15.2 Cartridges 30-75 mm

Munitions listed in this section begin with the Department of Defense Identification Code (DODIC) letter "B." This category of munitions includes cartridges between 30-mm and 75-mm in size. Examples include 40-mm practice cartridges, 40-mm high explosive antitank rounds, and 60-mm high explosive mortars.

15.2.1 B129, M789 30-mm High Explosive Dual Purpose Cartridge

15.2.1.1 Ordnance Description[1,2]

The M789 30-mm High Explosive Dual Purpose (HEDP) Cartridge (DODIC B129) is a standard round for the M230 machine gun. This ammunition is used during combat and on firing ranges during training. The M789 functions both as an armor-piercing weapon and as an anti-personnel round. Note that emission factors presented herein are only associated with the detonation of the projectile; emissions associated with the propelling charge are not addressed in this section.

The M789 30-mm HEDP Cartridge consists of a steel projectile body loaded with a high explosive and spin compensated shaped charge liner, point detonating bore safe fuse, and an aluminum cartridge case. This cartridge contains a shaped charge warhead for armor penetration. Upon impact, the fuse initiates the projectile explosive filler. Detonation of the filler charge collapses the shaped charge liner resulting in the formation of an armor piercing jet. In addition, main charge detonation produces fragmentation of the projectile body resulting in antipersonnel effects in target vicinity.

15.2.1.2 Emissions And Controls[1-4]

Primary emissions from the use of the M789 Cartridge include carbon dioxide (CO_2) and particulate matter. 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 used in the field, there are no controls associated with its use.

Table 15.2.1-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.2.1-2 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 15.2.1-1 EMISSION FACTORS FOR THE USE OF DODIC B129, M789 30-MM HIGH EXPLOSIVE DUAL PURPOSE (HEDP) CARTRIDGE (PROJECTILE ONLY) – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	4.4 E-03	1.4 E-01
630-08-0	Carbon monoxide (CO)	8.6 E-04	2.8 E-02
7439-92-1	Lead (Pb)	1.1 E-05	3.7 E-04
74-82-8	Methane	4.6 E-05	1.5 E-03
--	Oxides of nitrogen (NO_X)	2.0 E-04	6.6 E-03
--	PM-2.5[d]	2.5 E-03	8.0 E-02
--	PM-10[e]	3.9 E-03	1.3 E-01
12789-66-1	TSP	4.3 E-03	1.4 E-01

[a] Factors represent uncontrolled emissions. References 1-4.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.09 E-02 pounds per item. Reference 1.
[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.

Table 15.2.1-2 EMISSION FACTORS FOR THE USE OF DODIC B129, M789 30-MM HIGH EXPLOSIVE DUAL PURPOSE (HEDP) CARTRIDGE (PROJECTILE ONLY) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
208-96-8	Acenaphthylene[d,g]	3.5 E-08	1.1 E-06
75-07-0	Acetaldehyde[e,g]	7.7 E-07	2.5 E-05
7429-90-5	Aluminum[f,g]	1.2 E-04	3.9 E-03
7664-41-7	Ammonia[f,g]	1.1 E-05	3.5 E-04
7440-36-0	Antimony[e]	5.7 E-07	1.8 E-05
7440-38-2	Arsenic[e]	1.9 E-07	6.3 E-06
7440-39-3	Barium[f]	1.6 E-06	5.0 E-05
7440-43-9	Cadmium[e]	1.1 E-04	3.4 E-03
7440-47-3	Chromium[e]	1.3 E-05	4.3 E-04
18540-29-9	Hexavalent chromium[e,h]	3.5 E-07	1.1 E-05
7440-50-8	Copper[f]	4.8 E-04	1.5 E-02
75-71-8	Dichlorodifluoromethane[f]	2.7 E-09	8.7 E-08
--	Total dioxin/furan compounds[e]	2.0 E-12	6.3 E-11
74-85-1	Ethylene[f,g]	2.2 E-06	7.2 E-05
117-81-7	bis(2-Ethylhexyl)phthalate[e]	1.6 E-06	5.0 E-05
206-44-0	Fluoranthene[e,g]	6.7 E-09	2.2 E-07
86-73-7	Fluorene[d]	5.5 E-09	1.8 E-07
50-00-0	Formaldehyde[e,g]	3.8 E-07	1.2 E-05
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e]	2.6 E-13	8.5 E-12
7647-01-0	Hydrochloric acid[e]	1.6 E-06	5.3 E-05
7664-39-3	Hydrogen fluoride[e]	2.6 E-05	8.5 E-04
7439-92-1	Lead[e,g]	1.1 E-05	3.7 E-04
7439-96-5	Manganese[e,g]	9.3 E-06	3.0 E-04
75-09-2	Methylene chloride[e]	3.1 E-09	1.0 E-07
91-20-3	Naphthalene[e,g]	1.4 E-08	4.5 E-07
7440-02-0	Nickel[e,g]	1.9 E-06	6.0 E-05
7697-37-2	Nitric acid[f]	1.4 E-05	4.6 E-04
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	4.1 E-13	1.3 E-11
85-01-8	Phenanthrene[e,g]	1.6 E-08	5.3 E-07
115-07-1	Propylene[f,g]	3.6 E-08	1.2 E-06

Table 15.2.1-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
129-00-0	Pyrene[d,g]	4.9 E-09	1.6 E-07
7440-22-4	Silver[f]	3.5 E-07	1.1 E-05
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	1.6 E-13	5.2 E-12
108-88-3	Toluene[e,g]	3.8 E-08	1.2 E-06
75-69-4	Trichlorofluoromethane[f]	3.4 E-08	1.1 E-06
7440-62-2	Vanadium[f]	3.9 E-07	1.3 E-05
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	2.5 E-08	8.1 E-07
7440-66-6	Zinc[f]	4.1 E-04	1.3 E-02

[a] Factors represent uncontrolled emissions. References 1-4.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.09 E-02 pounds per item. Reference 1.
[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 B.
[h] EMISSION FACTOR RATING D.

References For Section 15.2.1

1. *Report No. 9 for the Exploding Ordnance Emission Study Phase II,* Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2006.

2. *Detailed Test Plan No. 9 for the Exploding Ordnance Emission Study Phase II,* Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2003.

3. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Exploding Ordnance Emission Study Phase II Series 9 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, June 2008.

4. 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, June 2007.

15.2.2 B519, M781 40-mm Practice Cartridge

15.2.2.1 Ordnance Description[1,2]

The M781 40-mm Practice Cartridge (DODIC B519) is a practice round used to train soldiers on the operation of the M203 grenade launcher, which is attached to the M16 rifle series or M4 series carbine. When launched, the M781 can reach a maximum distance of 400 meters. Upon impact with a target, the projectile releases a dye, causing a puff of bright yellow-orange smoke that simulates an explosion. Note that emission factors presented herein are only associated with the firing of the practice cartridge; emissions associated with the impact and detonation of the projectile are not addressed in this section.

The M781 40-mm Practice Cartridge consists of a zinc or aluminum projectile attached to a plastic cartridge case that contains a .38 caliber blank cartridge primer. When the firing pin of the weapon strikes the .38 caliber blank cartridge primer, the propellant of the blank cartridge is ignited, propelling the projectile through the launcher barrel to the target.

15.2.2.2 Emissions And Controls[1,3-6]

Primary emissions from the use of the M781 40-mm Practice Cartridge include carbon monoxide (CO) and carbon dioxide (CO_2). 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 used in the field, there are no controls associated with its use.

Table 15.2.2-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.2.2-2 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 15.2.2-1 EMISSION FACTORS FOR THE USE OF DODIC B519, M781 40-MM PRACTICE CARTRIDGE (PROPELLING CHARGE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	2.6 E-04	3.2 E-01
630-08-0	CO	3.5 E-04	4.4 E-01
7439-92-1	Lead (Pb)[f]	6.7 E-06	8.3 E-03
74-82-8	Methane	3.7 E-06	4.6 E-03
--	Oxides of nitrogen (NO_x)[f]	3.6 E-05	4.5 E-02
--	PM-2.5[d]	2.3 E-05	2.9 E-02
--	PM-10[e]	2.6 E-05	3.3 E-02
12789-66-1	TSP	2.3 E-05	2.9 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 8.0 E-04 pounds per item. Reference 1.
[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 C.

Table 15.2.2-2 EMISSION FACTORS FOR THE USE OF DODIC B519, M781 40-MM PRACTICE CARTRIDGE (PROPELLING CHARGE) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d]	1.1 E-10	1.4 E-07
208-96-8	Acenaphthylene[d]	2.1 E-09	2.7 E-06
75-07-0	Acetaldehyde[e]	6.8 E-08	8.4 E-05
75-05-8	Acetonitrile[e,g]	6.0 E-08	7.5 E-05
98-86-2	Acetophenone[e,h]	4.4 E-08	5.5 E-05
107-13-1	Acrylonitrile[e]	9.5 E-08	1.2 E-04
120-12-7	Anthracene[e,g]	6.0 E-11	7.5 E-08
7440-36-0	Antimony[e]	1.2 E-06	1.5 E-03
7440-39-3	Barium[f]	6.7 E-07	8.3 E-04
71-43-2	Benzene[e]	6.8 E-07	8.5 E-04
56-55-3	Benzo[a]anthracene[e]	1.8 E-11	2.2 E-08
205-99-2	Benzo[b]fluoranthene[e]	1.1 E-10	1.4 E-07
191-24-2	Benzo[g,h,i]perylene[e]	2.2 E-10	2.7 E-07
50-32-8	Benzo[a]pyrene[e]	8.0 E-11	1.0 E-07
75-15-0	Carbon disulfide[e]	1.3 E-07	1.7 E-04
56-23-5	Carbon tetrachloride[e]	2.7 E-09	3.3 E-06
7440-47-3	Chromium[e]	1.5 E-08	1.8 E-05
218-01-9	Chrysene[e]	4.0 E-11	5.0 E-08
7440-50-8	Copper[f]	7.2 E-08	8.9 E-05
98-82-8	Cumene[e]	3.6 E-09	4.5 E-06
107-06-2	1,2-Dichloroethane[e]	9.8 E-09	1.2 E-05
--	Total dioxin/furan compounds[e]	2.0 E-13	2.5 E-10
100-41-4	Ethylbenzene[e]	2.1 E-08	2.6 E-05
74-85-1	Ethylene[f]	1.7 E-06	2.2 E-03
206-44-0	Fluoranthene[e]	1.0 E-10	1.3 E-07
86-73-7	Fluorene[d]	2.7 E-10	3.3 E-07
50-00-0	Formaldehyde[e]	9.2 E-08	1.2 E-04
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e,h]	2.4 E-14	3.0 E-11
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e]	1.9 E-15	2.4 E-12

Table 15.2.2-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
74-90-8	Hydrogen cyanide[e,g]	6.1 E-07	7.6 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e]	1.2 E-10	1.4 E-07
7439-92-1	Lead[e]	6.7 E-06	8.3 E-03
7439-96-5	Manganese[e]	1.1 E-09	1.4 E-06
75-09-2	Methylene chloride[e]	3.2 E-07	4.0 E-04
91-20-3	Naphthalene[e]	1.2 E-08	1.5 E-05
7697-37-2	Nitric acid[f]	4.0 E-07	5.0 E-04
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e,h]	1.7 E-13	2.2 E-10
85-01-8	Phenanthrene[e]	3.2 E-10	4.0 E-07
115-07-1	Propylene[f]	1.6 E-07	2.0 E-04
129-00-0	Pyrene[d,g]	1.1 E-10	1.3 E-07
100-42-5	Styrene[e]	2.4 E-07	3.0 E-04
108-88-3	Toluene[e]	8.6 E-08	1.1 E-04
71-55-6	1,1,1-Trichloroethane[e,h]	1.2 E-07	1.4 E-04
95-63-6	1,2,4-Trimethylbenzene[f]	5.1 E-08	6.3 E-05
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	7.4 E-08	9.2 E-05
95-47-6	o-Xylene[e]	5.3 E-08	6.6 E-05
7440-66-6	Zinc[f]	4.2 E-06	5.2 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 8.0 E-04 pounds per item. Reference 1.
[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 B.
[h] EMISSION FACTOR RATING D.

References For Section 15.2.2

1. *Report No. 2 for the Firing Point Emission Study Phase II, Revision 1*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2006.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M918 40-mm Practice Cartridge or the M781 40-mm Practice Cartridge, Department of Defense Identification Codes: B584 and B519,* U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, June 2001.

3. *Detailed Test Plan No. 2 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 2 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 upo.n request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, July 2004.

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15.2.3 B535, M583A1 40-mm White Star Parachute Cartridge

15.2.3.1 Ordnance Description[1-3]

The M583A1 40-mm White Star Parachute Cartridge (DODIC B535) is used for illumination and signaling. It is fired from the 40-mm M79 and M203 grenade launchers, which are attached to the M16 series rifle or M4 series carbine. When the projectile reaches an altitude of 500 to 700 feet, a parachute deploys and a pyrotechnic flare candle is ignited. This ammunition is used during combat and on firing ranges during training.

The M583A1 40-mm White Star Parachute Cartridge consists of a one-piece hollow aluminum projectile body and an aluminum cartridge case assembly. The projectile contains a pyrotechnic flare candle, an ejection charge, and a parachute, while the cartridge assembly contains a propelling charge and a percussion primer.

15.2.3.2 Emissions And Controls[1,2,4,5]

Particulate matter and carbon dioxide (CO_2) are the primary emissions from the use of the M583A1 40-mm White Star Parachute Cartridge. 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 used in the field, there are no controls associated with its use.

Table 15.2.3-1 presents emission factors for carbon dioxide (CO_2), criteria pollutants, methane, and total suspended particulate (TSP). Table 15.2.3-2 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 15.2.3-1 EMISSION FACTORS FOR THE USE OF DODIC B535, M583A1 40-MM WHITE STAR PARACHUTE CARTRIDGE – CARBON DIOXIDE, CRITERIA POLLUTANTS, TOTAL NONMETHANE HYDROCARBONS, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2[f]	1.5 E-02	7.2 E-02
630-08-0	Carbon monoxide(CO)[f]	5.0 E-03	2.4 E-02
7439-92-1	Lead (Pb)[h]	1.6 E-04	7.9 E-04
--	Oxides of nitrogen (NO_x)	1.4 E-03	6.5 E-03
--	PM-2.5[d,h]	2.5 E-02	1.2 E-01
--	PM-10[e]	2.9 E-02	1.4 E-01
7446-09-5	Sulfur dioxide (SO_2)[g]	4.0 E-05	1.9 E-04
--	TNMHC	1.2 E-03	6.0 E-03
12789-66-1	TSP	3.6 E-02	1.7 E-01

[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 2.07 E-01 pounds per item. Reference 2.
[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 A.
[g] EMISSION FACTOR RATING C.
[h] EMISSION FACTOR RATING D.

Table 15.2.3-2 EMISSION FACTORS FOR THE USE OF DODIC B535, M583A1 40-MM WHITE STAR PARACHUTE CARTRIDGE – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
75-05-8	Acetonitrile[d]	2.2 E-07	1.1 E-06
7429-90-5	Aluminum[e,h]	1.4 E-05	6.8 E-05
7440-36-0	Antimony[d,i]	1.3 E-05	6.2 E-05
7440-39-3	Barium[e,i]	1.5 E-05	7.3 E-05
71-43-2	Benzene[d,h]	1.7 E-05	8.5 E-05
106-99-0	1,3-Butadiene[d,h]	3.3 E-06	1.6 E-05
7440-43-9	Cadmium[d,h]	3.3 E-08	1.6 E-07
56-23-5	Carbon tetrachloride[d,h]	3.7 E-07	1.8 E-06
7440-47-3	Chromium[d]	3.6 E-07	1.7 E-06
7440-48-4	Cobalt[d]	7.6 E-08	3.7 E-07
7440-50-8	Copper[e,g]	4.3 E-06	2.1 E-05
110-82-7	Cyclohexane[e]	3.0 E-06	1.4 E-05
--	Total dioxin/furan compounds[d]	8.1 E-12	3.9 E-11
100-41-4	Ethylbenzene[d,h]	6.2 E-07	3.0 E-06
74-85-1	Ethylene[e,h]	4.4 E-05	2.1 E-04
50-00-0	Formaldehyde[d]	4.7 E-06	2.3 E-05
76-13-1	Freon 113[e]	5.7 E-07	2.8 E-06
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[d]	1.5 E-12	7.4 E-12
110-54-3	Hexane[d,i]	2.7 E-06	1.3 E-05
74-90-8	Hydrogen cyanide[d]	9.4 E-07	4.5 E-06
7439-92-1	Lead[d,i]	1.6 E-04	7.9 E-04
7439-96-5	Manganese[d]	2.5 E-07	1.2 E-06
75-09-2	Methylene chloride[d]	3.8 E-03	1.9 E-02
91-57-6	2-Methylnaphthalene[f]	4.3 E-07	2.1 E-06
91-20-3	Naphthalene[d,h]	1.5 E-06	7.7 E-06
7440-02-0	Nickel[d,g]	1.2 E-07	5.7 E-07
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[d]	6.6 E-12	3.2 E-11
108-95-2	Phenol[d]	2.3 E-07	1.1 E-06
7723-14-0	Phosphorus[f,h]	2.5 E-05	1.2 E-04
115-07-1	Propylene[e]	9.9 E-06	4.8 E-05

Table 15.2.3-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7782-49-2	Selenium[d,i]	4.4 E-08	2.1 E-07
100-42-5	Styrene[d,h]	5.5 E-07	2.7 E-06
95-63-6	1,2,4-Trimethylbenzene[e]	4.1 E-07	2.0 E-06
540-84-1	2,2,4-Trimethylpentane[f,i]	2.8 E-06	1.4 E-05
106-42-3, 108-38-3	m-Xylene, p-Xylene[d,h]	2.2 E-06	1.1 E-05
95-47-6	o-Xylene[d]	4.8 E-07	2.3 E-06
7440-66-6	Zinc[e]	4.1 E-06	2.0 E-05

[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 2.07 E-01 pounds per item. Reference 2.
[d] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313.
[f] Hazardous air pollutant under CAA Section 112(b).
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING B.
[i] EMISSION FACTOR RATING D.

References For Section 15.2.3

1. *Detailed Test Plan for Phase IV-B Emission Characterization of Exploding Ordnance: [DODIC# B535] Cartridge 40-mm White Star Parachute (M583A1), [DODIC# B536] Cartridge 40-mm White Star Cluster (M585), [DODIC# L366] Simulator Projectile Air Burst (M74A1), [DODIC# L602] Simulator Flash Artillery (M21), [DODIC# M241] Destructor HE Universal (M10),* West Desert Test Center, U.S. Army Dugway Proving Ground, UT, April 2002.

2. *Sampling Results for AEC Phase IV-B Emission Characterization of Exploding Ordnance and Smoke/Pyrotechnics,* URS Group, Inc., Oak Ridge, TN, October 2004.

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 Phase IV-B Testing Conducted at Dugway Proving Ground, Utah,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, June 2007.

5. Supporting information including Excel spreadsheets supplied upon request by the U.S. Army Dugway Proving Ground test support contractor, URS Corporation, Oak Ridge, TN, January 2005.

15.2.4 B536, M585 40-mm White Star Cluster Cartridge

15.2.4.1 Ordnance Description[1-3]

The M585 40-mm White Star Cluster Cartridge (DODIC B536) is used for illumination and signaling. It is fired from the 40-mm M79 and M203 grenade launchers, which are attached to the M16 series rifle or M4 series carbine. When the projectile reaches an altitude of 550 feet, it produces a cluster of five white, free-falling stars resembling a firework. This ammunition is used during combat and on firing ranges during training.

The M585 40-mm White Star Cluster Cartridge consists of a one-piece hollow aluminum projectile body and an aluminum cartridge case assembly. The projectile contains an illuminant candle assembly of five pyrotechnic charges and an ejection charge, while the cartridge assembly contains a propelling charge and a percussion primer.

15.2.4.2 Emissions And Controls[1,2,4,5]

Carbon dioxide (CO_2) and carbon monoxide (CO) are the primary emissions from the use of the M585 40-mm White Star Cluster. 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 used in the field, there are no controls associated with its use.

Table 15.2.4-1 presents emission factors for CO_2, criteria pollutants, total nonmethane hydrocarbons (TNMHC), and total suspended particulate (TSP). Table 15.2.4-2 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 15.2.4-1 EMISSION FACTORS FOR THE USE OF DODIC B536, M585 40-MM WHITE STAR CLUSTER CARTRIDGE – CARBON DIOXIDE, CRITERIA POLLUTANTS, TOTAL NONMETHANE HYDROCARBONS, 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	2.6 E-02	1.4 E-01
630-08-0	CO	9.5 E-03	5.0 E-02
--	Oxides of nitrogen (NO_x)	3.4 E-04	1.8 E-03
--	PM-2.5[d,g]	3.5 E-03	1.8 E-02
--	PM-10[e]	2.6 E-03	1.3 E-02
--	TNMHC[f]	1.9 E-03	9.7 E-03
12789-66-1	TSP	3.2 E-03	1.7 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 1.91 E-01 pounds per item. Reference 2.
[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 15.2.4-2 EMISSION FACTORS FOR THE USE OF DODIC B536, M585 40-MM WHITE STAR CLUSTER CARTRIDGE – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
75-05-8	Acetonitrile[d]	1.4 E-06	7.4 E-06
7429-90-5	Aluminum[e,g]	1.1 E-05	5.6 E-05
7440-39-3	Barium[e]	3.6 E-06	1.9 E-05
71-43-2	Benzene[d,g]	3.1 E-05	1.6 E-04
106-99-0	1,3-Butadiene[d,h]	4.5 E-06	2.3 E-05
7440-43-9	Cadmium[d,h]	1.9 E-08	9.8 E-08
56-23-5	Carbon tetrachloride[d,h]	1.2 E-07	6.3 E-07
7440-48-4	Cobalt[d,h]	5.5 E-08	2.9 E-07
7440-50-8	Copper[e,g]	1.4 E-06	7.6 E-06
98-82-8	Cumene[d,i]	1.6 E-07	8.6 E-07
110-82-7	Cyclohexane[e]	1.5 E-06	7.9 E-06
100-41-4	Ethylbenzene[d,h]	1.2 E-06	6.3 E-06
74-85-1	Ethylene[e,h]	4.6 E-05	2.4 E-04
50-00-0	Formaldehyde[d]	6.1 E-06	3.2 E-05
76-13-1	Freon 113[e]	5.0 E-07	2.6 E-06
110-54-3	Hexane[d]	2.6 E-07	1.4 E-06
1634-04-4	Hydrogen cyanide[d,i]	1.2 E-05	6.4 E-05
7439-96-5	Manganese[d,h]	1.3 E-07	7.0 E-07
75-09-2	Methylene chloride[d]	6.3 E-03	3.3 E-02
91-20-3	Naphthalene[d,h]	7.2 E-07	4.2 E-06
7440-02-0	Nickel[d,g]	8.2 E-08	4.3 E-07
55-63-0	Nitroglycerin[e,i]	8.6 E-08	4.5 E-07
108-95-2	Phenol[d,i]	8.0 E-07	4.2 E-06
7723-14-0	Phosphorus[f,h]	4.3 E-06	2.3 E-05
115-07-1	Propylene[e,h]	2.0 E-05	1.1 E-04
7782-49-2	Selenium[d]	1.3 E-09	6.6 E-09
100-42-5	Styrene[d,h]	1.1 E-06	6.0 E-06
75-69-4	Trichlorofluoromethane[e]	1.7 E-07	8.7 E-07
95-63-6	1,2,4-Trimethylbenzene[e]	6.7 E-07	3.5 E-06
540-84-1	2,2,4-Trimethylpentane[f]	3.3 E-07	1.7 E-06

Table 15.2.4-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
106-42-3, 108-38-3	m-Xylene, p-Xylene[d,h]	4.1 E-06	2.2 E-05
95-47-6	o-Xylene[d]	9.4 E-07	4.9 E-06
7440-66-6	Zinc[e]	1.2 E-05	6.2 E-05

[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-01 pounds per item. Reference 2.
[d] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313.
[f] Hazardous air pollutant under CAA Section 112(b).
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING B.
[i] EMISSION FACTOR RATING D.

References For Section 15.2.4

1. *Detailed Test Plan for Phase IV-B Emission Characterization of Exploding Ordnance: [DODIC# B535] Cartridge 40-mm White Star Parachute (M583A1), [DODIC# B536] Cartridge 40-mm White Star Cluster (M585), [DODIC# L366] Simulator Projectile Air Burst (M74A1), [DODIC# L602] Simulator Flash Artillery (M21), [DODIC# M241] Destructor HE Universal (M10),* West Desert Test Center, U.S. Army Dugway Proving Ground, UT, April 2002.

2. *Sampling Results for AEC Phase IV-B Emission Characterization of Exploding Ordnance and Smoke/Pyrotechnics*, URS Group, Inc., Oak Ridge, TN, October 2004.

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 Phase IV-B Testing Conducted at Dugway Proving Ground, Utah*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, June 2007.

5. Supporting information including Excel spreadsheets supplied upon request by the U.S. Army Dugway Proving Ground test support contractor, URS Corporation, Oak Ridge, TN, January 2005.

15.2.5 B542, M430 40-mm High Explosive Dual Purpose Cartridge

15.2.5.1 Ordnance Description[1]

The M430 40-mm High Explosive Dual Purpose (HEDP) Cartridge (DODIC B542) is a standard round for the MK 19 Mod 3, 40-mm grenade machine gun. This ammunition is used during combat and on firing ranges during training. The M430 functions both as an armor-piercing weapon and as an anti-personnel round. Note that emission factors presented herein are only associated with the detonation of the projectile; emissions associated with the propelling charge are not addressed in this section.

The M430 40-mm HEDP Cartridge consists of a copper-lined steel projectile body attached to an M169 cartridge base. The projectile contains a bursting charge, a booster charge, and an initiator charge. The cartridge base contains a percussion primer and propelling charge. When the firing pin strikes the percussion primer, the propelling charge is ignited, propelling the projectile through the launcher barrel to the target.

15.2.5.2 Emissions And Controls[1-5]

Primary emissions from the use of the M430 40-mm HEDP Cartridge include carbon dioxide (CO_2) and particulate matter. 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 used in the field, there are no controls associated with its use.

Table 15.2.5-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.2.5-2 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 15.2.5-1 EMISSION FACTORS FOR THE USE OF DODIC B542, M430 40-MM HIGH EXPLOSIVE DUAL PURPOSE CARTRIDGE (PROJECTILE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	4.9 E-02	5.8 E-01
630-08-0	Carbon monoxide (CO)	4.0 E-03	4.8 E-02
7439-92-1	Lead (Pb)	8.0 E-05	9.6 E-04
74-82-8	Methane	8.9 E-05	1.1 E-03
--	Oxides of nitrogen (NO_X)	1.3 E-03	1.5 E-02
--	PM-2.5[d]	5.1 E-03	6.1 E-02
--	PM-10[e]	9.5 E-03	1.1 E-01
12789-66-1	TSP	1.1 E-02	1.4 E-01

[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 8.35 E-02 pounds per item. Reference 1.
[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.

Table 15.2.5-2 EMISSION FACTORS FOR THE USE OF DODIC B542, M430 40-MM HIGH EXPLOSIVE DUAL PURPOSE CARTRIDGE (PROJECTILE) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
75-05-8	Acetonitrile[d,g]	8.0 E-06	9.6 E-05
98-86-2	Acetophenone[d,h]	9.6 E-07	1.2 E-05
107-13-1	Acrylonitrile[d,g]	3.2 E-07	3.8 E-06
7429-90-5	Aluminum[e,g]	7.7 E-04	9.2 E-03
7664-41-7	Ammonia[f,g]	1.5 E-04	1.8 E-03
71-43-2	Benzene[d,g]	1.5 E-06	1.8 E-05
56-55-3	Benzo[a]anthracene[d,g]	2.7 E-10	3.2 E-09
205-99-2	Benzo[b]fluoranthene[d,g]	5.8 E-10	6.9 E-09
207-08-9	Benzo[k]fluoranthene[d]	1.0 E-10	1.2 E-09
191-24-2	Benzo[g,h,i]perylene[d,g]	7.6 E-10	9.1 E-09
50-32-8	Benzo[a]pyrene[d,g]	1.6 E-10	2.0 E-09
192-97-2	Benzo[e]pyrene[f,g]	5.2 E-10	6.2 E-09
108-90-7	Chlorobenzene[d]	5.0 E-08	6.0 E-07
74-87-3	Chloromethane[d,g]	1.5 E-07	1.8 E-06
7440-47-3	Chromium[d]	3.4 E-06	4.1 E-05
18540-29-9	Hexavalent chromium[d]	2.2 E-08	2.6 E-07
218-01-9	Chrysene[d,g]	4.0 E-10	4.8 E-09
7440-50-8	Copper[e]	2.0 E-03	2.4 E-02
--	Total dioxin/furan compounds[d]	8.3 E-12	9.9 E-11
100-41-4	Ethylbenzene[d]	1.8 E-08	2.2 E-07
74-85-1	Ethylene[e,g]	5.2 E-06	6.3 E-05
117-81-7	bis(2-Ethylhexyl)phthalate[d,g]	1.3 E-06	1.5 E-05
206-44-0	Fluoranthene[d]	8.5 E-10	1.0 E-08
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[d,h]	4.4 E-13	5.3 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[d,h]	1.9 E-13	2.3 E-12
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[d]	6.7 E-14	8.0 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[d]	1.2 E-13	1.5 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[d,h]	1.8 E-13	2.2 E-12
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[d,h]	6.8 E-13	8.1 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[d,h]	1.3 E-13	1.6 E-12

Table 15.2.5-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran[d,h]	2.7 E-13	3.3 E-12
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[d,h]	1.3 E-13	1.6 E-12
74-90-8	Hydrogen cyanide[d,g]	1.1 E-05	1.3 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[d]	2.4 E-10	2.9 E-09
7439-92-1	Lead[d,g]	8.0 E-05	9.6 E-04
7439-96-5	Manganese[d,g]	2.2 E-05	2.7 E-04
1634-04-4	Methyl tert-butyl ether[d,h]	1.8 E-09	2.2 E-08
91-20-3	Naphthalene[d,g]	1.3 E-08	1.6 E-07
7697-37-2	Nitric acid[e,g]	1.4 E-05	1.6 E-04
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[d,h]	4.6 E-12	5.5 E-11
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[d,h]	1.9 E-13	2.2 E-12
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin[d,h]	2.4 E-13	2.9 E-12
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[d,h]	4.0 E-13	4.8 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[d,h]	4.5 E-13	5.4 E-12
129-00-0	Pyrene[f]	1.8 E-09	2.1 E-08
100-42-5	Styrene[d,g]	2.2 E-07	2.6 E-06
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[d,h]	4.0 E-13	4.7 E-12
108-88-3	Toluene[d,g]	2.9 E-07	3.5 E-06
95-63-6	1,2,4-Trimethylbenzene[e,h]	1.0 E-08	1.2 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[h]	1.1 E-08	1.3 E-07
95-47-6	o-Xylene[d,h]	9.8 E-09	1.2 E-07
7440-66-6	Zinc[e,g]	1.2 E-04	1.4 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 8.35 E-02 pounds per item. Reference 1.
[d] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313.
[f] Hazardous air pollutant under CAA Section 112(b).
[g] EMISSION FACTOR RATING B.
[h] EMISSION FACTOR RATING D.

References For Section 15.2.5

1. *Report No. 3 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, February 2004.

2. *Detailed Test Plan No. 3 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 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 Exploding Ordnance Emission Study Phase II Series 3 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, January 2005.

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15.2.6 B571, M383 40-mm High Explosive Cartridge

15.2.6.1 Ordnance Description[1]

The M383 40-mm High Explosive Cartridge (DODIC B571) is an anti-personnel round that causes casualties by ground-burst effect. This ammunition is used during combat and on firing ranges during training. The cartridge is fired from the MK19 Mod 1, 40-mm grenade machine gun and also from the M75 and M129 grenade launchers. Note that emission factors presented herein are only associated with the detonation of the projectile; emissions associated with the propelling charge are not addressed in this section.

The M383 40-mm High Explosive Cartridge consists of a one-piece steel projectile body and an aluminum cartridge case assembly containing a propelling charge and a percussion primer. The projectile contains a bursting charge, a booster charge, and an initiator charge, as well as an aluminum ogive.

15.2.6.2 Emissions And Controls[1-5]

Carbon dioxide (CO_2), carbon monoxide (CO), and particulate matter are the primary emissions from the use of the M383 High Explosive Cartridge. 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 used in the field, there are no controls associated with its use.

Table 15.2.6-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.2.6-2 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 15.2.6-1 EMISSION FACTORS FOR THE USE OF DODIC B571, M383 40-MM HIGH EXPLOSIVE CARTRIDGE (PROJECTILE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	6.6 E-02	5.7 E-01
630-08-0	CO	7.0 E-03	6.0 E-02
7439-92-1	Lead (Pb)	7.3 E-05	6.2 E-04
74-82-8	Methane	1.4 E-04	1.2 E-03
--	Oxides of nitrogen (NO_X)	1.6 E-03	1.3 E-02
--	PM-2.5[d]	6.6 E-03	5.6 E-02
--	PM-10[e]	1.3 E-02	1.1 E-01
12789-66-1	TSP	1.6 E-02	1.4 E-01

[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 1.17 E-01 pounds per item. Reference 1.
[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.

Table 15.2.6-2 EMISSION FACTORS FOR THE USE OF DODIC B571, M383 40-MM HIGH EXPLOSIVE CARTRIDGE (PROJECTILE) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	6.8 E-09	5.8 E-08
208-96-8	Acenaphthylene[d]	1.4 E-07	1.2 E-06
75-05-8	Acetonitrile[e,g]	1.1 E-05	9.4 E-05
98-86-2	Acetophenone[e,h]	2.7 E-07	2.3 E-06
107-02-8	Acrolein[e]	8.4 E-07	7.2 E-06
107-13-1	Acrylonitrile[e,g]	1.9 E-06	1.6 E-05
7429-90-5	Aluminum[f,g]	8.8 E-04	7.5 E-03
7664-41-7	Ammonia[d,g]	2.6 E-04	2.2 E-03
120-12-7	Anthracene[e,g]	1.2 E-08	1.0 E-07
7440-39-3	Barium[f]	3.3 E-06	2.8 E-05
71-43-2	Benzene[e,g]	7.4 E-06	6.4 E-05
56-55-3	Benzo[a]anthracene[e,g]	6.2 E-09	5.3 E-08
205-99-2	Benzo[b]fluoranthene[e,g]	6.8 E-09	5.8 E-08
207-08-9	Benzo[k]fluoranthene[e]	3.5 E-09	3.0 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	8.2 E-09	7.0 E-08
50-32-8	Benzo[a]pyrene[e,g]	6.4 E-09	5.5 E-08
192-97-2	Benzo[e]pyrene[d,g]	6.4 E-09	5.5 E-08
85-68-7	Butylbenzylphthalate[d]	3.4 E-07	2.9 E-06
108-90-7	Chlorobenzene[e]	1.6 E-07	1.4 E-06
74-87-3	Chloromethane[e,g]	2.2 E-07	1.9 E-06
7440-47-3	Chromium[e]	5.3 E-06	4.6 E-05
18540-29-9	Hexavalent chromium[e]	2.2 E-08	1.9 E-07
218-01-9	Chrysene[e,g]	9.3 E-09	8.0 E-08
7440-50-8	Copper[f]	9.6 E-04	8.2 E-03
53-70-3	Dibenz[a,h]anthracene[e]	4.3 E-10	3.6 E-09
84-74-2	Dibutyl phthalate[e]	3.7 E-07	3.1 E-06
--	Total dioxin/furan compounds[e]	1.1 E-11	9.0 E-11
100-41-4	Ethylbenzene[e,h]	2.0 E-07	1.7 E-06
74-85-1	Ethylene[f,g]	1.8 E-05	1.5 E-04
117-81-7	bis(2-Ethylhexyl)phthalate[e,g]	4.7 E-07	4.0 E-06

Table 15.2.6-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
206-44-0	Fluoranthene[e]	3.3 E-08	2.8 E-07
86-73-7	Fluorene[d]	4.2 E-08	3.6 E-07
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	1.0 E-12	8.8 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	1.3 E-13	1.1 E-12
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e]	4.7 E-14	4.0 E-13
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e]	2.8 E-14	2.4 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	1.9 E-13	1.6 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	1.3 E-13	1.2 E-12
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e]	1.4 E-13	1.2 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	5.3 E-14	4.6 E-13
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e]	6.9 E-14	5.9 E-13
74-90-8	Hydrogen cyanide[e,g]	5.4 E-05	4.6 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e]	4.8 E-09	4.1 E-08
7439-92-1	Lead[e,g]	7.3 E-05	6.2 E-04
7439-96-5	Manganese[e,g]	1.9 E-05	1.6 E-04
80-62-6	Methyl methacrylate[e]	1.0 E-07	8.6 E-07
91-20-3	Naphthalene[e,g]	2.0 E-07	1.7 E-06
7697-37-2	Nitric acid[f,g]	1.2 E-05	1.0 E-04
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	7.7 E-12	6.6 E-11
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	3.4 E-13	2.9 E-12
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin[e]	6.6 E-14	5.6 E-13
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[e]	9.1 E-14	7.8 E-13
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e]	2.0 E-13	1.7 E-12
85-01-8	Phenanthrene[e,g]	9.0 E-08	7.7 E-07
115-07-1	Propylene[f,g]	6.8 E-06	5.8 E-05
129-00-0	Pyrene[d.]	4.6 E-08	3.9 E-07
100-42-5	Styrene[e,g]	2.2 E-07	1.9 E-06
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e]	1.2 E-14	1.0 E-13
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	2.5 E-13	2.1 E-12
108-88-3	Toluene[e,g]	1.6 E-06	1.4 E-05
75-69-4	Trichlorofluoromethane[f]	8.8 E-08	7.6 E-07
95-63-6	1,2,4-Trimethylbenzene[f,h]	9.0 E-08	7.7 E-07

Table 15.2.6-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
540-84-1	2,2,4-Trimethylpentane[d]	5.2 E-08	4.4 E-07
75-01-4	Vinyl chloride[e,h]	2.4 E-08	2.1 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	7.1 E-07	6.1 E-06
95-47-6	o-Xylene[e,h]	2.4 E-07	2.0 E-06
7440-66-6	Zinc[f,g]	1.1 E-04	9.2 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 1.17 E-01 pounds per item. Reference 1.
[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 B.
[h] EMISSION FACTOR RATING D.

References For Section 15.2.6

1. *Report No. 3 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, February 2004.

2. *Detailed Test Plan No. 3 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 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 Exploding Ordnance Emission Study Phase II Series 3 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, January 2005.

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15.2.7 B584, M918 40-mm Practice Cartridge

15.2.7.1 Ordnance Description[1,2]

The M918 40-mm Practice Cartridge (DODIC B584) is a practice round used only in training. Multiple cartridges are linked together and fired at targets of varying distance. The M918 mimics the appearance and behavior of the M430 cartridge used in combat. The M918 cartridge is designed to be fired from the MK 19 Mod 3, 40-mm grenade machine gun. It is also used in the M970 CSAT to simulate the loading and firing of large caliber ammunition. Upon impact with the target, gases generated by burning flash powder cause the base of the projectile body to rupture and produce a flash, smoke, and a loud report. Note that emission factors presented herein are only associated with the firing of the practice cartridge; emissions associated with the impact of the projectile are not addressed in this section.

The M918 40-mm Practice Cartridge contains a propellant and a primer mix. The projectile body is steel and contains an insert that has a flash charge chamber filled with flash charge composition. When the firing pin of the weapon strikes the percussion primer, the propellant within the chamber is ignited, propelling the projectile through the launcher barrel to the target.

15.2.7.2 Emissions And Controls[1,3-6]

Primary emissions from the use of the M918 40-mm Practice Cartridge include 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 used in the field, there are no controls associated with its use.

Table 15.2.7-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.2.7-2 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 15.2.7-1 EMISSION FACTORS FOR THE USE OF DODIC B584, M918 40-MM PRACTICE CARTRIDGE (PROPELLING CHARGE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	2.7 E-03	2.6 E-01
630-08-0	CO	2.6 E-03	2.5 E-01
7439-92-1	Lead (Pb)[f]	1.1 E-05	1.1 E-03
74-82-8	Methane[f]	5.4 E-06	5.3 E-04
--	Oxides of nitrogen (NO_x)[f]	9.7 E-05	9.5 E-03
--	PM-2.5[d]	1.2 E-04	1.1 E-02
--	PM-10[e]	1.4 E-04	1.4 E-02
12789-66-1	TSP	1.4 E-04	1.4 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 1.03 E-02 pounds per item. Reference 1.
[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 C.

Table 15.2.7-2 EMISSION FACTORS FOR THE USE OF DODIC B584, M918 40-MM PRACTICE CARTRIDGE (PROPELLING CHARGE) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d]	2.4 E-10	2.4 E-08
208-96-8	Acenaphthylene[d]	3.3 E-09	3.2 E-07
75-07-0	Acetaldehyde[e,h]	5.9 E-08	5.7 E-06
75-05-8	Acetonitrile[e,g]	1.5 E-07	1.5 E-05
107-02-8	Acrolein[e]	4.3 E-08	4.2 E-06
107-13-1	Acrylonitrile[e]	1.9 E-07	1.8 E-05
7664-41-7	Ammonia[d]	8.6 E-06	8.4 E-04
120-12-7	Anthracene[e,g]	1.3 E-10	1.3 E-08
7440-36-0	Antimony[e]	1.3 E-06	1.2 E-04
7440-38-2	Arsenic[e]	2.8 E-09	2.7 E-07
7440-39-3	Barium[f]	1.6 E-05	1.5 E-03
71-43-2	Benzene[e]	8.9 E-07	8.7 E-05
56-55-3	Benzo[a]anthracene[e]	2.4 E-10	2.3 E-08
205-99-2	Benzo[b]fluoranthene[e]	1.3 E-10	1.3 E-08
207-08-9	Benzo[k]fluoranthene[e]	2.9 E-10	2.8 E-08
191-24-2	Benzo[g,h,i]perylene[e]	8.2 E-10	8.0 E-08
50-32-8	Benzo[a]pyrene[e]	3.1 E-10	3.1 E-08
75-65-0	t-Butyl alcohol[e,h]	7.2 E-08	7.0 E-06
75-15-0	Carbon disulfide[e]	4.0 E-09	3.9 E-07
75-68-3	1-Chloro-1,1-difluoroethane[f,h]	5.7 E-08	5.6 E-06
75-45-6	Chlorodifluoromethane[f]	4.9 E-09	4.8 E-07
74-87-3	Chloromethane	2.7 E-09	2.6 E-07
7440-47-3	Chromium[e]	1.1 E-08	1.1 E-06
7440-48-4	Cobalt[e]	3.2 E-09	3.1 E-07
7440-50-8	Copper[f]	2.5 E-05	2.5 E-03
98-82-8	Cumene[e]	3.2 E-09	3.1 E-07
57-12-5	Particulate cyanide[e]	2.2 E-07	2.1 E-05
53-70-3	Dibenz[a,h]anthracene[e]	2.4 E-11	2.4 E-09
75-71-8	Dichlorodifluoromethane[f]	4.1 E-09	4.0 E-07
107-06-2	1,2-Dichloroethane[e]	1.9 E-08	1.8 E-06

Table 15.2.7-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
--	Total dioxin/furan compounds[e]	8.9 E-14	8.7 E-12
100-41-4	Ethylbenzene[e]	2.0 E-08	2.0 E-06
74-85-1	Ethylene[f,h]	2.1 E-06	2.1 E-04
206-44-0	Fluoranthene[e]	5.3 E-10	5.2 E-08
86-73-7	Fluorene[d]	6.3 E-10	6.1 E-08
50-00-0	Formaldehyde[e,h]	1.7 E-07	1.7 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	7.0 E-15	6.8 E-13
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	5.1 E-15	4.9 E-13
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e,h]	2.1 E-15	2.1 E-13
110-54-3	Hexane[e]	4.9 E-07	4.8 E-05
7647-01-0	Hydrochloric acid[e]	6.5 E-07	6.4 E-05
74-90-8	Hydrogen cyanide[e,g]	1.3 E-06	1.3 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e]	2.5 E-10	2.4 E-08
7439-92-1	Lead[e]	1.1 E-05	1.1 E-03
7439-96-5	Manganese[e]	2.1 E-08	2.0 E-06
74-87-3	Methyl chloride[e]	2.7 E-09	2.6 E-07
75-09-2	Methylene chloride[e]	1.4 E-07	1.4 E-05
91-20-3	Naphthalene[e]	2.2 E-08	2.2 E-06
7440-02-0	Nickel[e]	5.9 E-08	5.7 E-06
7697-37-2	Nitric acid[f]	1.4 E-06	1.4 E-04
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e,h]	6.8 E-14	6.6 E-12
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	7.0 E-15	6.8 E-13
85-01-8	Phenanthrene[e]	7.7 E-10	7.5 E-08
115-07-1	Propylene[f]	3.8 E-07	3.7 E-05
129-00-0	Pyrene[d,g]	1.1 E-09	1.1 E-07
7440-22-4	Silver[f]	7.4 E-10	7.2 E-08
100-42-5	Styrene[e]	2.4 E-08	2.3 E-06
127-18-4	Tetrachloroethylene[e]	4.4 E-09	4.3 E-07
108-88-3	Toluene[e]	1.4 E-07	1.4 E-05
75-69-4	Trichlorofluoromethane[f,g]	3.1 E-09	3.1 E-07
95-63-6	1,2,4-Trimethylbenzene[f]	9.1 E-09	8.9 E-07
75-01-4	Vinyl chloride[e]	2.4 E-09	2.3 E-07

Table 15.2.7-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	3.2 E-08	3.1 E-06
95-47-6	o-Xylene[e]	1.6 E-08	1.6 E-06
7440-66-6	Zinc[f]	1.9 E-06	1.9 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 1.03 E-02 pounds per item. Reference 1.
[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 B.
[h] EMISSION FACTOR RATING D.

References For Section 15.2.7

1. *Report No. 2 for the Firing Point Emission Study Phase II, Revision 1*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2006.

2. *Training Munitions Health Risk Assessment No. 39-EJ-1485-00, Residential Exposure from Inhalation of Air Emissions from the M918 40-mm Practice Cartridge or the M781 40-mm Practice Cartridge, Department of Defense Identification Codes: B584 and B519*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, June 2001.

3. *Detailed Test Plan No. 2 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 2 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, July 2004.

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15.2.8 B627, M83A3 60-mm Illuminating Cartridge

15.2.8.1 Ordnance Description[1-4]

The M83A3 60-mm Illuminating Cartridge (DODIC B627) is a mortar used to provide illumination for observation during night missions. This ammunition is used during combat and on firing ranges during training. The cartridge is fired from the M224 mortar tube in the Lightweight Company System. Note that emission factors presented herein are divided into those associated with firing the cartridge and those associated with the detonation of the projectile.

The M83A3 60-mm Illuminating Cartridge consists of a body tube, tail cone assembly, illuminant charge, parachute assembly, time fuse, fin assembly, four increments of propellant charge, ignition cartridge, and percussion primer. The number of propellant charge increments used indicates the zone into which the mortar is fired (e.g., one propellant charge increment is used to fire the mortar into "Zone 1"). The illuminant assembly, which consists of a first-fire charge and an illuminant charge, is contained in a boxboard casing, which is attached to the parachute with a suspension line. When the percussion primer strikes the firing pin in the mortar tube, the propellant charges are ignited, expelling the projectile from the tube. The time fuse functions approximately 15 seconds after firing, expelling the illuminant assembly and parachute, which falls slowly back to ground.

15.2.8.2 Emissions And Controls[1-6]

Primary emissions from the use of the M83A3 60-mm Illuminating Cartridge include particulate matter and carbon dioxide (CO_2). 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 used in the field, there are no controls associated with its use.

Table 15.2.8-1 presents emission factors for carbon dioxide (CO_2), criteria pollutants, methane, and total suspended particulate (TSP) for the firing of the cartridge. Table 15.2.8-2 presents similar data for the detonation of the projectile, while Table 15.2.8-3 presents combined emission factors for the firing of the cartridge and the detonation of the projectile. Table 15.2.8-4 presents emission factors for hazardous air pollutants and toxic chemicals for the firing of the cartridge. Table 15.2.8-5 presents similar data for the detonation of the projectile, while Table 15.2.8-6 presents combined emission factors for the firing of the cartridge and the detonation of the projectile. In each of the tables, the emission factors are presented in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW). Because the NEW for the propelling charge is dependent upon the number of propelling charge increments used, the emission factors are not presented in units of pounds of emissions per item (lb per item) except in Tables 15.2.8-2 and 15.2.8-5, which present emission factors for the detonation of the projectile.

Table 15.2.8-1 EMISSION FACTORS FOR THE USE OF DODIC B627, M83A3 60-MM ILLUMINATING CARTRIDGE (PROPELLING CHARGE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per lb NEW[c]
124-38-9	CO_2	9.6 E-02
630-08-0	Carbon monoxide (CO)	1.5 E-01
7439-92-1	Lead (Pb)[f]	8.0 E-04
74-82-8	Methane	1.8 E-03
--	Oxides of nitrogen (NO_x)	4.5 E-03
--	PM-2.5[d,f]	1.4 E-02
--	PM-10[e,f]	2.1 E-02
12789-66-1	TSP[f]	2.2 E-02

[a] Factors represent uncontrolled emissions. References 2, 4, 7, and 9.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance varies between 1.41 E-02 pounds per item and 3.83 E-02 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 6.00 E-03 pounds per item and between one and four propelling charge increments, each of which weighs 8.07 E-03 pounds. References 2, 5, and 9.
[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 15.2.8-2 EMISSION FACTORS FOR THE USE OF DODIC B627, M83A3 60-MM ILLUMINATING CARTRIDGE (PROJECTILE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, TOTAL NONMETHANE HYDROCARBONS, 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	3.6 E-02	6.6 E-02
630-08-0	CO	4.1 E-03	7.5 E-03
7439-92-1	Pb[d]	2.4 E-04	4.4 E-04
--	NO_x	7.9 E-03	1.5 E-02
--	PM-2.5[d]	4.8 E-01	8.8 E-01
--	PM-10	2.0 E-01	3.7 E-01
7446-09-5	Sulfur dioxide (SO_2)	1.4 E-04	2.7 E-04
--	TNMHC[d]	5.5 E-03	1.0 E-02
12789-66-1	TSP	2.5 E-01	4.6 E-01

[a] Factors represent uncontrolled emissions. References 1, 3, 6, and 8.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 5.42 E-01 pounds per item. References 1, 5, and 8.
[d] EMISSION FACTOR RATING C.

Table 15.2.8-3 EMISSION FACTORS FOR THE USE OF DODIC B627, M83A3 60-MM ILLUMINATING CARTRIDGE (TOTAL) – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, TOTAL NONMETHANE HYDROCARBONS, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per lb NEW[c]
124-38-9	CO_2	6.7 E-02
630-08-0	CO	1.3 E-02
7439-92-1	Pb[e]	4.5 E-04
74-82-8	Methane[e]	7.1 E-05
--	NO_x	1.4 E-02
--	PM-2.5[e]	8.4 E-01
--	PM-10[d]	3.6 E-01
7446-09-5	SO_2	2.6 E-04
--	TNMHC[e]	9.7 E-03
12789-66-1	TSP[d]	4.4 E-01

[a] Factors represent uncontrolled emissions. References 1-4 and 6-9.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance varies between 5.56 E-01 pounds per item and 5.80 E-01 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 6.00 E-03 pounds per item, between one and four propelling charge increments, each of which weighs 8.07 E-03 pounds, and a 5.42 E-01 pound illuminant charge located in the projectile. References 1, 2, 5, 8, and 9.
[d] EMISSION FACTOR RATING B.
[e] EMISSION FACTOR RATING C.

Table 15.2.8-4 EMISSION FACTORS FOR THE USE OF DODIC B627, M83A3 60-MM ILLUMINATING CARTRIDGE (PROPELLANT CHARGE) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per lb NEW[c]
83-32-9	Acenaphthene[d]	2.6 E-07
208-96-8	Acenaphthylene[d]	9.4 E-06
75-07-0	Acetaldehyde[e]	1.6 E-04
107-13-1	Acrylonitrile[e]	1.1 E-05
7429-90-5	Aluminum[f]	2.6 E-04
120-12-7	Anthracene[e]	2.6 E-07
7440-36-0	Antimony[e,h]	5.9 E-05
7440-39-3	Barium[f,h]	2.3 E-04
71-43-2	Benzene[e,h]	3.2 E-03
56-55-3	Benzo[a]anthracene[e]	2.0 E-07
205-99-2	Benzo[b]fluoranthene[e]	6.6 E-07
207-08-9	Benzo[k]fluoranthene[e]	3.2 E-07
191-24-2	Benzo[g,h,i]perylene[e]	2.9 E-07
50-32-8	Benzo[a]pyrene[e]	4.6 E-07
192-97-2	Benzo[e]pyrene[d]	4.3 E-07
106-99-0	1,3-Butadiene[e,h]	8.3 E-05
7440-43-9	Cadmium[e,h]	2.5 E-06
7440-47-3	Chromium[e,h]	4.1 E-05
18540-29-9	Hexavalent chromium[e,i]	1.5 E-02
218-01-9	Chrysene[e,h]	3.7 E-07
7440-50-8	Copper[f]	5.5 E-05
53-70-3	Dibenz[a,h]anthracene[e]	5.2 E-08
107-06-2	1,2-Dichloroethane[e,h]	1.1 E-04
--	Total dioxin/furan compounds[e,h]	7.8 E-11
100-41-4	Ethylbenzene[e,h]	2.9 E-05
74-85-1	Ethylene[f]	1.7 E-03
206-44-0	Fluoranthene[e]	1.9 E-07
86-73-7	Fluorene[d]	2.5 E-06
50-00-0	Formaldehyde[d]	4.0 E-04
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e,h]	7.8 E-11

Table 15.2.8-4 (cont.)

CASRN[b]	Pollutant	lb per lb NEW[c]
74-90-8	Hydrogen cyanide[e]	7.2 E-05
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	3.4 E-07
7439-92-1	Lead[e]	8.0 E-04
7439-96-5	Manganese[e,g]	5.8 E-06
75-09-2	Methylene chloride[e]	9.4 E-04
91-20-3	Naphthalene[e]	8.2 E-05
7440-02-0	Nickel[e,h]	9.9 E-06
55-63-0	Nitroglycerin[f,h]	9.2 E-06
85-01-8	Phenanthrene[e]	1.5 E-06
115-07-1	Propylene[f,h]	2.4 E-04
129-00-0	Pyrene[d]	7.3 E-10
100-42-5	Styrene[e,h]	1.3 E-03
108-88-3	Toluene[e,h]	3.8 E-04
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	1.1 E-05
95-47-6	o-Xylene[e,h]	4.0 E-06
7440-66-6	Zinc[f,h]	8.8 E-05

[a] Factors represent uncontrolled emissions. References 2, 4, 7, and 9.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance varies between 1.41 E-02 pounds per item and 3.83 E-02 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 6.00 E-03 pounds per item and between one and four propelling charge increments, each of which weighs 8.07 E-03 pounds. References 2, 5, and 9.
[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.

Table 15.2.8-5 EMISSION FACTORS FOR THE USE OF DODIC B627, M83A3 60-MM ILLUMINATING CARTRIDGE (PROJECTILE) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
75-07-0	Acetaldehyde[d]	4.1 E-05	7.5 E-05
75-05-8	Acetonitrile[d,i]	1.3 E-02	2.5 E-02
7429-90-5	Aluminum[e,g]	1.7 E-04	3.1 E-04
7440-36-0	Antimony[d]	2.7 E-06	4.9 E-06
7440-39-3	Barium[e]	1.9 E-04	3.5 E-04
71-43-2	Benzene[d,g]	3.5 E-05	6.5 E-05
7440-41-7	Beryllium[d]	1.8 E-07	3.3 E-07
106-99-0	1,3-Butadiene[d,h]	2.0 E-05	3.6 E-05
7440-43-9	Cadmium[d,h]	6.7 E-07	1.2 E-06
7440-47-3	Chromium[d,h]	1.9 E-06	3.5 E-06
7440-48-4	Cobalt[d,h]	3.5 E-07	6.4 E-07
7440-50-8	Copper[e,g]	1.5 E-05	2.7 E-05
4170-30-3	Crotonaldehyde[e]	4.1 E-06	7.5 E-06
--	Total dioxin/furan compounds[d]	1.6 E-07	3.0 E-07
100-41-4	Ethylbenzene[d]	3.6 E-05	6.7 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[d]	2.9 E-08	5.3 E-08
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[d,i]	3.3 E-09	6.0 E-09
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[d,i]	4.2 E-09	7.8 E-09
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[d,i]	2.8 E-09	5.2 E-09
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[d,i]	4.0 E-09	7.3 E-09
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[d,i]	4.0 E-09	7.4 E-09
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[d,i]	2.3 E-09	4.3 E-09
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran[d,i]	5.8 E-09	1.1 E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[d,i]	1.9 E-09	3.4 E-09
110-54-3	Hexane[d]	3.3 E-05	6.1 E-05
74-90-8	Hydrogen cyanide[d]	1.2 E-04	2.1 E-04
7439-92-1	Lead[d]	2.4 E-04	4.4 E-04
7439-96-5	Manganese[d,h]	4.4 E-06	8.2 E-06
91-57-6	2-Methylnaphthalene[f]	2.3 E-07	4.3 E-07
91-20-3	Naphthalene[d,h]	7.1 E-07	1.3 E-06

Table 15.2.8-5 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7440-02-0	Nickel[d,g]	8.8 E-07	1.6 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[d]	9.4 E-08	1.7 E-07
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[d,i]	8.3 E-09	1.5 E-08
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[d,i]	2.6 E-09	4.7 E-09
108-95-2	Phenol[d]	1.2 E-06	2.3 E-06
7723-14-0	Phosphorus[f,h]	1.0 E-04	1.9 E-04
123-38-6	Propionaldehyde[d]	5.0 E-06	9.3 E-06
110-86-1	Pyridine[e]	5.8 E-07	1.1 E-06
7440-28-0	Thallium[e]	7.9 E-07	1.5 E-06
108-88-3	Toluene[d,h]	2.6 E-05	4.8 E-05
95-63-6	1,2,4-Trimethylbenzene[e,i]	4.2 E-05	7.7 E-05
106-42-3, 108-38-3	m-Xylene, p-Xylene[d,h]	6.2 E-05	1.1 E-04
95-47-6	o-Xylene[d]	4.0 E-05	7.5 E-05
7440-66-6	Zinc[e]	1.5 E-03	2.9 E-03

[a] Factors represent uncontrolled emissions. References 1, 3, 6, and 8.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 5.42 E-01 pounds per item. References 1, 5, and 8.
[d] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313.
[f] Hazardous air pollutant under CAA Section 112(b).
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING B.
[i] EMISSION FACTOR RATING D.

Table 15.2.8-6 EMISSION FACTORS FOR THE USE OF DODIC B627, M83A3 60-MM ILLUMINATING CARTRIDGE (TOTAL) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per lb NEW[c]
83-32-9	Acenaphthene[d]	1.0 E-08
208-96-8	Acenaphthylene[d]	3.7 E-07
75-07-0	Acetaldehyde[e]	7.8 E-05
75-05-8	Acetonitrile[e,h]	2.4 E-02
107-13-1	Acrylonitrile[e]	4.2 E-07
7429-90-5	Aluminum[f,g]	3.1 E-04
120-12-7	Anthracene[e]	1.0 E-08
7440-36-0	Antimony[e]	7.1 E-06
7440-39-3	Barium[f]	3.4 E-04
71-43-2	Benzene[e]	1.9 E-04
56-55-3	Benzo[a]anthracene[e]	7.9 E-09
205-99-2	Benzo[b]fluoranthene[e]	2.6 E-08
207-08-9	Benzo[k]fluoranthene[e]	1.2 E-08
191-24-2	Benzo[g,h,i]perylene[e]	1.1 E-08
50-32-8	Benzo[a]pyrene[e]	1.8 E-08
192-97-2	Benzo[e]pyrene[d]	1.7 E-08
7440-41-7	Beryllium[e]	3.2 E-07
106-99-0	1,3-Butadiene[e]	3.8 E-05
7440-43-9	Cadmium[e]	1.3 E-06
18540-29-9	Hexavalent chromium[e,h]	5.9 E-04
7440-47-3	Chromium[e]	5.0 E-06
218-01-9	Chrysene[e]	1.5 E-08
7440-48-4	Cobalt[e]	6.1 E-07
7440-50-8	Copper[f,g]	2.8 E-05
4170-30-3	Crotonaldehyde[f]	7.2 E-06
53-70-3	Dibenz[a,h]anthracene[e]	2.1 E-09
107-06-2	1,2-Dichloroethane[e]	4.4 E-06
--	Total dioxin/furan compounds[e]	2.9 E-07
100-41-4	Ethylbenzene[e]	6.6 E-05
74-85-1	Ethylene[f]	6.5 E-05

Table 15.2.8-6 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
206-44-0	Fluoranthene[e]	4.3 E-09	7.5 E-09
86-73-7	Fluorene[d]	5.5 E-08	9.7 E-08
50-00-0	Formaldehyde[e]	8.7 E-06	1.6 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	2.9 E-08	5.1 E-08
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e,h]	3.3 E-09	5.8 E-09
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e,h]	4.2 E-09	7.5 E-09
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e,h]	2.8 E-09	5.0 E-09
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e,h]	4.0 E-09	7.0 E-09
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e,h]	4.0 E-09	7.1 E-09
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e,h]	2.3 E-09	4.1 E-09
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran[e,h]	5.8 E-09	1.0 E-08
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e,h]	1.9 E-09	3.3 E-09
110-54-3	Hexane[e]	3.3 E-05	5.8 E-05
74-90-8	Hydrogen cyanide[e]	1.2 E-04	2.1 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e]	7.5 E-09	1.3 E-08
7439-92-1	Lead[e]	2.5 E-04	4.5 E-04
7439-96-5	Manganese[e,g]	4.5 E-06	8.1 E-06
75-09-2	Methylene chloride[e]	2.1 E-05	3.7 E-05
91-57-6	2-Methylnaphthalene[d]	2.3 E-07	4.2 E-07
91-20-3	Naphthalene[e,g]	2.5 E-06	4.5 E-06
7440-02-0	Nickel[e]	1.1 E-06	1.9 E-06
55-63-0	Nitroglycerin[f]	2.0 E-07	3.6 E-07
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[d]	9.4 E-08	1.7 E-07
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[d,h]	8.3 E-09	1.5 E-08
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[e,h]	2.6 E-09	4.5 E-09
85-01-8	Phenanthrene[e]	3.3 E-08	5.9 E-08
108-95-2	Phenol[d]	1.2 E-06	2.2 E-06
7723-14-0	Phosphorus[d]	1.0 E-04	1.8 E-04
123-38-6	Propionaldehyde[e]	5.0 E-06	8.9 E-06
115-07-1	Propylene[f]	5.4 E-06	9.5 E-06
129-00-0	Pyrene[d]	1.6 E-11	2.9 E-11
110-86-1	Pyridine[e]	5.8 E-07	1.0 E-06
100-42-5	Styrene[e]	2.8 E-05	5.0 E-05

Table 15.2.8-6 (cont.)

CASRN[b]	Pollutant	lb per lb NEW[c]
7440-28-0	Thallium[f]	1.4 E-06
108-88-3	Toluene[e]	6.1 E-05
95-63-6	1,2,4-Trimethylbenzene[f,h]	7.4 E-05
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,g]	1.1 E-04
95-47-6	o-Xylene[e]	7.2 E-05
7440-66-6	Zinc[f]	2.8 E-03

[a] Factors represent uncontrolled emissions. References 1- 4 and 6-9.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance varies between 5.56 E-01 pounds per item and 5.80 E-01 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 6.00 E-03 pounds per item, between one and four propelling charge increments, each of which weighs 8.07 E-03 pounds, and a 5.42 E-01 pound illuminant charge located in the projectile. References 1, 2, 5, 8, and 9.
[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 B.
[h] EMISSION FACTOR RATING D.

References For Section 15.2.8

1. *Sampling Results for AEC Phase V Emission Characterization of Exploding Ordnance and Smoke/Pyrotechnics, Revision 1*, URS Group, Inc., Oak Ridge, TN, February 2007.

2. *Report No.10 for the Firing Point Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2006.

3. *Detailed Test Plan for Phase V Emission Characterization of Exploding Ordnance and Smoke/Pyrotechnics*, West Desert Test Center, U.S. Army Dugway Proving Ground, UT, October 2003.

4. *Detailed Test Plan No.10 for the Firing Point Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, June 2004.

5. *Munitions Items Disposition Action System (MIDAS)* website, https://midas.dac.army.mil/, U.S. Army Defense Ammunition Center, McAlester, OK, May 2007.

6. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Phase V-B Testing Conducted at Dugway Proving Ground, Utah*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, November 2007.

7. *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 10 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, February 2008.

8. Supporting information including Excel spreadsheets supplied upon request by the U.S. Army Dugway Proving Ground test support contractor, URS Group, Inc., Oak Ridge, TN, January 2006 and February 2007.

9. 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, January 2007.

15.2.9 B632, M49A4 60-mm High Explosive Cartridge

15.2.9.1 Ordnance Description[1]

The M49A4 60-mm High Explosive Cartridge (DODIC B632) is a mortar used against personnel and light material, providing both a fragmentation and blast effect. This ammunition is used during combat and on firing ranges during training. The cartridge is fired from the M2 and M19 60-mm mortars. Note that emission factors presented herein are only associated with the detonation of the projectile; emissions associated with the propelling charge are not addressed in this section.

The M49A4 60-mm High Explosive Cartridge consists of a projectile body, a point detonation fuse, and a fin-stabilized assembly. The projectile body is made of forged steel or pearlitic malleable iron and contains a bursting charge. The point detonation fuse is attached to the nose of the projectile and contains a booster charge and an initiator charge.

15.2.9.2 Emissions And Controls[1-5]

Carbon dioxide (CO_2) is the primary emission from the use of the M49A4 60-mm High Explosive Cartridge. 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 used in the field, there are no controls associated with its use.

Table 15.2.9-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.2.9-2 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 15.2.9-1 EMISSION FACTORS FOR THE USE OF DODIC B632, M49A4 60-MM HIGH EXPLOSIVE CARTRIDGE (PROJECTILE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	2.9 E-01	6.2 E-01
630-08-0	Carbon monoxide (CO)	3.0 E-02	6.5 E-02
7439-92-1	Lead (Pb)	2.3 E-04	5.1 E-04
74-82-8	Methane	8.4 E-04	1.8 E-03
--	Oxides of nitrogen (NO_X)	4.2 E-03	9.2 E-03
--	PM-2.5[d]	1.7 E-02	3.7 E-02
--	PM-10[e]	3.2 E-02	7.1 E-02
12789-66-1	TSP	3.9 E-02	8.5 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 4.57 E-01 pounds per item. Reference 1.
[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.

Table 15.2.9-2 EMISSION FACTORS FOR THE USE OF DODIC B632, M49A4 60-MM HIGH EXPLOSIVE CARTRIDGE (PROJECTILE) – 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]	2.8 E-08	6.1 E-08
208-96-8	Acenaphthylene[d,g]	1.6 E-07	3.5 E-07
75-05-8	Acetonitrile[e]	4.6 E-05	1.0 E-04
107-13-1	Acrylonitrile[e]	3.5 E-06	7.6 E-06
7429-90-5	Aluminum[f]	2.2 E-03	4.8 E-03
7664-41-7	Ammonia[d]	1.4 E-03	3.1 E-03
120-12-7	Anthracene[e]	3.1 E-08	6.7 E-08
7440-39-3	Barium[f,g]	1.4 E-05	3.1 E-05
71-43-2	Benzene[e]	1.0 E-05	2.3 E-05
56-55-3	Benzo[a]anthracene[e]	1.2 E-08	2.5 E-08
205-99-2	Benzo[b]fluoranthene[e]	6.6 E-09	1.4 E-08
207-08-9	Benzo[k]fluoranthene[e,g]	3.4 E-09	7.5 E-09
191-24-2	Benzo[g,h,i]perylene[e]	5.2 E-09	1.1 E-08
50-32-8	Benzo[a]pyrene[e]	6.6 E-09	1.4 E-08
192-97-2	Benzo[e]pyrene[d]	1.2 E-08	2.5 E-08
7440-43-9	Cadmium[e,g]	8.2 E-05	1.8 E-04
7440-47-3	Chromium[e,g]	1.1 E-05	2.5 E-05
218-01-9	Chrysene[e]	1.7 E-08	3.8 E-08
7440-50-8	Copper[f,g]	6.1 E-04	1.3 E-03
--	Total dioxin/furan compounds[e,g]	1.4 E-11	3.1 E-11
74-85-1	Ethylene[f]	5.4 E-05	1.2 E-04
117-81-7	bis(2-Ethylhexyl)phthalate[e]	2.4 E-06	5.2 E-06
206-44-0	Fluoranthene[e,g]	7.0 E-08	1.5 E-07
86-73-7	Fluorene[d,g]	3.4 E-08	7.4 E-08
50-00-0	Formaldehyde[e,g]	9.7 E-06	2.1 E-05
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e,g]	2.3 E-13	5.1 E-13
74-90-8	Hydrogen cyanide[e]	3.3 E-04	7.3 E-04
7439-92-1	Lead[e]	2.3 E-04	5.1 E-04
7439-96-5	Manganese[e]	1.1 E-04	2.3 E-04

Table 15.2.9-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
1634-04-4	Methyl tert-butyl ether[e,h]	1.1 E-07	2.4 E-07
91-20-3	Naphthalene[e]	8.3 E-07	1.8 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e,h]	1.3 E-11	2.9 E-11
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e,h]	8.4 E-13	1.8 E-12
85-01-8	Phenanthrene[e]	2.3 E-07	5.0 E-07
115-07-1	Propylene[f]	1.2 E-05	2.7 E-05
129-00-0	Pyrene[d,g]	1.7 E-07	3.8 E-07
100-42-5	Styrene[e]	3.8 E-07	8.3 E-07
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e,h]	1.0 E-13	2.2 E-13
108-88-3	Toluene[e]	1.7 E-06	3.7 E-06
75-69-4	Trichlorofluoromethane[f,g]	5.2 E-08	1.1 E-07
75-01-4	Vinyl chloride[e,g]	2.3 E-07	5.0 E-07
7440-66-6	Zinc[f]	4.2 E-04	9.2 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 4.57 E-01 pounds per item. Reference 1.
[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 C.
[h] EMISSION FACTOR RATING D.

References For Section 15.2.9

1. *Report No. 3 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, February 2004.

2. *Detailed Test Plan No. 3 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 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 Exploding Ordnance Emission Study Phase II Series 3 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, January 2005.

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15.2.10 B642, M720 60-mm High Explosive Cartridge

15.2.10.1 Ordnance Description[1,2]

The M720 60-mm High Explosive Cartridge (DODIC B642) is a mortar used against personnel, light vehicles, light bunkers, and similar targets. This ammunition is used during combat and on firing ranges during training. The cartridge is fired from the M224 mortar tube in the Lightweight Company System. Note that emission factors presented herein are divided into those associated with firing the cartridge and those associated with the detonation of the projectile.

The M720 60-mm High Explosive Cartridge consists of a projectile body, a multi-option fuse, a fin assembly, between zero and four propellant charge increments (depending upon the range desired), and an ignition cartridge. The number of propellant charge increments used indicates the zone into which the mortar is fired (e.g., one propellant charge increment is used to fire the mortar into "Zone 1"). The projectile body is made of alloy steel and contains a bursting charge.

15.2.10.2 Emissions And Controls[1-8]

Primary emissions from the use of the M720 60-mm High Explosive Cartridge include carbon dioxide (CO_2), carbon monoxide (CO), and particulate matter. 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 used in the field, there are no controls associated with its use.

Table 15.2.10-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP) for the firing of the cartridge. Table 15.2.10-2 presents similar data for the detonation of the projectile, while Table 15.2.10-3 presents combined emission factors for the firing of the cartridge and the detonation of the projectile. Table 15.2.10-4 presents emission factors for hazardous air pollutants and toxic chemicals for the firing of the cartridge. Table 15.2.10-5 presents similar data for the detonation of the projectile, while Table 15.2.10-6 presents combined emission factors for the firing of the cartridge and the detonation of the projectile. In each of the tables, the emission factors are presented in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW). Because the NEW for the propelling charge is dependent upon the number of propelling charge increments used, the emission factors are not presented in units of pounds of emissions per item (lb per item) except in Tables 15.2.10-2 and 15.2.10-5, which present emission factors for the detonation of the projectile.

Table 15.2.10-1 EMISSION FACTORS FOR THE USE OF DODIC B642, M720 60-MM HIGH EXPLOSIVE CARTRIDGE (PROPELLING CHARGE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: A (except as noted)

CASRN[b]	Pollutant	lb per lb NEW[c]
124-38-9	CO_2	1.5 E-01
630-08-0	CO	2.8 E-01
7439-92-1	Lead (Pb)[f]	1.0 E-04
74-82-8	Methane	1.0 E-03
--	Oxides of nitrogen (NO_X)	2.6 E-03
--	PM-2.5[d,f]	8.9 E-03
--	PM-10[e,f]	1.1 E-02
12789-66-1	TSP[f]	7.8 E-03

[a] Factors represent uncontrolled emissions. References 1, 3, and 8.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance varies between 7.93 E-03 pounds per item and 1.03 E-01 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 7.93 E-03 pounds per item and between zero and four propelling charge increments, each of which weighs 2.37 E-02 pounds. Reference 8.
[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 15.2.10-2 EMISSION FACTORS FOR THE USE OF DODIC B642, M720 60-MM HIGH EXPLOSIVE CARTRIDGE (PROJECTILE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	4.2 E-01	5.3 E-01
630-08-0	CO	4.8 E-02	6.1 E-02
7439-92-1	Pb	4.4 E-04	5.5 E-04
74-82-8	Methane	1.5 E-03	1.9 E-03
--	NO_x	5.3 E-03	6.6 E-03
--	PM-2.5	3.0 E-02	3.8 E-02
--	PM-10	6.5 E-02	8.2 E-02
12789-66-1	TSP	7.3 E-02	9.3 E-02

[a] Factors represent uncontrolled emissions. References 2, 4, and 8.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 7.91 E-01 pounds per item. Reference 8.

Table 15.2.10-3 EMISSION FACTORS FOR THE USE OF DODIC B642, M720 60-MM HIGH EXPLOSIVE CARTRIDGE (TOTAL) – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B

CASRN[b]	Pollutant	lb per lb NEW[c]
124-38-9	CO_2	5.0 E-01
630-08-0	CO	7.5 E-02
7439-92-1	Lead	5.2 E-04
74-82-8	Methane	1.9 E-03
--	NO_x	6.4 E-03
--	PM-2.5	3.7 E-02
--	PM-10	7.7 E-02
12789-66-1	TSP	8.7 E-02

[a] Factors represent uncontrolled emissions. References 1-4 and 8.

[b] CASRN = Chemical Abstracts Service Registry Number.

[c] NEW = net explosive weight. The NEW for this ordnance varies between 7.99 E-01 pounds per item and 8.94 E-01 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 7.93 E-03 pounds per item, between zero and four propelling charge increments, each of which weighs 2.37 E-02 pounds, and a 7.91 E-01 pound high explosive charge located in the projectile. Reference 8.

Table 15.2.10-4 EMISSION FACTORS FOR THE USE OF DODIC B642, M720 60-MM HIGH EXPLOSIVE CARTRIDGE (PROPELLING CHARGE) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per lb NEW[c]
75-07-0	Acetaldehyde[d]	7.2 E-05
75-05-8	Acetonitrile[d]	1.4 E-05
107-13-1	Acrylonitrile[d]	4.5 E-05
7440-36-0	Antimony[d,g]	4.2 E-05
7440-39-3	Barium[e,g]	3.6 E-05
71-43-2	Benzene[d]	2.7 E-04
191-24-2	Benzo[g,h,i]perylene[d]	1.0 E-07
50-32-8	Benzo[a]pyrene[d]	3.6 E-08
463-58-1	Carbonyl sulfide[d,h]	4.5 E-05
7440-47-3	Chromium[d,g]	8.1 E-06
7440-50-8	Copper[e]	5.1 E-05
57-12-5	Particulate cyanide[d,g]	1.2 E-05
107-06-2	1,2-Dichloroethane[d]	5.2 E-06
74-85-1	Ethylene[e,f]	2.5 E-04
50-00-0	Formaldehyde[d]	5.1 E-04
74-90-8	Hydrogen cyanide[d]	3.2 E-04
7439-92-1	Lead[d]	1.0 E-04
75-09-2	Methylene chloride[d,g]	5.4 E-05
80-62-6	Methyl methacrylate[d,g]	2.6 E-06
91-20-3	Naphthalene[d,f]	4.7 E-06
7697-37-2	Nitric acid[e,g]	1.7 E-04
115-07-1	Propylene[e]	3.9 E-05
100-42-5	Styrene[d,g]	5.5 E-06
108-88-3	Toluene[d]	1.3 E-05
71-55-6	1,1,1-Trichloroethane[d,h]	1.9 E-06
7440-66-6	Zinc[e,g]	3.0 E-05

Table 15.2.10-4 (cont.)

[a] Factors represent uncontrolled emissions. References 1, 3, and 8.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance varies between 7.93 E-03 pounds per item and 1.03 E-01 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 7.93 E-03 pounds per item and between zero and four propelling charge increments, each of which weighs 2.37 E-02 pounds. Reference 8.
[d] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313.
[f] EMISSION FACTOR RATING A.
[g] EMISSION FACTOR RATING C.
[h] EMISSION FACTOR RATING D.

Table 15.2.10-5 EMISSION FACTORS FOR THE USE OF DODIC B642, M720 60-MM HIGH EXPLOSIVE CARTRIDGE (PROJECTILE) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	6.3 E-08	7.9 E-08
208-96-8	Acenaphthylene[d]	1.4 E-06	1.8 E-06
75-07-0	Acetaldehyde[e]	3.2 E-05	4.0 E-05
107-13-1	Acrylonitrile[e]	2.4 E-07	3.1 E-07
7429-90-5	Aluminum[f,g]	1.9 E-03	2.3 E-03
7664-41-7	Ammonia[d,g]	2.6 E-03	3.3 E-03
120-12-7	Anthracene[e,g]	1.2 E-07	1.5 E-07
7440-39-3	Barium[f]	7.6 E-05	9.6 E-05
71-43-2	Benzene[e,g]	3.3 E-06	4.2 E-06
56-55-3	Benzo[a]anthracene[e,g]	7.9 E-08	1.0 E-07
205-99-2	Benzo[b]fluoranthene[e,g]	7.4 E-08	9.4 E-08
207-08-9	Benzo[k]fluoranthene[e]	2.0 E-07	2.6 E-07
191-24-2	Benzo[g,h,i]perylene[e,g]	3.9 E-08	4.9 E-08
50-32-8	Benzo[a]pyrene[e,g]	5.0 E-08	6.3 E-08
192-97-2	Benzo[e]pyrene[d,g]	7.2 E-08	9.1 E-08
74-87-3	Chloromethane[e,g]	6.1 E-07	7.8 E-07
7440-47-3	Chromium[e]	7.2 E-05	9.1 E-05
18540-29-9	Hexavalent chromium[e]	3.4 E-06	4.3 E-06
218-01-9	Chrysene[e,g]	1.2 E-07	1.6 E-07
7440-48-4	Cobalt[e]	2.1 E-05	2.7 E-05
7440-50-8	Copper[f]	1.0 E-03	1.3 E-03
75-71-8	Dichlorodifluoromethane[f]	4.0 E-08	5.0 E-08
--	Total dioxin/furan compounds[e]	5.9 E-11	7.5 E-11
74-85-1	Ethylene[f]	8.0 E-05	1.0 E-04
117-81-7	bis(2-Ethylhexyl)phthalate[f,g]	3.6 E-07	4.5 E-07
206-44-0	Fluoranthene[e]	6.2 E-07	7.9 E-07
86-73-7	Fluorene[d]	7.0 E-08	8.8 E-08
50-00-0	Formaldehyde[e]	2.8 E-05	3.6 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	4.4 E-12	5.6 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	4.6 E-12	5.8 E-12

Table 15.2.10-5 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e]	1.4 E-12	1.8 E-12
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e]	5.5 E-13	6.9 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	1.4 E-12	1.8 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	1.4 E-12	1.8 E-12
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e]	4.2 E-12	5.3 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	1.5 E-12	1.9 E-12
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran[e]	2.6 E-13	3.3 E-13
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e]	1.5 E-12	2.0 E-12
7647-01-0	Hydrochloric acid[e]	1.9 E-05	2.4 E-05
74-90-8	Hydrogen cyanide[e,g]	7.7 E-04	9.7 E-04
7664-39-3	Hydrogen fluoride[e]	4.0 E-05	5.1 E-05
193-39-5	Indeno[1,2,3-cd]pyrene[e]	2.7 E-08	3.4 E-08
7439-92-1	Lead[e,g]	4.4 E-04	5.5 E-04
7439-96-5	Manganese[e,g]	2.2 E-04	2.8 E-04
91-20-3	Naphthalene[e,g]	2.9 E-06	3.6 E-06
7440-02-0	Nickel[e]	1.2 E-04	1.5 E-04
7697-37-2	Nitric acid[f,g]	2.4 E-05	3.1 E-05
55-63-0	Nitroglycerin[f]	4.5 E-07	5.7 E-07
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	1.8 E-11	2.3 E-11
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	8.6 E-12	1.1 E-11
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin[e]	1.1 E-12	1.4 E-12
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[e]	1.8 E-12	2.3 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e]	3.4 E-12	4.2 E-12
85-01-8	Phenanthrene[e,g]	9.9 E-07	1.3 E-06
108-95-2	Phenol[e]	2.2 E-06	2.7 E-06
123-38-6	Propionaldehyde[e]	7.1 E-06	8.9 E-06
115-07-1	Propylene[f,g]	2.1 E-05	2.7 E-05
129-00-0	Pyrene[d]	6.9 E-07	8.7 E-07
7440-22-4	Silver[g]	1.3 E-05	1.6 E-05
100-42-5	Styrene[e,g]	4.6 E-07	5.9 E-07
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e]	1.6 E-12	2.0 E-12
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	3.6 E-12	4.5 E-12

Table 15.2.10-5 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
108-88-3	Toluene[e,g]	3.2 E-07	4.0 E-07
75-69-4	Trichlorofluoromethane[f]	2.3 E-08	2.9 E-08
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	1.1 E-07	1.3 E-07
7440-66-6	Zinc[f,g]	3.6 E-04	4.6 E-04

[a] Factors represent uncontrolled emissions. References 2, 4, and 8.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 7.91 E-01 pounds per item. Reference 8.
[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 B.
[h] EMISSION FACTOR RATING D.

Table 15.2.10-6 EMISSION FACTORS FOR THE USE OF DODIC B642, M720 60-MM HIGH EXPLOSIVE CARTRIDGE (TOTAL) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per lb NEW[c]
83-32-9	Acenaphthene[d,g]	7.4 E-08
208-96-8	Acenaphthylene[d]	1.7 E-06
75-07-0	Acetaldehyde[e]	4.3 E-05
75-05-8	Acetonitrile[e,g]	9.2 E-07
107-13-1	Acrylonitrile[e,g]	3.3 E-06
7429-90-5	Aluminum[f,g]	2.2 E-03
7664-41-7	Ammonia[d,g]	3.1 E-03
120-12-7	Anthracene[e,g]	1.4 E-07
7440-36-0	Antimony[e]	2.7 E-06
7440-39-3	Barium[f]	9.2 E-05
71-43-2	Benzene[e,g]	2.1 E-05
56-55-3	Benzo[a]anthracene[e,g]	9.3 E-08
205-99-2	Benzo[b]fluoranthene[e,g]	8.7 E-08
207-08-9	Benzo[k]fluoranthene[e]	2.4 E-07
191-24-2	Benzo[g,h,i]perylene[e,g]	5.2 E-08
50-32-8	Benzo[a]pyrene[e,g]	6.1 E-08
192-97-2	Benzo[e]pyrene[e,g]	8.6 E-08
463-58-1	Carbonyl sulfide[e,h]	3.0 E-06
74-87-3	Chloromethane[e,g]	7.3 E-07
7440-47-3	Chromium[e]	8.5 E-05
18540-29-9	Hexavalent chromium[e]	4.0 E-06
218-01-9	Chrysene[e,g]	1.5 E-07
7440-48-4	Cobalt[e]	2.5 E-05
7440-50-8	Copper[f]	1.2 E-03
57-12-5	Particulate cyanide[e]	8.0 E-07
75-71-8	Dichlorodifluoromethane[f]	4.7 E-08
107-06-2	1,2-Dichloroethane[e,g]	3.4 E-07
--	Total dioxin/furan compounds[e]	7.0 E-11
74-85-1	Ethylene[f]	1.1 E-04
117-81-7	bis(2-Ethylhexyl)phthalate[f,g]	4.2 E-07

Table 15.2.10-6 (cont.)

CASRN[b]	Pollutant	lb per lb NEW[c]
206-44-0	Fluoranthene[e]	7.3 E-07
86-73-7	Fluorene[d]	8.2 E-08
50-00-0	Formaldehyde[e]	6.7 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	5.2 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	5.4 E-12
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e]	1.6 E-12
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e]	6.5 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	1.7 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	1.7 E-12
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e]	5.0 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	1.8 E-12
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran[e]	3.1 E-13
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e]	1.8 E-12
7647-01-0	Hydrochloric acid[e]	2.2 E-05
74-90-8	Hydrogen cyanide[e,g]	9.3 E-04
7664-39-3	Hydrogen fluoride[e]	4.8 E-05
193-39-5	Indeno[1,2,3-cd]pyrene[e]	3.2 E-08
7439-92-1	Lead[e,g]	5.2 E-04
7439-96-5	Manganese[e,g]	2.6 E-04
75-09-2	Methylene chloride[e]	3.5 E-06
80-62-6	Methyl methacrylate[e]	1.7 E-07
91-20-3	Naphthalene[e,g]	3.7 E-06
7440-02-0	Nickel[e]	1.4 E-04
7697-37-2	Nitric acid[f,g]	4.0 E-05
55-63-0	Nitroglycerin[f]	5.4 E-07
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	2.1 E-11
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	1.0 E-11
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin[e]	1.3 E-12
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[e]	2.1 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e]	4.0 E-12
85-01-8	Phenanthrene[e,g]	1.2 E-06
108-95-2	Phenol[e]	2.6 E-06

Table 15.2.10-6 (cont.)

CASRN[b]	Pollutant	lb per lb NEW[c]
123-38-6	Propionaldehyde[e]	8.3 E-06
115-07-1	Propylene[f,g]	2.8 E-05
129-00-0	Pyrene[d]	8.1 E-07
7440-22-4	Silver[f]	1.5 E-05
100-42-5	Styrene[e,g]	9.1 E-07
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e]	1.9 E-12
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	4.2 E-12
108-88-3	Toluene[e,g]	1.2 E-06
71-55-6	1,1,1-Trichloroethane[e,h]	1.3 E-07
75-69-4	Trichlorofluoromethane[f]	2.7 E-08
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	1.2 E-07
7440-66-6	Zinc[f,g]	4.3 E-04

[a] Factors represent uncontrolled emissions. References 1-4 and 8.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance varies between 7.99 E-01 pounds per item and 8.94 E-01 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 7.93 E-03 pounds per item, between zero and four propelling charge increments, each of which weighs 2.37 E-02 pounds, and a 7.91 E-01 pound high explosive charge located in the projectile. Reference 8.
[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 B.
[h] EMISSION FACTOR RATING D.

References For Section 15.2.10

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. *Report No. 6 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, March 2005.

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. *Detailed Test Plan No.6 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, November 2002.

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 4 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

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

8. 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, March 2005, April 2005, and May 2005.

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15.2.11 B645, M766 60-mm Short Range Practice Mortar Cartridge

15.2.11.1 Ordnance Description[1-3]

The M766 60-mm Short Range Practice Mortar Cartridge (DODIC B645) is used for realistic, cost-effective training on the M224 60-mm mortar system. The M766 mortar has a range of approximately 560 meters, which is one-tenth of the range of a service cartridge. Upon impact with a target, the projectile releases a smoke along with a bang and a flash that allows the crew to see where the projectile has landed. Note that emission factors presented herein are only associated with the firing of the practice cartridge; emissions associated with the impact and detonation of the projectile are not addressed in this section.

The M766 60-mm Short Range Practice Mortar Cartridge consists of a projectile body, a fuse, a propellant charge, and an ignition cartridge with a primer. When the cartridge is loaded, it slides down the mortar tube until the percussion primer in the ignition cartridge strikes the firing pin in the base cap of the mortar. The flash from the primer ignites the ignition cartridge. The cartridge ignites the propellant charge and the gases from the propellant charge expel the projectile from the mortar tube and propel it to the desired height.

15.2.11.2 Emissions And Controls[1,2,4,5]

Carbon monoxide (CO) and carbon dioxide (CO_2) are the primary emissions from the use of the M766 60-mm Short Range Practice Mortar Cartridge. 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 used in the field, there are no controls associated with its use.

Table 15.2.11-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.2.11-2 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 15.2.11-1 EMISSION FACTORS FOR THE USE OF DODIC B645, M766 60-MM SHORT RANGE PRACTICE MORTAR CARTRIDGE (PROPELLING CHARGE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, 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	6.3 E-03	9.6 E-01
630-08-0	CO	7.8 E-03	1.2
7439-92-1	Lead (Pb)[f]	1.3 E-05	2.0 E-03
74-82-8	Methane	2.6 E-05	3.9 E-03
--	Oxides of nitrogen (NO_X)	9.8 E-05	1.5 E-02
--	PM-2.5[d,f]	1.2 E-03	1.9 E-01
--	PM-10[e,f]	1.4 E-03	2.1 E-01
12789-66-1	TSP[f]	1.3 E-03	1.9 E-01

[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 6.56 E-03 pounds per item. References 1 and 3.
[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 15.2.11-2 EMISSION FACTORS FOR THE USE OF DODIC B645, M766 60-MM SHORT RANGE PRACTICE MORTAR CARTRIDGE (PROPELLING CHARGE) – 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]	4.3 E-10	6.6 E-08
208-96-8	Acenaphthylene[d]	1.3 E-08	2.0 E-06
75-07-0	Acetaldehyde[e]	1.2 E-06	1.8 E-04
75-05-8	Acetonitrile[e,h]	2.4 E-06	3.6 E-04
107-13-1	Acrylonitrile[e]	3.6 E-07	5.5 E-05
7429-90-5	Aluminum[f]	2.9 E-05	4.4 E-03
7664-41-7	Ammonia[f,g]	1.5 E-05	2.3 E-03
7440-36-0	Antimony[e,h]	7.5 E-06	1.1 E-03
7440-38-2	Arsenic[e,h]	3.7 E-08	5.7 E-06
7440-39-3	Barium[f,h]	7.1 E-06	1.1 E-03
71-43-2	Benzene[e,h]	4.1 E-06	6.2 E-04
205-99-2	Benzo[b]fluoranthene[e]	4.9 E-10	7.5 E-08
207-08-9	Benzo[k]fluoranthene[e]	2.2 E-10	3.3 E-08
191-24-2	Benzo[g,h,i]perylene[e]	2.2 E-09	3.4 E-07
192-97-2	Benzo[e]pyrene[d]	7.1 E-10	1.1 E-07
7440-43-9	Cadmium[e,h]	7.4 E-08	1.1 E-05
7440-47-3	Chromium[e,h]	1.2 E-07	1.8 E-05
--	Total dioxin/furan compounds[e,h]	6.6 E-14	1.0 E-11
74-85-1	Ethylene[f]	6.4 E-06	9.7 E-04
206-44-0	Fluoranthene[e]	4.3 E-10	6.6 E-08
86-73-7	Fluorene[d]	1.5 E-09	2.3 E-07
50-00-0	Formaldehyde[e]	2.1 E-06	3.2 E-04
7647-01-0	Hydrochloric acid[e,h]	1.1 E-04	1.7 E-02
74-90-8	Hydrogen cyanide[e]	3.8 E-06	5.7 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	1.3 E-09	2.0 E-07
7439-92-1	Lead[e]	1.3 E-05	2.0 E-03
7439-96-5	Manganese[e,g]	7.4 E-08	1.1 E-05
75-09-2	Methylene chloride[e]	8.6 E-06	1.3 E-03
91-20-3	Naphthalene[e]	1.3 E-07	2.0 E-05
7440-02-0	Nickel[e,h]	3.7 E-08	5.7 E-06

Table 15.2.11-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[e,h]	6.1 E-14	9.3 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e,h]	1.9 E-14	2.9 E-12
108-88-3	Toluene[e,i]	7.9 E-07	1.2 E-04
7440-62-2	Vanadium[f,h]	2.2 E-08	3.4 E-06
7440-66-6	Zinc[f,h]	3.8 E-04	5.8 E-02

[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 6.56 E-03 pounds per item. References 1 and 3.
[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 15.2.11

1. *Report No.10 for the Firing Point Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2006.

2. *Detailed Test Plan No.10 for the Firing Point Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, June 2004.

3. *Munitions Items Disposition Action System (MIDAS)* website, https://midas.dac.army.mil/, U.S. Army Defense Ammunition Center, McAlester, OK, May 2007.

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 10 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, February 2008.

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, January 2007.

15.2.12 B643, M888 60-mm High Explosive Cartridge

15.2.12.1 Ordnance Description[1,2]

The M888 60-mm High Explosive (HE) Cartridge (DODIC B643) is used against personnel and light material to provide both fragmentation and blast effect. It is fired in the 60-mm M224 Mortar in the Lightweight Company System. This ammunition is used during combat and on firing ranges during training. Note that emission factors presented herein are only associated with the detonation of the projectile; emissions associated with the propelling charge are not addressed in this section.

15.2.12.2 Emissions And Controls[1-4]

Carbon dioxide (CO_2) is the primary emission from the use of the M888 60-mm HE Cartridge. 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 used in the field, there are no controls associated with its use.

Table 15.2.12-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.2.12-2 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 15.2.12-1 EMISSION FACTORS FOR THE USE OF DODIC B643, M888 60-MM HIGH EXPLOSIVE CARTRIDGE (PROJECTILE) – 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	3.6 E-01	4.4 E-01
630-08-0	Carbon monoxide (CO)[f]	3.1 E-02	3.8 E-02
7439-92-1	Lead (Pb)	6.1 E-04	7.4 E-04
74-82-8	Methane[f]	6.8 E-04	8.3 E-04
--	Oxides of nitrogen (NO_X)[f]	1.6 E-02	2.0 E-02
--	PM-2.5[d]	2.5 E-02	3.1 E-02
--	PM-10[e]	4.9 E-02	6.0 E-02
7446-09-5	Sulfur dioxide (SO_2)[g]	6.3 E-05	7.7 E-05
12789-66-1	TSP	5.6 E-02	6.8 E-02

[a] Factors represent uncontrolled emissions. References 1-4.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 8.21 E-01 pounds per item. Reference 1.
[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 D.

Table 15.2.12-2 EMISSION FACTORS FOR THE USE OF DODIC B643, M888 60-MM HIGH EXPLOSIVE CARTRIDGE (PROJECTILE) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
83-32-9	Acenaphthene[d,h]	4.3 E-08	5.2 E-08
208-96-8	Acenaphthylene[d,g]	1.2 E-07	1.4 E-07
75-07-0	Acetaldehyde[e,h]	8.8 E-06	1.1 E-05
75-05-8	Acetonitrile[e,h]	1.1 E-04	1.4 E-04
107-13-1	Acrylonitrile[e,h]	9.0 E-06	1.1 E-05
7429-90-5	Aluminum[f,h]	1.3 E-03	1.6 E-03
7664-41-7	Ammonia[f]	2.1 E-03	2.6 E-03
120-12-7	Anthracene[e]	3.7 E-08	4.6 E-08
7440-36-0	Antimony[e]	5.0 E-05	6.1 E-05
7440-38-2	Arsenic[e]	2.5 E-06	3.1 E-06
7440-39-3	Barium[f]	1.1 E-04	1.3 E-04
71-43-2	Benzene[e]	1.3 E-05	1.6 E-05
7440-43-9	Cadmium[e,i]	1.6 E-06	2.0 E-06
7440-47-3	Chromium[e]	1.8 E-05	2.2 E-05
18540-29-9	Hexavalent chromium[e]	9.1 E-07	1.1 E-06
218-01-9	Chrysene[e,h]	2.9 E-08	3.6 E-08
7440-48-4	Cobalt[e]	1.4 E-06	1.7 E-06
7440-50-8	Copper[f,h]	4.5 E-04	5.5 E-04
84-74-2	Dibutyl phthalate[e,h]	2.2 E-06	2.7 E-06
99-65-0	1,3-Dinitrobenzene[f,i]	3.2 E-07	3.9 E-07
121-14-2	2,4-Dinitrotoluene[e]	1.0 E-05	1.3 E-05
--	Total dioxin/furan compounds[e]	6.4 E-12	7.8 E-12
74-85-1	Ethylene[f,h]	4.0 E-05	4.9 E-05
206-44-0	Fluoranthene[e,g]	1.2 E-07	1.5 E-07
86-73-7	Fluorene[d,h]	6.4 E-08	7.8 E-08
50-00-0	Formaldehyde[e]	1.3 E-04	1.6 E-04
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	1.8 E-12	2.2 E-12
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	6.6 E-13	8.0 E-13
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	6.4 E-13	7.8 E-13
74-90-8	Hydrogen cyanide[e,h]	7.2 E-04	8.7 E-04

Table 15.2.12-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7439-92-1	Lead[e,g]	6.1 E-04	7.4 E-04
7439-96-5	Manganese[e,h]	1.1 E-04	1.3 E-04
75-09-2	Methylene chloride[e]	9.7 E-09	1.2 E-08
91-20-3	Naphthalene[e,g]	8.5 E-07	1.0 E-06
7440-02-0	Nickel[e]	2.3 E-05	2.7 E-05
7697-37-2	Nitric acid[f,i]	5.7 E-04	6.9 E-04
55-63-0	Nitroglycerin[f,i]	3.7 E-06	4.5 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	2.9 E-12	3.5 E-12
85-01-8	Phenanthrene[e,g]	3.7 E-07	4.6 E-07
115-07-1	Propylene[f]	8.5 E-06	1.0 E-05
129-00-0	Pyrene[d,g]	2.5 E-07	3.1 E-07
7440-22-4	Silver[f,i]	4.8 E-07	5.8 E-07
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e,h]	4.6 E-13	5.6 E-13
7440-28-0	Thallium[f]	1.5 E-07	1.9 E-07
108-88-3	Toluene[e]	3.7 E-06	4.5 E-06
7440-62-2	Vanadium[f,i]	2.6 E-06	3.2 E-06
7440-66-6	Zinc[f,h]	1.1 E-02	1.4 E-02

[a] Factors represent uncontrolled emissions. References 1-4.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 8.21 E-01 pounds per item. Reference 1.
[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 B.
[i] EMISSION FACTOR RATING D.

References For Section 15.2.12

1. *Report No. 11 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2007.

2. *Detailed Test Plan No. 11 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, August 2004.

3. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Exploding Ordnance Emission Study Phase II Series 11 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, August 2008.

4. 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, April 2008.

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15.2.13 BA11, M1001 40-mm High Velocity Canister Cartridge

15.2.13.1 Ordnance Description[1,2]

The M1001 40-mm High Velocity Canister Cartridge (DODIC BA11) is used against personnel within 100 meters of the weapon. It is fired from the MK19 Mod 1, 40-mm grenade machine gun. This ammunition 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 and the detonation of the projectile; emissions associated with the impact of the projectile are not addressed in this section.

15.2.13.2 Emissions And Controls[1-4]

Primary emissions from the use of the M1001 40-mm High Velocity Canister Cartridge include 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 used in the field, there are no controls associated with its use.

Table 15.2.13-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.2.13-2 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 15.2.13-1 EMISSION FACTORS FOR THE USE OF DODIC BA11, M1001 40-MM HIGH VELOCITY CANISTER CARTRIDGE – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: C

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	3.2 E-03	2.7 E-01
630-08-0	CO	3.4 E-03	2.9 E-01
7439-92-1	Lead (Pb)	1.2 E-05	9.9 E-04
74-82-8	Methane	3.8 E-05	3.2 E-03
--	Oxides of nitrogen (NO_X)	8.6 E-05	7.2 E-03
--	PM-2.5[d]	2.1 E-04	1.8 E-02
--	PM-10[e]	3.7 E-04	3.1 E-02
12789-66-1	TSP	4.5 E-04	3.8 E-02

[a] Factors represent uncontrolled emissions. References 1-4.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 1.19 E-02 pounds per item. Reference 1.
[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.

Table 15.2.13-2 EMISSION FACTORS FOR THE USE OF DODIC BA11, M1001 40-MM HIGH VELOCITY CANISTER CARTRIDGE – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
75-07-0	Acetaldehyde[d]	1.5 E-06	1.3 E-04
75-05-8	Acetonitrile[d]	3.6 E-07	3.1 E-05
107-13-1	Acrylonitrile[d]	2.4 E-07	2.0 E-05
7429-90-5	Aluminum[e]	2.4 E-05	2.0 E-03
7664-41-7	Ammonia[e]	8.1 E-06	6.8 E-04
7440-36-0	Antimony[d]	1.3 E-06	1.1 E-04
7440-39-3	Barium[e]	1.9 E-05	1.6 E-03
71-43-2	Benzenev	1.8 E-06	1.5 E-04
207-08-9	Benzo[k]fluoranthene[d]	3.5 E-10	2.9 E-08
191-24-2	Benzo[g,h,i]perylene[d]	4.6 E-09	3.9 E-07
192-97-2	Benzo[e]pyrene[f]	1.5 E-09	1.3 E-07
7440-43-9	Cadmium[d]	1.0 E-05	8.5 E-04
75-15-0	Carbon disulfide[d,g]	5.7 E-08	4.7 E-06
18540-29-9	Hexavalent chromium[d]	1.5 E-08	1.2 E-06
7440-50-8	Copper[e]	2.1 E-05	1.7 E-03
84-74-2	Dibutyl phthalate[d]	3.8 E-08	3.2 E-06
--	Total dioxin/furan compounds[d]	1.1 E-13	9.3 E-12
74-85-1	Ethylene[e]	1.3 E-05	1.1 E-03
50-00-0	Formaldehyde[d]	1.3 E-06	1.1 E-04
74-90-8	Hydrogen cyanide[d]	2.5 E-06	2.1 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e]	1.2 E-09	1.0 E-07
7439-92-1	Lead[d]	1.2 E-05	9.9 E-04
7439-96-5	Manganese[d]	6.8 E-07	5.7 E-05
75-09-2	Methylene chloride[d,g]	4.1 E-07	3.4 E-05
91-20-3	Naphthalene[d]	9.7 E-08	8.1 E-06
7440-02-0	Nickel[d]	6.6 E-08	5.5 E-06
55-63-0	Nitroglycerin[e]	2.1 E-08	1.8 E-06
123-38-6	Propionaldehyde[d]	1.6 E-07	1.3 E-05
115-07-1	Propylene[e]	2.3 E-06	1.9 E-04
129-00-0	Pyrene[f]	4.6 E-09	3.9 E-07

Table 15.2.13-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
108-88-3	Toluene[d]	4.9 E-07	4.1 E-05
7440-66-6	Zinc[e]	2.0 E-05	1.7 E-03

[a] Factors represent uncontrolled emissions. References 1-4.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 1.19 E-02 pounds per item. Reference 1.
[d] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313.
[f] Hazardous air pollutant under CAA Section 112(b).
[g] EMISSION FACTOR RATING D.

References For Section 15.2.13

1. *Report No. 12 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, April 2008.

2. *Detailed Test Plan No. 12 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, June 2005.

3. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Exploding Ordnance Emission Study Phase II Series 12 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2009.

4. 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, May and October 2008.

15.2.14 BA15, M769 60-mm Full Range Practice Cartridge

15.2.14.1 Ordnance Description[1,2]

The M769 60-mm Full Range Practice Cartridge (DODIC BA15) is a full range practice mortar for use in the 60-mm M224 Mortar in the Lightweight Company System. The cartridge is similar in appearance to the M720 and M720A1 High Explosive Cartridges. This ammunition is used on firing ranges during training; it is not used during combat. Note that emission factors presented herein are only associated with the detonation of the projectile; emissions associated with the propelling charge are not addressed in this section.

15.2.14.2 Emissions And Controls[1-4]

Particulate matter is the primary emission from the use of the M769 60-mm Full Range Practice Cartridge. 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 used in the field, there are no controls associated with its use.

Table 15.2.14-1 presents emission factors for carbon dioxide (CO_2), criteria pollutants, and total suspended particulate (TSP). Table 15.2.14-2 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 15.2.14-1 EMISSION FACTORS FOR THE USE OF DODIC BA15, M769 60-MM FULL RANGE PRACTICE CARTRIDGE (PROJECTILE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	3.2 E-03	1.3 E-01
630-08-0	Carbon monoxide (CO)	5.7 E-05	2.3 E-03
7439-92-1	Lead (Pb)	3.2 E-05	1.3 E-03
--	Oxides of nitrogen (NO_X)[f]	5.7 E-04	2.3 E-02
--	PM-2.5[d,f]	1.5 E-02	6.1 E-01
--	PM-10[e]	1.7 E-02	7.2 E-01
12789-66-1	TSP[f]	1.8 E-02	7.4 E-01

[a] Factors represent uncontrolled emissions. References 1-4.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 2.44 E-02 pounds per item. Reference 1.
[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 A.

Table 15.2.14-2 EMISSION FACTORS FOR THE USE OF DODIC BA15, M769 60-MM FULL RANGE PRACTICE CARTRIDGE (PROJECTILE) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7429-90-5	Aluminum[e,f]	1.8 E-03	7.5 E-02
7664-41-7	Ammonia[e]	5.4 E-06	2.2 E-04
7440-36-0	Antimony[d,f]	9.1 E-06	3.7 E-04
7440-39-3	Barium[e,f]	1.1 E-05	4.7 E-04
7440-50-8	Copper[e]	1.5 E-04	6.1 E-03
84-74-2	Dibutyl phthalate[d]	8.2 E-08	3.4 E-06
--	Total dioxin/furan compounds[d]	1.1 E-12	4.6 E-11
74-85-1	Ethylene[e,f]	1.6 E-06	6.6 E-05
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[d,g]	1.5 E-13	6.2 E-12
7647-01-0	Hydrochloric acid[d,f]	8.5 E-05	3.5 E-03
7439-92-1	Lead[d]	3.2 E-05	1.3 E-03
7439-96-5	Manganese[d,f]	8.8 E-06	3.6 E-04
75-09-2	Methylene chloride[d]	1.5 E-07	6.3 E-06
7440-66-6	Zinc[e]	2.6 E-03	1.1 E-01

[a] Factors represent uncontrolled emissions. References 1-4.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 2.44 E-02 pounds per item. Reference 1.
[d] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313.
[f] EMISSION FACTOR RATING B.
[g] EMISSION FACTOR RATING D.

References For Section 15.2.14

1. *Report No. 12 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, April 2008.

2. *Detailed Test Plan No. 12 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, June 2005.

3. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Exploding Ordnance Emission Study Phase II Series 12 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2009.

4. 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, May and October 2008.

15.2.15 B505, M662 40-mm Red Star Parachute Cartridge

15.2.15.1 Ordnance Description[1-3]

The M662 40-mm Red Star Parachute Cartridge (DODIC B505) is designed for illumination and signaling with less weight and bulk and greater accuracy than comparable hand-held signals. The cartridges are fired from 40-mm Grenade Launchers M79 and M203 (attached to the M16 series rifle or M4 series carbine). This ammunition is used during combat and on firing ranges during training.

The M662 40-mm Red Star Parachute Cartridge is a fixed round of ammunition consisting of a projectile assembly and a cartridge case assembly. The projectile has a one-piece, hollow aluminum body that contains a pyrotechnic flare candle assembly attached to a parachute. The cartridge functions when the weapon firing pin strikes the primer, igniting the propelling charge. The cartridge is then propelled to altitude, at which time the candle and parachute assembly is discharged from the cartridge.

15.2.15.2 Emissions And Controls[1,2,4,5]

Carbon dioxide (CO_2) and particulate matter are the primary emissions from the use of the M662 40-mm Red Star Parachute Cartridge. 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 used in the field, there are no controls associated with its use.

Table 15.2.15-1 presents emission factors for CO_2, criteria pollutants, total non-methane hydrocarbons (TNMHC), and total suspended particulate (TSP). Table 15.2.15-2 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 15.2.15-1 EMISSION FACTORS FOR THE USE OF DODIC B505, M662 40-MM RED STAR PARACHUTE CARTRIDGE – CARBON DIOXIDE, CRITERIA POLLUTANTS, TOTAL NONMETHANE HYDROCARBONS, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
124-38-9	CO_2	4.7 E-02	2.5 E-01
630-08-0	Carbon monoxide (CO)	2.2 E-03	1.2 E-02
7439-92-1	Lead (Pb)[f]	1.6 E-05	8.7 E-05
--	Oxides of nitrogen (NO_X)[f]	3.1 E-04	1.6 E-03
--	PM-2.5[d]	8.2 E-03	4.3 E-02
--	PM-10[e]	9.9 E-03	5.2 E-02
7446-09-5	Sulfur dioxide (SO_2)[g]	1.5 E-04	7.8 E-04
--	TNMHC[g]	1.5 E-05	7.9 E-05
12789-66-1	TSP	1.2 E-02	6.6 E-02

[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 1.88 E-01 pounds per item. References 1 and 3.
[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 C.
[g] EMISSION FACTOR RATING D.

Table 15.2.15-2 EMISSION FACTORS FOR THE USE OF DODIC B505, M662 40-MM RED STAR PARACHUTE CARTRIDGE – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
208-96-8	Acenaphthylene[d]	9.4 E-08	5.0 E-07
75-07-0	Acetaldehyde[e,g]	3.3 E-06	1.7 E-05
107-02-8	Acrolein[e]	2.0 E-07	1.0 E-06
7664-41-7	Ammonia[f]	1.3 E-06	6.7 E-06
7440-43-9	Cadmium[e]	9.9 E-07	5.3 E-06
7440-47-3	Chromium[e]	5.4 E-07	2.9 E-06
7440-50-8	Copper[f]	7.2 E-06	3.8 E-05
--	Total dioxin/furan compounds[e]	1.1 E-10	6.0 E-10
50-00-0	Formaldehyde[e]	1.1 E-06	6.0 E-06
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e,h]	1.2 E-11	6.3 E-11
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	6.6 E-12	3.5 E-11
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e,h]	7.3 E-12	3.9 E-11
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	2.5 E-13	1.3 E-12
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e]	8.4 E-13	4.5 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e,h]	6.7 E-12	3.5 E-11
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e,h]	4.8 E-13	2.6 E-12
7439-92-1	Lead[e]	1.6 E-05	8.7 E-05
7439-97-6	Mercury[e]	6.3 E-08	3.4 E-07
75-09-2	Methylene chloride[e,h]	1.4 E-06	7.5 E-06
91-20-3	Naphthalene[e]	6.3 E-07	3.3 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	3.5 E-11	1.9 E-10
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e,h]	2.2 E-11	1.2 E-10
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin[e,h]	9.3 E-12	5.0 E-11
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[e,h]	8.2 E-12	4.4 E-11
108-95-2	Phenol[e]	4.8 E-07	2.6 E-06
110-86-1	Pyridine[f,h]	7.7 E-08	4.1 E-07
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e,h]	4.0 E-12	2.1 E-11
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e,h]	1.5 E-12	7.8 E-12
108-88-3	Toluene[e,h]	2.9 E-06	1.5 E-05
7440-66-6	Zinc[f,h]	8.9 E-06	4.7 E-05

Table 15.2.15-2 (cont.)

[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 1.88 E-01 pounds per item. References 1 and 3.
[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 B.
[h] EMISSION FACTOR RATING D.

References For Section 15.2.15

1. *Sampling Results for AEC Phase VIII Emission Characterization of Exploding Ordnance and Smoke/Pyrotechnics*, URS Group, Inc., Oak Ridge, TN, February 2008.

2. *Detailed Test Plan for Phase VIII Emission Characterization of Exploding Ordnance and Smoke/Pyrotechnics*, West Desert Test Center, U.S. Army Dugway Proving Ground, UT, November 2005.

3. *Munitions Items Disposition Action System (MIDAS)* website, https://midas.dac.army.mil/, U.S. Army Defense Ammunition Center, McAlester, OK, August 2008.

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Phase VIII Testing Conducted at Dugway Proving Ground, Utah*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, August 2008.

5. Supporting information including Excel spreadsheets supplied upon request by the U.S. Army Dugway Proving Ground test support contractor, URS Corporation, Oak Ridge, TN, March 2008.

15.2.16 Updates Since July 2006

Section 15.2 was created during July 2006. Revisions to the section since that date are summarized below.

Revision 7, July 2009

- Section, 15.2.13, which presents emission factors for DODIC BA11, the M1001 40-mm High Velocity Canister Cartridge, was added.
- Section, 15.2.14, which presents emission factors for DODIC BA15, the M769 60-mm Full Range Practice Cartridge, was added.

Revision 6, October 2008

- Section, 15.2.12, which presents emission factors for DODIC B643, the M888 60-mm High Explosive Cartridge, was added.
- Section, 15.2.15, which presents emission factors for DODIC B505, the M662 40-mm Red Star Parachute Cartridge, was added.

Revision 5, June 2008

- Section, 15.2.1, which presents emission factors for DODIC B129, the M789 30-mm High Explosive Dual Purpose (HEDP) Cartridge, was added.

Revision 4, February 2008

- Section, 15.2.8, which presents emission factors for DODIC B627, the M83A3 60-mm Illuminating Cartridge, was updated to include additional data.
- Section, 15.2.11, which presents emission factors for DODIC B645, the M766 60-mm Short Range Practice Mortar Cartridge, was added.

Revision 3, November 2007

- Section, 15.2.8, which presents emission factors for DODIC B627, the M83A3 60-mm Illuminating Cartridge, was added.

Revision 2, June 2007

- Section, 15.2.3, which presents emission factors for DODIC B535, the M583A1 40-mm White Star Parachute Cartridge, was added.
- Section, 15.2.4, which presents emission factors for DODIC B536, the M585 40-mm White Star Cluster Cartridge, was added.
- Where present, data regarding the average annual quantities of ordnance used on Army installations during training exercises have been deleted because the quantities used vary from installation to installation and from year to year.

- Section, 15.2.10, which presents emission factors for DODIC B642, the M720 60-mm High Explosive Cartridge, was updated to include additional data.