are described in this paper.

There are two situations that may describe the consolidated shot process: 1) munitions may be collected from anywhere on site and detonated at a designated, sited disposal area or 2) munitions may be collected within a grid and detonated at a designated spot within the grid. In either situation the same procedures, as described in the following paragraphs, must be followed.

D2.0 Placement of Munitions

Munitions shall be placed with their sides touching such that their axis is horizontal as shown in Figure D-1. The munitions shall be placed so that the nose of each munition is pointing in the same direction. Munitions shall be oriented so that lugs and/or strong-backs, and nose and/or tail plate sections are facing away from personnel locations.

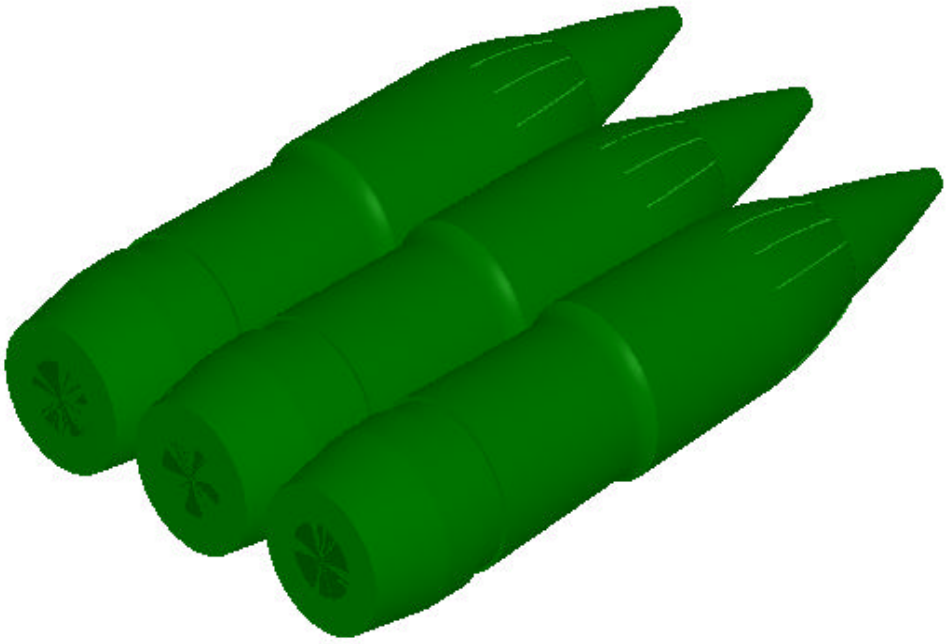

Figure D-1 – Placement of Munitions for Consolidated Shots

CONSOLIDATED SHOTS

D3.0 Safe Personnel Separation Distance

D3.0.1 This document covers procedures for intentional detonations only.

D3.0.2 In accordance with DoD 6055.9-STD Chapter 5 paragraph E.4.a(2), the safe separation distance for all personnel will be the greater of the overpressure distance or the appropriate fragment range as determined by the maximum fragment range or the mitigated fragment range.

D3.1 Overpressure Distance

In accordance with DoD 6055.9-STD Chapter 5 paragraph E.4.a(2), the allowable overpressure distance will be determined as the scaled distance, K328, based on the total net explosive weight (NEW) of all munitions plus the initiating explosives.

D3.2 Fragment Criteria

D3.2.1 Maximum Fragment Range

The maximum fragmentation characteristics shall be computed in accordance with HNC-ED-CS-S-98-1. The maximum fragment range shall be computed using these fragmentation characteristics with a trajectory analysis such as the computer software TRAJ. The maximum fragment range shall be the maximum fragmentation distance computed for the most probable munition (MPM) for an OE area at a site, and this shall be the maximum fragment range for a consolidated shot.

D3.2.2 Fragment Mitigation

Fragment mitigation may be provided by an appropriate Department of Defense Explosives Safety Board (DDESB) approved engineering control. Typical engineering controls for intentional detonation include tamping and sandbags. The design of such an engineering control shall be based on the maximum fragmentation characteristics of the MPM. The NEW used for the design of the engineering control shall be the total NEW of all munitions plus the initiating explosives. Engineering controls not already approved by DDESB may be submitted (along with appropriate technical data) as part of a site specific explosive safety submission for use at that site. Engineering controls will not be put into use until approved by DDESB and specific applications verified by the appropriate agency; for example, the OE-CX verifies applications for U.S. Army Corps of Engineers.

D4.0 Initiation

The consolidated shot shall be initiated in such a manner that detonation of all munitions is simultaneous.

D5.0 References

CONSOLIDATED SHOTS

DoD 6055.9-STD, “Department of Defense Ammunition and Explosives Safety Standards”, August 1997.

HNC-ED-CS-S-98-1, Methods for Predicting Primary Fragmentation Characteristics of Cased Explosives, January 1998.

Memorandum, DDESB, DDESB-KO, 27 January 1998, subject: Guidance for Clearance Plans.