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GB AMMUNITION REQUIREMENTS FOR ARTILLERY WEAPONS

SECTION I

INTRODUCTION

1. Purpose. This training circular is published as a guide for commanders and staff officers concerned with toxic chemical warfare operations and training. It presents a simplified method for determining nerve gas (GB) ammunition requirements for artillery weapons. This is an interim publication to be used pending incorporation of the information into appropriate technical manual.

2. Scope. This circular describes a method that can be used for calculating GB ammunition requirements for the 105-mm, 155-mm, and 8-inch howitzers, and the 4.5-inch rocket launcher. It considers the elements of weather, terrain, gas discipline, and casualty level in the determination of ammunition requirements.

3. General. The tables in this circular incorporate the latest information available at the time of publication. Where test data were not available, extrapolations were made. It is realized that the downwind cloud travel effect and the residual contamination of shell craters are of concern to the commander. However, no evaluation has been given to these effects in this circular. Information on these subjects will be included in a technical manual. The ammunition requirements determined by the method discussed in this circular will serve as a guide in planning combat operations, CPX's, maneuvers, and exercises. In actual warfare, ammunition requirements

will probably have to be adjusted on the basis of experience. See FM 3-5 for additional information on toxic chemicals and effects of weather and terrain.

Section II

PROCEDURE

4. Method. The method used in this circular is based upon the weight of agent required per unit area to obtain heavy casualties (40 to 80 percent) under favorable conditions (that is, wind speed less than 12 miles per hour, stable atmosphere, level or rolling terrain, and sparse vegetation). The relative efficiency of ammunition has been considered in arriving at table values. To compensate for other conditions, correction factors (see notes in table I) are provided to make table I more flexible. Some of the required data may be difficult to determine and, in some cases, it may have to be estimated.

5. Target data. Before selection of a weapon for the mission and calculation of ammunition requirements, it is necessary to determine the target data described below.

a. The target should be defined in terms of—

(1) Size in hectares (100-meter squares).
(2) Type of terrain.
(3) Type of vegetation.
(4) Available cover.
(5) Availability of protective equipment and degree of gas discipline of enemy troops.

b. The following weather conditions expected on target area at the time the mission is to be fired should be determined:

(1) Air temperature.
(2) Wind speed.
(3) Air stability (temperature gradient).

c. The number of rounds required for the specific target can then be determined in a three-step process as follows:

(1) From table I select the amount of agent needed per hectare with respect to temperature, method of fire (TOT, 30 seconds, or 4 minutes), and degree of protection.
(2) Multiply this figure by the size of the target in hectares and apply the appropriate correction factors (notes 1 through 7 in table I). This product is the total weight of agent needed for the target area.
(3) Convert this total weight into the number of rounds of specific artillery ammunition by dividing it by the weight of agent per munition given in table II (see sec. III for examples).

6. Weapons data. The weapon for the mission should now be selected. Ammunition requirements should be determined for several weapons to achieve greater flexibility in operation. Before selection of the optimum weapon to accomplish the mission, the following should be considered:

a. Availability of weapons and ammunition.

b. Range and position of weapons in relation to target.

c. Size of target.

d. Rate of fire desired.

7. Delivery methods. The method used in this circular allows the commander maximum flexibility in his choice of delivering the toxic agent on the target. There are several considerations for employing nerve gas that will normally produce maximum casualties with a minimum expenditure of ammunition. The following should be considered:

a. Gas discipline of enemy (table I).

(1) If gas discipline is expected to be good and protective masks are readily available, the mission should be fired TOT to obtain maximum surprise. If sufficient artillery weapons are not available for TOT fire, the mission must be fired within 30 seconds and will require more ammunition than TOT fire.

(2) If the gas discipline is poor but protective masks are available, the mission may be fired within 30 seconds. However, if weapons are available for TOT fire, considerable ammunition will be saved.

(3) If no gas protection is available to the enemy, then the mission may be fired within 4 minutes. However, an increased savings of ammunition can be experienced if 30-second or TOT fire is placed on the target.

b. Characteristics of weapon (table II).

(1) Large-area targets can be very efficiently engaged by 4.5-inch rocket units. The 4.5-inch rocket should not be employed in less than one battery (12 launchers) because of the dispersion characteristics of the rockets from each launcher.

(2) The 105-mm, 155-mm, and 8-inch howitzers are well suited for point or small area targets because of their range and accuracy. Massed artillery fires should be used where possible on large-area targets.

(3) For very small targets, such as a point target, ammunition requirements depend on the aimability of the weapon used. It may be necessary to shift aiming points somewhat upwind or to frame the target in order to obtain required coverage.

A minimum of one battery of the howitzers should be used to engage small targets.

c. Target coverage. Basic artillery techniques regarding target coverage should be used in proportioning fire units. For example, if the ammunition requirement indicates 10 rounds of 105-mm TOT fire on a target to accomplish the desired mission, at least two 6-piece batteries (12 rounds) should be placed on the target. Assuming that, as with the case of conventional artillery, desired results are not obtained with the first fire mission, the fire mission could be repeated. The desired element of surprise and the protection available to the enemy will have a bearing on repeating the fire missions.

Table I. Pounds of GB/hectare delivered on target for heavy casualties (40%–80%)

Degree of protection	Pounds of GB/hectare					
	Temperature over 50° F.			Temperature less than 50° F.		
	TOT	30 sec	4 min	TOT	30 sec	4 min
Full protection, excellent gas discipline.	33	41	Not recommended.	50	63	Not recommended.
Protective masks, poor gas discipline.	25	33	Not recommended.	38	50	Not recommended.
No protection	17	25	33	25	38	50.

Notes. 1. For moderate casualties (20%–40%), multiply by 0.4.
2. Rugged mountains, multiply by 2.
3. Heavily wooded terrain, multiply by 1.5.
4. Deep fortifications, poorly ventilated, multiply by 2.
5. Very low temperature, less than 20° F., multiply by 2.
6. Lapse condition, multiply by 1.5.
7. Wind speed over 12 mph, multiply by 1.5.

Table II. Pounds of GB/shell and weapons data

Weapon	Lbs of GB/shell	Maximum range in meters	Weapons/battery	Capabilities	
				Rounds/battery 30 sec	Rounds/battery 4 min
105-mm howitzer	1.8	11,300	6	24	96
155-mm howitzer	6.5	15,000	6	12	48
4.5-in. rocket	3.2	8,200	12 launchers (25 rnds/launcher).	300	900
8-in. howitzer	15.8	17,000	4	4	25

SECTION III

SAMPLE PROBLEMS

8. Problem 1. How many 105-mm rounds, GB-filled, would be required to produce heavy casualties (40% to 80%) in an open area 400 by 500 meters? The following information is given:

a. Gas discipline ..... poor, masks available.
b. Temperature ..... 40° F.
c. Wind speed ..... 8 miles per hour.
d. Temperature gradient ..... neutral.
e. Terrain ..... level.
f. Vegetation ..... sparse.
g. Personnel cover ..... open.
h. Firing time ..... 30 seconds.

SOLUTION:

(1) For *a* and *b* above, table I gives 50 lbs GB/hectare.

(2) To solve for number of hectares: $\frac{400}{100} \times \frac{500}{100} = 20$ hectares.

(3) Multiply number of hectares by lbs of GB/hectare. 20 hectares × 50 lbs GB/hectare = 1,000 lbs GB required for mission.

(4) Check notes 1 through 7, table I. None of the factors apply to the given conditions *c* through *h;* therefore, the requirement for the specific target remains 1,000 lbs GB.

(5) From table II following across the 105-mm howitzer line, it is found that the shell contains 1.8 lbs GB. Dividing the total amount needed for the mission by this number yields:

$$\frac{1{,}000 \text{ lbs GB}}{1.8 \text{ lbs GB}} = 556 \text{ rounds (105-mm)}$$

9. Problem 2. How many 155-mm GB-filled howitzer rounds per hectare will be required to incapacitate 80 percent of personnel by a surprise attack in an open area? Personnel are assumed to be at rest. The following conditions exist:

a. Temperature ..... 85° F.
b. Firing time ..... 30 seconds.
c. Temperature gradient ..... inversion.
d. Wind speed ..... 3 miles per hour.
e. Gas discipline ..... poor, masks available.

SOLUTION:

$$\frac{33 \text{ lbs GB/hectare}}{6.5 \text{ lbs GB/round}} = 5.1 \text{ rounds/hectare (155-mm)}$$

10. Problem 3. How many 105-mm GB-filled howitzer rounds will be required to incapacitate 80 percent of the personnel who are engaged in moderate activity and are deployed over an area of 200 by 500 meters with open slit trenches and foxholes available? The following information is also available:

a. Expected firing time ..... 30 seconds.
b. Temperature gradient ..... lapse.
c. Temperature ..... 70° F.
d. Wind speed ..... 12 miles per hour.
e. Gas discipline ..... poor, masks available.

SOLUTION:

$$\frac{33 \text{ lbs GB/hectare} \times 10 \text{ hectares} \times 1.5 \text{ (lapse)}}{1.8 \text{ lbs GB/round}} = 275 \text{ rounds (105-mm)}$$

11. Problem 4. How many 4.5-inch rocket rounds, GB-filled, would be required to produce 60 percent casualties in an open area 400 by 500 meters? The following information is furnished:

a. Gas discipline ..... poor, masks available.
b. Temperature ..... 40° F.
c. Wind speed ..... 8 miles per hour.
d. Temperature gradient ..... neutral.
e. Terrain ..... level.
f. Vegetation ..... sparse.
g. Personnel cover ..... open.
h. Firing time ..... 30 seconds.

SOLUTION:

$$\frac{50 \text{ lbs GB/hectare} \times 20 \text{ hectares}}{3.2 \text{ lbs GB/round}} = 312.5 \text{ rounds (4.5-in. rocket)}$$

12. Problem 5. How many hectares will 200 155-mm howitzer rounds, GB-filled, cover if heavy casualties on personnel in hasty field fortifications are required? The following information is given:

a. Gas discipline ..... poor, masks available.
b. Temperature ..... 80° F.
c. Wind speed ..... 15 miles per hour.
d. Temperature gradient ..... inversion.
e. Terrain ..... rugged mountains.
f. Vegetation ..... heavily wooded.

SOLUTION:

$$\frac{200 \text{ rounds} \times 6.5 \text{ lbs GB/round}}{33 \text{ lbs/hectare} \times 1.5 \times 1.5 \times 2} = 8.75 \text{ hectares}$$

[AG 353 (28 Aug 57)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

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OS Sup Agcy
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Units organized under following TOE's:
3–32, Hq & Hq Det, Cml Gp Field, Army or ComZ
7–14, Inf Hv Mort Co
7–15, Inf Bn
7–17, Inf R Co

NG: State AG; units—same as Active Army.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

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