15.6 Rockets, Rocket Motors, And Igniters

Munitions listed in this section begin with the Department of Defense Identification Code (DODIC) letter "H." This category of munitions includes rockets, rocket motors, and igniters. Examples include 66-mm rockets, 2.75-inch rocket warheads, 2.75-inch rocket motors, and rocket fuses.

15.6.1 H459, 2.75-inch Flechette, MK40 Mod 3 Motor

15.6.1.1 Ordnance Description[1]

The 2.75-inch Flechette, MK40 Mod 3 Motor (DODIC H459) is a rocket motor fired from a variety of rotary-wing and other low speed aircraft. The motor is designed to deliver a variety of warheads and develops a nominal thrust of 720 pounds for a burn time between 1.55 and 1.69 seconds. This ammunition is used during combat and on firing ranges during training. Note that emission factors presented herein include only those associated with the use of the rocket motor; emissions associated with the impact and/or detonation of the warhead are not addressed in this section.

The 2.75-inch Flechette, MK40 Mod 3 Motor consists of a motor body, a nozzle, an igniter assembly, and a propelling charge. The igniter assembly includes an ignition charge, an initiation charge, a black powder charge, and a black powder booster charge.

15.6.1.2 Emissions And Controls[1-5]

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The primary emissions from the use of the 2.75-inch Flechette, MK40 Mod 3 Motor 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 15.6.1-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.6.1-2 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 15.6.1-1 EMISSION FACTORS FOR THE USE OF DODIC H459, 2.75-INCH FLECHETTE, MK40 MOD 3 MOTOR (PROPELLING ROCKET) – 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	2.4	4.0 E-01
630-08-0	CO	1.5	2.5 E-01
7439-92-1	Lead (Pb)[f]	5.1 E-02	8.5 E-03
74-82-8	Methane[f]	2.2 E-02	3.6 E-03
--	Oxides of nitrogen (NO_x)[f]	2.6 E-02	4.3 E-03
--	PM-2.5[d]	1.0 E-01	1.7 E-02
--	PM-10[e]	1.1 E-01	1.9 E-02
12789-66-1	TSP	1.0 E-01	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 6.02 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 C.

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Table 15.6.1-2 EMISSION FACTORS FOR THE USE OF DODIC H459, 2.75-INCH FLECHETTE, MK40 MOD 3 MOTOR (PROPELLING ROCKET) – 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]	4.8 E-07	7.9 E-08
208-96-8	Acenaphthylene[d]	3.0 E-05	4.9 E-06
75-07-0	Acetaldehyde[e,h]	4.8 E-04	7.9 E-05
75-05-8	Acetonitrile[e]	2.2 E-04	3.7 E-05
107-13-1	Acrylonitrile[e]	4.8 E-05	8.0 E-06
7429-90-5	Aluminum[f]	1.4 E-04	2.3 E-05
7664-41-7	Ammonia[d]	4.9 E-03	8.2 E-04
120-12-7	Anthracene[e]	1.2 E-06	2.0 E-07
71-43-2	Benzene[e]	1.7 E-03	2.8 E-04
56-55-3	Benzo[a]anthracene[e]	1.7 E-06	2.8 E-07
205-99-2	Benzo[b]fluoranthene[e]	2.0 E-06	3.3 E-07
207-08-9	Benzo[k]fluoranthene[e]	1.5 E-06	2.5 E-07
191-24-2	Benzo[g,h,i]perylene[e]	1.3 E-05	2.2 E-06
50-32-8	Benzo[a]pyrene[d]	2.8 E-06	4.6 E-07
192-97-2	Benzo[e]pyrene[e]	3.1 E-06	5.1 E-07
7440-43-9	Cadmium[e]	1.2 E-03	2.0 E-04
74-87-3	Chloromethane[e]	1.2 E-05	2.0 E-06
7440-47-3	Chromium[e,h]	4.1 E-06	6.8 E-07
218-01-9	Chrysene[e]	2.1 E-06	3.5 E-07
7440-50-8	Copper[f]	4.4 E-03	7.4 E-04
53-70-3	Dibenz[a,h]anthracene[e]	1.0 E-07	1.7 E-08
75-71-8	Dichlorodifluoromethane[f]	3.7 E-05	6.1 E-06
--	Total dioxin/furan compounds[e]	1.7 E-10	2.8 E-11
74-85-1	Ethylene[f,g]	2.0 E-03	3.3 E-04
86-73-7	Fluorene[d]	3.7 E-06	6.2 E-07
50-00-0	Formaldehyde[e]	3.4 E-04	5.6 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	1.8 E-11	3.1 E-12
74-90-8	Hydrogen cyanide[e,h]	4.2 E-03	7.0 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e]	4.2 E-06	6.9 E-07
7439-92-1	Lead[e]	5.1 E-02	8.5 E-03

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Table 15.6.1-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7439-96-5	Manganese[e,g]	5.0 E-05	8.3 E-06
75-09-2	Methylene chloride[e]	2.8 E-03	4.7 E-04
91-20-3	Naphthalene[e]	1.1 E-04	1.9 E-05
55-63-0	Nitroglycerin[f,h]	8.1 E-06	1.3 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	1.5 E-10	2.5 E-11
85-01-8	Phenanthrene[e]	1.2 E-05	2.0 E-06
108-95-2	Phenol[e]	2.2 E-05	3.7 E-06
129-00-0	Pyrene[d]	2.8 E-05	4.6 E-06
100-42-5	Styrene[e,g]	3.5 E-05	5.8 E-06
108-88-3	Toluene[e]	1.1 E-04	1.9 E-05
75-69-4	Trichlorofluoromethane[f]	1.7 E-05	2.8 E-06
7440-66-6	Zinc[f,g]	1.9 E-03	3.1 E-04

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.02 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 B.
[h] EMISSION FACTOR RATING D.

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References For Section 15.6.1

1. *Report No. 7 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2004.

2. *Detailed Test Plan No. 7 for the Firing Point Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, March 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 7 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, April 2005 and October 2005.

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15.6.5 H557, M72A3 66-mm High Explosive Antitank Rocket

15.6.5.1 Ordnance Description[1-3]

The M72A3 66-mm High Explosive Antitank Rocket (DODIC H557) is part of the M72 Light Antitank Weapon (LAW) system. The LAW system is a light, compact, single shot, shoulder-fired weapon that consists of a rocket, launcher, and sling assembly. This ammunition is used during combat and on firing ranges during training. It is primarily used for penetration of armored targets, but may also be used effectively against bunkers and other light field fortifications. Note that emission factors presented herein are divided into those associated with the detonation of the warhead and those associated with the propelling rocket motor.

The M72A3 66-mm High Explosive Antitank Rocket consists of a warhead, point initiating base detonating (PIBD) fuse, fin assembly, motor body, and igniter. Components of the warhead assembly include a warhead body, copper cone, nose cap assembly, a booster, and multiple charges. The motor body contains propellant, while the igniter contains a primer mix and black powder.

15.6.5.2 Emissions And Controls[1-3, 5-12]

Carbon dioxide (CO_2) is the primary pollutant emitted from the use of the M72A3 66-mm High Explosive Antitank Rocket. 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.

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Table 15.6.5-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP) for the use of the propelling rocket motor. Table 15.6.5-2 presents similar data for use of the warhead, while Table 15.6.5-3 presents combined emission factors for the use of both the propelling rocket motor and warhead. Table 15.6.5-4 presents emission factors for hazardous air pollutants and toxic chemicals for the use of the propelling rocket motor. Table 15.6.5-5 presents similar emission factors for use of the warhead, while Table 15.6.5-6 presents combined hazardous air pollutant and toxic chemical emission factors for the use of both the propelling rocket motor and warhead. In all of the 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 15.6.5-1 EMISSION FACTORS FOR THE USE OF DODIC H557, M72A3 66-MM HIGH EXPLOSIVE ANTITANK ROCKET (PROPELLING ROCKET) – 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	8.5 E-02	6.4 E-01
630-08-0	Carbon monoxide (CO)	5.8 E-03	4.4 E-02
7439-92-1	Lead (Pb)[d]	1.8 E-05	1.3 E-04
74-82-8	Methane[e]	1.4 E-04	1.0 E-03
--	Oxides of nitrogen (NO_x)[d]	2.1 E-03	1.6 E-02
--	PM-2.5[f]	7.7 E-03	5.7 E-02
--	PM-10[g]	8.1 E-03	6.0 E-02
7446-09-5	Sulfur dioxide (SO_2)[d]	2.1 E-05	1.5 E-04
12789-66-1	TSP	7.0 E-03	5.2 E-02

[a] Factors represent uncontrolled emissions. References 2, 3, 6, 7, and 12.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 1.34 E-01 pounds per item. Reference 12.
[d] EMISSION FACTOR RATING C.
[e] EMISSION FACTOR RATING D.
[f] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[g] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.

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Table 15.6.5-2 EMISSION FACTORS FOR THE USE OF DODIC H557, M72A3 66-MM HIGH EXPLOSIVE ANTITANK ROCKET (WARHEAD) – 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	3.6 E-01	5.3 E-01
630-08-0	CO	5.0 E-02	7.3 E-02
7439-92-1	Lead	1.2 E-03	1.7 E-03
74-82-8	Methane	6.0 E-04	8.7 E-04
--	NO_x	5.0 E-03	7.3 E-03
--	PM-2.5[d]	3.0 E-02	4.4 E-02
--	PM-10[e]	5.2 E-02	7.7 E-02
12789-66-1	TSP	6.1 E-02	9.0 E-02

[a] Factors represent uncontrolled emissions. References 1, 5, and 12.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.84 E-01 pounds per item. Reference 12.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 µm.
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.

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Table 15.6.5-3 EMISSION FACTORS FOR THE USE OF DODIC H557, M72A3 66-MM HIGH EXPLOSIVE ANTITANK ROCKET (TOTAL) – 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	4.5 E-01	5.5 E-01
630-08-0	CO	5.5 E-02	6.8 E-02
7439-92-1	Lead	1.2 E-03	1.5 E-03
74-82-8	Methane	7.4 E-04	9.0 E-04
--	NO_x	7.1 E-03	8.7 E-03
--	PM-2.5[d]	3.8 E-02	4.6 E-02
--	PM-10[e]	6.1 E-02	7.4 E-02
7446-09-5	SO_2[f]	2.1 E-05	2.5 E-05
12789-66-1	TSP	6.1 E-02	9.0 E-02

[a] Factors represent uncontrolled emissions. References 1-3, 5-7, and 12.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 8.18 E-01 pounds per item. Reference 12.
[d] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 µm.
[e] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.
[f] EMISSION FACTOR RATING C.

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Table 15.6.5-4 EMISSION FACTORS FOR THE USE OF DODIC H557, M72A3 66-MM HIGH EXPLOSIVE ANTITANK ROCKET (PROPELLING ROCKET) – 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]	1.6 E-10	1.2 E-09
208-96-8	Acenaphthylene[d]	2.0 E-09	1.5 E-08
75-07-0	Acetaldehyde[e]	2.6 E-06	2.0 E-05
75-05-8	Acetonitrile[e,h]	1.5 E-06	1.1 E-05
107-13-1	Acrylonitrile[e]	6.8 E-07	5.1 E-06
7429-90-5	Aluminum[f,h]	1.5 E-04	1.1 E-03
120-12-7	Anthracene[e]	5.0 E-10	3.8 E-09
7440-36-0	Antimony[e,h]	6.6 E-06	4.9 E-05
7440-39-3	Barium[f]	1.4 E-05	1.0 E-04
71-43-2	Benzene[e]	2.0 E-06	1.5 E-05
56-55-3	Benzo[a]anthracene[e]	5.0 E-10	3.8 E-09
205-99-2	Benzo[b]fluoranthene[e]	4.7 E-10	3.5 E-09
207-08-9	Benzo[k]fluoranthene[e]	2.1 E-09	1.6 E-08
191-24-2	Benzo[g,h,i]perylene[e]	1.4 E-09	1.0 E-08
50-32-8	Benzo[a]pyrene[e]	2.0 E-09	1.5 E-08
7440-43-9	Cadmium[e,h]	1.1 E-06	8.1 E-06
75-15-0	Carbon disulfide[e]	4.1 E-08	3.0 E-07
74-87-3	Chloromethane[e]	2.5 E-08	1.9 E-07
7440-47-3	Chromium[e]	7.3 E-07	5.4 E-06
18540-29-9	Hexavalent chromium[e]	2.9 E-07	2.1 E-06
218-01-9	Chrysene[e]	1.1 E-09	8.4 E-09
7440-50-8	Copper[f,h]	4.8 E-05	3.6 E-04
75-71-8	Dichlorodifluoromethane[f,h]	8.8 E-08	6.6 E-07
107-06-2	1,2-Dichloroethane[e]	2.3 E-08	1.7 E-07
--	Total dioxin/furan compounds[e]	2.2 E-11	1.6 E-10
100-41-4	Ethylbenzene[e]	3.8 E-08	2.9 E-07
74-85-1	Ethylene[f]	1.7 E-05	1.2 E-04
206-44-0	Fluoranthene[e]	1.7 E-09	1.3 E-08
86-73-7	Fluorene[d]	9.1 E-10	6.8 E-09
50-00-0	Formaldehyde[e,g]	1.3 E-05	9.7 E-05

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Table 15.6.5-4 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e,h]	1.4 E-12	1.0 E-11
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	6.1 E-14	4.5 E-13
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	9.0 E-14	6.7 E-13
110-54-3	Hexane[e]	5.1 E-06	3.8 E-05
7647-01-0	Hydrochloric acid[e,h]	6.8 E-04	5.1 E-03
74-90-8	Hydrogen cyanide[e]	2.1 E-05	1.6 E-04
7439-92-1	Lead[e]	1.8 E-05	1.3 E-04
7439-96-5	Manganese[e]	8.3 E-07	6.2 E-06
75-09-2	Methylene chloride[e,h]	1.7 E-05	1.2 E-04
91-20-3	Naphthalene[e]	3.0 E-08	2.2 E-07
7440-02-0	Nickel[e]	5.9 E-07	4.4 E-06
7697-37-2	Nitric acid[f]	3.7 E-05	2.8 E-04
55-63-0	Nitroglycerin[f,h]	5.6 E-07	4.2 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e,h]	1.9 E-11	1.4 E-10
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e]	2.9 E-13	2.2 E-12
85-01-8	Phenanthrene[e]	2.4 E-09	1.8 E-08
108-95-2	Phenol[e]	1.4 E-06	1.1 E-05
129-00-0	Pyrene[d]	2.1 E-09	1.5 E-08
7440-22-4	Silver[f]	2.5 E-07	1.9 E-06
100-42-5	Styrene[e]	5.7 E-07	4.2 E-06
7664-93-9	Sulfuric acid[f,h]	3.1 E-04	2.3 E-03
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e]	1.3 E-13	9.5 E-13
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	2.9 E-13	2.2 E-12
108-88-3	Toluene[e,h]	4.6 E-08	3.5 E-07
71-55-6	1,1,1-Trichloroethane[e]	2.1 E-07	1.6 E-06
75-69-4	Trichlorofluoromethane[f,h]	1.7 E-07	1.3 E-06
95-63-6	1,2,4-Trimethylbenzene[f]	2.6 E-08	1.9 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	1.5 E-07	1.1 E-06
95-47-6	o-Xylene[e]	1.5 E-07	1.1 E-06
7440-66-6	Zinc[f,g]	1.8 E-05	1.4 E-04

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Table 15.6.5-4 (cont.)

[a] Factors represent uncontrolled emissions. References 2, 3, 6, 7, and 12.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 1.34 E-01 pounds per item. Reference 12.
[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.

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Table 15.6.5-5 EMISSION FACTORS FOR THE USE OF DODIC H557, M72A3 66-MM HIGH EXPLOSIVE ANTITANK ROCKET (WARHEAD) – 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]	2.8 E-08	4.1 E-08
208-96-8	Acenaphthylene[d]	7.7 E-07	1.1 E-06
75-05-8	Acetonitrile[e,g]	7.7 E-05	1.1 E-04
107-13-1	Acrylonitrile[e,g]	5.4 E-06	7.9 E-06
7429-90-5	Aluminum[f,g]	1.1 E-03	1.6 E-03
120-12-7	Anthracene[e,g]	4.7 E-08	6.9 E-08
7440-39-3	Barium[f]	3.4 E-04	5.0 E-04
71-43-2	Benzene[e,g]	1.5 E-05	2.1 E-05
56-55-3	Benzo[a]anthracene[e,g]	1.7 E-08	2.5 E-08
207-08-9	Benzo[k]fluoranthene[e]	6.0 E-09	8.8 E-09
50-32-8	Benzo[a]pyrene[e,g]	2.4 E-09	3.6 E-09
192-97-2	Benzo[e]pyrene[d,g]	2.6 E-09	3.8 E-09
85-68-7	Butylbenzylphthalate[d]	2.1 E-06	3.0 E-06
74-87-3	Chloromethane[g]	1.1 E-06	1.6 E-06
7440-47-3	Chromium[e]	1.4 E-05	2.1 E-05
218-01-9	Chrysene[e,g]	1.6 E-08	2.3 E-08
7440-50-8	Copper[f]	3.0 E-03	4.4 E-03
57-12-5	Particulate cyanide[e]	1.8 E-04	2.6 E-04
84-74-2	Dibutyl phthalate[e]	3.3 E-06	4.8 E-06
75-71-8	Dichlorodifluoromethane[f]	1.3 E-08	1.9 E-08
107-06-2	1,2-Dichloroethane[e]	2.9 E-07	4.2 E-07
121-14-2	2,4-Dinitrotoluene[e,h]	9.7 E-08	1.4 E-07
--	Total dioxin/furan compounds[e]	5.5 E-10	8.0 E-10
100-41-4	Ethylbenzene[e]	3.5 E-07	5.1 E-07
74-85-1	Ethylene[f,g]	4.7 E-05	6.9 E-05
117-81-7	bis(2-Ethylhexyl)phthalate[e,g]	1.1 E-05	1.6 E-05
206-44-0	Fluoranthene[e]	1.2 E-07	1.8 E-07
86-73-7	Fluorene[d]	3.9 E-08	5.7 E-08
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	3.0 E-11	4.3 E-11
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	3.8 E-12	5.6 E-12

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Table 15.6.5-5 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e]	4.9 E-13	7.1 E-13
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e]	1.6 E-13	2.4 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	8.6 E-13	1.3 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	8.0 E-13	1.2 E-12
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e]	7.0 E-13	1.0 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	2.8 E-13	4.1 E-13
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e]	2.2 E-13	3.2 E-13
74-90-8	Hydrogen cyanide[e,g]	8.8 E-05	1.3 E-04
7439-92-1	Lead[e,g]	1.2 E-03	1.7 E-03
7439-96-5	Manganese[e,g]	9.5 E-05	1.4 E-04
75-09-2	Methylene chloride[e]	6.5 E-07	9.5 E-07
91-20-3	Naphthalene[e,g]	1.4 E-06	2.0 E-06
7697-37-2	Nitric acid[f,g]	3.2 E-06	4.7 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	5.0 E-10	7.3 E-10
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e,h]	1.1 E-11	1.6 E-11
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e]	2.2 E-13	3.2 E-13
85-01-8	Phenanthrene[e,g]	2.7 E-07	4.0 E-07
108-95-2	Phenol[e]	1.5 E-06	2.2 E-06
115-07-1	Propylene[f,g]	9.4 E-06	1.4 E-05
129-00-0	Pyrene[d]	1.7 E-07	2.5 E-07
7440-22-4	Silver[f]	2.7 E-05	3.9 E-05
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	4.5 E-13	6.6 E-13
127-18-4	Tetrachloroethylene[e]	3.2 E-07	4.7 E-07
108-88-3	Toluene[e,g]	1.3 E-05	1.9 E-05
75-69-4	Trichlorofluoromethane[f]	2.5 E-09	3.7 E-09
95-63-6	1,2,4-Trimethylbenzene[f]	4.8 E-08	7.0 E-08
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	5.2 E-07	7.6 E-07
95-47-6	o-Xylene[e]	2.4 E-07	3.5 E-07
7440-66-6	Zinc[f,g]	7.4 E-04	1.1 E-03

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Table 15.6.5-5 (cont.)

[a] Factors represent uncontrolled emissions. References 1, 5, and 12.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 6.84 E-01 pounds per item. Reference 12.
[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.

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Table 15.6.5-6 EMISSION FACTORS FOR THE USE OF DODIC H557, M72A3 66-MM HIGH EXPLOSIVE ANTITANK ROCKET (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,g]	2.8 E-08	3.5 E-08
208-96-8	Acenaphthylene[d]	7.7 E-07	9.4 E-07
75-07-0	Acetaldehyde[e,g]	2.6 E-06	3.2 E-06
75-05-8	Acetonitrile[e,g]	7.8 E-05	9.6 E-05
107-13-1	Acrylonitrile[e,g]	6.1 E-06	7.5 E-06
7429-90-5	Aluminum[f,g]	1.2 E-03	1.5 E-03
120-12-7	Anthracene[e,g]	4.8 E-08	5.9 E-08
7440-36-0	Antimony[e,h]	6.6 E-06	8.0 E-06
7440-39-3	Barium[f]	3.6 E-04	4.4 E-04
71-43-2	Benzene[e,g]	1.7 E-05	2.0 E-05
56-55-3	Benzo[a]anthracene[e,g]	1.8 E-08	2.2 E-08
205-99-2	Benzo[b]fluoranthene[e,g]	4.7 E-10	5.8 E-10
207-08-9	Benzo[k]fluoranthene[e]	8.2 E-09	1.0 E-08
191-24-2	Benzo[g,h,i]perylene[e,g]	1.4 E-09	1.7 E-09
50-32-8	Benzo[a]pyrene[e,g]	4.5 E-09	5.4 E-09
192-97-2	Benzo[e]pyrene[d,g]	2.6 E-09	3.2 E-09
85-68-7	Butylbenzylphthalate[d]	2.1 E-06	2.5 E-06
7440-43-9	Cadmium[e,h]	1.1 E-06	1.3 E-06
75-15-0	Carbon disulfide[e]	4.1 E-08	5.0 E-08
74-87-3	Chloromethane[e,g]	1.1 E-06	1.4 E-06
7440-47-3	Chromium[e]	1.5 E-05	1.8 E-05
18540-29-9	Hexavalent chromium[e,g]	2.9 E-07	3.5 E-07
218-01-9	Chrysene[e,g]	1.7 E-08	2.0 E-08
7440-50-8	Copper[f]	3.1 E-03	3.8 E-03
57-12-5	Particulate cyanide[e]	1.8 E-04	2.2 E-04
84-74-2	Dibutyl phthalate[e]	3.3 E-06	4.0 E-06
75-71-8	Dichlorodifluoromethane[f]	1.0 E-07	1.2 E-07
107-06-2	1,2-Dichloroethane[e]	3.1 E-07	3.8 E-07
121-14-2	2,4-Dinitrotoluene[e,h]	9.7 E-08	1.2 E-07
--	Total dioxin/furan compounds[e]	5.7 E-10	7.0 E-10

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Table 15.6.5-6 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
100-41-4	Ethylbenzene[e]	3.9 E-07	4.8 E-07
74-85-1	Ethylene[f,g]	6.4 E-05	7.8 E-05
117-81-7	bis(2-Ethylhexyl)phthalate[e,g]	1.1 E-05	1.3 E-05
206-44-0	Fluoranthene[e]	1.3 E-07	1.5 E-07
86-73-7	Fluorene[d]	4.0 E-08	4.9 E-08
50-00-0	Formaldehyde[e,g]	1.3 E-05	1.6 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[e]	3.1 E-11	3.8 E-11
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[e]	3.9 E-12	4.8 E-12
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[e]	4.9 E-13	6.0 E-13
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[e]	1.6 E-13	2.0 E-13
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[e]	8.6 E-13	1.1 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[e]	8.0 E-13	9.8 E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[e]	7.0 E-13	8.5 E-13
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[e]	3.7 E-13	4.5 E-13
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[e]	2.2 E-13	2.7 E-13
110-54-3	Hexane[e]	5.1 E-06	6.2 E-06
7647-01-0	Hydrochloric acid[e,h]	6.8 E-04	8.3 E-04
74-90-8	Hydrogen cyanide[e,g]	1.1 E-04	1.3 E-04
7439-92-1	Lead[e,g]	1.2 E-03	1.5 E-03
7439-96-5	Manganese[e,g]	9.6 E-05	1.2 E-04
75-09-2	Methylene chloride[e]	1.7 E-05	2.1 E-05
91-20-3	Naphthalene[e,g]	1.4 E-06	1.7 E-06
7440-02-0	Nickel[e]	5.9 E-07	7.2 E-07
7697-37-2	Nitric acid[f,g]	4.1 E-05	5.0 E-05
55-63-0	Nitroglycerin[f]	5.6 E-07	6.8 E-07
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[e]	5.2 E-10	6.3 E-10
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[e]	1.1 E-11	1.3 E-11
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[e]	5.1 E-13	6.2 E-13
85-01-8	Phenanthrene[e,g]	2.7 E-07	3.3 E-07
108-95-2	Phenol[e]	2.9 E-06	3.6 E-06
115-07-1	Propylene[f,g]	9.4 E-06	1.1 E-05
129-00-0	Pyrene[d]	1.7 E-07	2.1 E-07

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Table 15.6.5-6 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7440-22-4	Silver[f]	2.7 E-05	3.3 E-05
100-42-5	Styrene[e,h]	5.7 E-07	6.9 E-07
7664-93-9	Sulfuric acid[f,h]	3.1 E-04	3.7 E-04
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[e]	1.3 E-13	1.6 E-13
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[e]	7.4 E-13	9.1 E-13
127-18-4	Tetrachloroethylene[e]	3.2 E-07	3.9 E-07
108-88-3	Toluene[e,g]	1.3 E-05	1.6 E-05
71-55-6	1,1,1-Trichloroethane[e]	2.1 E-07	2.6 E-07
75-69-4	Trichlorofluoromethane[f,h]	1.7 E-07	2.1 E-07
95-63-6	1,2,4-Trimethylbenzene[f]	7.4 E-08	9.0 E-08
106-42-3, 108-38-3	m-Xylene, p-Xylene[e]	6.7 E-07	8.2 E-07
95-47-6	o-Xylene[e]	3.9 E-07	4.8 E-07
7440-66-6	Zinc[f,g]	7.5 E-04	9.2 E-04

[a] Factors represent uncontrolled emissions. References 1-3, 5-7, and 12.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 8.18 E-01 pounds per item. Reference 12.
[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.

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References For Section 15.6.5

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

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

3. *Report No. 7 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2004.

4. *Training Munitions Health Risk Assessment No. 39-DA-1485-02, Residential Exposure from Inhalation of Air Emissions After Detonation of the M72 Shape-Charged Armor Piercing Warhead, Department of Defense Identification Code: H557*, U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program, September 2002.

5. *Detailed Test Plan No. 1 for the Exploding Ordnance Emission Study, Series I*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, December 2000.

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

7. *Detailed Test Plan No. 7 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, August 2003.

8. *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.

9. *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 1 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, July 2006.

10. *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.

11. *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 7 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, September 2006.

12. 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, October 2004, March 2005, April 2005, and October 2005.

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15.6.6 H708, M73 35-mm Subcaliber Practice Rocket

15.6.6.1 Ordnance Description[1-5]

The M73 35-mm Subcaliber Practice Rocket, (DODIC H708) is used to train personnel in the operation of the M72 series 66-mm antitank rocket. It is launched from a tubular, telescoping, smooth bore, open breech weapon. 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 the use of the rocket motor and those associated with the impact and/or detonation of the warhead.

The M73 35-mm Subcaliber Practice Rocket consists of a spotting head (warhead), rocket motor, and igniter assembly. Upon contact with the launcher's firing pin, the igniter initiates the propellant and propels the rocket from the launcher. The spotting head contains a flash composition to assist in locating the fired rocket.

15.6.6.2 Emissions And Controls[1-4, 6-9]

Carbon dioxide (CO_2) is the primary emission from the use of the M73 35-mm Subcaliber Practice Rocket. 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 15.6.6-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP) for the use of the propelling rocket motor. Table 15.6.6-2 presents similar data for use of the warhead, while Table 15.6.6-3 presents combined emission factors for the use of both the propelling rocket motor and warhead. Table 15.6.6-4 presents emission factors for hazardous air pollutants and toxic chemicals for the use of the propelling rocket motor. Table 15.6.6-5 presents similar emission factors for use of the warhead, while Table 15.6.6-6 presents combined hazardous air pollutant and toxic chemical emission factors for the use of both the propelling rocket motor and warhead. In all of the 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).

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Table 15.6.6-1 EMISSION FACTORS FOR THE USE OF DODIC H708, M73 35-MM SUBCALIBER PRACTICE ROCKET (PROPELLING ROCKET) - 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	1.4 E-02	5.1 E-01
630-08-0	Carbon monoxide (CO)	2.5 E-03	9.4 E-02
7439-92-1	Lead (Pb)[d]	6.2 E-06	2.3 E-04
74-82-8	Methane[d]	7.1 E-06	2.7 E-04
--	PM-2.5[e]	1.2 E-03	4.4 E-02
--	PM-10[f]	1.2 E-03	4.6 E-02
12789-66-1	TSP	1.3 E-03	4.8 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, 6, and 8.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 2.64 E-02 pounds per item. References 1 and 8.
[d] EMISSION FACTOR RATING C.
[e] PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).
[f] PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.

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Table 15.6.6-2 EMISSION FACTORS FOR THE USE OF DODIC H708, M73 35-MM SUBCALIBER PRACTICE ROCKET (WARHEAD) - 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	7.3 E-06	2.3 E-03
--	Oxides of nitrogen (NO_X)	4.0 E-06	1.3 E-03
--	PM-2.5	5.3 E-04	1.7 E-01
--	PM-10	5.5 E-04	1.7 E-01
7446-09-5	Sulfur dioxide (SO_2)[d]	2.5 E-04	7.8 E-02
--	Total nonmethane hydrocarbons (TNMHC)[d]	2.1 E-06	6.6 E-04
12789-66-1	TSP	5.5 E-04	1.7 E-01

[a] Factors represent uncontrolled emissions. References 3, 4, 7, and 9.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.20 E-03 pounds per item. References 3 and 5.
[d] EMISSION FACTOR RATING C.

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Table 15.6.6-3 EMISSION FACTORS FOR THE USE OF DODIC H708, M73 35-MM SUBCALIBER PRACTICE ROCKET (TOTAL) - CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, 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	1.4 E-02	4.6 E-01
630-08-0	CO	2.5 E-03	8.4 E-02
7439-92-1	Pb[e]	6.2 E-06	2.1 E-04
74-82-8	Methane[e]	7.1 E-06	2.4 E-04
--	NO_X[d]	4.0 E-06	1.4 E-04
--	PM-2.5	1.7 E-03	5.7 E-02
--	PM-10	1.8 E-03	5.9 E-02
7446-09-5	SO_2[e]	2.5 E-04	8.5 E-03
--	TNMHC[e]	2.1 E-06	7.1 E-05
12789-66-1	TSP	1.8 E-03	6.2 E-02

[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 is 2.96 E-02 pounds per item. References 1, 3, 5, and 8.
[d] EMISSION FACTOR RATING A.
[e] EMISSION FACTOR RATING C.

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Table 15.6.6-4 EMISSION FACTORS FOR THE USE OF DODIC H708, M73 35-MM SUBCALIBER PRACTICE ROCKET (PROPELLING ROCKET) - 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]	6.0 E-07	2.3 E-05
107-13-1	Acrylonitrile[d]	1.6 E-06	6.0 E-05
7429-90-5	Aluminum[e]	1.3 E-05	4.8 E-04
7440-36-0	Antimony[d]	2.1 E-06	7.8 E-05
7440-39-3	Barium[e]	1.1 E-06	4.3 E-05
71-43-2	Benzene[d]	6.8 E-07	2.6 E-05
56-55-3	Benzo[a]anthracene[d]	6.0 E-10	2.3 E-08
75-65-0	t-Butyl alcohol[d,h]	8.5 E-07	3.2 E-05
7440-43-9	Cadmium[d]	7.4 E-05	2.8 E-03
75-15-0	Carbon disulfide[d,h]	4.3 E-08	1.6 E-06
7440-47-3	Chromium[d,h]	4.0 E-06	1.5 E-04
18540-29-9	Hexavalent chromium[d,h]	1.1 E-07	4.0 E-06
7440-50-8	Copper[e]	5.8 E-06	2.2 E-04
98-82-8	Cumene[d,h]	6.6 E-08	2.5 E-06
75-71-8	Dichlorodifluoromethane[e]	9.1 E-09	3.4 E-07
--	Total dioxin/furan compounds[d]	2.3 E-14	8.7 E-13
74-85-1	Ethylene[e,g]	4.7 E-06	1.8 E-04
206-44-0	Fluoranthene[d]	2.5 E-09	9.3 E-08
86-73-7	Fluorene[f]	9.5 E-10	3.6 E-08
50-00-0	Formaldehyde[d,g]	1.3 E-06	5.1 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[d]	2.3 E-14	8.7 E-13
7647-01-0	Hydrochloric acid[d]	1.4 E-04	5.3 E-03
74-90-8	Hydrogen cyanide[d]	1.2 E-07	4.5 E-06
7664-39-3	Hydrogen fluoride[d]	1.4 E-06	5.2 E-05
7439-92-1	Lead[d]	6.2 E-06	2.3 E-04
108-10-1	Methyl isobutyl ketone[d,h]	6.2 E-06	2.4 E-04
80-62-6	Methyl methacrylate[d,h]	4.0 E-06	1.5 E-04
91-20-3	Naphthalene[d]	3.2 E-08	1.2 E-06
55-63-0	Nitroglycerin[e,h]	1.9 E-07	7.1 E-06
85-01-8	Phenanthrene[d]	2.4 E-09	9.1 E-08

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Table 15.6.4-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
123-38-6	Propionaldehyde[d,h]	3.9 E-07	1.5 E-05
129-00-0	Pyrene[f]	2.9 E-09	1.1 E-07
100-42-5	Styrene[d,g]	8.7 E-08	3.3 E-06
7664-93-9	Sulfuric acid[e]	5.3 E-05	2.0 E-03
127-18-4	Tetrachloroethylene[d,h]	1.3 E-08	4.8 E-07
108-88-3	Toluene[d]	1.5 E-07	5.8 E-06
95-63-6	1,2,4-Trimethylbenzene[e,h]	1.6 E-05	5.9 E-04
7440-62-2	Vanadium	4.2 E-09	1.6 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[d,h]	6.1 E-07	2.3 E-05
95-47-6	o-Xylene[d,h]	5.5 E-07	2.1 E-05
7440-66-6	Zinc[e,g]	9.4 E-06	3.6 E-04

[a] Factors represent uncontrolled emissions. References 1, 2, 6, and 8.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 2.64 E-02 pounds per item. References 1 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 B.
[h] EMISSION FACTOR RATING D.

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Table 15.6.6-5 EMISSION FACTORS FOR THE USE OF DODIC H708, M73 35-MM SUBCALIBER PRACTICE ROCKET (WARHEAD) - HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS[a]

EMISSION FACTOR RATING: D (except as noted)

CASRN[b]	Pollutant[d]	lb per item	lb per lb NEW[c]
7440-36-0	Antimony[f]	2.7 E-05	8.6 E-03
71-43-2	Benzene[e]	4.5 E-08	1.4 E-05
7440-43-9	Cadmium	8.4 E-09	2.6 E-06
121-14-2	2,4-Dinitrotoluene[f]	2.2 E-08	7.0 E-06
--	Total dioxin/furan compounds[f]	3.8 E-11	1.2 E-08
100-41-4	Ethylbenzene	3.7 E-08	1.2 E-05
50-00-0	Formaldehyde[f]	9.2 E-08	2.9 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	1.9 E-12	5.8 E-10
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	3.9 E-13	1.2 E-10
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	1.4 E-13	4.5 E-11
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[f]	2.4 E-14	7.5 E-12
110-54-3	Hexane	5.6 E-08	1.7 E-05
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	3.4 E-11	1.1 E-08
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran	1.7 E-12	5.5 E-10
108-88-3	Toluene[f]	3.0 E-07	9.4 E-05
106-42-3, 108-38-3	m-Xylene, p-Xylene	2.1 E-07	6.5 E-05
95-47-6	o-Xylene	5.7 E-08	1.8 E-05

[a] Factors represent uncontrolled emissions. References 3, 4, 7, and 9.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 3.20 E-03 pounds per item. References 3 and 5.
[d] All chemicals in this table are reportable under EPCRA Section 313 and hazardous air pollutants under CAA Section 112(b).
[e] EMISSION FACTOR RATING B.
[f] EMISSION FACTOR RATING C.

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Table 15.6.6-6 EMISSION FACTORS FOR THE USE OF DODIC H708, M73 35-MM SUBCALIBER PRACTICE ROCKET (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]
75-07-0	Acetaldehyde[d]	6.0 E-07	2.0 E-05
107-13-1	Acrylonitrile[d]	1.6 E-06	5.3 E-05
7429-90-5	Aluminum[e]	1.3 E-05	4.3 E-04
7440-36-0	Antimony[d]	3.0 E-05	1.0 E-03
7440-39-3	Barium[e]	1.1 E-06	3.8 E-05
71-43-2	Benzene[d]	7.2 E-07	2.4 E-05
56-55-3	Benzo[a]anthracene[d]	6.0 E-10	2.0 E-08
75-65-0	t-Butyl alcohol[d,h]	8.5 E-07	2.9 E-05
7440-43-9	Cadmium[d]	7.4 E-05	2.5 E-03
75-15-0	Carbon disulfide[d,h]	4.3 E-08	1.5 E-06
7440-47-3	Chromium[d,h]	4.0 E-06	1.3 E-04
18540-29-9	Hexavalent chromium[d]	1.1 E-07	3.5 E-06
7440-50-8	Copper[e]	5.8 E-06	2.0 E-04
98-82-8	Cumene[d,h]	6.6 E-08	2.2 E-06
75-71-8	Dichlorodifluoromethane[e]	9.1 E-09	3.1 E-07
121-14-2	2,4-Dinitrotoluene[d]	2.2 E-08	7.6 E-07
--	Total dioxin/furan compounds[d]	3.8 E-11	1.3 E-09
100-41-4	Ethylbenzene[d,h]	3.7 E-08	1.3 E-06
74-85-1	Ethylene[e,g]	4.7 E-06	1.6 E-04
206-44-0	Fluoranthene[d]	2.5 E-09	8.3 E-08
86-73-7	Fluorene[f]	9.5 E-10	3.2 E-08
50-00-0	Formaldehyde[d,g]	1.4 E-06	4.8 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[d,h]	1.9 E-12	6.4 E-11
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[d,h]	3.9 E-13	1.3 E-11
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[d,h]	1.4 E-13	4.9 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[d]	2.4 E-14	8.1 E-13
110-54-3	Hexane[d,h]	5.6 E-08	1.9 E-06
7647-01-0	Hydrochloric acid[d]	1.4 E-04	4.7 E-03
74-90-8	Hydrogen cyanide[d]	1.2 E-07	4.0 E-06
7664-39-3	Hydrogen fluoride[d]	1.4 E-06	4.6 E-05

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Table 15.6.4-6 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
7439-92-1	Lead[d]	6.2 E-06	2.1 E-04
108-10-1	Methyl isobutyl ketone[d,h]	6.2 E-06	2.1 E-04
80-62-6	Methyl methacrylate[d,h]	4.0 E-06	1.4 E-04
91-20-3	Naphthalene[d]	3.2 E-08	1.1 E-06
55-63-0	Nitroglycerin[e,h]	1.9 E-07	6.3 E-06
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[d,h]	3.4 E-11	1.1 E-09
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[d,h]	1.7 E-12	5.9 E-11
85-01-8	Phenanthrene[d]	2.4 E-09	8.1 E-08
123-38-6	Propionaldehyde[d,h]	3.9 E-07	1.3 E-05
129-00-0	Pyrene[f]	2.9 E-09	9.8 E-08
100-42-5	Styrene[d,g]	8.7 E-08	2.9 E-06
7664-93-9	Sulfuric acid[e]	5.3 E-05	1.8 E-03
127-18-4	Tetrachloroethylene[d,h]	1.3 E-08	4.3 E-07
108-88-3	Toluene[d]	4.6 E-07	1.5 E-05
95-63-6	1,2,4-Trimethylbenzene[e,h]	1.6 E-05	5.3 E-04
7440-62-2	Vanadium[e]	4.2 E-09	1.4 E-07
106-42-3, 108-38-3	m-Xylene, p-Xylene[d,h]	8.2 E-07	2.8 E-05
95-47-6	o-Xylene[d,h]	6.1 E-07	2.0 E-05
7440-66-6	Zinc[e,g]	9.4 E-06	3.2 E-04

[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 is 2.96 E-02 pounds per item. References 1, 3, 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 B.
[h] EMISSION FACTOR RATING D.

References For Section 15.6.6

1. *Report No. 9 for the Firing Point Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, May 2005.

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

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

4. *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.

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

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 9 Testing Conducted at Aberdeen Proving Ground, Maryland*, 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 Phase VIII Testing Conducted at Dugway Proving Ground, Utah*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, August 2008.

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, September 2004, April 2005, and May 2005.

9. 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.

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15.6.7 H974, 2.75-inch M267 Practice Warhead, MK66 Mod 3 Motor

15.6.7.1 Ordnance Description[1]

The 2.75-inch M267 Practice Warhead, MK66 Mod 3 Motor (DODIC H974) is a rocket fired from a variety of rotary-wing, other low speed aircraft as well as from high performance aircraft. The motor develops a nominal thrust of 1,300 pounds for a burn time between 1.05 and 1.10 seconds. This ammunition is used on firing ranges during training; it is not used during combat. Note that emission factors presented herein include only those associated with the use of the propelling rocket motor; emissions associated with the impact and/or use of the warhead are not addressed in this section.

The 2.75-inch M267 Practice Warhead, MK66 Mod 3 Motor consists of a motor body, a nozzle, an igniter assembly, and a propelling charge. The igniter assembly includes an ignition charge, an initiation charge, a black powder charge, and a black powder booster charge.

15.6.7.2 Emissions And Controls[1-5]

Carbon dioxide (CO_2) is the primary pollutant emitted from the use of the 2.75-inch M267 Practice Warhead, MK66 Mod 3 Motor. 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 15.6.7-1 presents emission factors for CO_2, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.6.7-2 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).

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Table 15.6.7-1 EMISSION FACTORS FOR THE USE OF DODIC H974, 2.75-INCH M267 PRACTICE WARHEAD, MK66 MOD 3 MOTOR (PROPELLING ROCKET) – 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	4.8	6.7 E-01
630-08-0	Carbon monoxide (CO)	5.3 E-01	7.4 E-02
7439-92-1	Lead (Pb)[f]	7.0 E-02	9.7 E-03
74-82-8	Methane[f]	6.2 E-03	8.7 E-04
--	PM-2.5[d]	1.7 E-01	2.4 E-02
--	PM-10[e]	1.6 E-01	2.3 E-02
12789-66-1	TSP	1.5 E-01	2.0 E-02

[a] Factors represent uncontrolled emissions. References 1, 2, and 5.
[b] CASRN = Chemical Abstracts Service Registry Number.
[c] NEW = net explosive weight. The NEW for this ordnance is 7.17 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 C.

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Table 15.6.7-2 EMISSION FACTORS FOR THE USE OF DODIC H974, 2.75-INCH M267 PRACTICE WARHEAD, MK66 MOD 3 MOTOR (PROPELLING ROCKET) – 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]	3.8 E-07	5.2 E-08
208-96-8	Acenaphthylene[d]	1.3 E-05	1.8 E-06
75-07-0	Acetaldehyde[e]	2.0 E-04	2.8 E-05
75-05-8	Acetonitrile[e]	8.7 E-05	1.2 E-05
107-13-1	Acrylonitrile[e]	2.6 E-05	3.6 E-06
7429-90-5	Aluminum[f]	2.6 E-04	3.6 E-05
120-12-7	Anthracene[e]	1.0 E-06	1.5 E-07
71-43-2	Benzene[e]	3.8 E-04	5.2 E-05
56-55-3	Benzo[a]anthracene[e]	7.6 E-07	1.1 E-07
205-99-2	Benzo[b]fluoranthene[e]	6.2 E-07	8.7 E-08
207-08-9	Benzo[k]fluoranthene[e]	5.4 E-07	7.6 E-08
191-24-2	Benzo[g,h,i]perylene[e]	2.5 E-06	3.5 E-07
50-32-8	Benzo[a]pyrene[e]	1.2 E-06	1.6 E-07
192-97-2	Benzo[e]pyrene[e]	8.0 E-07	1.1 E-07
7440-43-9	Cadmium[e]	6.6 E-04	9.1 E-05
7440-47-3	Chromium[e]	1.4 E-05	1.9 E-06
218-01-9	Chrysene[e]	7.4 E-07	1.0 E-07
7440-50-8	Copper[f]	1.7 E-02	2.4 E-03
53-70-3	Dibenz[a,h]anthracene[e]	5.4 E-08	7.5 E-09
74-85-1	Ethylene[f,g]	8.4 E-04	1.2 E-04
206-44-0	Fluoranthene[e]	6.2 E-06	8.6 E-07
86-73-7	Fluorene[d]	2.0 E-06	2.7 E-07
50-00-0	Formaldehyde[e,g]	2.5 E-04	3.5 E-05
7647-01-0	Hydrochloric acid[e]	1.7 E-03	2.3 E-04
74-90-8	Hydrogen cyanide[e]	7.4 E-04	1.0 E-04
193-39-5	Indeno[1,2,3-cd]pyrene[e]	1.0 E-06	1.4 E-07
7439-92-1	Lead[e]	7.0 E-02	9.7 E-03
7439-96-5	Manganese[e]	4.7 E-05	6.5 E-06
75-09-2	Methylene chloride[e]	1.3 E-04	1.8 E-05
91-20-3	Naphthalene[e]	8.6 E-06	1.2 E-06

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Table 15.6.7-2 (cont.)

CASRN[b]	Pollutant	lb per item	lb per lb NEW[c]
85-01-8	Phenanthrene[e]	7.4 E-06	1.0 E-06
129-00-0	Pyrene[d]	1.1 E-05	1.5 E-06
7440-22-4	Silver[f]	6.8 E-06	9.6 E-07
100-42-5	Styrene[e]	1.7 E-05	2.4 E-06
7664-93-9	Sulfuric acid[f]	1.6 E-03	2.2 E-04
108-88-3	Toluene[e]	4.7 E-05	6.6 E-06
7440-66-6	Zinc[f,g]	8.6 E-04	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 is 7.17 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 B.

References For Section 15.6.7

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1. *Report No. 7 for the Firing Point Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2004.

2. *Detailed Test Plan No. 7 for the Firing Point Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, August 2003.

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 7 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, April 2005 and October 2005.

15.6.8 Updates Since July 2006

Section 15.6 was created during July 2006. Revisions to this section since that date are summarized below.

Revision 3, October 2008

- Section 15.6.6, which presents emission factors for DODIC H708, the M73 35-mm Subcaliber Practice Rocket, was updated to include additional data.

Revision 2, November 2007

- Section 15.6.6, which presents emission factors for DODIC H708, the M73 35-mm Subcaliber Practice Rocket, was added.

- Where present, data regarding the average annual quantities of ordnance used on Army installations during training exercises were deleted because the quantities used vary from installation to installation and from year to year.

Revision 1, September 2006

- Section 15.6.1, which presents emission factors for DODIC H459, the 2.75-inch Flechette, MK40 Mod 3 Motor, was added.

- Section 15.6.5, which presents emission factors for DODIC H557, the M72A3 66-mm High Explosive Antitank Rocket, was updated to include additional data.

- Section 15.6.7, which presents emission factors for DODIC H974, the 2.75-inch M267 Practice Warhead, MK66 Mod 3 Motor, was added.

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