15.3 Cartridges 75 mm And Larger

Munitions in this category begin with the Department of Defense Identification Code (DODIC) letter "C." This category of munitions includes cartridges larger than or equal to 75-mm in size. Examples include 75-mm high explosive cartridges, 75-mm white phosphorus smoke cartridges, 81-mm high explosive cartridges, and 105-mm illumination cartridges.

15.3.1 C226, M301A3 81-mm Illuminating Cartridge

15.3.1.1 Ordnance Description[1]

The M301A3 81-mm Illuminating Cartridge (DODIC C226) is a pyrotechnic mortar that is used to spot infiltrating troops by lighting up the field. This ammunition is used during combat and on firing ranges during training. The cartridge is fired from the M1, M29, M29A1, and M252 81-mm mortars. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the detonation of the projectile are not addressed in this section.

The M301A3 81-mm Illuminating Cartridge consists of a projectile body, a time fuze with an expulsion charge, a fin assembly, between three and eight propellant charge increments (depending upon the range desired), and an ignition cartridge. The projectile body contains an illuminant candle and a parachute assembly. The ignition cartridge contains propellant, primer mix, and black powder.

15.3.1.2 Emissions And Controls[1-5]

Primary emissions from the use of the M301A3 81-mm Illuminating 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 15.3.1-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.3.1-2 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 pound net explosive weight contained in the item (lb per lb NEW). Because the NEW for this ordnance 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).

Table 15.3.1-1 EMISSION FACTORS FOR THE USE OF DODIC C226, M301A3 81-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	1.9 E-01
630-08-0	CO	1.9 E-01
7439-92-1	Lead (Pb)[f]	1.7 E-05
74-82-8	Methane	5.6 E-04
--	Oxides of nitrogen (NO_X)	4.8 E-03
--	PM-2.5[d,f]	1.0 E-02
--	PM-10[e,f]	1.2 E-02
12789-66-1	TSP[f]	1.2 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 varies between 1.05 E-01 pounds per item and 2.51 E-01 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 1.69 E-02 pounds per item and between three and eight propelling charge increments, each of which weighs 2.93 E-02 pounds. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.

Table 15.3.1-2 EMISSION FACTORS FOR THE USE OF DODIC C226, M301A3 81-MM ILLUMINATING 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]
83-32-9	Acenaphthene[d]	5.2 E-08
208-96-8	Acenaphthylene[d,g]	1.6 E-06
75-07-0	Acetaldehyde[e]	6.1 E-05
75-05-8	Acetonitrile[e]	1.7 E-05
98-86-2	Acetophenone[e,i]	2.3 E-06
107-13-1	Acrylonitrile[e]	8.6 E-06
7429-90-5	Aluminum[f,h]	2.0 E-04
120-12-7	Anthracene[e]	6.3 E-08
7440-36-0	Antimony[e,i]	5.9 E-06
7440-39-3	Barium[f,h]	3.7 E-06
71-43-2	Benzene[e]	5.5 E-04
56-55-3	Benzo[a]anthracene[e,g]	4.8 E-08
205-99-2	Benzo[b]fluoranthene[e]	1.3 E-07
207-08-9	Benzo[k]fluoranthene[e]	7.9 E-08
191-24-2	Benzo[g,h,i]perylene[e]	1.0 E-07
50-32-8	Benzo[a]pyrene[e]	5.7 E-08
192-97-2	Benzo[e]pyrene[d]	9.5 E-08
123-72-8	Butyraldehyde[f,h]	1.3 E-05
75-15-0	Carbon disulfide[e,h]	1.1 E-06
74-87-3	Chloromethane[e,h]	4.8 E-08
218-01-9	Chrysene[e,h]	1.2 E-07
7440-50-8	Copper[f]	4.7 E-04
98-82-8	Cumene[e,i]	3.7 E-07
57-12-5	Particulate cyanide[e,i]	2.1 E-05
53-70-3	Dibenz[a,h]anthracene[e]	1.7 E-08
107-06-2	1,2-Dichloroethane[e]	8.5 E-06
--	Total dioxin/furan compounds[e,h]	3.6 E-11
100-41-4	Ethylbenzene[e,g]	3.0 E-06
74-85-1	Ethylene[f,g]	3.3 E-04
206-44-0	Fluoranthene[e]	9.3 E-08

Table 15.3.1-2 (cont.)

CASRN[b]	Pollutant	lb per lb NEW[c]
86-73-7	Fluorene[d,g]	3.6 E-07
50-00-0	Formaldehyde[e]	2.9 E-04
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e,h]	5.5 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e,h]	4.2 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e,h]	3.1 E-13
74-90-8	Hydrogen cyanide[e]	2.5 E-05
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	8.8 E-08
7439-92-1	Lead[e]	1.7 E-05
7439-96-5	Manganese[e,g]	4.2 E-06
75-09-2	Methylene chloride[e]	2.1 E-05
80-62-6	Methyl methacrylate[e,i]	4.4 E-07
1634-04-4	Methyl tert-butyl ether[e,h]	5.1 E-07
91-20-3	Naphthalene[e,g]	1.2 E-05
7440-02-0	Nickel[e,i]	6.5 E-06
55-63-0	Nitroglycerin[f]	8.8 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e,h]	3.0 E-11
85-01-8	Phenanthrene[e]	3.7 E-07
108-95-2	Phenol[e]	4.3 E-06
115-07-1	Propylene[f]	4.9 E-05
129-00-0	Pyrene[d]	6.1 E-08
100-42-5	Styrene[e,h]	9.0 E-05
7664-93-9	Sulfuric acid[f,h]	2.7 E-04
108-88-3	Toluene[e]	3.8 E-05
71-55-6	1,1,1-Trichloroethane[e,h]	2.3 E-06
95-63-6	1,2,4-Trimethylbenzene[e,i]	5.7 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	3.0 E-06
95-47-6	o-Xylene[e,h]	3.0 E-06
7440-66-6	Zinc[f,h]	1.2 E-03

Table 15.3.1-2 (cont.)

[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 varies between 1.05 E-01 pounds per item and 2.51 E-01 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 1.69 E-02 pounds per item and between three and eight propelling charge increments, each of which weighs 2.93 E-02 pounds. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.3.1

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. *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.

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

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 4 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, October 2004 and March 2005.

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15.3.3 C379, M934 120-mm High Explosive Cartridge

15.3.3.1 Ordnance Description[1]

The M934 120-mm High Explosive Cartridge (DODIC C379) is a mortar used against personnel and material targets, providing for fragmentation and blast effects. This ammunition is used during combat and on firing ranges during training. The cartridge is fired from the M120 Battalion Mortar System (BMS). Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact and/or detonation of the projectile are not addressed in this section.

The M934 120-mm High Explosive Cartridge consists of a projectile body, a fuze, a fin assembly, between zero and four propellant charge increments (depending upon the range desired), and an ignition cartridge. The ignition cartridge contains propellant, a primer mix, and black powder. 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").

15.3.3.2 Emissions And Controls[1-5]

Carbon dioxide (CO_2) is the primary pollutant emitted from the use of the M934 120-mm High Explosive 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 15.3.3-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.3.3-2 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 pound net explosive weight contained in the item (lb per lb NEW). Because the NEW for this ordnance 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).

Table 15.3.3-1 EMISSION FACTORS FOR THE USE OF DODIC C379, M934 120-MM HIGH EXPLOSIVE CARTRIDGE (PROPELLING CHARGE) – CARBON DIOXIDE, CRITERIA POLLUTANTS, AND TOTAL SUSPENDED PARTICULATE[a]

EMISSION FACTOR RATING: B (except as noted)

CASRN[b]	Pollutant	lb per lb NEW[c]
124-38-9	CO_2[f]	6.8 E-01
630-08-0	Carbon monoxide (CO)[f]	5.6 E-02
7439-92-1	Lead (Pb)	4.2 E-05
--	Oxides of nitrogen (NO_x)[f]	7.1 E-04
--	PM-2.5[d]	1.4 E-02
--	PM-10[e]	1.7 E-02
12789-66-1	TSP	2.6 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 varies between 1.54 E-01 pounds per item and 1.42 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 1.54 E-01 pounds per item and between zero and four propelling charge increments, each of which weighs 3.15 E-01 pounds. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING A.

Table 15.3.3-2 EMISSION FACTORS FOR THE USE OF DODIC C379, M934 120-MM HIGH EXPLOSIVE CARTRIDGE (PROPELLING CHARGE) – 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,h]	1.3 E-07
75-07-0	Acetaldehyde[e,h]	3.1 E-04
75-05-8	Acetonitrile[e,h]	1.2 E-04
98-86-2	Acetophenone[e,i]	1.0 E-05
107-02-8	Acrolein[e]	3.8 E-05
107-13-1	Acrylonitrile[e,h]	6.9 E-05
7429-90-5	Aluminum[f,h]	2.5 E-03
7440-39-3	Barium[f]	4.3 E-05
71-43-2	Benzene[e,h]	1.5 E-04
192-97-2	Benzo[e]pyrene[d]	1.4 E-07
75-65-0	t-Butyl alcohol[e]	2.2 E-06
18540-29-9	Hexavalent chromium[e]	1.1 E-06
7440-50-8	Copper[f,h]	3.2 E-04
53-70-3	Dibenz[a,h]anthracene[h]	1.7 E-08
--	Total dioxin/furan compounds[e]	4.9 E-11
100-41-4	Ethylbenzene[e,h]	2.2 E-06
74-85-1	Ethylene[f,g]	3.8 E-04
86-73-7	Fluorene[d,g]	3.5 E-07
50-00-0	Formaldehyde[e,h]	4.5 E-04
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	3.9 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	1.2 E-12
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	7.3 E-13
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	1.0 E-13
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e,i]	4.6 E-14
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran[e]	3.0 E-13
74-90-8	Hydrogen cyanide[e,h]	3.7 E-04
7439-92-1	Lead[e,h]	4.2 E-05
7439-96-5	Manganese[e,g]	1.4 E-05
91-20-3	Naphthalene[e,g]	1.4 E-05

Table 15.3.3-2 (cont.)

CASRN[b]	Pollutant	lb per lb NEW[c]
7440-02-0	Nickel[e]	1.0 E-05
7697-37-2	Nitric acid[f,h]	4.7 E-04
55-63-0	Nitroglycerin[f]	1.0 E-05
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	4.0 E-11
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	2.4 E-12
85-01-8	Phenanthrene[e,h]	7.9 E-07
115-07-1	Propylene[f]	6.5 E-05
100-42-5	Styrene[e,i]	3.8 E-06
7664-93-9	Sulfuric acid[f]	2.3 E-03
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e]	7.2 E-13
108-88-3	Toluene[e]	3.0 E-05
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	1.5 E-06
95-47-6	o-Xylene[e]	1.7 E-06
7440-66-6	Zinc[f]	1.6 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 varies between 1.54 E-01 pounds per item and 1.42 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 1.54 E-01 pounds per item and between zero and four propelling charge increments, each of which weighs 3.15 E-01 pounds. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING B.
[i] EMISSION FACTOR RATING D.

References For Section 15.3.3

1. *Report No. 8 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, December 2004.

2. *Detailed Test Plan No. 8 for the Firing Point Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2002.

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

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 8 Testing Conducted at Aberdeen Proving Ground, Maryland,* MACTEC Federal Programs, Inc., Research Triangle Park, NC, September 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, October 2004, April 2005, and October 2005.

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15.3.5 C511, M490 105-mm Target Practice Tracer Cartridge

15.3.5.1 Ordnance Description[1,2]

The M490 105-mm Target Practice Tracer Cartridge (DODIC C511) is intended for training in marksmanship using the 105-mm gun and the M68 tank cannon. The M13 Tracer is used in both the 105-mm M490 Target Practice Tracer Cartridge and the 105-mm M724 Target Practice Discarding Sabot Tracer (DODIC C520). This ammunition is used on firing ranges during training; it is not used during combat. Note that emission factors presented herein are divided into those associated with firing the cartridge and those associated with the combustion of the tracer compound.

The M490 105-mm Target Practice Tracer Cartridge consists of a cartridge case, propelling charge, electric primer, and projectile. The projectile consists of a steel body, a standoff spike, and a boom and fin assembly with tracer. The M13 Tracer consists of an ignition composition that is initiated from the burning propellant in the cartridge, and a tracer composition that burns brightly and is easily visible.

15.3.5.2 Emissions And Controls[1-8]

Carbon dioxide (CO_2) is the primary pollutant emitted from the use of the M490 105-mm Target Practice Tracer 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 15.3.5-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP) for the firing of the cartridge. Table 15.3.5-2 presents similar data for the burning of the tracer, while Table 15.3.5-3 presents combined emission factors for the use of the cartridge and the tracer. Table 15.3.5-4 presents emission factors for hazardous air pollutants and toxic chemicals for the firing of the cartridge. Table 15.3.5-5 presents emission factors for the burning of the tracer, while Table 15.3.5-6 presents combined emission factors for the use of the cartridge and the tracer. 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 15.3.5-1 EMISSION FACTORS FOR THE USE OF DODIC C511, M490 105-MM TARGET PRACTICE TRACER CARTRIDGE (PROPELLING CHARGE) - 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[f]	7.6	6.3 E-01
630-08-0	Carbon monoxide (CO)[f]	1.3 E-01	1.1 E-02
7439-92-1	Lead (Pb)	6.8 E-04	5.7 E-05
--	Oxides of nitrogen (NO_x)[f]	2.6 E-02	2.1 E-03
--	PM-2.5[d]	7.3 E-02	6.0 E-03
--	PM-10[e]	2.0 E-01	1.6 E-02
12789-66-1	TSP	2.8 E-01	2.4 E-02

[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 is 12.08 pounds per item. 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 A.

Table 15.3.5-2 EMISSION FACTORS FOR THE USE OF DODIC C511, M490 105-MM TARGET PRACTICE TRACER CARTRIDGE (TRACER) – CARBON DIOXIDE, CRITERIA POLLUTANTS, 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	2.5 E-03	1.7 E-01
630-08-0	CO	2.7 E-05	1.9 E-03
74-82-8	Methane	4.7 E-06	3.3 E-04
--	NO_x	2.0 E-04	1.4 E-02
--	PM-2.5	5.5 E-03	3.8 E-01
--	PM-10	5.9 E-03	4.1 E-01
12789-66-1	TSP	5.9 E-03	4.1 E-01

[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 1.43 E-02 pounds per item. Reference 8.

Table 15.3.5-3 EMISSION FACTORS FOR THE USE OF DODIC C511, M490 105-MM TARGET PRACTICE TRACER CARTRIDGE (TOTAL) – 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[d]	7.6	6.3 E-01
630-08-0	CO[d]	1.3 E-01	1.1 E-02
7439-92-1	Lead	6.8 E-04	5.6 E-05
74-82-8	Methane[e]	4.7 E-06	3.9 E-07
--	NO_x[d]	2.6 E-02	2.1 E-03
--	PM-2.5	7.8 E-02	6.5 E-03
--	PM-10	2.0 E-01	1.7 E-02
12789-66-1	TSP	2.9 E-01	2.4 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 is 12.09 pounds per item. This weight includes a 12.08 pound propellant charge and a 1.43 E-02 pound tracer. Reference 8.
[d] EMISSION FACTOR RATING A.
[e] EMISSION FACTOR RATING C.

Table 15.3.5-4 EMISSION FACTORS FOR THE USE OF DODIC C511, M490 105-MM TARGET PRACTICE TRACER 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]	3.6 E-07	3.0 E-08
75-07-0	Acetaldehyde[e]	6.9 E-05	5.7 E-06
7429-90-5	Aluminum[f]	2.7 E-03	2.2 E-04
120-12-7	Anthracene[e]	1.3 E-07	1.1 E-08
7440-39-3	Barium[f,h]	1.3 E-04	1.1 E-05
56-55-3	Benzo[a]anthracene[e,g]	1.4 E-07	1.1 E-08
205-99-2	Benzo[b]fluoranthene[e]	1.2 E-07	1.0 E-08
207-08-9	Benzo[k]fluoranthene[e]	1.4 E-07	1.1 E-08
191-24-2	Benzo[g,h,i]perylene[e]	1.9 E-07	1.6 E-08
50-32-8	Benzo[a]pyrene[e]	7.9 E-08	6.6 E-09
192-97-2	Benzo[e]pyrene[d]	1.1 E-07	8.9 E-09
7440-47-3	Chromium[e,i]	2.2 E-05	1.8 E-06
18540-29-9	Hexavalent chromium[e,h]	8.4 E-06	6.9 E-07
218-01-9	Chrysene[e,h]	2.2 E-07	1.9 E-08
7440-48-4	Cobalt[e,h]	1.6 E-05	1.4 E-06
7440-50-8	Copper[f,h]	7.0 E-04	5.8 E-05
75-71-8	Dichlorodifluoromethane[f]	7.3 E-06	6.0 E-07
--	Total dioxin/furan compounds[e,h]	4.2 E-09	3.5 E-10
75-21-8	Ethylene oxide[e,i]	5.0 E-05	4.1 E-06
117-81-7	bis(2-Ethylhexyl)phthalate[e,h]	1.6 E-04	1.3 E-05
206-44-0	Fluoranthene[e]	6.7 E-07	5.6 E-08
86-73-7	Fluorene[d,g]	5.1 E-07	4.2 E-08
50-00-0	Formaldehyde[e]	2.2 E-04	1.8 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e,h]	3.6 E-10	3.0 E-11
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e,h]	7.9 E-11	6.6 E-12
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e,h]	4.7 E-12	3.9 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e,h]	1.3 E-11	1.1 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e,h]	1.5 E-11	1.3 E-12
74-90-8	Hydrogen cyanide[e]	2.6 E-04	2.2 E-05
7439-92-1	Lead[e]	6.8 E-04	5.7 E-05

Table 15.3.5-4 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7439-96-5	Manganese[e]	3.3 E-04	2.7 E-05
91-20-3	Naphthalene[e,g]	1.9 E-06	1.6 E-07
7440-02-0	Nickel[e,h]	6.4 E-05	5.3 E-06
7697-37-2	Nitric acid[f]	1.2 E-03	9.5 E-05
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e,h]	3.6 E-09	3.0 E-10
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e,h]	1.6 E-10	1.3 E-11
85-01-8	Phenanthrene[e]	1.4 E-06	1.1 E-07
108-95-2	Phenol[e]	7.9 E-05	6.5 E-06
129-00-0	Pyrene[d]	3.8 E-07	3.1 E-08
7782-49-2	Selenium[e,i]	2.1 E-05	1.8 E-06
108-88-3	Toluene[e]	2.6 E-06	2.2 E-07
540-84-1	2,2,4-Trimethylpentane[d,h]	6.0 E-05	4.9 E-06
7440-66-6	Zinc[f,h]	6.5 E-03	5.4 E-04

[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 is 12.08 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 A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

Table 15.3.5-5 EMISSION FACTORS FOR THE USE OF DODIC C511, M490 105-MM TARGET PRACTICE TRACER CARTRIDGE (TRACER) – 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]	4.7 E-10	3.3 E-08
75-05-8	Acetonitrile[e]	3.3 E-08	2.3 E-06
107-02-8	Acrolein[e]	3.1 E-06	2.2 E-04
107-13-1	Acrylonitrile[e]	9.5 E-07	6.6 E-05
107-05-1	Allyl chloride[e]	1.1 E-07	8.0 E-06
7429-90-5	Aluminum[f]	2.5 E-06	1.8 E-04
120-12-7	Anthracene[e]	4.4 E-10	3.1 E-08
7440-39-3	Barium[f]	9.1 E-05	6.4 E-03
71-43-2	Benzene[e]	2.6 E-06	1.8 E-04
205-99-2	Benzo[b]fluoranthene[e]	6.8 E-10	4.8 E-08
207-08-9	Benzo[k]fluoranthene[e]	6.5 E-11	4.5 E-09
191-24-2	Benzo[g,h,i]perylene[e]	9.4 E-10	6.5 E-08
192-97-2	Benzo[e]pyrene[d,g]	6.4 E-10	4.5 E-08
100-44-7	Benzyl chloride[e,g]	9.6 E-08	6.7 E-06
74-83-9	Bromomethane[e]	2.1 E-07	1.5 E-05
108-90-7	Chlorobenzene[e,g]	1.9 E-06	1.3 E-04
74-87-3	Chloromethane[e]	1.2 E-06	8.7 E-05
218-01-9	Chrysene[e]	4.8 E-10	3.3 E-08
7440-50-8	Copper[f]	2.5 E-06	1.7 E-04
84-74-2	Dibutyl phthalate[e]	3.1 E-07	2.2 E-05
75-71-8	Dichlorodifluoromethane[f]	7.0 E-10	4.9 E-08
--	Total dioxin/furan compounds[e]	9.5 E-13	6.6 E-11
140-88-5	Ethyl acrylate[e]	1.5 E-07	1.0 E-05
100-41-4	Ethylbenzene[e,g]	3.2 E-07	2.2 E-05
117-81-7	bis(2-Ethylhexyl)phthalate[f]	1.8 E-06	1.2 E-04
206-44-0	Fluoranthene[e]	1.5 E-09	1.0 E-07
86-73-7	Fluorene[d]	9.9 E-11	6.9 E-09
50-00-0	Formaldehyde[e]	9.9 E-08	6.9 E-06
76-13-1	Freon 113[f]	1.4 E-06	9.7 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	1.0 E-13	7.0 E-12

Table 15.3.5-5 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	2.6 E-14	1.8 E-12
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e]	3.4 E-14	2.3 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	3.4 E-14	2.4 E-12
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e]	3.0 E-14	2.1 E-12
7647-01-0	Hydrochloric acid[e,g]	6.8 E-05	4.8 E-03
7439-96-5	Manganese[e]	1.2 E-06	8.3 E-05
75-09-2	Methylene chloride[e]	1.2 E-07	8.7 E-06
108-10-1	Methyl isobutyl ketone[e,g]	6.3 E-08	4.4 E-06
80-62-6	Methyl methacrylate[e,g]	1.9 E-08	1.3 E-06
91-20-3	Naphthalene[e]	1.3 E-08	9.0 E-07
55-63-0	Nitroglycerin[f]	3.5 E-07	2.4 E-05
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	6.3 E-13	4.4 E-11
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e]	3.9 E-14	2.7 E-12
129-00-0	Pyrene[d]	1.6 E-09	1.1 E-07
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e]	2.4 E-16	1.7 E-14
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e,g]	6.3 E-14	4.4 E-12
108-88-3	Toluene[e]	4.0 E-07	2.8 E-05
71-55-6	1,1,1-Trichloroethane[e]	7.0 E-08	4.9 E-06
75-69-4	Trichlorofluoromethane[f]	4.0 E-10	2.8 E-08
95-63-6	1,2,4-Trimethylbenzene[f,g]	2.0 E-08	1.4 E-06
75-01-4	Vinyl chloride[e]	7.5 E-07	5.2 E-05
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,g]	1.0 E-06	7.1 E-05
95-47-6	o-Xylene[e,g]	3.1 E-07	2.2 E-05
7440-66-6	Zinc[f]	4.1 E-06	2.9 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 1.43 E-02 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 D.

Table 15.3.5-6 EMISSION FACTORS FOR THE USE OF DODIC C511, M490 105-MM TARGET PRACTICE TRACER CARTRIDGE (TOTAL) – 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]	3.6 E-07	3.0 E-08
75-07-0	Acetaldehyde[e,h]	6.9 E-05	5.7 E-06
75-05-8	Acetonitrile[e]	3.3 E-08	2.7 E-09
107-02-8	Acrolein[e]	3.1 E-06	2.6 E-07
107-13-1	Acrylonitrile[e]	9.5 E-07	7.8 E-08
107-05-1	Allyl chloride[e]	1.1 E-07	9.4 E-09
7429-90-5	Aluminum[f,h]	2.7 E-03	2.2 E-04
120-12-7	Anthracene[e,h]	1.3 E-07	1.1 E-08
7440-39-3	Barium[f]	2.2 E-04	1.8 E-05
71-43-2	Benzene[e]	2.6 E-06	2.2 E-07
56-55-3	Benzo[a]anthracene[e,g]	1.4 E-07	1.1 E-08
205-99-2	Benzo[b]fluoranthene[e,h]	1.2 E-07	1.0 E-08
207-08-9	Benzo[k]fluoranthene[e,h]	1.4 E-07	1.1 E-08
191-24-2	Benzo[g,h,i]perylene[e,h]	1.9 E-07	1.6 E-08
50-32-8	Benzo[a]pyrene[e,h]	7.9 E-08	6.6 E-09
192-97-2	Benzo[e]pyrene[d,h]	1.1 E-07	8.9 E-09
100-44-7	Benzyl chloride[e]	9.6 E-08	8.0 E-09
74-83-9	Bromomethane[e]	2.1 E-07	1.8 E-08
108-90-7	Chlorobenzene[e]	1.9 E-06	1.6 E-07
74-87-3	Chloromethane[e]	1.2 E-06	1.0 E-07
7440-47-3	Chromium[e,i]	2.2 E-05	1.8 E-06
18540-29-9	Hexavalent chromium[e]	8.4 E-06	6.9 E-07
218-01-9	Chrysene[e]	2.2 E-07	1.9 E-08
7440-48-4	Cobalt[e]	1.6 E-05	1.4 E-06
7440-50-8	Copper[f]	7.0 E-04	5.8 E-05
84-74-2	Dibutyl phthalate[e]	3.1 E-07	2.6 E-08
75-71-8	Dichlorodifluoromethane[f,h]	7.3 E-06	6.0 E-07
--	Total dioxin/furan compounds[e]	4.2 E-09	3.5 E-10
140-88-5	Ethyl acrylate[e]	1.5 E-07	1.2 E-08
100-41-4	Ethylbenzene[e]	3.2 E-07	2.6 E-08

Table 15.3.5-6 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
75-21-8	Ethylene oxide[e,i]	5.0 E-05	4.1 E-06
117-81-7	bis(2-Ethylhexyl)phthalate[e]	1.6 E-04	1.4 E-05
206-44-0	Fluoranthene[e,h]	6.7 E-07	5.6 E-08
86-73-7	Fluorene[d,g]	5.1 E-07	4.2 E-08
50-00-0	Formaldehyde[e,h]	2.2 E-04	1.8 E-05
76-13-1	Freon 113[f]	1.4 E-06	1.2 E-07
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	3.6 E-10	3.0 E-11
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	7.9 E-11	6.6 E-12
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e]	3.4 E-14	2.8 E-15
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e]	4.7 E-12	3.9 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	1.3 E-11	1.1 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	1.5 E-11	1.3 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	3.4 E-14	2.8 E-15
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e]	3.0 E-14	2.5 E-15
7647-01-0	Hydrochloric acid[e]	6.8 E-05	5.6 E-06
74-90-8	Hydrogen cyanide[e,h]	2.6 E-04	2.1 E-05
7439-92-1	Lead[e,h]	6.8 E-04	5.6 E-05
7439-96-5	Manganese[e,h]	3.3 E-04	2.7 E-05
75-09-2	Methylene chloride[e]	1.2 E-07	1.0 E-08
108-10-1	Methyl isobutyl ketone[e]	6.3 E-08	5.2 E-09
80-62-6	Methyl methacrylate[e]	1.9 E-08	1.6 E-09
91-20-3	Naphthalene[e,g]	1.9 E-06	1.6 E-07
7440-02-0	Nickel[e]	6.4 E-05	5.3 E-06
7697-37-2	Nitric acid[f,h]	1.2 E-03	9.5 E-05
55-63-0	Nitroglycerin[f]	3.5 E-07	2.9 E-08
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	3.6 E-09	3.0 E-10
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	1.6 E-10	1.3 E-11
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e]	3.9 E-14	3.2 E-15
85-01-8	Phenanthrene[e,h]	1.4 E-06	1.1 E-07
108-95-2	Phenol[e,h]	7.9 E-05	6.5 E-06
129-00-0	Pyrene[d,h]	3.8 E-07	3.1 E-08
7782-49-2	Selenium[e,i]	2.1 E-05	1.8 E-06

Table 15.3.5-6 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e]	2.4 E-16	2.0 E-17
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	6.3 E-14	5.2 E-15
108-88-3	Toluene[e,h]	3.0 E-06	2.5 E-07
71-55-6	1,1,1-Trichloroethane[e]	7.0 E-08	5.8 E-09
75-69-4	Trichlorofluoromethane[f]	4.0 E-10	3.3 E-11
95-63-6	1,2,4-Trimethylbenzene[f]	2.0 E-08	1.7 E-09
540-84-1	2,2,4-Trimethylpentane[d]	6.0 E-05	4.9 E-06
75-01-4	Vinyl chloride[e]	7.5 E-07	6.2 E-08
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	1.0 E-06	8.5 E-08
95-47-6	o-Xylene[e]	3.1 E-07	2.6 E-08
7440-66-6	Zinc[f]	6.5 E-03	5.4 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 is 12.09 pounds per item. This weight includes a 12.08 pound propellant charge and a 1.43 E-02 pound tracer. 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 A.
[h] EMISSION FACTOR RATING B.
[i] EMISSION FACTOR RATING D.

References For Section 15.3.5

1. *Report No. 5 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2003.

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. 5 for the Firing Point Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, August 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 5 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, January 2005, April 2005, May 2005, and June 2005.

15.3.7 C784, M831 120-mm Target Practice Tracer Cartridge

15.3.7.1 Ordnance Description[1,2]

The M831 120-mm Target Practice Tracer Cartridge is a target practice round that simulates the ballistics of the M830 High Explosive Anti-Tank MP-T Cartridge. This ammunition is fired from the M256 tank cannon and is used on firing ranges during training; it is not used during combat. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact and/or detonation of the round are not addressed in this section. Furthermore, emissions associated with the combustion of the tracer composition are not addressed in this section.

The M831 120-mm Target Practice Tracer Cartridge consists of a cartridge case, propelling charge, primer, and projectile. The projectile consists of a steel body with spike and plastic obturator, in addition to a fin and boom assembly with tracer.

15.3.7.2 [1-5]

Carbon dioxide (CO_2) is the primary pollutant emitted from the use of the M831 120-mm Target Practice Tracer 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 15.3.7-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.3.7-2 presents emission factors for hazardous air pollutants and toxic chemicals. 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 15.3.7-1 EMISSION FACTORS FOR THE IGNITION OF DODIC C784, M831 120-MM TARGET PRACTICE TRACER 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 item	lb per lb NEW[c]
124-38-9	CO_2	12	9.2 E-01
630-08-0	Carbon monoxide (CO)	1.3 E-01	9.6 E-03
7439-92-1	Lead (Pb)[g]	1.6 E-02	1.2 E-03
74-82-8	Methane	3.4 E-03	2.5 E-04
--	Oxides of nitrogen (NO_x)	3.5 E-02	2.6 E-03
--	PM-2.5[d,f]	9.9 E-02	7.3 E-03
--	PM-10[e,f]	1.5 E-01	1.1 E-02
12789-66-1	TSP[f]	1.7 E-01	1.3 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 13.47 pounds per item. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING B.
[g] EMISSION FACTOR RATING C.

Table 15.3.7-2 EMISSION FACTORS FOR THE USE OF DODIC C784, M831 120-MM TARGET PRACTICE TRACER 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]	2.7 E-07	2.0 E-08
75-07-0	Acetaldehyde[e]	3.8 E-05	2.8 E-06
75-05-8	Acetonitrile[e]	5.7 E-05	4.3 E-06
107-13-1	Acrylonitrile[e,h]	1.4 E-05	1.0 E-06
7429-90-5	Aluminum[f]	1.7 E-03	1.3 E-04
120-12-7	Anthracene[e]	1.2 E-07	9.1 E-09
7440-36-0	Antimony[e,i]	9.9 E-05	7.4 E-06
7440-39-3	Barium[f,i]	3.8 E-04	2.8 E-05
71-43-2	Benzene[e]	4.4 E-05	3.3 E-06
207-08-9	Benzo[k]fluoranthene[e]	4.3 E-08	3.2 E-09
191-24-2	Benzo[g,h,i]perylene[e]	4.1 E-07	3.0 E-08
50-32-8	Benzo[a]pyrene[e]	5.8 E-08	4.3 E-09
192-97-2	Benzo[e]pyrene[d]	7.1 E-08	5.3 E-09
108-90-7	Chlorobenzene[e,i]	1.8 E-05	1.4 E-06
7440-47-3	Chromium[e,i]	1.9 E-05	1.4 E-06
18540-29-9	Hexavalent chromium[e,h]	1.1 E-05	8.4 E-07
218-01-9	Chrysene[e,h]	7.1 E-08	5.3 E-09
7440-50-8	Copper[f,h]	6.6 E-03	4.9 E-04
84-74-2	Dibutyl phthalate[e,h]	1.9 E-05	1.4 E-06
--	Total dioxin/furan compounds[e,h]	9.7 E-10	7.2 E-11
117-81-7	bis(2-Ethylhexyl)phthalate[e,h]	3.8 E-04	2.8 E-05
206-44-0	Fluoranthene[e]	3.2 E-07	2.4 E-08
86-73-7	Fluorene[d,g]	3.4 E-07	2.5 E-08
50-00-0	Formaldehyde[e]	1.4 E-04	1.0 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e,h]	9.0 E-11	6.7 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e,h]	2.1 E-11	1.5 E-12
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e,i]	8.5 E-12	6.3 E-13
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e,i]	5.9 E-12	4.4 E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e,h]	4.3 E-12	3.2 E-13
74-90-8	Hydrogen cyanide[e]	5.3 E-04	4.0 E-05

Table 15.3.7-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7439-92-1	Lead[e,h]	1.6 E-02	1.2 E-03
7439-96-5	Manganese[e]	1.8 E-05	1.3 E-06
75-09-2	Methylene chloride[e]	4.7 E-04	3.5 E-05
91-20-3	Naphthalene[e,g]	1.5 E-07	1.1 E-08
7440-02-0	Nickel[e,i]	2.7 E-05	2.0 E-06
7697-37-2	Nitric acid[f]	1.4 E-03	1.0 E-04
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e,h]	8.0 E-10	6.0 E-11
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e,h]	3.3 E-11	2.5 E-12
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin[e,i]	8.6 E-12	6.4 E-13
85-01-8	Phenanthrene[e]	7.2 E-07	5.4 E-08
108-95-2	Phenol[e]	4.6 E-05	3.4 E-06
129-00-0	Pyrene[d]	2.5 E-07	1.9 E-08
7440-22-4	Silver[f,i]	2.5 E-05	1.9 E-06
100-42-5	Styrene[e,i]	6.7 E-06	5.0 E-07
108-88-3	Toluene[e]	7.5 E-06	5.6 E-07
75-69-4	Trichlorofluoromethane[f,h]	1.6 E-05	1.2 E-06
540-84-1	2,2,4-Trimethylpentane[d,i]	1.4 E-03	1.0 E-04
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	1.2 E-05	8.5 E-07
7440-66-6	Zinc[f,h]	9.7 E-04	7.2 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 13.47 pounds per item. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.3.7

1. *Report No. 5 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2003.

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

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

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 5 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 and June 2005.

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15.3.8 C785, M865 120-mm TPCSDS-T Cartridge

15.3.8.1 Ordnance Description[1]

The M865 120-mm Target Practice, Cone Stabilized, Discarding Sabot-Tracer (TPCSDS-T) Cartridge is a range-limited kinetic energy-type training cartridge. The cartridge consists of a cartridge case, propellant, primer, and projectile. This ammunition is fired from the M256 tank cannon and is used on firing ranges during training; it is not used during combat. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact of the round are not addressed in this section. Furthermore, emissions associated with the combustion of the tracer composition are not addressed in this section.

15.3.8.2 Emissions And Controls[1-5]

Carbon dioxide (CO_2) is the primary pollutant emitted from the use of the M865 120-mm TPCSDS-T 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 15.3.8-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.3.8-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.3.8-1 EMISSION FACTORS FOR THE IGNITION OF DODIC C785, M865 120-MM TPCSDS-T 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 item	lb per lb NEW[c]
124-38-9	CO_2	15	8.7 E-01
630-08-0	Carbon monoxide (CO)	1.5 E-01	8.5 E-03
7439-92-1	Lead (Pb)[f]	1.4 E-03	7.8 E-05
74-82-8	Methane	3.5 E-03	2.0 E-04
--	Oxides of nitrogen (NO_x)	5.5 E-02	3.1 E-03
--	PM-2.5[d,f]	9.1 E-02	5.2 E-03
--	PM-10[e,f]	1.8 E-01	1.0 E-02
12789-66-1	TSP[f]	2.3 E-01	1.3 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 17.47 pounds per item. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.

Table 15.3.8-2 EMISSION FACTORS FOR THE USE OF DODIC C785, M865 120-MM TPCSDS-T 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,h]	7.0 E-07	4.0 E-08
75-07-0	Acetaldehyde[e]	1.6 E-03	9.3 E-05
75-05-8	Acetonitrile[e]	1.0 E-05	5.9 E-07
107-13-1	Acrylonitrile[e]	1.9 E-05	1.1 E-06
7429-90-5	Aluminum[f,h]	1.4 E-03	8.2 E-05
120-12-7	Anthracene[e,h]	2.0 E-07	1.2 E-08
7440-36-0	Antimony[e]	1.7 E-05	9.8 E-07
7440-39-3	Barium[f]	1.9 E-05	1.1 E-06
71-43-2	Benzene[e,h]	1.1 E-04	6.1 E-06
56-55-3	Benzo[a]anthracene[e,g]	6.1 E-08	3.5 E-09
205-99-2	Benzo[b]fluoranthene[e,h]	6.3 E-08	3.6 E-09
207-08-9	Benzo[k]fluoranthene[e,h]	7.2 E-08	4.1 E-09
191-24-2	Benzo[g,h,i]perylene[e,h]	4.7 E-07	2.7 E-08
50-32-8	Benzo[a]pyrene[e,h]	5.3 E-08	3.0 E-09
192-97-2	Benzo[e]pyrene[d,h]	1.1 E-07	6.2 E-09
108-90-7	Chlorobenzene[e,i]	9.2 E-06	5.3 E-07
7440-47-3	Chromium[e]	1.9 E-05	1.1 E-06
18540-29-9	Hexavalent chromium[e]	4.8 E-06	2.8 E-07
218-01-9	Chrysene[e]	1.3 E-07	7.5 E-09
7440-50-8	Copper[f,h]	2.5 E-03	1.4 E-04
57-12-5	Particulate cyanide[e]	1.7 E-04	9.9 E-06
121-14-2	2,4-Dinitrotoluene[e]	2.0 E-05	1.1 E-06
--	Total dioxin/furan compounds[e]	2.5 E-09	1.4 E-10
100-41-4	Ethylbenzene[e,h]	1.3 E-05	7.4 E-07
74-85-1	Ethylene[f,g]	3.6 E-04	2.0 E-05
117-81-7	bis(2-Ethylhexyl)phthalate[e]	1.5 E-04	8.6 E-06
206-44-0	Fluoranthene[e,h]	5.8 E-07	3.3 E-08
86-73-7	Fluorene[d,g]	7.5 E-07	4.3 E-08
50-00-0	Formaldehyde[e,h]	3.3 E-04	1.9 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	2.2 E-10	1.2 E-11

Table 15.3.8-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	4.5 E-11	2.6 E-12
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e]	3.0 E-12	1.7 E-13
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e]	2.7 E-12	1.5 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	7.6 E-12	4.3 E-13
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	1.2 E-11	6.7 E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e]	9.4 E-12	5.4 E-13
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e]	5.5 E-12	3.1 E-13
74-90-8	Hydrogen cyanide[e,h]	1.2 E-03	7.1 E-05
7439-92-1	Lead[e,h]	1.4 E-03	7.8 E-05
7439-96-5	Manganese[e,h]	1.8 E-05	1.0 E-06
75-09-2	Methylene chloride[e,h]	5.1 E-04	2.9 E-05
91-20-3	Naphthalene[e,g]	4.7 E-06	2.7 E-07
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	2.1 E-09	1.2 E-10
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	8.1 E-11	4.6 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e]	4.6 E-12	2.7 E-13
85-01-8	Phenanthrene[e,h]	1.6 E-06	9.1 E-08
108-95-2	Phenol[e,h]	2.2 E-05	1.3 E-06
129-00-0	Pyrene[d,h]	5.0 E-07	2.9 E-08
100-42-5	Styrene[e,i]	1.4 E-05	8.2 E-07
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	3.7 E-12	2.1 E-13
108-88-3	Toluene[e,h]	1.5 E-05	8.8 E-07
540-84-1	2,2,4-Trimethylpentane[d,i]	1.2 E-05	6.6 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	1.2 E-05	6.7 E-07
7440-66-6	Zinc[f]	8.4 E-04	4.8 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 17.47 pounds per item. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING B.
[i] EMISSION FACTOR RATING D.

References For Section 15.3.8

1. *Report No. 5 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2003.

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

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

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 5 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 and June 2005.

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15.3.11 C868, M821 81-mm High Explosive Cartridge

15.3.11.1 Ordnance Description[1]

The M821 81-mm High Explosive Cartridge (DODIC C868) is a mortar used against personnel and light material targets. This ammunition is used during combat and on firing ranges during training. The cartridge is fired from the M252 improved 81-mm mortar system. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact and/or detonation of the projectile are not addressed in this section.

The M821 81-mm High Explosive Cartridge consists of a projectile body, a fuze, a fin assembly, between zero and four propellant charge increments (depending upon the range desired), and an ignition cartridge. The ignition cartridge contains propellant, a primer mix, and black powder. 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").

15.3.11.2 Emissions And Controls[1-5]

Primary emissions from the use of the M821 81-mm High Explosive 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 15.3.11-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.3.11-2 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 pound net explosive weight contained in the item (lb per lb NEW). Because the NEW for this ordnance 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).

Table 15.3.11-1 EMISSION FACTORS FOR THE USE OF DODIC C868, M821 81-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	1.9 E-01
7439-92-1	Lead (Pb)[g]	5.7 E-05
74-82-8	Methane	2.8 E-04
--	PM-2.5[d,f]	8.9 E-03
--	PM-10[e,f]	1.1 E-02
12789-66-1	TSP[f]	9.2 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 varies between 1.69 E-02 pounds per item and 3.64 E-01 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 1.69 E-02 pounds per item and between zero and four propelling charge increments, each of which weighs 8.66 E-02 pounds. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.
[g] EMISSION FACTOR RATING C.

Table 15.3.11-2 EMISSION FACTORS FOR THE USE OF DODIC C868, M821 81-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]
83-32-9	Acenaphthene[d]	7.1 E-09
75-07-0	Acetaldehyde[e,h]	6.3 E-05
75-05-8	Acetonitrile[e]	9.2 E-06
107-13-1	Acrylonitrile[e]	1.7 E-05
7429-90-5	Aluminum[f,h]	1.9 E-04
120-12-7	Anthracene[e]	3.9 E-09
7440-36-0	Antimony[e,i]	2.6 E-05
7440-39-3	Barium[f,i]	2.7 E-05
71-43-2	Benzene[e]	9.8 E-05
192-97-2	Benzo[e]pyrene[d]	3.8 E-10
123-72-8	Butyraldehyde[f,i]	2.7 E-04
75-15-0	Carbon disulfide[e,h]	1.1 E-06
463-58-1	Carbonyl sulfide[e,i]	2.9 E-05
74-87-3	Chloromethane[e,h]	3.5 E-08
7440-47-3	Chromium[e,h]	3.2 E-06
7440-50-8	Copper[f]	1.9 E-04
98-82-8	Cumene[e,i]	1.8 E-07
107-06-2	1,2-Dichloroethane[e]	2.1 E-06
100-41-4	Ethylbenzene[e,g]	7.5 E-07
74-85-1	Ethylene[f,g]	6.8 E-05
86-73-7	Fluorene[d,g]	4.2 E-09
50-00-0	Formaldehyde[e,h]	6.3 E-05
74-90-8	Hydrogen cyanide[e,h]	4.2 E-05
7439-92-1	Lead[e,h]	5.7 E-05
75-09-2	Methylene chloride[e]	3.4 E-05
80-62-6	Methyl methacrylate[e,h]	1.3 E-06
1634-04-4	Methyl tert-butyl ether[e,i]	3.4 E-07
91-20-3	Naphthalene[e,g]	3.6 E-06
7440-02-0	Nickel[e,i]	4.1 E-06
7697-37-2	Nitric acid[f]	1.2 E-04

Table 15.3.11-2 (cont.)

CASRN[b]	Pollutant	lb per lb NEW[c]
55-63-0	Nitroglycerin[f,h]	1.5 E-06
108-95-2	Phenol[e]	3.0 E-06
100-42-5	Styrene[e,h]	4.4 E-06
7664-93-9	Sulfuric acid[f,i]	6.2 E-04
108-88-3	Toluene[e]	4.8 E-06
95-63-6	1,2,4-Trimethylbenzene[f,h]	8.4 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	3.7 E-06
95-47-6	o-Xylene[e]	3.7 E-06
7440-66-6	Zinc[f,h]	1.2 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 varies between 1.69 E-02 pounds per item and 3.64 E-01 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 1.69 E-02 pounds per item and between zero and four propelling charge increments, each of which weighs 8.67 E-02 pounds. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.3.11

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

2. *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.

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

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 4 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, October 2004 and March 2005.

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15.3.12 C876, M880 81-mm Target Practice Short Range Cartridge

15.3.12.1 Ordnance Description[1]

The M880 81-mm Target Practice Short Range Cartridge (DODIC C876) is a mortar used to train soldiers on the operation of the M252 improved 81-mm mortar system. This ammunition is only used on firing ranges during training; it is not used during combat. Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact and/or detonation of the projectile are not addressed in this section.

The M880 81-mm Target Practice Short Range Cartridge consists of a hollow projectile body, a fuze containing a pyrotechnic smoke charge, a fin assembly, three removable plastic plugs to vary the range, and an ignition cartridge. The ignition cartridge contains propellant and a primer mix.

15.3.12.2 Emissions And Controls[1-5]

Primary emissions from the use of the M880 81-mm Target Practice Short Range 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 15.3.12-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.3.12-2 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 15.3.12-1 EMISSION FACTORS FOR THE USE OF DODIC C876, M880 81-MM TARGET PRACTICE SHORT RANGE 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 item	lb per lb NEW[c]
124-38-9	CO_2	2.9 E-03	2.4 E-01
630-08-0	CO	4.9 E-03	4.0 E-01
7439-92-1	Lead (Pb)[f]	1.3 E-05	1.1 E-03
74-82-8	Methane	1.6 E-05	1.3 E-03
--	Oxides of nitrogen (NO_X)	4.2 E-05	3.4 E-03
--	PM-2.5[d,f]	8.9 E-05	7.3 E-03
--	PM-10[e,f]	9.5 E-05	7.7 E-03
12789-66-1	TSP[f]	8.6 E-05	7.0 E-03

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 1.23 E-02 pounds per item. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.

Table 15.3.12-2 EMISSION FACTORS FOR THE USE OF DODIC C876, M880 81-MM TARGET PRACTICE SHORT RANGE 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]	2.2 E-09	1.8 E-07
208-96-8	Acenaphthylene[d,g]	1.0 E-08	8.1 E-07
75-07-0	Acetaldehyde[e]	2.7 E-07	2.2 E-05
75-05-8	Acetonitrile[e]	3.9 E-07	3.1 E-05
107-13-1	Acrylonitrile[e,h]	1.1 E-06	9.3 E-05
7429-90-5	Aluminum[f]	2.9 E-06	2.3 E-04
120-12-7	Anthracene[e]	1.6 E-09	1.3 E-07
7440-36-0	Antimony[e,h]	7.3 E-06	5.9 E-04
7440-39-3	Barium[f,h]	1.5 E-05	1.2 E-03
71-43-2	Benzene[e,h]	4.7 E-06	3.8 E-04
56-55-3	Benzo[a]anthracene[e,g]	2.5 E-09	2.0 E-07
205-99-2	Benzo[b]fluoranthene[e]	1.2 E-08	1.0 E-06
207-08-9	Benzo[k]fluoranthene[e]	8.1 E-09	6.6 E-07
191-24-2	Benzo[g,h,i]perylene[e]	3.5 E-09	2.8 E-07
50-32-8	Benzo[a]pyrene[e]	1.3 E-09	1.1 E-07
192-97-2	Benzo[e]pyrene[d]	3.8 E-09	3.1 E-07
85-68-7	Butylbenzylphthalate[d,h]	1.8 E-07	1.5 E-05
75-15-0	Carbon disulfide[e,h]	3.4 E-08	2.8 E-06
463-58-1	Carbonyl sulfide[e,i]	1.3 E-06	1.1 E-04
74-87-3	Chloromethane[e,h]	1.7 E-09	1.4 E-07
218-01-9	Chrysene[e,h]	2.7 E-08	2.2 E-06
53-70-3	Dibenz[a,h]anthracene[e]	1.8 E-09	1.5 E-07
107-06-2	1,2-Dichloroethane[e]	9.3 E-08	7.6 E-06
100-41-4	Ethylbenzene[e,g]	1.5 E-08	1.2 E-06
74-85-1	Ethylene[f,g]	6.5 E-06	5.3 E-04
206-44-0	Fluoranthene[e]	5.4 E-08	4.4 E-06
86-73-7	Fluorene[d,g]	4.4 E-09	3.6 E-07
50-00-0	Formaldehyde[e]	2.0 E-06	1.6 E-04
74-90-8	Hydrogen cyanide[e]	3.7 E-06	3.0 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e,g]	3.1 E-09	2.5 E-07

Table 15.3.12-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7439-92-1	Lead[e]	1.3 E-05	1.1 E-03
75-09-2	Methylene chloride[e,h]	1.0 E-05	8.1 E-04
80-62-6	Methyl methacrylate[e,i]	7.2 E-08	5.8 E-06
1634-04-4	Methyl tert-butyl ether[e,i]	1.1 E-08	8.8 E-07
91-20-3	Naphthalene[e,g]	8.7 E-08	7.0 E-06
85-01-8	Phenanthrene[e]	3.9 E-08	3.2 E-06
115-07-1	Propylene[f]	1.5 E-06	1.3 E-04
129-00-0	Pyrene[d]	2.9 E-08	2.4 E-06
100-42-5	Styrene[e,h]	1.4 E-07	1.2 E-05
108-88-3	Toluene[e]	2.7 E-07	2.2 E-05
71-55-6	1,1,1-Trichloroethane[e,i]	3.0 E-08	2.4 E-06
75-69-4	Trichlorofluoromethane[f,h]	4.8 E-09	3.9 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e,h]	7.3 E-08	6.0 E-06
95-47-6	o-Xylene[e,h]	3.7 E-08	3.0 E-06

[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 1.23 E-02 pounds per item. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.
[i] EMISSION FACTOR RATING D.

References For Section 15.3.12

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. *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.

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

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 4 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, October 2004 and March 2005.

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15.3.13 C995, M136 AT4 Recoilless Rifle, 84-mm Cartridge

15.3.13.1 Ordnance Description[1]

The M136 AT4 Recoilless Rifle (DODIC C995) is a shoulder-fired weapon that delivers an 84-mm armor-piercing warhead. It is used against armored targets such as tanks as well as targets such as gun emplacements, pillboxes, and personnel. The projectile associated with the 84-mm cartridge fired from the rifle contains an initiator charge, a booster charge, and a bursting charge. This ammunition is used during combat and on firing ranges during training. Although DODIC C995 includes the launcher, propelling charge, and projectile, 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.

15.3.13.2 Emissions And Controls[1-5]

The primary emissions from the use of the 84-mm cartridge fired from the M136 AT4 Recoilless Rifle are 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 15.3.13-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.3.13-2 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 15.3.13-1 EMISSION FACTORS FOR THE USE OF DODIC C995, M136 AT4 RECOILLESS RIFLE, 84-MM CARTRIDGE (PROJECTILE) - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SYSPENDED 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-01	3.2 E-01
630-08-0	Carbon monoxide (CO)	5.7 E-02	4.2 E-02
7439-92-1	Lead (Pb)	4.4 E-05	3.2 E-05
74-82-8	Methane	8.6 E-04	6.3 E-04
--	Oxides of nitrogen (NO_X)	1.8 E-02	1.3 E-02
--	PM-2.5[d]	7.2 E-02	5.2 E-02
--	PM-10[e]	1.3 E-01	9.4 E-02
12789-66-1	TSP	1.9 E-01	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 1.37 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 15.3.13-2 EMISSION FACTORS FOR THE USE OF DODIC C995, M136 AT4 RECOILLESS RIFLE, 84-MM 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]	6.0 E-09	4.4 E-09
208-96-8	Acenaphthylene[d]	2.7 E-08	2.0 E-08
75-07-0	Acetaldehyde[e]	8.6 E-06	6.3 E-06
75-05-8	Acetonitrile[e,g]	7.5 E-05	5.5 E-05
107-13-1	Acrylonitrile[e,g]	2.1 E-06	1.6 E-06
7429-90-5	Aluminum[f,g]	2.4 E-02	1.8 E-02
7664-41-7	Ammonia[d,g]	2.3 E-03	1.7 E-03
120-12-7	Anthracene[e,g]	3.9 E-09	2.9 E-09
71-43-2	Benzene[e,g]	4.8 E-06	3.5 E-06
75-65-0	t-Butyl alcohol[e]	2.4 E-07	1.8 E-07
7440-47-3	Chromium[e]	3.1 E-05	2.3 E-05
18540-29-9	Hexavalent chromium[e]	2.3 E-07	1.7 E-07
7440-50-8	Copper[f]	3.8 E-03	2.8 E-03
98-82-8	Cumene[e,h]	3.6 E-07	2.6 E-07
84-74-2	Dibutyl phthalate[e]	3.6 E-06	2.6 E-06
--	Total dioxin/furan compounds[e]	2.4 E-10	1.8 E-10
100-41-4	Ethylbenzene[e]	5.0 E-07	3.7 E-07
74-85-1	Ethylene[f,g]	4.4 E-05	3.2 E-05
117-81-7	bis(2-Ethylhexyl)phthalate[e,g]	2.1 E-05	1.5 E-05
206-44-0	Fluoranthene[e]	1.1 E-08	7.7 E-09
86-73-7	Fluorene[d]	9.9 E-09	7.2 E-09
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	2.3 E-11	1.7 E-11
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	1.7 E-12	1.3 E-12
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e]	6.3 E-13	4.6 E-13
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e]	3.0 E-13	2.2 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	8.5 E-13	6.2 E-13
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	9.8 E-13	7.2 E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e]	4.6 E-13	3.4 E-13
74-90-8	Hydrogen cyanide[e,g]	2.7 E-04	2.0 E-04
7439-92-1	Lead[e,g]	4.4 E-05	3.2 E-05

Table 15.3.13-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7439-96-5	Manganese[e,g]	4.5 E-04	3.3 E-04
75-09-2	Methylene chloride[e]	1.0 E-06	7.4 E-07
91-20-3	Naphthalene[e,g]	2.0 E-07	1.5 E-07
7697-37-2	Nitric acid[f,g]	2.0 E-04	1.5 E-04
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	2.1 E-10	1.6 E-10
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	8.6 E-12	6.3 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e]	3.8 E-13	2.8 E-13
85-01-8	Phenanthrene[e,g]	3.2 E-08	2.3 E-08
123-38-6	Propionaldehyde[e]	1.4 E-06	9.9 E-07
115-07-1	Propylene[f,g]	1.0 E-05	7.3 E-06
129-00-0	Pyrene[d]	1.3 E-08	9.6 E-09
7440-22-4	Silver[e]	6.3 E-05	4.6 E-05
100-42-5	Styrene[e]	4.0 E-07	2.9 E-07
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	6.9 E-13	5.0 E-13
108-88-3	Toluene[e,g]	1.7 E-06	1.2 E-06
75-69-4	Trichlorofluoromethane[f]	2.0 E-07	1.5 E-07
95-63-6	1,2,4-Trimethylbenzene[f,h]	4.2 E-06	3.0 E-06
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	1.1 E-06	8.2 E-07
95-47-6	o-Xylene[e]	5.8 E-07	4.2 E-07
7440-66-6	Zinc[f,g]	2.5 E-04	1.8 E-04

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 1.37 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 15.3.13

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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15.3.15 CA09, M931 120-mm Full Range Practice Cartridge

15.3.15.1 Ordnance Description[1]

The M931 120-mm Full Range Practice Cartridge (DODIC CA09) is a full-range practice mortar that is used to simulate the use of the M933 and M934 120-mm High Explosive Cartridges. This ammunition is used on firing ranges during training; it is not used during combat. It is fired from the 120-mm, M120 Battalion Mortar System (BMS). Note that emission factors presented herein are only associated with the firing of the cartridge; emissions associated with the impact and/or detonation of the projectile are not addressed in this section.

The M931 120-mm Full Range Practice Cartridge consists of a hollow projectile body with vent tubes and base plug, a point detonating (PD) practice fuze, a fin assembly, between zero and four propellant charge increments, and an ignition cartridge. The ignition cartridge contains propellant, a primer mix, and black powder. 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").

15.3.15.2 Emissions And Controls[1-5]

The primary emissions from the use of the M931 120-mm Full Range Practice Cartridge are carbon dioxide (CO_2) and carbon monoxide (CO). Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e. those chemicals regulated under Section 313 of the *Emergency Planning and Community Right to Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically used in the field, there are no controls associated with its use.

Table 15.3.15-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.3.15-2 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 pound net explosive weight contained in the item (lb per lb NEW). Because the NEW for this ordnance 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).

15.3.15.3 Updates Since July 2006

Section 15.3 was created during July 2006. Revisions to this section since that date are summarized below.

Revision 2, September 2006

- Section 15.3.3, which presents emission factors for DODIC C379, the M934 120-mm High Explosive Cartridge, was added.
- Section 15.3.5, which presents emission factors for DODIC C511, the M490 105-mm Target Practice-Tracer Cartridge, was updated to include additional data.
- Section 15.3.15, which presents emission factors for DODIC CA09, the M931 120-mm Full Range Practice Cartridge, was added.

- Section 15.3.5, which presents emission factors for DODIC C511, M490 105-mm Target Practice-Tracer Cartridge, was added.

- Section 15.3.7, which presents emission factors for DODIC C784, M831 120-mm Target Practice-Tracer Cartridge, was added.

- Section 15.3.8, which presents emission factors for DODIC C785, M865 120-mm TPCSDS-T Cartridge, was added.

Table 15.3.15-1 EMISSION FACTORS FOR THE USE OF DODIC CA09, M931 120-MM FULL RANGE PRACTICE 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	2.1 E-01
630-08-0	CO	3.8 E-01
7439-92-1	Lead (Pb)[f]	2.5 E-05
74-82-8	Methane	7.6 E-04
--	Oxides of nitrogen (NO_X)	9.7 E-04
--	PM-2.5[d,f]	3.1 E-02
--	PM-10[e,f]	3.6 E-02
12789-66-1	TSP[f]	4.0 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance varies between 1.54 E-01 pounds per item and 1.33 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 1.54 E-01 pounds per item and between zero and four propelling charge increments, each of which weighs 2.94 E-01 pounds. Reference 5.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (μm).
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 μm.
[f] EMISSION FACTOR RATING B.

Table 15.3.15-2 EMISSION FACTORS FOR THE USE OF DODIC CA09, M931 120-MM FULL RANGE PRACTICE CARTRIDGE (PROPELLING CHARGE) – HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: C (except as noted)

CASRN[b]	Pollutant	lb/lb NEW[c]
83-32-9	Acenaphthene[d]	1.8 E-07
208-96-8	Acenaphthylene[d,g]	4.1 E-06
75-07-0	Acetaldehyde[e]	9.4 E-06
75-05-8	Acetonitrile[e]	9.2 E-06
107-13-1	Acrylonitrile[e]	3.2 E-06
7429-90-5	Aluminum[f]	2.8 E-03
7664-41-7	Ammonia[d,g]	7.5 E-04
120-12-7	Anthracene[e]	1.7 E-06
7440-39-3	Barium[f,h]	8.3 E-05
71-43-2	Benzene[e]	1.3 E-04
192-97-2	Benzo[e]pyrene[d,h]	3.0 E-07
106-99-0	1,3-Butadiene[e]	3.3 E-05
18540-29-9	Hexavalent chromium[e]	1.4 E-07
7440-50-8	Copper[f]	2.9 E-04
57-12-5	Particulate cyanide[e,h]	1.0 E-03
53-70-3	Dibenz[a,h]anthracene[e]	1.1 E-08
75-71-8	Dichlorodifluoromethane[f]	5.6 E-07
--	Total dioxin/furan compounds[e,h]	4.1 E-11
100-41-4	Ethylbenzene[e,g]	1.4 E-06
74-85-1	Ethylene[f]	2.4 E-04
86-73-7	Fluorene[d,g]	7.0 E-07
50-00-0	Formaldehyde[e]	2.2 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e,h]	3.7 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e,h]	9.2 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e,h]	4.2 E-13
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e,h]	1.3 E-13
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e,h]	8.1 E-14
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran[e,h]	1.2 E-13
7647-01-0	Hydrochloric acid[e]	4.9 E-04
74-90-8	Hydrogen cyanide[e]	3.2 E-04

Table 15.3.15-2 (cont.)

CASRN[b]	Pollutant	lb/lb NEW[c]
7439-92-1	Lead[e]	2.5 E-05
7439-96-5	Manganese[e,g]	2.2 E-05
91-20-3	Naphthalene[e,g]	1.2 E-05
7440-02-0	Nickel[e,h]	4.5 E-06
55-63-0	Nitroglycerin[f]	5.4 E-07
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e,h]	3.3 E-11
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e,h]	1.8 E-12
85-01-8	Phenanthrene[e]	2.4 E-06
108-95-2	Phenol[e]	7.1 E-06
115-07-1	Propylene[f]	8.5 E-05
100-42-5	Styrene[e,h]	8.2 E-06
7664-93-9	Sulfuric acid[f,h]	4.0 E-04
108-88-3	Toluene[e]	1.9 E-05
95-63-6	1,2,4-Trimethylbenzene[f,h]	9.2 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	2.4 E-06
95-47-6	o-Xylene[e]	1.1 E-06
7440-66-6	Zinc[f,h]	2.6 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 varies between 1.54 E-01 pounds per item and 1.33 pounds per item, depending upon the number of propelling charge increments used. This value includes an ignition charge of 1.54 E-01 pounds per item and between zero and four propelling charge increments, each of which weighs 2.94 E-01 pounds. Reference 5.
[d] Hazardous air pollutant under CAA Section 112(b).
[e] Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
[f] Reportable chemical under EPCRA Section 313.
[g] EMISSION FACTOR RATING A.
[h] EMISSION FACTOR RATING C.

References For Section 15.3.15

1. *Report No. 8 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, December 2004.

2. *Detailed Test Plan No. 8 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2002.

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

4. *Background Document, Report on Revisions to 5th Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 8 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, September 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, October 2004, April 2005, and October 2005.