15.1 Cartridges Smaller Than 30 mm

Munitions listed in this section begin with the Department of Defense Identification Code (DODIC) letter "A." This category of munitions includes cartridges that are smaller than 30-mm in size. Cartridges, which are also referred to as rounds, are cases that contain a primer, propelling charge, and projectile. They are fired from pistols, rifles, and machine guns. Examples include 5.56-mm cartridges, 7.62-mm cartridges, and .50 caliber cartridges.

15.1.4 A059, M855 5.56-mm Ball Cartridge

15.1.4.1 Ordnance Description[1-4]

The M855 5.56-mm Ball Cartridge (DODIC A059) is intended for use against unarmored targets. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is used during combat and on firing ranges during training. It is fired from the M249 machine gun and the M16 series of rifles. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

The M855 5.56-mm Ball Cartridge is used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 1,440,000 M855 cartridges are used per year at a given training facility.[3,4]

15.1.4.2 Emissions And Controls[1,2, 5-11]

The primary emissions from the detonation of the M855 5.56-mm Ball Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Two variants of the M16 rifle, the M16A1 and M16A2, were tested to address emission product variation as a function of weapon type. In addition, a variant with a bullet consisting of a steel penetrator and a lead-antimony slug, and a variant with a bullet consisting of a tungsten-nylon penetrator (no-lead variant) were tested to address emission product variation as a function of bullet type. Only slight differences were noted in the emission factors that were developed for each variant; therefore, only average emission factors are presented herein.

Table 15.1.4-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.4-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.4-1 EMISSION FACTORS FOR THE USE OF DODIC A059, M855 5.56-MM BALL CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	8.7 E-04	2.2 E-01
630-08-0	CO	1.6 E-03	4.2 E-01
7439-92-1	Lead (Pb)[f]	5.1 E-06	1.3 E-03
74-82-8	Methane	9.7 E-06	2.5 E-03
--	Oxides of nitrogen (NO_X)[g]	8.5 E-05	2.2 E-02
--	PM-2.5[d]	2.8 E-05	7.2 E-03
--	PM-10[e]	3.9 E-05	1.0 E-02
12789-66-1	TSP	3.8 E-05	9.8 E-03

[a] Factors represent uncontrolled emissions. References 1, 2, 5, 6, 10, and 11.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.91 E-03 pounds per item. References 10 and 11.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.
[g] EMISSION FACTOR RATING C.

Table 15.1.4-2 EMISSION FACTORS FOR THE USE OF DODIC A059, M855 5.56-MM BALL CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	7.2 E-11	1.8 E-08
208-96-8	Acenaphthylene[d]	4.2 E-10	1.1 E-07
75-07-0	Acetaldehyde[e,g]	2.4 E-07	6.1 E-05
75-05-8	Acetonitrile[e]	3.3 E-07	8.4 E-05
107-02-8	Acrolein[e]	2.6 E-08	6.5 E-06
107-13-1	Acrylonitrile[e,g]	5.2 E-08	1.3 E-05
7429-90-5	Aluminum[f]	1.5 E-07	3.7 E-05
7664-41-7	Ammonia[d,g]	3.0 E-05	7.8 E-03
120-12-7	Anthracene[e]	5.2 E-11	1.3 E-08
7440-36-0	Antimony[e]	1.5 E-06	3.9 E-04
7440-39-3	Barium[f,i]	6.9 E-07	1.8 E-04
71-43-2	Benzene[e,g]	6.3 E-07	1.6 E-04
56-55-3	Benzo[a]anthracene[e]	1.9 E-10	5.0 E-08
205-99-2	Benzo[b]fluoranthene[e]	3.1 E-10	8.0 E-08
207-08-9	Benzo[k]fluoranthene[e,g]	1.5 E-10	3.8 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	1.1 E-09	2.7 E-07
50-32-8	Benzo[a]pyrene[e,g]	2.9 E-10	7.3 E-08
192-97-2	Benzo[e]pyrene[d]	4.4 E-10	1.1 E-07
106-99-0	1,3-Butadiene[e,g]	1.2 E-08	3.1 E-06
75-65-0	t-Butyl alcohol[e,h]	2.8 E-09	7.2 E-07
74-87-3	Chloromethane[e]	1.1 E-09	2.9 E-07
218-01-9	Chrysene[e]	2.1 E-10	5.5 E-08
7440-50-8	Copper[f]	1.5 E-05	3.8 E-03
57-12-5	Particulate cyanide[e,g]	8.3 E-08	2.1 E-05
53-70-3	Dibenz[a,h]anthracene[e]	4.0 E-11	1.0 E-08
75-71-8	Dichlorodifluoromethane[f,i]	8.9 E-11	2.3 E-08
107-06-2	1,2-Dichloroethane[e,g]	1.2 E-08	3.2 E-06
--	Total dioxin/furan compounds[e,i]	3.1 E-15	8.0 E-13
100-41-4	Ethylbenzene[e,i]	2.0 E-09	5.0 E-07
74-85-1	Ethylene[f]	6.7 E-07	1.7 E-04

Table 15.1.4-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
206-44-0	Fluoranthene[e]	3.9 E-10	9.9 E-08
86-73-7	Fluorene[d]	2.3 E-10	5.9 E-08
50-00-0	Formaldehyde[e,i]	1.8 E-07	4.7 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	8.2 E-15	2.1 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	1.2 E-15	3.0 E-13
110-54-3	Hexane[e,h]	3.4 E-07	8.6 E-05
74-90-8	Hydrogen cyanide[e]	2.2 E-05	5.6 E-03
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	3.5 E-10	8.9 E-08
7439-92-1	Lead[e]	5.1 E-06	1.3 E-03
75-09-2	Methylene chloride[e,h]	1.0 E-07	2.6 E-05
75-86-5	2-Methyllactonitrile[f,i]	3.1 E-08	7.8 E-06
91-20-3	Naphthalene[e,g]	9.3 E-09	2.4 E-06
7697-37-2	Nitric acid[f,h]	4.4 E-07	1.1 E-04
85-01-8	Phenanthrene[e]	3.0 E-10	7.6 E-08
123-38-6	Propionaldehyde[e]	1.0 E-08	2.6 E-06
115-07-1	Propylene[f,g]	1.2 E-07	3.0 E-05
129-00-0	Pyrene[d]	9.5 E-10	2.4 E-07
7782-49-2	Selenium[e,h]	9.9 E-09	2.5 E-06
100-42-5	Styrene[e,g]	8.3 E-09	2.1 E-06
7664-93-9	Sulfuric acid[f,h]	2.9 E-07	7.5 E-05
108-88-3	Toluene[e]	3.0 E-08	7.6 E-06
71-55-6	1,1,1-Trichloroethane[e]	1.6 E-09	4.1 E-07
95-63-6	1,2,4-Trimethylbenzene[f,i]	1.9 E-09	4.8 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,i]	3.5 E-09	9.1 E-07
95-47-6	o-Xylene[e,i]	2.8 E-09	7.3 E-07
7440-66-6	Zinc[f,g]	2.0 E-06	5.0 E-04

Table 15.1.4-2 (cont.)

[a] Factors represent uncontrolled emissions. References 1, 2, 5, 6, 10, and 11.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.91 E-03 pounds per item. References 10 and 11.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.4

1. *Report No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2002.

2. *Report No. 4 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2002.

3. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M855 5.56-mm Ball Cartridge, Department of Defense Identification Code: A059*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, June 2001.

4. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M855 5.56-mm Tungsten Ball Cartridge, Department of Defense Identification Code: A059*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, June 2001.

5. *Detailed Test Plan No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

6. *Detailed Test Plan No. 4 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

7. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

8. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 3 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

9. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 4 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

10. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.

11. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, March 2005.

15.1.5 A063, M856 5.56-mm Tracer Cartridge

15.1.5.1 Ordnance Description[1,2]

The M856 5.56-mm Tracer Cartridge (DODIC A063) is fired from the M249 machine gun and the M16 series of rifles. It consists of a cartridge case, primer, propelling charge, and bullet coated with a tracer compound. The propelling charge, activated by the primer, provides the force to send the bullet to the target. When tracer rounds are used, they are typically fired in a ratio of one tracer round to four ball rounds that do not contain the tracer composition. The visible trail left by the tracer can be used to see where the bullet hits the target, or to make adjustments in the firing position, if necessary. In addition, the M856 can be used during nighttime firing and for signaling purposes. This cartridge is used during combat and on firing ranges during training.

Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section. Furthermore, emissions associated with the combustion of the tracer composition are not addressed in this section.

The M856 5.56-mm Tracer Cartridge is used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 346,000 M856 cartridges are used per year at a given training facility.[2]

15.1.5.2 Emissions And Controls[1, 3-6]

The primary emissions from the detonation of the M856 5.56-mm Tracer Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.5-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.5-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.5-1 EMISSION FACTORS FOR THE USE OF DODIC A063, M856 5.56-MM TRACER CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	7.5 E-04	1.9 E-01
630-08-0	CO	1.4 E-03	3.5 E-01
7439-92-1	Lead (Pb)[f]	2.7 E-06	6.8 E-04
74-82-8	Methane	6.7 E-06	1.7 E-03
--	Oxides of nitrogen (NO_X)[f]	6.5 E-05	1.6 E-02
--	PM-2.5[d]	3.3 E-05	8.4 E-03
--	PM-10[e]	4.9 E-05	1.2 E-02
12789-66-1	TSP	4.6 E-05	1.2 E-02

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.98 E-03 pounds per item. Reference 6.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.

Table 15.1.5-2 EMISSION FACTORS FOR THE USE OF DODIC A063, M856 5.56-MM TRACER CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	2.9 E-11	7.2 E-09
208-96-8	Acenaphthylene[d]	6.1 E-10	1.5 E-07
75-05-8	Acetonitrile[e,g]	9.7 E-08	2.4 E-05
107-13-1	Acrylonitrile[e,g]	3.8 E-08	9.5 E-06
7429-90-5	Aluminum[f]	2.9 E-07	7.3 E-05
7664-41-7	Ammonia[d,g]	2.3 E-05	5.8 E-03
120-12-7	Anthracene[e]	7.1 E-11	1.8 E-08
7440-36-0	Antimony[e]	1.6 E-06	4.0 E-04
7440-39-3	Barium[f]	4.8 E-07	1.2 E-04
71-43-2	Benzene[e,g]	4.4 E-07	1.1 E-04
56-55-3	Benzo[a]anthracene[e]	2.2 E-10	5.6 E-08
205-99-2	Benzo[b]fluoranthene[e]	4.5 E-10	1.1 E-07
207-08-9	Benzo[k]fluoranthene[e,g]	1.9 E-10	4.7 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	1.1 E-09	2.8 E-07
50-32-8	Benzo[a]pyrene[e,g]	2.9 E-10	7.4 E-08
192-97-2	Benzo[e]pyrene[d]	5.9 E-10	1.5 E-07
106-99-0	1,3-Butadiene[e,g]	8.5 E-09	2.1 E-06
74-87-3	Chloromethane[e,g]	1.4 E-09	3.4 E-07
218-01-9	Chrysene[e]	2.7 E-10	6.8 E-08
7440-50-8	Copper[f]	2.3 E-05	5.9 E-03
57-12-5	Particulate cyanide[e,g]	7.5 E-07	1.9 E-04
107-06-2	1,2-Dichloroethane[e,g]	7.8 E-09	2.0 E-06
100-41-4	Ethylbenzene[e]	2.1 E-09	5.3 E-07
74-85-1	Ethylene[f]	4.8 E-07	1.2 E-04
206-44-0	Fluoranthene[e]	6.3 E-10	1.6 E-07
86-73-7	Fluorene[d]	2.6 E-10	6.6 E-08
50-00-0	Formaldehyde[e,h]	4.5 E-08	1.1 E-05
110-54-3	Hexane[e]	2.6 E-07	6.5 E-05
74-90-8	Hydrogen cyanide[e]	6.0 E-06	1.5 E-03
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	4.6 E-10	1.2 E-07

Table 15.1.5-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7439-92-1	Lead[e]	2.7 E-06	6.8 E-04
75-09-2	Methylene chloride[e]	7.8 E-08	1.9 E-05
75-86-5	2-Methyllactonitrile[f,i]	6.6 E-09	1.7 E-06
91-20-3	Naphthalene[e,g]	7.8 E-09	2.0 E-06
85-01-8	Phenanthrene[e]	3.9 E-10	9.8 E-08
123-38-6	Propionaldehyde[e]	8.6 E-09	2.2 E-06
115-07-1	Propylene[f,g]	8.3 E-08	2.1 E-05
129-00-0	Pyrene[d]	1.3 E-09	3.4 E-07
100-42-5	Styrene[e,g]	6.2 E-09	1.6 E-06
7664-93-9	Sulfuric acid[f,g]	2.9 E-08	7.4 E-06
108-88-3	Toluene[e]	3.0 E-08	7.5 E-06
71-55-6	1,1,1-Trichloroethane[e]	1.8 E-09	4.6 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	1.7 E-09	4.2 E-07
95-47-6	o-Xylene[e,h]	2.5 E-09	6.3 E-07
7440-66-6	Zinc[f,g]	3.0 E-06	7.6 E-04

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.98 E-03 pounds per item. Reference 6.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

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1. *Report No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2002.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M856 5.56-mm Tracer Cartridge, Department of Defense Identification Code: A063*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, June 2001.

3. *Detailed Test Plan No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

4. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

5. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 3 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

6. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.

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15.1.6 A065, M862 5.56-mm Practice Ball Cartridge

15.1.6.1 Ordnance Description[1,2]

The M862 5.56-mm Practice Ball Cartridge (DODIC A065) is fired from the M16 series rifle using the XM2 practice bolt. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is designed for training exercises where range restrictions preclude the use of standard service ammunition; it is not used during combat. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the projectile are not addressed in this section.

The M862 5.56-mm Practice Ball Cartridge is used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 100,000 M862 cartridges are used per year at a given training facility.[2]

15.1.6.2 Emissions And Controls[1, 3-6]

The primary emissions from the detonation of the M862 5.56-mm Practice Ball Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.6-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.6-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.6-1 EMISSION FACTORS FOR THE USE OF DODIC A065, M862 5.56-MM PRACTICE BALL CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	3.2 E-04	2.5 E-01
630-08-0	CO	4.0 E-04	3.1 E-01
7439-92-1	Lead (Pb)[f]	3.1 E-06	2.4 E-03
74-82-8	Methane	2.2 E-06	1.7 E-03
--	Oxides of nitrogen (NO_X)[f]	1.9 E-05	1.5 E-02
--	PM-2.5[d]	1.0 E-05	7.9 E-03
--	PM-10[e]	1.1 E-05	8.9 E-03
7446-09-5	Sulfur dioxide (SO_2)[g]	1.3 E-07	1.0 E-04
12789-66-1	TSP	1.2 E-05	9.1 E-03

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 1.29 E-03 pounds per item. Reference 6.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.
[g] EMISSION FACTOR RATING C.

Table 15.1.6-2 EMISSION FACTORS FOR THE USE OF DODIC A065, M862 5.56-MM PRACTICE BALL CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	2.3 E-11	1.8 E-08
208-96-8	Acenaphthylene[d]	4.5 E-10	3.5 E-07
75-05-8	Acetonitrile[e,g]	9.6 E-08	7.4 E-05
107-02-8	Acrolein[e]	7.6 E-08	5.9 E-05
107-13-1	Acrylonitrile[e,g]	1.5 E-08	1.1 E-05
7429-90-5	Aluminum[f]	9.5 E-08	7.4 E-05
120-12-7	Anthracene[e]	1.2 E-11	9.6 E-09
7440-36-0	Antimony[e]	1.7 E-06	1.3 E-03
7440-38-2	Arsenic[e,h]	5.3 E-09	4.1 E-06
7440-39-3	Barium[f]	1.7 E-06	1.3 E-03
71-43-2	Benzene[e,g]	2.7 E-07	2.1 E-04
56-55-3	Benzo[a]anthracene[e]	7.6 E-11	5.9 E-08
205-99-2	Benzo[b]fluoranthene[e]	1.4 E-10	1.1 E-07
207-08-9	Benzo[k]fluoranthene[e,g]	9.1 E-11	7.0 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	1.2 E-09	9.2 E-07
50-32-8	Benzo[a]pyrene[e,g]	3.0 E-10	2.3 E-07
192-97-2	Benzo[e]pyrene[d]	3.4 E-10	2.7 E-07
75-15-0	Carbon disulfide[e]	6.1 E-09	4.7 E-06
74-87-3	Chloromethane[e,g]	3.3 E-10	2.6 E-07
218-01-9	Chrysene[e]	9.3 E-11	7.2 E-08
7440-50-8	Copper[f]	1.9 E-07	1.5 E-04
57-12-5	Particulate cyanide[e]	7.2 E-09	5.6 E-06
107-06-2	1,2-Dichloroethane[e,g]	4.5 E-09	3.5 E-06
74-85-1	Ethylene[f]	6.9 E-07	5.3 E-04
206-44-0	Fluoranthene[e]	3.8 E-10	2.9 E-07
86-73-7	Fluorene[d]	5.5 E-11	4.3 E-08
50-00-0	Formaldehyde[e,h]	5.1 E-08	4.0 E-05
74-90-8	Hydrogen cyanide[e]	1.2 E-06	9.6 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	4.4 E-10	3.4 E-07
7439-92-1	Lead[e]	3.1 E-06	2.4 E-03

Table 15.1.6-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
75-09-2	Methylene chloride[e]	1.8 E-07	1.4 E-04
91-20-3	Naphthalene[e,g]	5.9 E-09	4.6 E-06
7697-37-2	Nitric acid[f,h]	7.5 E-07	5.8 E-04
85-01-8	Phenanthrene[e]	1.1 E-10	8.8 E-08
115-07-1	Propylene[f,g]	5.6 E-08	4.3 E-05
129-00-0	Pyrene[d]	1.2 E-09	9.1 E-07
100-42-5	Styrene[e,g]	7.5 E-10	5.9 E-07
7664-93-9	Sulfuric acid[f,h]	1.0 E-07	8.0 E-05
108-88-3	Toluene[e]	1.3 E-08	9.8 E-06
71-55-6	1,1,1-Trichloroethane[e]	1.5 E-10	1.2 E-07
95-63-6	1,2,4-Trimethylbenzene[f,h]	8.2 E-10	6.4 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	9.7 E-10	7.5 E-07
95-47-6	o-Xylene[e,h]	5.5 E-10	4.3 E-07
7440-66-6	Zinc[f,g]	9.2 E-08	7.1 E-05

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 1.29 E-03 pounds per item. Reference 6.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.6

1. *Report No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2002.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M862 5.56-mm Practice Cartridge, Department of Defense Identification Code: A065*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, June 2001.

3. *Detailed Test Plan No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

4. *Hazard Classification of United States Military Explosives and Munitions,* U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

5. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 3 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

6. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.

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15.1.7 A066, M193 5.56-mm Ball Cartridge

15.1.7.1 Ordnance Description[1]

The M193 5.56-mm Ball Cartridge (DODIC A066) is intended for use against unarmored targets. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is used during combat and on firing ranges during training. It is fired from the M16 series rifles. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

15.1.7.2 Emissions And Controls[1-5]

The primary emissions from the detonation of the M193 5.56-mm Ball Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.7-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.7-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.7-1 EMISSION FACTORS FOR THE USE OF DODIC A066, M193 5.56-MM BALL CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	1.0 E-03	2.4 E-01
630-08-0	CO	1.8 E-03	4.4 E-01
7439-92-1	Lead (Pb)[f]	1.3 E-05	3.2 E-03
74-82-8	Methane	1.3 E-05	3.2 E-03
--	Oxides of nitrogen (NO_X)[f]	5.6 E-05	1.3 E-02
--	PM-2.5[d]	3.2 E-05	7.6 E-03
--	PM-10[e]	3.8 E-05	9.2 E-03
12789-66-1	TSP	4.2 E-05	1.0 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 4.13 E-03 pounds per item. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B

Table 15.1.7-2 EMISSION FACTORS FOR THE USE OF DODIC A066, M193 5.56-MM BALL CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	2.1 E-10	5.1 E-08
208-96-8	Acenaphthylene[d]	1.6 E-09	3.8 E-07
75-07-0	Acetaldehyde[e]	3.1 E-07	7.6 E-05
75-05-8	Acetonitrile[e,g]	7.3 E-07	1.8 E-04
107-02-8	Acrolein[e]	6.6 E-08	1.6 E-05
107-13-1	Acrylonitrile[e,g]	5.8 E-08	1.4 E-05
7429-90-5	Aluminum[f]	1.3 E-07	3.2 E-05
7664-41-7	Ammonia[d,g]	4.2 E-05	1.0 E-02
120-12-7	Anthracene[e]	6.6 E-11	1.6 E-08
7440-36-0	Antimony[e]	1.7 E-06	4.1 E-04
7440-39-3	Barium[f]	4.4 E-07	1.1 E-04
71-43-2	Benzene[e,g]	6.2 E-07	1.5 E-04
74-87-3	Chloromethane[e]	1.1 E-09	2.7 E-07
7440-50-8	Copper[f]	9.5 E-06	2.3 E-03
107-06-2	1,2-Dichloroethane[e,g]	1.5 E-08	3.6 E-06
--	Total dioxin/furan compounds[e]	6.7 E-15	1.6 E-12
74-85-1	Ethylene[f]	8.9 E-07	2.2 E-04
86-73-7	Fluorene[d]	5.8 E-10	1.4 E-07
50-00-0	Formaldehyde[e]	4.7 E-07	1.1 E-04
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e,g]	5.0 E-16	1.2 E-13
74-90-8	Hydrogen cyanide[e]	2.4 E-05	5.8 E-03
7439-92-1	Lead[e]	1.3 E-05	3.2 E-03
91-20-3	Naphthalene[e,g]	2.2 E-08	5.3 E-06
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[e]	1.8 E-15	4.4 E-13
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e,h]	1.1 E-16	2.7 E-14
123-38-6	Propionaldehyde[e,h]	2.1 E-08	5.2 E-06
115-07-1	Propylene[f,g]	8.5 E-08	2.1 E-05
129-00-0	Pyrene[d]	2.2 E-10	5.4 E-08
100-42-5	Styrene[e,g]	7.9 E-09	1.9 E-06
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	4.3 E-15	1.0 E-12

Table 15.1.7-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
108-88-3	Toluene[e]	2.7 E-08	6.6 E-06
7440-66-6	Zinc[f,g]	1.2 E-06	2.8 E-04

[a] Factors represent uncontrolled emissions. References 1, 2, 4 and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 4.13 E-03 pounds per item. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.7

1. *Report No. 6 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2004.

2. *Detailed Test Plan No. 6 for the Firing Point Emission Study Phase II,* Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2001.

3. *Hazard Classification of United States Military Explosives and Munitions,* U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 6 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

5. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2004, April 2005, and May 2005.

15.1.8 A068, M196 5.56-mm Tracer Cartridge

15.1.8.1 Ordnance Description[1]

The M196 5.56-mm Tracer Cartridge (DODIC A068) is fired from the M16 series of rifles. It consists of a cartridge case, primer, propelling charge, and bullet coated with a tracer compound. The propelling charge, activated by the primer, provides the force to send the bullet to the target. When tracer rounds are used, they are typically fired in a ratio of one tracer round to four ball rounds that do not contain the tracer composition. The visible trail left by the tracer can be used to see where the bullet hits the target, or to make adjustments in the firing position, if necessary. In addition, the M196 can be used during nighttime firing and for signaling purposes. This cartridge is used during combat and on firing ranges during training.

Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the projectile are not addressed in this section. Furthermore, emissions associated with the combustion of the tracer composition are not addressed in this section.

15.1.8.2 Emissions And Controls[1-5]

The primary emissions from the detonation of the M196 5.56-mm Tracer Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.8-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.8-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.8-1 EMISSION FACTORS FOR THE USE OF DODIC A068, M196 5.56-MM TRACER CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	9.8 E-04	2.5 E-01
630-08-0	CO	1.6 E-03	4.2 E-01
7439-92-1	Lead (Pb)[f]	2.8 E-06	7.2 E-04
74-82-8	Methane	6.2 E-06	1.6 E-03
--	Oxides of nitrogen (NO_X)[f]	1.7 E-05	4.5 E-03
--	PM-2.5[d]	5.1 E-05	1.3 E-02
--	PM-10[e]	6.7 E-05	1.7 E-02
12789-66-1	TSP	7.0 E-05	1.8 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.84 E-03 pounds per item. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.

Table 15.1.8-2 EMISSION FACTORS FOR THE USE OF DODIC A068, M196 5.56-MM TRACER CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	1.7 E-10	4.5 E-08
208-96-8	Acenaphthylene[d]	1.2 E-09	3.1 E-07
75-07-0	Acetaldehyde[e]	1.2 E-07	3.2 E-05
75-05-8	Acetonitrile[e,g]	2.3 E-07	6.1 E-05
98-86-2	Acetophenone[e,i]	3.3 E-08	8.5 E-06
107-13-1	Acrylonitrile[e,g]	2.0 E-08	5.2 E-06
7429-90-5	Aluminum[g]	1.1 E-07	2.9 E-05
7664-41-7	Ammonia[d,g]	3.8 E-05	9.8 E-03
120-12-7	Anthracene[e]	9.1 E-11	2.4 E-08
7440-36-0	Antimony[e]	1.3 E-06	3.5 E-04
7440-39-3	Barium[f]	4.7 E-07	1.2 E-04
71-43-2	Benzene[e,g]	1.9 E-07	5.0 E-05
205-99-2	Benzo[b]fluoranthene[e]	1.2 E-10	3.2 E-08
50-32-8	Benzo[a]pyrene[e,g]	1.2 E-10	3.1 E-08
192-97-2	Benzo[e]pyrene[d]	1.2 E-10	3.2 E-08
108-90-7	Chlorobenzene[e,h]	9.7 E-10	2.5 E-07
74-87-3	Chloromethane[e,g]	2.3 E-09	6.0 E-07
7440-50-8	Copper[f]	2.1 E-05	5.4 E-03
57-12-5	Particulate cyanide[e,g]	1.2 E-06	3.2 E-04
107-06-2	1,2-Dichloroethane[e,g]	3.8 E-09	9.8 E-07
--	Total dioxin/furan compounds[e]	1.7 E-13	4.3 E-11
100-41-4	Ethylbenzene[e]	1.6 E-09	4.2 E-07
74-85-1	Ethylene[f]	3.8 E-07	9.8 E-05
117-81-7	bis(2-Ethylhexyl)phthalate[e,h]	3.0 E-08	7.8 E-06
86-73-7	Fluorene[d]	4.4 E-10	1.1 E-07
50-00-0	Formaldehyde[e,i]	1.6 E-07	4.0 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e,h]	4.0 E-14	1.1 E-11
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e,h]	3.0 E-14	7.7 E-12

Table 15.1.8-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	1.0 E-14	2.6 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	6.2 E-17	1.6 E-14
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e]	1.0 E-14	2.6 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	2.4 E-15	6.3 E-13
74-90-8	Hydrogen cyanide[e,h]	3.0 E-06	7.7 E-04
7439-92-1	Lead[e]	2.8 E-06	7.2 E-04
1634-04-4	Methyl tert-butyl ether[e,h]	6.7 E-10	1.7 E-07
91-20-3	Naphthalene[e,g]	1.3 E-08	3.3 E-06
7697-37-2	Nitric acid[f,h]	2.5 E-07	6.5 E-05
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin[e,i]	4.0 E-15	1.0 E-12
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[e,h]	9.3 E-15	2.4 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e,i]	1.0 E-14	2.7 E-12
115-07-1	Propylene[f,g]	5.3 E-08	1.4 E-05
100-42-5	Styrene[e,g]	7.9 E-09	2.1 E-06
7664-93-9	Sulfuric acid[f,h]	3.5 E-07	9.1 E-05
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e,h]	2.9 E-14	7.6 E-12
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e,h]	2.2 E-14	5.6 E-12
7440-28-0	Thallium[f,h]	1.4 E-08	3.6 E-06
108-88-3	Toluene[e]	1.5 E-08	4.0 E-06
7440-66-6	Zinc[f,g]	2.4 E-06	6.2 E-04

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.84 E-03 pounds per item. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.8

1. *Report No. 6 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2004.

2. *Detailed Test Plan No. 6 for the Firing Point Emission Study Phase II,* Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2001.

3. *Hazard Classification of United States Military Explosives and Munitions,* U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 6 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

5. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2004, April 2005, and May 2005.

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15.1.9 A080, M200 5.56-mm Blank Cartridge

15.1.9.1 Ordnance Description[1,2]

The M200 5.56-mm Blank Cartridge (DODIC A080) is fired from the M16 series of rifles fitted with a blank firing attachment. The cartridge consists of a cartridge case, primer, and propelling charge. This cartridge does not have a projectile and is designed for training exercises and saluting purposes; it is not used during combat.

The M200 5.56-mm Blank Cartridge is used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 1,000,000 M200 cartridges are used per year at a training site.[2]

15.1.9.2 Emissions And Controls[1, 3-6]

The primary emissions from the detonation of the M200 5.56-mm Blank Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.9-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.9-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.9-1 EMISSION FACTORS FOR THE USE OF DODIC A080, M200 5.56-MM BLANK CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	2.3 E-04	2.6 E-01
630-08-0	CO	2.8 E-04	3.2 E-01
7439-92-1	Lead (Pb)[f]	9.7 E-07	1.1 E-03
74-82-8	Methane	1.6 E-06	1.8 E-03
--	Oxides of nitrogen (NO_X)[f]	2.0 E-05	2.3 E-02
--	PM-2.5[d]	6.0 E-06	6.8 E-03
--	PM-10[e]	6.9 E-06	7.8 E-03
7446-09-5	Sulfur dioxide (SO_2)[g]	9.8 E-08	1.1 E-04
12789-66-1	TSP	7.5 E-06	8.5 E-03

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 8.84 E-04 pounds per item. Reference 6.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.
[g] EMISSION FACTOR RATING C.

Table 15.1.9-2 EMISSION FACTORS FOR THE USE OF DODIC A080, M200 5.56-MM BLANK CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	4.2 E-11	4.7 E-08
208-96-8	Acenaphthylene[d]	6.3 E-10	7.1 E-07
75-05-8	Acetonitrile[e,g]	1.5 E-07	1.7 E-04
107-13-1	Acrylonitrile[e,g]	3.8 E-08	4.3 E-05
7429-90-5	Aluminum[f]	1.9 E-07	2.2 E-04
7440-36-0	Antimony[e]	7.2 E-07	8.2 E-04
7440-39-3	Barium[f]	4.0 E-07	4.5 E-04
71-43-2	Benzene[e,g]	3.5 E-07	4.0 E-04
56-55-3	Benzo[a]anthracene[e]	1.9 E-10	2.2 E-07
205-99-2	Benzo[b]fluoranthene[e]	2.3 E-10	2.6 E-07
207-08-9	Benzo[k]fluoranthene[e,g]	1.5 E-10	1.7 E-07
191-24-2	Benzo[g,h,i]perylene[e,g]	4.2 E-10	4.7 E-07
50-32-8	Benzo[a]pyrene[e,g]	2.1 E-10	2.4 E-07
192-97-2	Benzo[e]pyrene[d]	2.4 E-10	2.7 E-07
106-99-0	1,3-Butadiene[e,g]	3.8 E-09	4.2 E-06
75-15-0	Carbon disulfide[e]	1.8 E-08	2.0 E-05
74-87-3	Chloromethane[e,g]	1.1 E-10	1.3 E-07
218-01-9	Chrysene[e]	1.7 E-10	1.9 E-07
7440-50-8	Copper[f]	3.6 E-07	4.1 E-04
57-12-5	Particulate cyanide[e,g]	1.5 E-08	1.7 E-05
53-70-3	Dibenz[a,h]anthracene[e]	4.4 E-11	5.0 E-08
107-06-2	1,2-Dichloroethane[e,g]	6.9 E-09	7.8 E-06
100-41-4	Ethylbenzene[e]	9.8 E-10	1.1 E-06
74-85-1	Ethylene[f]	6.8 E-07	7.7 E-04
206-44-0	Fluoranthene[e]	1.3 E-10	1.4 E-07
86-73-7	Fluorene[d]	1.2 E-10	1.4 E-07
50-00-0	Formaldehyde[e,h]	5.9 E-08	6.6 E-05
110-54-3	Hexane[e,i]	9.9 E-09	1.1 E-05
74-90-8	Hydrogen cyanide[e]	1.0 E-06	1.2 E-03
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	3.6 E-10	4.0 E-07

Table 15.1.9-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7439-92-1	Lead[e]	9.7 E-07	1.1 E-03
75-09-2	Methylene chloride[e]	6.4 E-08	7.3 E-05
108-10-1	Methyl isobutyl ketone[e,h]	1.1 E-09	1.2 E-06
91-20-3	Naphthalene[e,g]	7.8 E-09	8.8 E-06
7697-37-2	Nitric acid[f,h]	3.3 E-07	3.8 E-04
85-01-8	Phenanthrene[e]	1.2 E-10	1.3 E-07
108-95-2	Phenol[e,h]	5.6 E-09	6.3 E-06
115-07-1	Propylene[f,g]	1.6 E-07	1.8 E-04
129-00-0	Pyrene[d]	2.0 E-10	2.3 E-07
100-42-5	Styrene[e,g]	4.8 E-09	5.4 E-06
7664-93-9	Sulfuric acid[f,h]	1.9 E-07	2.1 E-04
108-88-3	Toluene[e]	5.2 E-08	5.9 E-05
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	2.4 E-09	2.8 E-06
7440-66-6	Zinc[f,g]	1.2 E-07	1.4 E-04

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 8.84 E-04 pounds per item. Reference 6.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.9

1. *Report No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2002.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M200 5.56-mm Blank Cartridge, Department of Defense Identification Code: A080*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, November 2000.

3. *Detailed Test Plan No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

4. *Hazard Classification of United States Military Explosives and Munitions,* U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

5. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 3 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

6. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.

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15.1.10 A086, .22 Caliber Long Rifle Ball Cartridge

15.1.10.1 Ordnance Description[1,2]

The .22 Caliber Long Rifle Ball Cartridge (DODIC A086) is fired from the M2A1 and Winchester rifle model Nos. 52 and 75; Remington model Nos. M40X and 513T; and machine gun trainers M3 and M4. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is used on firing ranges for marksmanship practice and match use; it is not used during combat. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

The .22 Caliber Long Rifle Ball Cartridge is used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 6,550 .22 Caliber Long Rifle Ball Cartridges are used per year at a given training facility.[2]

15.1.10.2 Emissions And Controls[1, 3-6]

The primary emissions from the detonation of the .22 Caliber Long Rifle Ball Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.10-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.10-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.10-1 EMISSION FACTORS FOR THE USE OF DODIC A086, .22 CALIBER LONG RIFLE BALL CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	7.5 E-05	1.8 E-01
630-08-0	CO	8.0 E-05	2.0 E-01
7439-92-1	Lead (Pb)[f]	1.9 E-06	4.6 E-03
74-82-8	Methane	5.2 E-07	1.3 E-03
--	Oxides of nitrogen (NO_X)[f]	5.0 E-06	1.2 E-02
--	PM-2.5[d]	2.6 E-06	6.3 E-03
--	PM-10[e]	3.4 E-06	8.3 E-03
12789-66-1	TSP	3.3 E-06	8.2 E-03

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 4.06 E-04 pounds per item. Reference 7.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.

Table 15.1.10-2 EMISSION FACTORS FOR THE USE OF DODIC A086, .22 CALIBER LONG RIFLE BALL CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	1.8 E-11	4.5 E-08
208-96-8	Acenaphthylene[d]	3.9 E-10	9.7 E-07
75-07-0	Acetaldehyde[e,g]	1.9 E-08	4.7 E-05
75-05-8	Acetonitrile[e,g]	8.1 E-09	2.0 E-05
107-13-1	Acrylonitrile[e,g]	7.1 E-09	1.7 E-05
120-12-7	Anthracene[e]	9.7 E-12	2.4 E-08
7440-36-0	Antimony[e]	8.9 E-09	2.2 E-05
71-43-2	Benzene[e,g]	6.0 E-08	1.5 E-04
56-55-3	Benzo[a]anthracene[e]	8.0 E-12	2.0 E-08
205-99-2	Benzo[b]fluoranthene[e]	1.8 E-11	4.4 E-08
207-08-9	Benzo[k]fluoranthene[e,g]	1.5 E-11	3.6 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	1.3 E-10	3.2 E-07
50-32-8	Benzo[a]pyrene[e,g]	3.2 E-11	7.9 E-08
192-97-2	Benzo[e]pyrene[d]	3.3 E-11	8.1 E-08
123-72-8	Butyraldehyde[f,h]	5.8 E-09	1.4 E-05
218-01-9	Chrysene[e]	9.3 E-12	2.3 E-08
7440-50-8	Copper[f]	6.8 E-09	1.7 E-05
107-06-2	1,2-Dichloroethane[e,g]	9.4 E-10	2.3 E-06
--	Total dioxin/furan compounds[e]	2.8 E-15	7.0 E-12
74-85-1	Ethylene[f]	3.9 E-07	9.6 E-04
206-44-0	Fluoranthene[e]	1.2 E-11	2.8 E-08
86-73-7	Fluorene[d]	4.5 E-11	1.1 E-07
50-00-0	Formaldehyde[e,h]	8.2 E-08	2.0 E-04
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	6.2 E-16	1.5 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	1.6 E-16	4.0 E-13
74-90-8	Hydrogen cyanide[e]	8.3 E-08	2.0 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	3.5 E-11	8.7 E-08
7439-92-1	Lead[e]	1.9 E-06	4.6 E-03
75-09-2	Methylene chloride[e]	1.8 E-07	4.4 E-04

Table 15.1.10-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
91-20-3	Naphthalene[e,g]	3.3 E-09	8.2 E-06
7697-37-2	Nitric acid[f,i]	5.9 E-08	1.5 E-04
55-63-0	Nitroglycerin[f,h]	7.0 E-09	1.7 E-05
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e,h]	1.4 E-15	3.3 E-12
85-01-8	Phenanthrene[e]	5.2 E-11	1.3 E-07
115-07-1	Propylene[f,g]	6.4 E-08	1.6 E-04
129-00-0	Pyrene[d]	2.3 E-11	5.6 E-08
100-42-5	Styrene[e,g]	3.0 E-09	7.3 E-06
108-88-3	Toluene[e]	6.0 E-09	1.5 E-05
71-55-6	1,1,1-Trichloroethane[e]	6.4 E-10	1.6 E-06
7440-66-6	Zinc[f,g]	1.6 E-08	3.8 E-05

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 4.06 E-04 pounds per item. Reference 7.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.10

1. *Report No. 4 for the Firing Point Emission Study Phase II,* Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2002.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the Long Rifle .22 Caliber Ball Cartridge, Department of Defense Identification Code: A106,* U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, August 2001.

3. *Detailed Test Plan No. 4 for the Firing Point Emission Study Phase II,* Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

4. *Hazard Classification of United States Military Explosives and Munitions,* U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

5. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 4 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

6. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.

7. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, March 2005.

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15.1.11 A106, .22 Caliber Standard Velocity Long Rifle Ball Cartridge

15.1.11.1 Ordnance Description[1,2]

The .22 Caliber Standard Velocity Long Rifle Ball Cartridge (DODIC A106) is intended for use against unarmored targets. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is used on firing ranges during training exercises; it is not used during combat. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

The .22 Caliber Standard Velocity Long Rifle Ball Cartridge is used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 6,550 .22 Caliber Standard Velocity Long Rifle Ball Cartridges are used per year at a given training facility.[2]

15.1.11.2 Emissions And Controls[1, 3-6]

The primary emissions from the detonation of the .22 Caliber Standard Velocity Long Rifle Ball Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.11-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.11-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.11-1 EMISSION FACTORS FOR THE USE OF DODIC A106, .22 CALIBER STANDARD VELOCITY LONG RIFLE BALL CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	6.8 E-05	1.7 E-01
630-08-0	CO	7.2 E-05	1.8 E-01
7439-92-1	Lead (Pb)[f]	1.8 E-06	4.5 E-03
74-82-8	Methane	6.8 E-08	1.7 E-04
--	Oxides of nitrogen (NO_X)[f]	3.1 E-06	7.5 E-03
--	PM-2.5[d]	1.9 E-06	4.8 E-03
--	PM-10[e]	2.6 E-06	6.3 E-03
12789-66-1	TSP	3.2 E-06	7.9 E-03

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 4.06 E-04 pounds per item. Reference 7.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.

Table 15.1.11-2 EMISSION FACTORS FOR THE USE OF DODIC A106, .22 CALIBER STANDARD VELOCITY LONG RIFLE BALL CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	2.8 E-12	7.0 E-09
208-96-8	Acenaphthylene[d]	3.8 E-11	9.4 E-08
75-07-0	Acetaldehyde[e,g]	1.3 E-08	3.2 E-05
107-13-1	Acrylonitrile[e,g]	3.3 E-09	8.1 E-06
120-12-7	Anthracene[e]	3.3 E-12	8.2 E-09
7440-36-0	Antimony[e]	7.6 E-08	1.9 E-04
7440-39-3	Barium[f]	5.6 E-08	1.4 E-04
71-43-2	Benzene[e,g]	1.7 E-08	4.2 E-05
56-55-3	Benzo[a]anthracene[e]	3.9 E-12	9.7 E-09
85-68-7	Butylbenzylphthalate[d,i]	8.6 E-09	2.1 E-05
123-72-8	Butyraldehyde[f,h]	2.9 E-09	7.3 E-06
218-01-9	Chrysene[e]	3.3 E-12	8.2 E-09
7440-50-8	Copper[f]	8.8 E-09	2.2 E-05
107-06-2	1,2-Dichloroethane[e,g]	3.3 E-10	8.1 E-07
74-85-1	Ethylene[f]	4.9 E-08	1.2 E-04
206-44-0	Fluoranthene[e]	6.5 E-12	1.6 E-08
86-73-7	Fluorene[d]	9.0 E-12	2.2 E-08
50-00-0	Formaldehyde[e,h]	9.8 E-08	2.4 E-04
74-90-8	Hydrogen cyanide[e]	4.1 E-08	1.0 E-04
67-63-0	Isopropyl alcohol[f,i]	1.8 E-09	4.3 E-06
7439-92-1	Lead[e]	1.8 E-06	4.5 E-03
75-09-2	Methylene chloride[e]	4.7 E-08	1.2 E-04
91-20-3	Naphthalene[e,g]	3.9 E-10	9.7 E-07
55-63-0	Nitroglycerin[f,h]	4.1 E-09	1.0 E-05
85-01-8	Phenanthrene[e]	1.6 E-11	4.1 E-08
129-00-0	Pyrene[d]	5.1 E-12	1.2 E-08
100-42-5	Styrene[e,g]	2.0 E-10	4.9 E-07
108-88-3	Toluene[e]	4.4 E-10	1.1 E-06
71-55-6	1,1,1-Trichloroethane[e]	1.3 E-09	3.1 E-06

Table 15.1.11-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
95-63-6	1,2,4-Trimethylbenzene[f,h]	5.9 E-10	1.4 E-06
95-47-6	o-Xylene[e,h]	5.2 E-10	1.3 E-06
7440-66-6	Zinc[f,g]	1.2 E-08	3.0 E-05

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 4.06 E-04 pounds per item. Reference 7.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.11

1. *Report No. 4 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2002.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from Long Rifle .22 Caliber Ball Cartridge, Standard Velocity, Department of Defense Identification Code: A086*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, August 2001.

3. *Detailed Test Plan No. 4 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

4. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

5. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 4 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

6. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.

7. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, March 2005.

15.1.12 A111, M82 7.62-mm Blank Cartridge

15.1.12.1 Ordnance Description[1,2]

The M82 7.62-mm Blank Cartridge (DODIC A111) is fired from the M14 rifle as well as the M60, M219, and M240 machine guns equipped with a blank firing attachment. It consists of a cartridge case, primer, and propelling charge. This cartridge does not have a projectile and is designed for training exercises and saluting purposes; it is not used during combat.

The M82 7.62-mm Blank Cartridge is used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 588,000 M82 cartridges are used per year at a given training facility.[2]

15.1.12.2 Emissions And Controls[1, 3-6]

The primary emissions from the detonation of the M82 7.62-mm Blank Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.12-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.12-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.12-1 EMISSION FACTORS FOR THE USE OF DODIC A111, M82 7.62-MM BLANK CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	9.5 E-04	3.5 E-01
630-08-0	CO	6.8 E-04	2.5 E-01
7439-92-1	Lead (Pb)[f]	2.6 E-06	9.7 E-04
74-82-8	Methane	2.9 E-06	1.1 E-03
--	Oxides of nitrogen (NO_X)[f]	4.4 E-05	1.6 E-02
--	PM-2.5[d]	1.5 E-05	5.6 E-03
--	PM-10[e]	1.7 E-05	6.1 E-03
7446-09-5	Sulfur dioxide (SO_2)[g]	3.5 E-07	1.3 E-04
12789-66-1	TSP	1.7 E-05	6.2 E-03

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 2.73 E-03 pounds per item. Reference 6.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.
[g] EMISSION FACTOR RATING C.

Table 15.1.12-2 EMISSION FACTORS FOR THE USE OF DODIC A111, M82 7.62-MM BLANK CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	4.7 E-12	1.7 E-09
208-96-8	Acenaphthylene[d]	4.1 E-10	1.5 E-07
75-05-8	Acetonitrile[e,g]	6.8 E-08	2.5 E-05
107-13-1	Acrylonitrile[e,g]	4.9 E-08	1.8 E-05
7429-90-5	Aluminum[f]	2.5 E-07	9.3 E-05
7440-36-0	Antimony[e]	1.7 E-06	6.4 E-04
7440-39-3	Barium[f]	7.6 E-07	2.8 E-04
71-43-2	Benzene[e,g]	3.6 E-07	1.3 E-04
56-55-3	Benzo[a]anthracene[e]	4.0 E-11	1.5 E-08
205-99-2	Benzo[b]fluoranthene[e]	5.6 E-11	2.1 E-08
207-08-9	Benzo[k]fluoranthene[e,g]	3.0 E-11	1.1 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	2.2 E-10	7.9 E-08
50-32-8	Benzo[a]pyrene[e,g]	4.2 E-11	1.5 E-08
192-97-2	Benzo[e]pyrene[d]	1.5 E-10	5.6 E-08
75-15-0	Carbon disulfide[e]	1.0 E-09	3.8 E-07
74-87-3	Chloromethane[e,g]	7.2 E-10	2.6 E-07
218-01-9	Chrysene[e]	4.7 E-11	1.7 E-08
7440-50-8	Copper[f]	8.7 E-07	3.2 E-04
57-12-5	Particulate cyanide[e,h]	1.9 E-08	7.1 E-06
--	Total dioxin/furan compounds[e]	7.0 E-15	2.6 E-12
74-85-1	Ethylene[f]	8.9 E-07	3.3 E-04
206-44-0	Fluoranthene[e]	1.4 E-10	5.0 E-08
86-73-7	Fluorene[d]	5.4 E-11	2.0 E-08
50-00-0	Formaldehyde[e,h]	9.9 E-08	3.6 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	5.1 E-15	1.9 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	1.9 E-15	7.0 E-13
110-54-3	Hexane[e,h]	1.7 E-07	6.2 E-05
74-90-8	Hydrogen cyanide[e]	2.2 E-06	8.2 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	7.6 E-11	2.8 E-08
7439-92-1	Lead[e]	2.6 E-06	9.7 E-04

Table 15.1.12-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
75-09-2	Methylene chloride[e]	1.2 E-07	4.4 E-05
91-20-3	Naphthalene[e,g]	7.7 E-09	2.8 E-06
7697-37-2	Nitric acid[f,h]	1.2 E-06	4.2 E-04
115-07-1	Propylene[f,g]	9.4 E-08	3.4 E-05
129-00-0	Pyrene[d]	2.2 E-10	8.0 E-08
7664-93-9	Sulfuric acid[f,i]	3.3 E-07	1.2 E-04
108-88-3	Toluene[e]	2.1 E-08	7.6 E-06
71-55-6	1,1,1-Trichloroethane[e,i]	3.4 E-10	1.2 E-07
95-63-6	1,2,4-Trimethylbenzene[f,h]	9.8 E-10	3.6 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	2.1 E-09	7.8 E-07
95-47-6	o-Xylene[e,h]	1.6 E-09	5.8 E-07
7440-66-6	Zinc[f,g]	1.8 E-07	6.6 E-05

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 2.73 E-03 pounds per item. Reference 6.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.12

1. *Report No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2002.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M82 7.62-mm Blank Cartridge, Department of Defense Identification Code: A112*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, June 2001.

3. *Detailed Test Plan No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

4. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

5. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 3 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

6. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.

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15.1.13 A131, M62 7.62-mm Tracer Cartridge

15.1.13.1 Ordnance Description[1]

The M62 7.62-mm Tracer Cartridge (DODIC A131) is fired from the M14 rifle and the M60 and M240 machine guns. It consists of a cartridge case, primer, propelling charge, and bullet coated with a tracer compound. The propelling charge, activated by the primer, provides the force to send the bullet to the target. When tracer rounds are used, they are typically fired in a ratio of one tracer round to four ball rounds that do not contain the tracer composition. The visible trail left by the tracer can be used to see where the bullet hits the target, or to make adjustments in the firing position, if necessary. In addition, the M62 can be used during nighttime firing and to allow occasional target marking capabilities for suppressive tactics employed by maneuvering troops. This cartridge is used during combat and on firing ranges during training.

Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the projectile are not addressed in this section. Furthermore, emissions associated with the combustion of the tracer composition are not addressed in this section.

15.1.13.2 Emissions And Controls[1-5]

The primary emissions from the detonation of the M62 7.62-mm Tracer Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.13-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.13-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.13-1 EMISSION FACTORS FOR THE USE OF DODIC A131, M62 7.62-MM TRACER CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	1.7 E-03	2.5 E-01
630-08-0	CO	2.8 E-03	4.0 E-01
7439-92-1	Lead (Pb)[f]	7.8 E-06	1.1 E-03
74-82-8	Methane	1.6 E-05	2.2 E-03
--	Oxides of nitrogen (NO_X)[f]	4.3 E-05	6.1 E-03
--	PM-2.5[d]	5.8 E-05	8.4 E-03
--	PM-10[e]	9.1 E-05	1.3 E-02
12789-66-1	TSP	9.9 E-05	1.4 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.94 E-03 pounds per item. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.

Table 15.1.13-2 EMISSION FACTORS FOR THE USE OF DODIC A131, M62 7.62-MM TRACER CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	5.2 E-10	7.5 E-08
208-96-8	Acenaphthylene[d]	3.2 E-09	4.6 E-07
75-07-0	Acetaldehyde[e]	4.0 E-07	5.8 E-05
75-05-8	Acetonitrile[e,g]	9.1 E-07	1.3 E-04
98-86-2	Acetophenone[e,i]	2.8 E-08	4.0 E-06
107-02-8	Acrolein[e]	1.6 E-07	2.3 E-05
107-13-1	Acrylonitrile[e,g]	7.2 E-08	1.0 E-05
7429-90-5	Aluminum[g]	3.1 E-07	4.4 E-05
7664-41-7	Ammonia[d,g]	4.6 E-05	6.6 E-03
120-12-7	Anthracene[e]	1.2 E-10	1.8 E-08
7440-36-0	Antimony[e]	2.4 E-06	3.4 E-04
7440-39-3	Barium[f]	1.0 E-06	1.5 E-04
71-43-2	Benzene[e,g]	7.7 E-07	1.1 E-04
74-87-3	Chloromethane[e,g]	4.6 E-09	6.6 E-07
7440-50-8	Copper[f]	3.0 E-05	4.3 E-03
57-12-5	Particulate cyanide[e,g]	8.9 E-07	1.3 E-04
107-06-2	1,2-Dichloroethane[e,g]	1.5 E-08	2.2 E-06
--	Total dioxin/furan compounds[e]	5.7 E-13	8.3 E-11
100-41-4	Ethylbenzene[e]	7.2 E-09	1.0 E-06
74-85-1	Ethylene[f]	1.0 E-06	1.4 E-04
86-73-7	Fluorene[d]	1.2 E-09	1.7 E-07
50-00-0	Formaldehyde[e,i]	8.0 E-07	1.2 E-04
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e,i]	4.7 E-15	6.8 E-13
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e,i]	6.0 E-15	8.7 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	1.3 E-14	1.9 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e,h]	5.3 E-15	7.6 E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e]	1.1 E-14	1.6 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	4.1 E-15	5.9 E-13
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e,h]	2.5 E-15	3.6 E-13
7647-01-0	Hydrochloric acid[e,h]	1.3 E-06	1.9 E-04

Table 15.1.13-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
74-90-8	Hydrogen cyanide[e]	1.4 E-05	2.1 E-03
7439-92-1	Lead[e]	7.8 E-06	1.1 E-03
91-20-3	Naphthalene[e,g]	5.0 E-08	7.2 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e,h]	4.9 E-13	7.0 E-11
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin[e,h]	3.7 E-15	5.4 E-13
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[e,h]	8.8 E-15	1.3 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e,i]	7.5 E-15	1.1 E-12
123-38-6	Propionaldehyde[e,h]	2.8 E-08	4.0 E-06
115-07-1	Propylene[f,g]	1.5 E-07	2.2 E-05
129-00-0	Pyrene[d]	4.1 E-10	5.9 E-08
100-42-5	Styrene[e]	8.2 E-09	1.2 E-06
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e,h]	1.7 E-14	2.5 E-12
108-88-3	Toluene[e]	4.9 E-08	7.0 E-06
95-63-6	1,2,4-Trimethylbenzene[f,h]	5.5 E-09	7.9 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	9.6 E-09	1.4 E-06
95-47-6	o-Xylene[e,h]	1.6 E-08	2.3 E-06
7440-66-6	Zinc[f,g]	3.9 E-06	5.7 E-04

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.94 E-03 pounds per item. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.13

1. *Report No. 6 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2004.

2. *Detailed Test Plan No. 6 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2001.

3. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 6 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

5. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2004, April 2005, and May 2005.

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15.1.14 A136, M118 7.62-mm Ball Match Cartridge

15.1.14.1 Ordnance Description[1]

The M118 7.62-mm Ball Match Cartridge (DODIC A136) is designed and engineered specifically for high-accuracy weapons. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is used during combat and on firing ranges during training. It is fired from the M14, M21, M24, and M40A1 rifles. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

15.1.14.2 Emissions And Controls[1-5]

The primary emissions from the detonation of the M118 7.62-mm Ball Match Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.14-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.14-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.14-1 EMISSION FACTORS FOR THE USE OF DODIC A136, M118 7.62-MM BALL MATCH CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	1.6 E-03	2.5 E-01
630-08-0	CO	3.0 E-03	4.7 E-01
7439-92-1	Lead (Pb)[f]	6.2 E-06	9.8 E-04
74-82-8	Methane	2.3 E-05	3.6 E-03
--	Oxides of nitrogen (NO_X)[f]	4.1 E-05	6.5 E-03
--	PM-2.5[d]	4.7 E-05	7.4 E-03
--	PM-10[e]	6.2 E-05	9.8 E-03
12789-66-1	TSP	6.7 E-05	1.1 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.37 E-03. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.

Table 15.1.14-2 EMISSION FACTORS FOR THE USE OF DODIC A136, M118 7.62-MM BALL MATCH CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	2.7 E-10	4.2 E-08
208-96-8	Acenaphthylene[d]	1.6 E-09	2.5 E-07
75-07-0	Acetaldehyde[e]	1.4 E-07	2.1 E-05
75-05-8	Acetonitrile[e,g]	9.6 E-07	1.5 E-04
107-02-8	Acrolein[e]	4.7 E-08	7.4 E-06
107-13-1	Acrylonitrile[e,g]	3.6 E-08	5.7 E-06
7429-90-5	Aluminum[f]	4.2 E-07	6.5 E-05
7664-41-7	Ammonia[d,g]	7.1 E-05	1.1 E-02
120-12-7	Anthracene[e]	1.8 E-10	2.9 E-08
7440-36-0	Antimony[e]	2.1 E-06	3.4 E-04
7440-39-3	Barium[f]	1.3 E-06	2.1 E-04
71-43-2	Benzene[e,g]	5.5 E-07	8.6 E-05
56-55-3	Benzo[a]anthracene[e]	3.2 E-10	5.1 E-08
205-99-2	Benzo[b]fluoranthene[e]	5.3 E-10	8.3 E-08
207-08-9	Benzo[k]fluoranthene[e,g]	1.8 E-10	2.9 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	4.9 E-09	7.6 E-07
50-32-8	Benzo[a]pyrene[e,g]	6.4 E-10	1.0 E-07
192-97-2	Benzo[e]pyrene[d]	1.0 E-09	1.6 E-07
74-87-3	Chloromethane[e,g]	3.5 E-09	5.4 E-07
18540-29-9	Hexavalent chromium[e,i]	2.4 E-09	3.8 E-07
218-01-9	Chrysene[e]	3.6 E-10	5.6 E-08
7440-50-8	Copper[f]	2.3 E-05	3.6 E-03
57-12-5	Particulate cyanide[e]	2.5 E-07	4.0 E-05
84-74-2	Dibutyl phthalate[e,h]	3.1 E-08	4.9 E-06
75-71-8	Dichlorodifluoromethane[f,h]	9.1 E-10	1.4 E-07
107-06-2	1,2-Dichloroethane[e,g]	1.1 E-08	1.7 E-06
100-41-4	Ethylbenzene[e]	3.2 E-09	5.1 E-07
74-85-1	Ethylene[f]	5.1 E-07	8.0 E-05
117-81-7	bis(2-Ethylhexyl)phthalate[e,i]	1.9 E-07	2.9 E-05
206-44-0	Fluoranthene[e]	1.5 E-09	2.4 E-07

Table 15.1.14-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
86-73-7	Fluorene[d]	6.9 E-10	1.1 E-07
50-00-0	Formaldehyde[e,i]	4.0 E-07	6.3 E-05
74-90-8	Hydrogen cyanide[e]	1.9 E-05	3.0 E-03
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	6.3 E-10	1.0 E-07
7439-92-1	Lead[e]	6.2 E-06	9.8 E-04
91-20-3	Naphthalene[e,g]	2.7 E-08	4.2 E-06
85-01-8	Phenanthrene[e]	1.2 E-09	1.9 E-07
129-00-0	Pyrene[d]	7.7 E-09	1.2 E-06
100-42-5	Styrene[e,g]	7.1 E-09	1.1 E-06
108-88-3	Toluene[e]	4.2 E-08	6.6 E-06
7440-66-6	Zinc[f,g]	3.0 E-06	4.7 E-04

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.37 E-03. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.14

1. *Report No. 6 for the Firing Point Emission Study Phase II,* Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2004.

2. *Detailed Test Plan No. 6 for the Firing Point Emission Study Phase II,* Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2001.

3. *Hazard Classification of United States Military Explosives and Munitions,* U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 6 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

5. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2004, April 2005 and May 2005.

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15.1.15 A143, M80 7.62-mm Ball Cartridge

15.1.15.1 Ordnance Description[1,2]

The M80 7.62-mm Ball Cartridge (DODIC A143) is intended for use against unarmored targets. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is used during combat and on firing ranges during training. It is fired from the M14 rifle as well as the M60, M219, and M240 machine guns. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

The M80 7.62-mm Ball Cartridge is used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 872,000 M80 cartridges are used per year at a given training facility.[2]

15.1.15.2 Emissions And Controls[1, 3-6]

The primary emissions from the detonation of the M80 7.62-mm Ball Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.15-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.15-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.15-1 EMISSION FACTORS FOR THE USE OF DODIC A143, M80 7.62-MM BALL CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	1.2 E-03	2.0 E-01
630-08-0	CO	2.3 E-03	3.6 E-01
7439-92-1	Lead (Pb)[f]	4.9 E-06	7.8 E-04
74-82-8	Methane	1.0 E-05	1.7 E-03
--	Oxides of nitrogen (NO_X)[f]	9.7 E-05	1.5 E-02
--	PM-2.5[d]	3.8 E-05	6.1 E-03
--	PM-10[e]	5.1 E-05	8.1 E-03
12789-66-1	TSP	5.1 E-05	8.0 E-03

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.30 E-03 pounds per item. Reference 6.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.

Table 15.1.15-2 EMISSION FACTORS FOR THE USE OF DODIC A143, M80 7.62-MM BALL CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	4.3 E-11	6.9 E-09
208-96-8	Acenaphthylene[d]	5.8 E-10	9.2 E-08
75-05-8	Acetonitrile[e,g]	2.4 E-07	3.8 E-05
107-13-1	Acrylonitrile[e,g]	7.1 E-08	1.1 E-05
7429-90-5	Aluminum[f]	2.2 E-07	3.4 E-05
7664-41-7	Ammonia[d,g]	3.3 E-05	5.2 E-03
120-12-7	Anthracene[e]	6.8 E-11	1.1 E-08
7440-36-0	Antimony[e]	2.0 E-06	3.2 E-04
7440-39-3	Barium[f]	6.1 E-07	9.7 E-05
71-43-2	Benzene[e,g]	7.1 E-07	1.1 E-04
56-55-3	Benzo[a]anthracene[e]	3.4 E-10	5.4 E-08
205-99-2	Benzo[b]fluoranthene[e]	3.5 E-10	5.6 E-08
207-08-9	Benzo[k]fluoranthene[e,g]	1.7 E-10	2.8 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	2.4 E-09	3.8 E-07
50-32-8	Benzo[a]pyrene[e,g]	4.4 E-10	7.0 E-08
192-97-2	Benzo[e]pyrene[d]	7.2 E-10	1.1 E-07
106-99-0	1,3-Butadiene[e,g]	1.9 E-08	3.0 E-06
75-15-0	Carbon disulfide[e]	4.5 E-09	7.2 E-07
74-87-3	Chloromethane[e,g]	3.0 E-09	4.8 E-07
218-01-9	Chrysene[e]	3.2 E-10	5.0 E-08
7440-50-8	Copper[f]	1.0 E-05	1.6 E-03
57-12-5	Particulate cyanide[e,g]	6.6 E-07	1.0 E-04
53-70-3	Dibenz[a,h]anthracene[e]	3.8 E-11	6.0 E-09
107-06-2	1,2-Dichloroethane[e,g]	9.9 E-09	1.6 E-06
75-09-2	Dichloromethane[e]	1.0 E-07	1.6 E-05
--	Total dioxin/furan compounds[e]	1.2 E-14	1.9 E-12
100-41-4	Ethylbenzene[e]	3.2 E-09	5.0 E-07
74-85-1	Ethylene[f]	9.7 E-07	1.5 E-04
206-44-0	Fluoranthene[e]	6.4 E-10	1.0 E-07
86-73-7	Fluorene[d]	1.9 E-10	3.0 E-08

Table 15.1.15-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
50-00-0	Formaldehyde[e,h]	8.4 E-08	1.3 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	9.6 E-15	1.5 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	2.5 E-15	4.0 E-13
110-54-3	Hexane[e]	2.0 E-07	3.1 E-05
74-90-8	Hydrogen cyanide[e]	4.5 E-06	7.1 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	4.6 E-10	7.3 E-08
7439-92-1	Lead[e]	4.9 E-06	7.8 E-04
91-20-3	Naphthalene[e,g]	2.4 E-08	3.8 E-06
85-01-8	Phenanthrene[e]	3.1 E-10	4.9 E-08
115-07-1	Propylene[f,g]	1.8 E-07	2.9 E-05
129-00-0	Pyrene[d]	2.2 E-09	3.5 E-07
100-42-5	Styrene[e,g]	9.3 E-09	1.5 E-06
108-88-3	Toluene[e]	4.4 E-08	7.0 E-06
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	5.3 E-09	8.4 E-07
95-47-6	o-Xylene[e,h]	4.2 E-09	6.7 E-07
7440-66-6	Zinc[f,g]	1.4 E-06	2.2 E-04

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.30 E-03 pounds per item. Reference 6.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.

References For Section 15.1.15

1. *Report No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2002.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M80 7.62-mm Ball Cartridge, Department of Defense Identification Code: A122*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, December 2000.

3. *Detailed Test Plan No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

4. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

5. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 3 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

6. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.

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15.1.16 A171, M852 7.62-mm Ball Match Cartridge

15.1.16.1 Ordnance Description[1]

The M852 7.62-mm Ball Match Cartridge (DODIC A171) is designed and engineered specifically for competitive weapons. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is intended only for competitive matches and selective combat use. The cartridge is fired from the M14 National Match rifle. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

15.1.16.2 Emissions And Controls[1-5]

The primary emissions from the detonation of the M852 7.62-mm Ball Match Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.16-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.16-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.16-1 EMISSION FACTORS FOR THE USE OF DODIC A171, M852 7.62-MM BALL MATCH CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	1.7 E-03	2.8 E-01
630-08-0	CO	3.0 E-03	4.9 E-01
7439-92-1	Lead (Pb)[f]	5.0 E-06	8.3 E-04
74-82-8	Methane	1.1 E-05	1.8 E-03
--	Oxides of nitrogen (NO_X)[f]	4.1 E-05	6.7 E-03
--	PM-2.5[d]	5.8 E-05	9.5 E-03
--	PM-10[e]	8.2 E-05	1.4 E-02
12789-66-1	TSP	8.6 E-05	1.4 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.08 E-03 pounds per item. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.

Table 15.1.16-2 EMISSION FACTORS FOR THE USE OF DODIC A171, M852 7.62-MM BALL MATCH CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	4.6 E-10	7.6 E-08
208-96-8	Acenaphthylene[d]	2.4 E-09	3.9 E-07
75-07-0	Acetaldehyde[e]	3.9 E-07	6.4 E-05
75-05-8	Acetonitrile[e,g]	4.8 E-07	8.0 E-05
107-02-8	Acrolein[e]	7.7 E-08	1.3 E-05
107-13-1	Acrylonitrile[e,g]	5.2 E-08	8.6 E-06
7429-90-5	Aluminum[f]	3.6 E-07	6.0 E-05
7664-41-7	Ammonia[d,g]	6.8 E-05	1.1 E-02
120-12-7	Anthracene[e]	1.0 E-10	1.7 E-08
7440-36-0	Antimony[e]	2.0 E-06	3.3 E-04
7440-39-3	Barium[f]	1.3 E-06	2.2 E-04
71-43-2	Benzene[e,g]	5.3 E-07	8.8 E-05
74-87-3	Chloromethane[e,g]	3.1 E-09	5.0 E-07
18540-29-9	Hexavalent chromium[e,i]	1.7 E-09	2.9 E-07
7440-50-8	Copper[f]	2.2 E-05	3.6 E-03
57-12-5	Particulate cyanide[e,g]	9.9 E-07	1.6 E-04
107-06-2	1,2-Dichloroethane[e,g]	1.1 E-08	1.9 E-06
--	Total dioxin/furan compounds[e]	2.5 E-13	4.1 E-11
100-41-4	Ethylbenzene[e]	4.8 E-09	7.9 E-07
74-85-1	Ethylene[f]	7.7 E-07	1.3 E-04
86-73-7	Fluorene[d]	8.8 E-10	1.4 E-07
50-00-0	Formaldehyde[e,i]	2.5 E-07	4.2 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	6.5 E-14	1.1 E-11
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	3.9 E-14	6.5 E-12
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e,h]	1.2 E-15	2.0 E-13
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e,h]	2.2 E-15	3.6 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e,g]	1.4 E-14	2.4 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	5.2 E-15	8.5 E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e,g]	1.2 E-14	2.0 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	5.7 E-15	9.5 E-13

Table 15.1.16-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e,h]	5.8 E-15	9.5 E-13
7647-01-0	Hydrochloric acid[e,i]	7.7 E-07	1.3 E-04
74-90-8	Hydrogen cyanide[e]	2.2 E-05	3.6 E-03
7439-92-1	Lead[e]	5.0 E-06	8.3 E-04
91-20-3	Naphthalene[e,g]	3.4 E-08	5.6 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e,h]	5.9 E-14	9.8 E-12
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin[e,h]	6.2 E-15	1.0 E-12
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[e]	7.1 E-15	1.2 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e,h]	7.5 E-15	1.2 E-12
100-42-5	Styrene[e,g]	1.3 E-08	2.2 E-06
7664-93-9	Sulfuric acid[f,g]	7.3 E-07	1.2 E-04
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	1.8 E-14	3.0 E-12
108-88-3	Toluene[e]	6.3 E-08	1.0 E-05
95-63-6	1,2,4-Trimethylbenzene[f,g]	9.1 E-10	1.5 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	1.6 E-09	2.6 E-07
95-47-6	o-Xylene[e,h]	8.0 E-10	1.3 E-07
7440-66-6	Zinc[f,g]	2.3 E-06	3.8 E-04

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.08 E-03 pounds per item. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.16

1. *Report No. 6 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2004.

2. *Detailed Test Plan No. 6 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2001.

3. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 6 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

5. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2004, April 2005, and May 2005.

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15.1.17 A182, M1 .30 Caliber Ball Cartridge

15.1.17.1 Ordnance Description[1,2]

The M1 .30 Caliber Ball Cartridge (DODIC A182) is a general use ammunition intended for anti-personnel and unarmored targets. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is used during combat and on firing ranges during training. The cartridge is fired from the M1, M2, and M3 series carbines. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

15.1.17.2 Emissions And Controls[1-5]

The primary emissions from the detonation of the M1 .30 Caliber Ball Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.17-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.17-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW). The emission factors presented in Table 15.1.17-1 and Table 15.1.17-2 are based on three trials (or test runs).

Table 15.1.17-1 EMISSION FACTORS FOR THE USE OF DODIC A182, M1 .30 CALIBER BALL CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	5.5 E-04	2.9 E-01
630-08-0	CO	8.6 E-04	4.5 E-01
7439-92-1	Lead (Pb)[f]	3.9 E-06	2.1 E-03
74-82-8	Methane	3.6 E-06	1.9 E-03
--	Oxides of nitrogen (NO_X)[f]	2.9 E-05	1.5 E-02
--	PM-2.5[d]	1.0 E-05	5.4 E-03
--	PM-10[e]	1.4 E-05	7.1 E-03
12789-66-1	TSP	1.6 E-05	8.5 E-03

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 1.91 E-03 pounds per item. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.

Table 15.1.17-2 EMISSION FACTORS FOR THE USE OF DODIC A182,
M1 .30 CALIBER BALL CARTRIDGE -
HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	1.3 E-10	6.7 E-08
208-96-8	Acenaphthylene[d]	9.2 E-10	4.8 E-07
75-07-0	Acetaldehyde[e]	3.7 E-07	1.9 E-04
75-05-8	Acetonitrile[e,g]	4.4 E-07	2.3 E-04
107-02-8	Acrolein[e]	2.8 E-07	1.4 E-04
107-13-1	Acrylonitrile[e,g]	6.8 E-08	3.5 E-05
7429-90-5	Aluminum[f]	2.4 E-08	1.3 E-05
7664-41-7	Ammonia[d,g]	7.9 E-06	4.1 E-03
120-12-7	Anthracene[e]	3.8 E-11	2.0 E-08
7440-36-0	Antimony[e]	1.2 E-08	6.2 E-06
7440-39-3	Barium[f]	1.2 E-06	6.4 E-04
71-43-2	Benzene[e,g]	5.5 E-07	2.9 E-04
56-55-3	Benzo[a]anthracene[e]	6.6 E-11	3.5 E-08
205-99-2	Benzo[b]fluoranthene[e]	9.5 E-11	5.0 E-08
207-08-9	Benzo[k]fluoranthene[e,g]	4.6 E-11	2.4 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	2.7 E-10	1.4 E-07
50-32-8	Benzo[a]pyrene[e,g]	8.6 E-11	4.5 E-08
192-97-2	Benzo[e]pyrene[d]	9.5 E-11	5.0 E-08
123-72-8	Butyraldehyde[d,i]	2.2 E-08	1.1 E-05
74-87-3	Chloromethane[e]	1.2 E-09	6.1 E-07
218-01-9	Chrysene[e]	6.2 E-11	3.2 E-08
7440-50-8	Copper[f]	2.4 E-06	1.3 E-03
107-06-2	1,2-Dichloroethane[e,g]	1.0 E-08	5.4 E-06
--	Total dioxin/furan compounds[e]	2.1 E-14	1.1 E-11
100-41-4	Ethylbenzene[e]	3.8 E-09	2.0 E-06
74-85-1	Ethylene[f]	7.6 E-07	4.0 E-04
206-44-0	Fluoranthene[e]	8.5 E-11	4.5 E-08
86-73-7	Fluorene[d]	2.1 E-10	1.1 E-07
50-00-0	Formaldehyde[e,i]	1.1 E-06	6.0 E-04
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e,h]	1.4 E-14	7.6 E-12

Table 15.1.17-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	2.2 E-15	1.1 E-12
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e]	2.2 E-15	1.2 E-12
74-90-8	Hydrogen cyanide[e]	1.7 E-06	9.0 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	1.1 E-10	5.7 E-08
7439-92-1	Lead[e]	3.9 E-06	2.1 E-03
91-20-3	Naphthalene[e,g]	1.6 E-08	8.5 E-06
85-01-8	Phenanthrene[e]	1.9 E-10	9.9 E-08
123-38-6	Propionaldehyde[e,h]	3.4 E-08	1.8 E-05
115-07-1	Propylene[f,g]	8.0 E-08	4.2 E-05
129-00-0	Pyrene[d]	1.3 E-10	6.8 E-08
100-42-5	Styrene[e,g]	8.5 E-09	4.4 E-06
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e,h]	2.0 E-15	1.0 E-12
108-88-3	Toluene[e]	1.9 E-07	1.0 E-04
95-63-6	1,2,4-Trimethylbenzene[f,h]	3.8 E-10	2.0 E-07
7440-66-6	Zinc[f,g]	3.5 E-07	1.9 E-04

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 1.91 E-03 pounds per item. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.17

1. *Report No. 6 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2004.

2. *Detailed Test Plan No. 6 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2001.

3. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 6 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

5. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2004, April 2005, and May.

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15.1.18 A212, M2 .30 Caliber Ball Cartridge

15.1.18.1 Ordnance Description[1]

The M2 .30 Caliber Ball Cartridge (DODIC A212) is a general use ammunition intended for anti-personnel and unarmored targets. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is used during combat and on firing ranges during training. The cartridge is fired from the M1 rifle, the M1918A1 automatic rifle series, and the M37 and M1919 series machine guns. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

15.1.18.2 Emissions And Controls[1-5]

The primary emissions from the detonation of the M2 .30 Caliber Ball Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.18-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.18-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.18-1 EMISSION FACTORS FOR THE USE OF DODIC A212, M2 .30 CALIBER BALL CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	1.9 E-03	2.6 E-01
630-08-0	CO	3.0 E-03	4.2 E-01
7439-92-1	Lead (Pb)[f]	1.8 E-05	2.5 E-03
74-82-8	Methane	7.3 E-06	1.0 E-03
--	Oxides of nitrogen (NO_X)[f]	1.3 E-05	1.8 E-03
--	PM-2.5[d]	7.3 E-05	1.0 E-02
--	PM-10[e]	9.4 E-05	1.3 E-02
12789-66-1	TSP	9.6 E-05	1.3 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 7.23 E-03 pounds per item. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.

Table 15.1.18-2 EMISSION FACTORS FOR THE USE OF DODIC A212, M2 .30 CALIBER BALL CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	2.0 E-10	2.7 E-08
208-96-8	Acenaphthylene[d]	1.9 E-09	2.6 E-07
75-07-0	Acetaldehyde[e]	1.2 E-07	1.6 E-05
75-05-8	Acetonitrile[e,g]	3.1 E-07	4.2 E-05
107-02-8	Acrolein[e]	7.7 E-08	1.1 E-05
107-13-1	Acrylonitrile[e,g]	4.0 E-08	5.6 E-06
7429-90-5	Aluminum[f]	2.8 E-08	3.8 E-06
7664-41-7	Ammonia[d,g]	4.5 E-05	6.2 E-03
120-12-7	Anthracene[e]	1.1 E-10	1.5 E-08
7440-36-0	Antimony[e]	1.6 E-06	2.2 E-04
7440-39-3	Barium[f]	9.4 E-07	1.3 E-04
71-43-2	Benzene[e,g]	3.4 E-07	4.7 E-05
56-55-3	Benzo[a]anthracene[e]	2.6 E-10	3.5 E-08
205-99-2	Benzo[b]fluoranthene[e]	3.9 E-10	5.4 E-08
207-08-9	Benzo[k]fluoranthene[e,g]	2.1 E-10	3.0 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	8.2 E-10	1.1 E-07
50-32-8	Benzo[a]pyrene[e,g]	3.7 E-10	5.1 E-08
192-97-2	Benzo[e]pyrene[d]	3.7 E-10	5.1 E-08
74-87-3	Chloromethane[e]	1.8 E-09	2.5 E-07
18540-29-9	Hexavalent chromium[e,i]	4.2 E-09	5.9 E-07
218-01-9	Chrysene[e]	2.4 E-10	3.4 E-08
7440-50-8	Copper[f]	1.1 E-05	1.6 E-03
57-12-5	Particulate cyanide[e,g]	2.1 E-06	2.9 E-04
75-71-8	Dichlorodifluoromethane[f,h]	9.1 E-10	1.3 E-07
--	Total dioxin/furan compounds[e]	9.2 E-14	1.3 E-11
100-41-4	Ethylbenzene[e]	7.3 E-09	1.0 E-06
74-85-1	Ethylene[f]	9.2 E-07	1.3 E-04
117-81-7	bis(2-Ethylhexyl)phthalate[e,i]	4.0 E-07	5.5 E-05
206-44-0	Fluoranthene[e]	2.7 E-10	3.8 E-08
86-73-7	Fluorene[d]	6.3 E-10	8.7 E-08

Table 15.1.18-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
50-00-0	Formaldehyde[e,i]	8.8 E-10	1.2 E-07
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	1.3 E-14	1.9 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	2.2 E-14	3.1 E-12
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e,g]	1.0 E-14	1.4 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	6.5 E-15	9.0 E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e,g]	3.7 E-16	5.1 E-14
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	2.7 E-15	3.8 E-13
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e,h]	2.4 E-15	3.3 E-13
74-90-8	Hydrogen cyanide[e]	5.3 E-06	7.4 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	4.3 E-10	6.0 E-08
7439-92-1	Lead[e]	1.8 E-05	2.5 E-03
1634-04-4	Methyl tert-butyl ether[e,h]	4.0 E-09	5.6 E-07
91-20-3	Naphthalene[e,g]	2.0 E-08	2.7 E-06
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin[e,h]	2.5 E-15	3.5 E-13
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[e]	4.4 E-15	6.1 E-13
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e,h]	5.4 E-15	7.5 E-13
85-01-8	Phenanthrene[e]	5.1 E-10	7.1 E-08
115-07-1	Propylene[f,g]	2.3 E-07	3.1 E-05
129-00-0	Pyrene[d]	4.5 E-10	6.3 E-08
100-42-5	Styrene[e,g]	1.6 E-08	2.2 E-06
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e,i]	4.8 E-15	6.6 E-13
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	1.7 E-14	2.4 E-12
108-88-3	Toluene[e]	9.1 E-08	1.3 E-05
95-47-6	o-Xylene[e,h]	1.6 E-08	2.2 E-06
7440-66-6	Zinc[f,g]	2.1 E-06	2.9 E-04

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 7.23 E-03 pounds per item. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.18

1. *Report No. 6 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2004.

2. *Detailed Test Plan No. 6 for the Firing Point Emission Study Phase II,* Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2001.

3. *Hazard Classification of United States Military Explosives and Munitions,* U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 6 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

5. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2004, April 2005, and May 2005.

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15.1.20 A247, M72 .30 Caliber Ball Match Cartridge

15.1.20.1 Ordnance Description[1]

The M72 .30 Caliber Ball Match Cartridge (DODIC A247) is designed and engineered specifically for competitive weapons. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is intended only for competitive matches and selective combat use. The cartridge is fired from the M1 and .30 Caliber National Match rifles. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

15.1.20.2 Emissions And Controls[1-5]

The primary emissions from the detonation of the M72 .30 Caliber Ball Match Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.20-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.20-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.20-1 EMISSION FACTORS FOR THE USE OF DODIC A247, M72 .30 CALIBER BALL MATCH CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	1.8 E-03	2.5 E-01
630-08-0	CO	3.0 E-03	4.2 E-01
7439-92-1	Lead (Pb)[f]	1.4 E-05	2.0 E-03
74-82-8	Methane	5.0 E-06	6.9 E-04
--	Oxides of nitrogen (NO_X)[f]	1.6 E-05	2.2 E-03
--	PM-2.5[d]	6.0 E-05	8.2 E-03
--	PM-10[e]	7.6 E-05	1.1 E-02
12789-66-1	TSP	8.1 E-05	1.1 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 7.23 E-03 pounds per item. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.

Table 15.1.20-2 EMISSION FACTORS FOR THE USE OF DODIC A247, M72 .30 CALIBER BALL MATCH CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	2.0 E-10	2.8 E-08
208-96-8	Acenaphthylene[d]	1.6 E-09	2.2 E-07
75-07-0	Acetaldehyde[e]	5.2 E-08	7.2 E-06
75-05-8	Acetonitrile[e,g]	2.4 E-07	3.3 E-05
107-02-8	Acrolein[e]	3.0 E-08	4.1 E-06
107-13-1	Acrylonitrile[e,g]	2.4 E-08	3.3 E-06
7664-41-7	Ammonia[d,g]	3.9 E-05	5.4 E-03
120-12-7	Anthracene[e]	9.3 E-11	1.3 E-08
7440-36-0	Antimony[e]	2.2 E-06	3.0 E-04
7440-39-3	Barium[f]	1.3 E-06	1.7 E-04
71-43-2	Benzene[e,g]	2.1 E-07	2.9 E-05
56-55-3	Benzo[a]anthracene[e]	3.5 E-10	4.8 E-08
205-99-2	Benzo[b]fluoranthene[e]	5.2 E-10	7.3 E-08
207-08-9	Benzo[k]fluoranthene[e,g]	2.6 E-10	3.6 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	1.1 E-09	1.5 E-07
50-32-8	Benzo[a]pyrene[e,g]	5.4 E-10	7.4 E-08
192-97-2	Benzo[e]pyrene[d]	6.3 E-10	8.7 E-08
218-01-9	Chrysene[e]	3.7 E-10	5.1 E-08
7440-50-8	Copper[f]	1.0 E-05	1.4 E-03
57-12-5	Particulate cyanide[e,g]	6.1 E-07	8.4 E-05
53-70-3	Dibenz[a,h]anthracene[e]	5.4 E-11	7.5 E-09
--	Total dioxin/furan compounds[e]	1.1 E-16	1.6 E-14
100-41-4	Ethylbenzene[e]	1.9 E-09	2.6 E-07
74-85-1	Ethylene[f]	3.9 E-07	5.4 E-05
117-81-7	bis(2-Ethylhexyl)phthalate[e,h]	8.2 E-08	1.1 E-05
206-44-0	Fluoranthene[e]	3.3 E-10	4.6 E-08
86-73-7	Fluorene[d]	5.4 E-10	7.5 E-08
50-00-0	Formaldehyde[e,i]	2.0 E-07	2.8 E-05
74-90-8	Hydrogen cyanide[e]	7.7 E-06	1.1 E-03
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	5.4 E-10	7.5 E-08

Table 15.1.20-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7439-92-1	Lead[e]	1.4 E-05	2.0 E-03
91-20-3	Naphthalene[e,g]	1.8 E-08	2.5 E-06
129-00-0	Pyrene[d]	5.6 E-10	7.7 E-08
100-42-5	Styrene[e,g]	9.5 E-09	1.3 E-06
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e,h]	1.1 E-16	1.6 E-14
108-88-3	Toluene[e]	6.3 E-08	8.7 E-06
95-63-6	1,2,4-Trimethylbenzene[f,i]	7.5 E-09	1.0 E-06
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	7.2 E-09	1.0 E-06
95-47-6	o-Xylene[e,h]	4.0 E-09	5.6 E-07
7440-66-6	Zinc[f,g]	1.7 E-06	2.3 E-04

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 7.23 E-03 pounds per item. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.20

1. *Report No. 6 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2004.

2. *Detailed Test Plan No. 6 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2001.

3. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 6 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

5. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2004, April 2005, and May 2005.

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15.1.21 A363, M882 9-mm Ball Cartridge

15.1.21.1 Ordnance Description[1,2]

The M882 9-mm Ball Cartridge (DODIC A363) is fired from the M9 pistol. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is used during combat and on firing ranges during training. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

The M882 9-mm Ball Cartridge is used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 76,000 M882 cartridges are used per year at a given training facility.[2]

15.1.21.2 Emissions And Controls[1, 3-6]

The primary emissions from the detonation of the M882 9-mm Ball Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.21-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.21-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.21-1 EMISSION FACTORS FOR THE USE OF DODIC A363, M882 9-MM BALL CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	2.0 E-04	2.6 E-01
630-08-0	CO	3.1 E-04	3.9 E-01
7439-92-1	Lead (Pb)[f]	6.8 E-06	8.6 E-03
74-82-8	Methane	1.4 E-06	1.8 E-03
--	Oxides of nitrogen (NO_X)[f]	1.5 E-05	1.9 E-02
--	PM-2.5[d]	2.0 E-05	2.6 E-02
--	PM-10[e]	2.4 E-05	3.0 E-02
7446-09-5	Sulfur dioxide (SO_2)[g]	8.2 E-08	1.0 E-04
12789-66-1	TSP	2.1 E-05	2.7 E-02

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 7.89 E-04 pounds per item. Reference 6.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.
[g] EMISSION FACTOR RATING C.

Table 15.1.21-2 EMISSION FACTORS FOR THE USE OF DODIC A363, M882 9-MM BALL CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	3.6 E-11	4.6 E-08
208-96-8	Acenaphthylene[d]	2.4 E-10	3.1 E-07
75-05-8	Acetonitrile[e,g]	4.5 E-08	5.7 E-05
107-02-8	Acrolein[e]	8.1 E-09	1.0 E-05
107-13-1	Acrylonitrile[e,g]	2.2 E-08	2.8 E-05
7429-90-5	Aluminum[f]	7.0 E-08	8.9 E-05
7664-41-7	Ammonia[d,g]	2.1 E-06	2.6 E-03
120-12-7	Anthracene[e]	3.9 E-11	4.9 E-08
7440-36-0	Antimony[e]	2.0 E-06	2.6 E-03
7440-38-2	Arsenic[e,h]	4.5 E-09	5.7 E-06
7440-39-3	Barium[f]	1.7 E-06	2.2 E-03
71-43-2	Benzene[e,g]	1.9 E-07	2.4 E-04
56-55-3	Benzo[a]anthracene[e]	2.3 E-10	2.9 E-07
205-99-2	Benzo[b]fluoranthene[e]	2.5 E-10	3.2 E-07
207-08-9	Benzo[k]fluoranthene[e,g]	1.6 E-10	2.0 E-07
191-24-2	Benzo[g,h,i]perylene[e,g]	6.7 E-10	8.5 E-07
50-32-8	Benzo[a]pyrene[e,g]	2.3 E-10	2.9 E-07
192-97-2	Benzo[e]pyrene[d]	2.7 E-10	3.4 E-07
106-99-0	1,3-Butadiene[e]	1.2 E-09	1.5 E-06
75-15-0	Carbon disulfide[e]	1.6 E-09	2.0 E-06
218-01-9	Chrysene[e]	2.4 E-10	3.0 E-07
7440-50-8	Copper[f]	9.8 E-07	1.2 E-03
53-70-3	Dibenz[a,h]anthracene[e]	3.0 E-11	3.9 E-08
75-71-8	Dichlorodifluoromethane[f,h]	1.7 E-10	2.1 E-07
107-06-2	1,2-Dichloroethane[e,g]	2.8 E-09	3.5 E-06
100-41-4	Ethylbenzene[e]	1.5 E-09	1.9 E-06
74-85-1	Ethylene[f]	5.2 E-07	6.6 E-04
206-44-0	Fluoranthene[e]	4.5 E-10	5.6 E-07
86-73-7	Fluorene[d]	1.1 E-10	1.3 E-07
50-00-0	Formaldehyde[e,h]	5.2 E-08	6.6 E-05

Table 15.1.21-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
110-54-3	Hexane[e,h]	4.9 E-07	6.3 E-04
74-90-8	Hydrogen cyanide[e]	1.8 E-06	2.3 E-03
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	3.0 E-10	3.8 E-07
7439-92-1	Lead[e]	6.8 E-06	8.6 E-03
75-09-2	Methylene chloride[e,h]	2.3 E-07	2.9 E-04
91-20-3	Naphthalene[e,g]	4.5 E-09	5.6 E-06
7697-37-2	Nitric acid[f,h]	1.9 E-07	2.4 E-04
85-01-8	Phenanthrene[e]	2.4 E-10	3.1 E-07
115-07-1	Propylene[f,g]	1.5 E-07	1.9 E-04
129-00-0	Pyrene[d]	1.0 E-09	1.3 E-06
100-42-5	Styrene[e,g]	2.1 E-09	2.6 E-06
7664-93-9	Sulfuric acid[f,h]	6.4 E-08	8.1 E-05
108-88-3	Toluene[e]	3.1 E-08	3.9 E-05
71-55-6	1,1,1-Trichloroethane[e]	1.9 E-10	2.4 E-07
95-63-6	1,2,4-Trimethylbenzene[f,h]	8.5 E-10	1.1 E-06
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	4.5 E-09	5.7 E-06
95-47-6	o-Xylene[e,h]	3.0 E-09	3.8 E-06
7440-66-6	Zinc[f,g]	1.6 E-07	2.1 E-04

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 7.89 E-04 pounds per item. Reference 6.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.

References For Section 15.1.21

1. *Report No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2002.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M882 9-mm Ball Cartridge, Department of Defense Identification Code: A363*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, December 2000.

3. *Detailed Test Plan No. 3 for the Firing Point Emission Study Phase II,* Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

4. *Hazard Classification of United States Military Explosives and Munitions,* U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

5. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 3 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

6. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.

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15.1.25 A475, M1911 .45 Caliber Ball Cartridge

15.1.25.1 Ordnance Description[1,2]

The M1911 .45 Caliber Ball Cartridge (DODIC A475) is fired from the M1911A1 pistol and the M3A1 submachine gun. It consists of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. This cartridge is used during combat and on firing ranges during training. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the bullet are not addressed in this section.

The M1911 .45 Caliber Ball Cartridge is used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 1,000 M1911 cartridges are used per year at a given training facility.[2]

15.1.25.2 Emissions And Controls[1, 3-6]

The primary emissions from the detonation of the M1911 .45 Caliber Ball Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.25-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.25-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.25-1 EMISSION FACTORS FOR THE USE OF DODIC A475, M1911 .45 CALIBER BALL CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	2.2 E-04	2.8 E-01
630-08-0	CO	2.6 E-04	3.4 E-01
7439-92-1	Lead (Pb)[f]	1.2 E-05	1.6 E-02
74-82-8	Methane	7.8 E-07	1.0 E-03
--	Oxides of nitrogen (NO_X)[f]	8.1 E-06	1.0 E-02
--	PM-2.5[d]	3.1 E-05	4.0 E-02
--	PM-10[e]	3.7 E-05	4.7 E-02
12789-66-1	TSP	3.2 E-05	4.2 E-02

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 7.80 E-04 pounds per item. Reference 6.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.

Table 15.1.25-2 EMISSION FACTORS FOR THE USE OF DODIC A475, M1911 .45 CALIBER BALL CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	2.2 E-11	2.8 E-08
75-05-8	Acetonitrile[e,g]	1.6 E-08	2.0 E-05
107-13-1	Acrylonitrile[e,g]	9.1 E-09	1.2 E-05
7429-90-5	Aluminum[f]	1.4 E-07	1.8 E-04
7440-36-0	Antimony[e]	2.9 E-06	3.7 E-03
7440-38-2	Arsenic[e,i]	5.2 E-09	6.6 E-06
7440-39-3	Barium[f]	1.5 E-06	1.9 E-03
71-43-2	Benzene[e,g]	1.3 E-07	1.6 E-04
56-55-3	Benzo[a]anthracene[e]	1.1 E-10	1.5 E-07
205-99-2	Benzo[b]fluoranthene[e]	1.4 E-10	1.7 E-07
207-08-9	Benzo[k]fluoranthene[e,g]	9.2 E-11	1.2 E-07
191-24-2	Benzo[g,h,i]perylene[e,g]	1.6 E-10	2.1 E-07
192-97-2	Benzo[e]pyrene[d]	1.1 E-10	1.5 E-07
106-99-0	1,3-Butadiene[e,g]	2.5 E-09	3.2 E-06
75-15-0	Carbon disulfide[e]	6.5 E-09	8.4 E-06
74-87-3	Chloromethane[e,g]	4.3 E-10	5.5 E-07
218-01-9	Chrysene[e]	1.4 E-10	1.8 E-07
7440-50-8	Copper[f]	1.5 E-06	2.0 E-03
53-70-3	Dibenz[a,h]anthracene[e]	1.6 E-11	2.0 E-08
107-06-2	1,2-Dichloroethane[e,g]	2.3 E-09	3.0 E-06
--	Total dioxin/furan compounds[e]	3.7 E-15	4.7 E-12
100-41-4	Ethylbenzene[e]	1.3 E-09	1.7 E-06
74-85-1	Ethylene[f]	3.9 E-07	5.0 E-04
206-44-0	Fluoranthene[e]	2.6 E-10	3.3 E-07
86-73-7	Fluorene[d]	9.8 E-11	1.3 E-07
50-00-0	Formaldehyde[e,h]	2.5 E-08	3.2 E-05
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e,g]	8.5 E-16	1.1 E-12
110-54-3	Hexane[e]	6.3 E-08	8.0 E-05
74-90-8	Hydrogen cyanide[e,h]	1.0 E-06	1.3 E-03
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	1.2 E-10	1.5 E-07

Table 15.1.25-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7439-92-1	Lead[e]	1.2 E-05	1.6 E-02
75-09-2	Methylene chloride[e,h]	5.0 E-08	6.5 E-05
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	2.1 E-15	2.6 E-12
85-01-8	Phenanthrene[e]	1.6 E-10	2.1 E-07
115-07-1	Propylene[f,g]	1.2 E-07	1.6 E-04
129-00-0	Pyrene[d]	3.9 E-10	4.9 E-07
100-42-5	Styrene[e,g]	3.2 E-09	4.2 E-06
108-88-3	Toluene[e]	2.5 E-08	3.2 E-05
95-63-6	1,2,4-Trimethylbenzene[f,h]	3.1 E-10	3.9 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	3.3 E-09	4.2 E-06
95-47-6	o-Xylene[e,h]	1.7 E-09	2.1 E-06
7440-66-6	Zinc[f,g]	2.4 E-07	3.1 E-04

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 7.80 E-04 pounds per item. Reference 6.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.1.25

1. *Report No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2002.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M1911 .45 Caliber Ball Cartridge, Department of Defense Identification Code: A475*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, June 2001.

3. *Detailed Test Plan No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

4. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

5. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 3 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

6. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.

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15.1.28 A557, M33 .50 Caliber Ball Cartridge and M17 .50 Caliber Tracer Cartridge

15.1.28.1 Ordnance Description[1,2,3]

The M33 .50 Caliber Ball Cartridge (DODIC A557) and the M17 .50 Caliber Tracer Cartridge (DODIC A557) are fired from the M2 and M85 machine guns. Both the M33 .50 Caliber Ball Cartridge and the M17 .50 Caliber Tracer Cartridge consist of a cartridge case, primer, propelling charge, and bullet. The propelling charge, activated by the primer, provides the force to send the bullet to the target. When these rounds are used, they are typically fired in a ratio of one tracer round to four ball rounds. The visible trail left by the tracer can be used to see where the bullet hits the target, or to make adjustments in the firing position, if necessary. This cartridge is used during combat and on firing ranges during training.

Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the projectile are not addressed in this section. Furthermore, emissions associated with the combustion of the tracer composition are not addressed in this section.

The M33 .50 Caliber Ball Cartridge and the M17 .50 Caliber Tracer Cartridge are used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 6,550 M33 cartridges and 324,000 M17 cartridges are used per year at a given training facility.[2,3]

15.1.28.2 Emissions And Controls[1, 4-7]

The primary emissions from the detonation of the M33 .50 Caliber Ball Cartridge and the M17 .50 Caliber Tracer Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.28-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP) from the detonation of the M33 .50 Caliber Ball Cartridge. Table 15.1.28-2 presents emission factors for hazardous air pollutants and toxic chemicals from the detonation of the M33 .50 Caliber Ball Cartridge. Similar data are provided for the M17 .50 Caliber Tracer Cartridge in Tables 15.1.28-3 and 15.1.28-4. In all four tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.1.28-1 EMISSION FACTORS FOR THE USE OF DODIC A557, M33 .50 CALIBER BALL CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	5.1 E-03	1.5 E-01
630-08-0	CO	1.1 E-02	3.3 E-01
7439-92-1	Lead (Pb)[f]	1.3 E-05	4.0 E-04
74-82-8	Methane	1.3 E-04	3.8 E-03
--	Oxides of nitrogen (NO_X)[f]	1.2 E-03	3.6 E-02
--	PM-2.5[d]	1.9 E-04	5.6 E-03
--	PM-10[e]	3.1 E-04	9.3 E-03
12789-66-1	TSP	3.2 E-04	9.6 E-03

[a] Factors represent uncontrolled emissions. References 1, 4, and 7.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.36 E-02 pounds per item. Reference 7.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.

Table 15.1.28-2 EMISSION FACTORS FOR THE USE OF DODIC A557, M33 .50 CALIBER BALL CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	1.5 E-09	4.5 E-08
208-96-8	Acenaphthylene[d]	6.9 E-09	2.1 E-07
75-05-8	Acetonitrile[e]	1.2 E-06	3.7 E-05
107-13-1	Acrylonitrile[e,g]	2.7 E-07	8.1 E-06
7429-90-5	Aluminum[f]	7.7 E-07	2.3 E-05
7664-41-7	Ammonia[d,g]	3.3 E-04	9.9 E-03
120-12-7	Anthracene[e]	7.2 E-10	2.2 E-08
7440-36-0	Antimony[e]	3.3 E-06	1.0 E-04
7440-39-3	Barium[f]	2.2 E-06	6.4 E-05
71-43-2	Benzene[e,g]	4.0 E-06	1.2 E-04
56-55-3	Benzo[a]anthracene[e]	1.7 E-09	5.1 E-08
205-99-2	Benzo[b]fluoranthene[e]	2.6 E-09	7.8 E-08
207-08-9	Benzo[k]fluoranthene[e,g]	1.2 E-09	3.6 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	1.3 E-08	3.9 E-07
50-32-8	Benzo[a]pyrene[e,g]	3.7 E-09	1.1 E-07
192-97-2	Benzo[e]pyrene[d]	5.4 E-09	1.6 E-07
106-99-0	1,3-Butadiene[e,g]	1.5 E-07	4.5 E-06
74-87-3	Chloromethane[e,g]	2.6 E-09	7.8 E-08
218-01-9	Chrysene[e]	2.1 E-09	6.3 E-08
7440-50-8	Copper[f]	4.6 E-05	1.4 E-03
57-12-5	Particulate cyanide[e,g]	1.1 E-05	3.4 E-04
53-70-3	Dibenz[a,h]anthracene[e]	3.0 E-10	8.8 E-09
107-06-2	1,2-Dichloroethane[e,g]	7.4 E-08	2.2 E-06
--	Total dioxin/furan compounds[e]	6.5 E-14	1.9 E-12
100-41-4	Ethylbenzene[e]	3.0 E-08	9.0 E-07
74-85-1	Ethylene[f]	4.0 E-06	1.2 E-04
206-44-0	Fluoranthene[e]	3.1 E-09	9.1 E-08
86-73-7	Fluorene[d]	3.4 E-09	1.0 E-07
50-00-0	Formaldehyde[e,h]	4.5 E-07	1.3 E-05
74-90-8	Hydrogen cyanide[e]	1.6 E-04	4.8 E-03

Table 15.1.28-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	3.0 E-09	8.8 E-08
7439-92-1	Lead[e]	1.3 E-05	4.0 E-04
75-09-2	Methylene chloride[e]	8.0 E-07	2.4 E-05
91-20-3	Naphthalene[e,g]	1.8 E-07	5.3 E-06
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	6.5 E-14	1.9 E-12
85-01-8	Phenanthrene[e]	3.5 E-09	1.0 E-07
115-07-1	Propylene[f,g]	1.1 E-06	3.1 E-05
129-00-0	Pyrene[d]	8.2 E-09	2.4 E-07
100-42-5	Styrene[e,g]	1.3 E-07	4.0 E-06
108-88-3	Toluene[e]	4.0 E-07	1.2 E-05
95-63-6	1,2,4-Trimethylbenzene[f,h]	7.1 E-09	2.1 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	2.0 E-08	5.8 E-07
95-47-6	o-Xylene[e,h]	3.8 E-08	1.1 E-06
7440-66-6	Zinc[f,g]	6.7 E-06	2.0 E-04

[a] Factors represent uncontrolled emissions. References 1, 4, and 7.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.36 E-02 pounds per item. Reference 7.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.

Table 15.1.28-3 EMISSION FACTORS FOR THE USE OF DODIC A557, M17 .50 CALIBER TRACER CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	5.8 E-03	1.7 E-01
630-08-0	CO	1.1 E-02	3.3 E-01
7439-92-1	Lead (Pb)[f]	1.4 E-05	4.0 E-04
74-82-8	Methane	3.7 E-05	1.1 E-03
--	Oxides of nitrogen (NO_X)[f]	7.5 E-04	2.2 E-02
--	PM-2.5[d]	2.2 E-04	6.4 E-03
--	PM-10[e]	3.7 E-04	1.1 E-02
12789-66-1	TSP	4.0 E-04	1.2 E-02

[a] Factors represent uncontrolled emissions. References 1, 4, and 7.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.38 E-02 pounds per item. Reference 7.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.

Table 15.1.28-4 EMISSION FACTORS FOR THE USE OF DODIC A557, M17 .50 CALIBER TRACER CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	1.0 E-09	3.1 E-08
208-96-8	Acenaphthylene[d]	9.3 E-09	2.8 E-07
75-05-8	Acetonitrile[e,g]	1.1 E-06	3.3 E-05
107-13-1	Acrylonitrile[e,g]	2.4 E-07	7.1 E-06
7429-90-5	Aluminum[f]	8.5 E-07	2.5 E-05
7664-41-7	Ammonia[d,g]	2.2 E-04	6.6 E-03
120-12-7	Anthracene[e]	5.2 E-10	1.5 E-08
7440-36-0	Antimony[e]	6.7 E-06	2.0 E-04
7440-39-3	Barium[f,h]	1.1 E-05	3.1 E-04
71-43-2	Benzene[e,g]	3.8 E-06	1.1 E-04
56-55-3	Benzo[a]anthracene[e]	2.9 E-09	8.5 E-08
205-99-2	Benzo[b]fluoranthene[e]	4.7 E-09	1.4 E-07
207-08-9	Benzo[k]fluoranthene[e,g]	2.7 E-09	8.1 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	8.3 E-09	2.5 E-07
50-32-8	Benzo[a]pyrene[e,g]	4.1 E-09	1.2 E-07
192-97-2	Benzo[e]pyrene[d]	5.7 E-09	1.7 E-07
106-99-0	1,3-Butadiene[e,g]	1.6 E-07	4.8 E-06
74-87-3	Chloromethane[e,g]	2.5 E-09	7.5 E-08
218-01-9	Chrysene[e]	3.0 E-09	8.8 E-08
7440-50-8	Copper[f]	1.3 E-04	3.8 E-03
57-12-5	Particulate cyanide[e,g]	3.9 E-06	1.2 E-04
53-70-3	Dibenz[a,h]anthracene[e]	4.9 E-10	1.4 E-08
107-06-2	1,2-Dichloroethane[e,g]	7.5 E-08	2.2 E-06
--	Total dioxin/furan compounds[e]	2.0 E-12	5.9 E-11
100-41-4	Ethylbenzene[e]	3.5 E-08	1.0 E-06
74-85-1	Ethylene[f]	2.5 E-06	7.3 E-05
206-44-0	Fluoranthene[e]	3.9 E-09	1.2 E-07
86-73-7	Fluorene[d]	3.8 E-09	1.1 E-07
50-00-0	Formaldehyde[e,h]	2.9 E-07	8.7 E-06
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	1.0 E-13	3.1 E-12

Table 15.1.28-4 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
110-54-3	Hexane[e]	2.5 E-06	7.3 E-05
74-90-8	Hydrogen cyanide[e]	8.6 E-05	2.6 E-03
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	4.4 E-09	1.3 E-07
7439-92-1	Lead[e]	1.4 E-05	4.0 E-04
75-09-2	Methylene chloride[e]	1.2 E-06	3.4 E-05
91-20-3	Naphthalene[e,g]	2.1 E-07	6.3 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	1.8 E-12	5.2 E-11
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	1.1 E-13	3.3 E-12
85-01-8	Phenanthrene[e]	3.0 E-09	9.0 E-08
115-07-1	Propylene[f,g]	6.7 E-07	2.0 E-05
129-00-0	Pyrene[d]	5.6 E-09	1.7 E-07
100-42-5	Styrene[e,g]	1.3 E-07	3.9 E-06
7664-93-9	Sulfuric acid[f,h]	3.0 E-06	8.9 E-05
108-88-3	Toluene[e]	4.3 E-07	1.3 E-05
71-55-6	1,1,1-Trichloroethane[e]	6.7 E-09	2.0 E-07
95-63-6	1,2,4-Trimethylbenzene[f,h]	6.8 E-09	2.0 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	6.4 E-08	1.9 E-06
95-47-6	o-Xylene[e,h]	5.3 E-08	1.6 E-06
7440-66-6	Zinc[f,g]	2.1 E-05	6.3 E-04

[a] Factors represent uncontrolled emissions. References 1, 4, and 7.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.38 E-02 pounds per item. Reference 7.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.

References For Section 15.1.28

1. *Report No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2002.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M33 .50 Caliber Ball Cartridge, Department of Defense Identification Code: A552*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, June 2001.

3. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M17 .50 Caliber Tracer Cartridge, Department of Defense Identification Code: A571*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, June 2001.

4. *Detailed Test Plan No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

5. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

6. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 3 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

7. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.

15.1.29 A598, M1A1 .50 Caliber Blank Cartridge

15.1.29.1 Ordnance Description[1,2]

The M1A1 .50 Caliber Blank Cartridge (DODIC A598) is fired from the M2 and M85 machine guns equipped with the M19 and M20 blank ammunition firing attachments, respectively. It consists of a cartridge case, primer, and propelling charge. This cartridge does not have a projectile and is designed for training exercises; it is not used during combat.

The M1A1 .50 Caliber Blank Cartridge is used during many Army training exercises, which are held at nearly every Army training installation. At most locations, the training areas are at least 1,000 meters (over 0.5 mile) away from populated areas. On average, 124,000 M1A1 cartridges are used per year at a training site.[2]

15.1.29.2 Emissions And Controls[1, 3-6]

The primary emissions from the detonation of the M1A1 .50 Caliber Blank Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically detonated in the field, there are no controls associated with its use.

Table 15.1.29-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.1.29-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

15.1.29.3 Updates Since July 2006

Section 15.1 was created during July 2006. Revisions to this section since that date are summarized below.

Revision 1, July 2006

- Section 15.1.7, which presents emission factors for DODIC A066, M193 5.56-mm Ball Cartridge, was added.
- Section 15.1.8, which presents emission factors for DODIC A068, M196 5.56-mm Tracer Cartridge, was added.
- Section 15.1.13, which presents emission factors for DODIC A131, M62 7.62-mm Tracer Cartridge, was added.
- Section 15.1.14, which presents emission factors for DODIC A136, M118 7.62-mm Ball Match Cartridge, was added.
- Section 15.1.16, which presents emission factors for DODIC A171, M852 7.62-mm Ball Match Cartridge, was added.

- Section 15.1.17, which presents emission factors for DODIC A182, M1 .30 Caliber Ball Cartridge, was added.

- Section 15.1.18, which presents emission factors for DODIC A212, M2 .30 Caliber Ball Cartridge, was added.

- Section 15.1.20, which presents emission factors for DODIC A247, M72 .30 Caliber Ball Match Cartridge, was added.

Table 15.1.29-1 EMISSION FACTORS FOR THE USE OF DODIC A598, M1A1 .50 CALIBER BLANK CARTRIDGE - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	2.1 E-03	3.1 E-01
630-08-0	CO	1.8 E-03	2.7 E-01
7439-92-1	Lead (Pb)[f]	1.2 E-05	1.7 E-03
74-82-8	Methane	3.4 E-06	5.0 E-04
--	Oxides of nitrogen (NO_X)[f]	2.8 E-05	4.1 E-03
--	PM-2.5[d]	8.8 E-05	1.3 E-02
--	PM-10[e]	9.8 E-05	1.4 E-02
12789-66-1	TSP	8.7 E-05	1.3 E-02

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.89 E-03 pounds per item. Reference 6.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.

Table 15.1.29-2 EMISSION FACTORS FOR THE USE OF DODIC A598, M1A1 .50 CALIBER BLANK CARTRIDGE - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
208-96-8	Acenaphthylene[d]	5.1 E-10	7.3 E-08
75-05-8	Acetonitrile[e,g]	2.0 E-08	2.9 E-06
107-13-1	Acrylonitrile[e,g]	7.0 E-09	1.0 E-06
7429-90-5	Aluminum[f]	1.8 E-06	2.7 E-04
7440-36-0	Antimony[e]	6.9 E-06	9.9 E-04
7440-39-3	Barium[f]	4.3 E-06	6.2 E-04
71-43-2	Benzene[e,g]	2.4 E-07	3.4 E-05
74-87-3	Chloromethane[e,g]	2.0 E-09	2.9 E-07
7440-50-8	Copper[f]	1.0 E-06	1.5 E-04
--	Total dioxin/furan compounds[e]	1.4 E-14	2.1 E-12
74-85-1	Ethylene[f]	3.8 E-07	5.5 E-05
206-44-0	Fluoranthene[e]	1.7 E-10	2.5 E-08
86-73-7	Fluorene[d]	1.6 E-10	2.3 E-08
50-00-0	Formaldehyde[e,h]	7.8 E-08	1.1 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	2.9 E-15	4.2 E-13
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	3.6 E-16	5.2 E-14
110-54-3	Hexane[e]	2.3 E-07	3.3 E-05
74-90-8	Hydrogen cyanide[e]	1.0 E-06	1.5 E-04
7439-92-1	Lead[e]	1.2 E-05	1.7 E-03
75-09-2	Methylene chloride[e]	1.8 E-07	2.6 E-05
91-20-3	Naphthalene[e,g]	2.9 E-08	4.1 E-06
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	1.1 E-14	1.6 E-12
129-00-0	Pyrene[d]	1.6 E-10	2.3 E-08
100-42-5	Styrene[e,g]	1.7 E-09	2.4 E-07
7664-93-9	Sulfuric acid[f,h]	3.1 E-06	4.5 E-04
108-88-3	Toluene[e]	1.3 E-08	1.9 E-06
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	1.8 E-09	2.6 E-07
7440-66-6	Zinc[f,g]	4.6 E-07	6.7 E-05

Table 15.1.29-2 (cont.)

[a] Factors represent uncontrolled emissions. References 1, 3, and 6.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.89 E-03 pounds per item. Reference 6.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.

References For Section 15.1.29

1. *Report No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2002.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M1A1 .50 Caliber Blank Cartridge, Department of Defense Identification Code: A559*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, January 2001.

3. *Detailed Test Plan No. 3 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2001.

4. *Hazard Classification of United States Military Explosives and Munitions*, U.S. Army Defense Ammunition Center, Logistics Review and Technical Assistance Office, McAlester, OK, Revision 11, February 2001.

5. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 3 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

6. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2004.