

## 15.10 Fuses and Primers

Munitions listed in this section begin with the Department of Defense Identification Code (DODIC) letters “N.” This category of munitions includes fuses and primers, which are devices used to initiate the operation of other munitions. Examples include point detonating fuses, proximity fuses, percussion primers, and electric primers for ammunition used in guns and high explosive artillery.

### 15.10.1 N278, M564 Mechanical Time and Super Quick (MTSQ) Fuse

#### 15.10.1.1 Ordnance Description<sup>1,2</sup>

The M564 MTSQ Fuse (DODIC N278) is used to initiate 105-mm, 155-mm, and 8-inch projectiles when a choice between time and super quick action is desired. The classification of MTSQ indicates a fuse that functions at a preset time and is backed up by an impact action in case the fuse does not function at the preset time. A mechanical clockwork timing mechanism contained in the fuse allows it to be set to function at any time from 1 to 100 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 fuse; emissions associated with the use of the ammunition to which the fuse is attached are not addressed in this section.

#### 15.10.1.2 Emissions And Controls<sup>1-4</sup>

Carbon dioxide (CO<sub>2</sub>) is the primary emission from the use of the M564 MTSQ Fuse. 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 15.10.1-1 presents emission factors for CO<sub>2</sub>, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.10.1-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.10.1-1 EMISSION FACTORS FOR THE USE OF DODIC N278, M564 MECHANICAL TIME AND SUPER QUICK (MTSQ) FUSE – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE<sup>a</sup>

EMISSION FACTOR RATING: B (except as noted)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
124-38-9	CO <sub>2</sub>	5.2 E-02	8.3 E-01
630-08-0	Carbon monoxide (CO) <sup>f</sup>	8.7 E-04	1.4 E-02
7439-92-1	Lead (Pb)	5.1 E-04	8.1 E-03
74-82-8	Methane <sup>f</sup>	1.1 E-05	1.7 E-04
--	Oxides of nitrogen (NO <sub>x</sub> )	8.3 E-04	1.3 E-02
--	PM-2.5 <sup>d</sup>	4.3 E-03	6.8 E-02
--	PM-10 <sup>e</sup>	7.9 E-03	1.2 E-01
12789-66-1	TSP	8.8 E-03	1.4 E-01

<sup>a</sup> Factors represent uncontrolled emissions. References 1-4.

<sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.

<sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 6.32 E-02 pounds per item. Reference 1.

<sup>d</sup> PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).

<sup>e</sup> PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.

<sup>f</sup> EMISSION FACTOR RATING C.

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Table 15.10.1-2 EMISSION FACTORS FOR THE USE OF DODIC DODIC N278,  
M564 MECHANICAL TIME AND SUPER QUICK (MTSQ) FUSE –  
HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS<sup>a</sup>

EMISSION FACTOR RATING: C (except as noted)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
208-96-8	Acenaphthylene <sup>d</sup>	2.8 E-08	4.4 E-07
75-07-0	Acetaldehyde <sup>e</sup>	1.3 E-06	2.1 E-05
75-05-8	Acetonitrile <sup>e</sup>	2.8 E-06	4.5 E-05
107-13-1	Acrylonitrile <sup>e</sup>	4.0 E-06	6.4E-05
7429-90-5	Aluminum <sup>f,g</sup>	6.7 E-04	1.1 E-02
7664-41-7	Ammonia <sup>f</sup>	6.5 E-06	1.0 E-04
120-12-7	Anthracene <sup>e</sup>	3.9 E-09	6.1 E-08
7440-36-0	Antimony <sup>e</sup>	5.0 E-05	7.9 E-04
7440-38-2	Arsenic <sup>e</sup>	1.3 E-07	2.1 E-06
7440-39-3	Barium <sup>f,g</sup>	8.9 E-05	1.4 E-03
71-43-2	Benzene <sup>e</sup>	9.7 E-07	1.5 E-05
56-55-3	Benzo[a]anthracene <sup>e</sup>	1.8 E-09	2.8 E-08
205-99-2	Benzo[b]fluoranthene <sup>e</sup>	1.1 E-09	1.8 E-08
207-08-9	Benzo[k]fluoranthene <sup>e</sup>	1.9 E-09	3.1 E-08
192-97-2	Benzo[e]pyrene <sup>d</sup>	1.4 E-09	2.2 E-08
7440-43-9	Cadmium <sup>e</sup>	8.2 E-07	1.3 E-05
75-15-0	Carbon disulfide <sup>e,h</sup>	1.1 E-07	1.7 E-06
74-87-3	Chloromethane <sup>e,h</sup>	7.2 E-08	1.1 E-06
7440-47-3	Chromium <sup>e</sup>	1.2 E-06	1.9 E-05
218-01-9	Chrysene <sup>e</sup>	3.3 E-09	5.2 E-08
7440-48-4	Cobalt <sup>e</sup>	2.5 E-07	4.0 E-06
7440-50-8	Copper <sup>f,g</sup>	3.0 E-04	4.7 E-03
--	Total dioxin/furan compounds <sup>e</sup>	8.0 E-12	1.3 E-10
100-41-4	Ethylbenzene <sup>e,h</sup>	1.5 E-07	2.4 E-06
74-85-1	Ethylene <sup>f</sup>	4.6 E-06	7.3 E-05
206-44-0	Fluoranthene <sup>e</sup>	1.3 E-08	2.1 E-07
86-73-7	Fluorene <sup>d</sup>	5.0 E-09	7.8 E-08
50-00-0	Formaldehyde <sup>e</sup>	1.8 E-06	2.8 E-05

Table 15.10.1-2 (cont.)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin <sup>e,g</sup>	1.1 E-12	1.7 E-11
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran <sup>e</sup>	1.4 E-13	2.2 E-12
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran <sup>e</sup>	9.8 E-14	1.5 E-12
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin <sup>e</sup>	1.5 E-13	2.4 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin <sup>e</sup>	3.1 E-14	4.9 E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran <sup>e</sup>	3.1 E-13	4.8 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran <sup>e</sup>	1.4 E-13	2.2 E-12
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran <sup>e</sup>	1.1 E-13	1.8 E-12
74-90-8	Hydrogen cyanide <sup>e</sup>	5.6 E-06	8.9 E-05
193-39-5	Indeno[1,2,3-cd]pyrene <sup>e</sup>	3.6 E-10	5.8 E-09
7439-92-1	Lead <sup>e,g</sup>	5.1 E-04	8.1 E-03
7439-96-5	Manganese <sup>e,g</sup>	2.3 E-05	3.6 E-04
75-09-2	Methylene chloride <sup>e</sup>	1.5 E-07	2.3 E-06
80-62-6	Methyl methacrylate <sup>e</sup>	6.2 E-07	9.8 E-06
91-20-3	Naphthalene <sup>e</sup>	3.3 E-08	5.2 E-07
7440-02-0	Nickel <sup>e</sup>	1.5 E-06	2.4 E-05
7697-37-2	Nitric acid <sup>f</sup>	1.8 E-06	2.8 E-05
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin <sup>e</sup>	5.7 E-12	9.0 E-11
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran <sup>e</sup>	1.1 E-13	1.7 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran <sup>e</sup>	1.5 E-13	2.3 E-12
85-01-8	Phenanthrene <sup>e</sup>	3.1 E-08	4.9 E-07
129-00-0	Pyrene <sup>d</sup>	1.4 E-08	2.2 E-07
7440-22-4	Silver <sup>f</sup>	1.2 E-07	1.9 E-06
100-42-5	Styrene <sup>e,h</sup>	1.5 E-07	2.3 E-06
7440-28-0	Thallium <sup>f</sup>	9.4 E-08	1.5 E-06
108-88-3	Toluene <sup>e</sup>	2.1 E-07	3.3 E-06
7440-62-2	Vanadium <sup>f,g</sup>	9.4 E-08	1.5 E-06
7440-66-6	Zinc <sup>f</sup>	1.7 E-04	2.7 E-03

Table 15.10.1-2 (cont.)

- <sup>a</sup> Factors represent uncontrolled emissions. References 1-4.
- <sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.
- <sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 6.32 E-02 pounds per item. Reference 1.
- <sup>d</sup> Hazardous air pollutant under CAA Section 112(b).
- <sup>e</sup> Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).
- <sup>f</sup> Reportable chemical under EPCRA Section 313.
- <sup>g</sup> EMISSION FACTOR RATING B.
- <sup>h</sup> EMISSION FACTOR RATING D.

References For Section 15.10.1

1. *Report No. 11 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2007.
2. *Detailed Test Plan No. 11 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, August 2004.
3. *Background Document, Report on Revisions to 5<sup>th</sup> Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Firing Point Emission Study Phase II Series 11 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, August 2008.
4. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, April 2008.

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## 15.10.2 N285, M577A1 Mechanical Time and Super Quick (MTSQ) Fuse

### 15.10.2.1 Ordnance Description<sup>1,2</sup>

The M577A1 Mechanical Time and Super Quick (MTSQ) Fuse (DODIC N285) is used to initiate projectiles carrying payloads that are expelled during projectile flight (airburst). The classification of MTSQ indicates a fuse that functions at a preset time and is backed up by an impact action in case the fuse does not function at the preset time. A mechanical clockwork timing mechanism contained in the fuse allows it to be set to function at any time from 2 to 200 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 fuse; emissions associated with the use of the ammunition to which the fuse is attached are not addressed in this section.

### 15.10.2.2 Emissions And Controls<sup>1-4</sup>

The primary emissions from the use of the M577A1 MTSQ Fuse are carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), and particulate matter. Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically used in the field, there are no controls associated with its use.

Table 15.10.2-1 presents emission factors for CO<sub>2</sub>, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.10.2-2 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).

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Table 15.10.2-1 EMISSION FACTORS FOR THE USE OF DODIC N285,  
M577A1 MECHANICAL TIME AND SUPER QUICK (MTSQ) FUSE – CARBON DIOXIDE,  
CRITERIA POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE<sup>a</sup>

EMISSION FACTOR RATING: B (except as noted)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
124-38-9	CO <sub>2</sub>	5.9 E-04	6.3 E-01
630-08-0	CO	2.0 E-04	2.2 E-01
7439-92-1	Lead (Pb) <sup>f</sup>	4.0 E-06	4.3 E-03
74-82-8	Methane <sup>f</sup>	5.6 E-06	6.0 E-03
--	Oxides of nitrogen (NO <sub>x</sub> )	9.4 E-06	1.0 E-02
--	PM-2.5 <sup>d</sup>	8.9 E-05	9.5 E-02
--	PM-10 <sup>e</sup>	1.7 E-04	1.9 E-01
12789-66-1	TSP <sup>f</sup>	2.2 E-04	2.4 E-01

<sup>a</sup> Factors represent uncontrolled emissions. References 1-4.

<sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.

<sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 9.39 E-04 pounds per item. Reference 1.

<sup>d</sup> PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).

<sup>e</sup> PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.

<sup>f</sup> EMISSION FACTOR RATING C.

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Table 15.10.2-2 EMISSION FACTORS FOR THE USE OF DODIC N285,  
M577A1 MECHANICAL TIME AND SUPER QUICK (MTSQ) FUSE –  
HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS<sup>a</sup>

EMISSION FACTOR RATING: C (except as noted)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
208-96-8	Acenaphthylene <sup>d</sup>	8.4 E-09	8.9 E-06
75-07-0	Acetaldehyde <sup>e</sup>	3.0 E-07	3.2 E-04
75-05-8	Acetonitrile <sup>e,g</sup>	6.1 E-08	6.5 E-05
107-13-1	Acrylonitrile <sup>e,g</sup>	5.6 E-07	5.9 E-04
7429-90-5	Aluminum <sup>f,h</sup>	5.1 E-06	5.4 E-03
7664-41-7	Ammonia <sup>f</sup>	4.8 E-06	5.1 E-03
7440-39-3	Barium <sup>f</sup>	2.5 E-06	2.7 E-03
71-43-2	Benzene <sup>e,g</sup>	3.8 E-07	4.0 E-04
192-97-2	Benzo[e]pyrene <sup>d</sup>	9.8 E-10	1.0 E-06
74-87-3	Chloromethane <sup>e</sup>	5.9 E-09	6.3 E-06
107-06-2	1,2-Dichloroethane <sup>e</sup>	1.2 E-08	1.3 E-05
76-14-2	Dichlorotetrafluoroethane <sup>f,g</sup>	5.4 E-08	5.8 E-05
--	Total dioxin/furan compounds <sup>e</sup>	9.7 E-14	1.0 E-10
100-41-4	Ethylbenzene <sup>e</sup>	1.3 E-08	1.4 E-05
74-85-1	Ethylene <sup>f</sup>	4.7 E-06	5.0 E-03
206-44-0	Fluoranthene <sup>e</sup>	6.6 E-09	7.0 E-06
50-00-0	Formaldehyde <sup>e</sup>	1.3 E-07	1.4 E-04
76-13-1	Freon 113 <sup>f</sup>	6.4 E-08	6.8 E-05
74-90-8	Hydrogen cyanide <sup>e</sup>	3.7 E-06	4.0 E-03
7664-39-3	Hydrogen fluoride <sup>e</sup>	8.3 E-07	8.8 E-04
7439-92-1	Lead <sup>e</sup>	4.0 E-06	4.3 E-03
7439-96-5	Manganese <sup>e,h</sup>	5.8 E-08	6.2 E-05
74-95-3	Methylene bromide <sup>f,g</sup>	3.3 E-07	3.5 E-04
75-09-2	Methylene chloride <sup>e</sup>	1.0 E-07	1.1 E-04
80-62-6	Methyl methacrylate <sup>e,g</sup>	1.2 E-07	1.2 E-04
85-01-8	Phenanthrene <sup>e</sup>	1.0 E-08	1.1 E-05
115-07-1	Propylene <sup>f</sup>	9.5 E-07	1.0 E-03
129-00-0	Pyrene <sup>d</sup>	8.6 E-09	9.2 E-06
108-88-3	Toluene <sup>e,g</sup>	1.0 E-07	1.1 E-04
75-69-4	Trichlorofluoromethane <sup>f</sup>	1.0 E-08	1.1 E-05

Table 15.10.2-2 (cont.)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
106-42-3, 108-38-3	m-Xylene, p-Xylene <sup>e,g</sup>	1.7 E-08	1.8 E-05
7440-66-6	Zinc <sup>f</sup>	4.8 E-05	5.1 E-02

<sup>a</sup> Factors represent uncontrolled emissions. References 1-4.

<sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.

<sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 9.34 E-04 pounds per item. Reference 1.

<sup>d</sup> Hazardous air pollutant under CAA Section 112(b).

<sup>e</sup> Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).

<sup>f</sup> Reportable chemical under EPCRA Section 313.

<sup>g</sup> EMISSION FACTOR RATING D.

<sup>h</sup> EMISSION FACTOR RATING B.

#### References For Section 15.10.2

1. *Report No. 9 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2006.
2. *Detailed Test Plan No. 9 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2003.
3. *Background Document, Report on Revisions to 5<sup>th</sup> Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Exploding Ordnance Emission Study Phase II Series 9 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, June 2008.
4. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, June 2007.

### 15.10.3 N286, M582 Mechanical Time and Super Quick (MTSQ) Fuse

#### 15.10.3.1 Ordnance Description<sup>1-3</sup>

The M582 Mechanical Time and Super Quick (MTSQ) Fuse (DODIC N286) is used to initiate the explosive train of projectiles. The classification of MTSQ indicates a fuse that functions at a preset time and is backed up by an impact action in case the fuse does not function at the preset time. A mechanical clockwork timing mechanism contained in the fuse allows it to be set to function at any time from 2 to 200 seconds. The M582 fuse has an aluminum ogive with an anodized black coating and a steel lower body. This ammunition is used during combat and on firing ranges during training. Note that emission factors presented herein are only associated with the use of the fuse; emissions associated with the impact and detonation of the projectile to which it is attached are not addressed in this section.

#### 15.10.3.2 Emissions And Controls<sup>1,2,4,5</sup>

Carbon dioxide (CO<sub>2</sub>) and particulate matter are the primary emissions from the use of the M582 Mechanical Time and Super Quick (MTSQ) Fuse. 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 fired in the field, there are no controls associated with its use.

Table 15.10.3-1 presents emission factors for CO<sub>2</sub>, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.10.3-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

Table 15.10.3-1 EMISSION FACTORS FOR THE USE OF DODIC N286,  
M582 MECHANICAL TIME AND SUPER QUICK (MTSQ) FUSE – CARBON DIOXIDE, CRITERIA  
POLLUTANTS, METHANE, AND TOTAL SUSPENDED PARTICULATE<sup>a</sup>

EMISSION FACTOR RATING: C

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
124-38-9	CO <sub>2</sub>	3.0 E-02	5.6 E-01
630-08-0	Carbon monoxide (CO)	2.4 E-03	4.6 E-02
7439-92-1	Lead (Pb)	5.0 E-04	9.4 E-03
74-82-8	Methane	4.4 E-05	8.3 E-04
--	Oxides of nitrogen (NO <sub>x</sub> )	1.1 E-03	2.0 E-02
--	PM-2.5 <sup>d</sup>	1.0 E-02	1.9 E-01
--	PM-10 <sup>e</sup>	1.5 E-02	2.9 E-01
12789-66-1	TSP	1.6 E-02	3.1 E-01

<sup>a</sup> Factors represent uncontrolled emissions. References 1, 2, 4, and 5.

<sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.

<sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 5.27 E-02 pounds per item. References 1 and 3.

<sup>d</sup> PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).

<sup>e</sup> PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.

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Table 15.10.3-2 EMISSION FACTORS FOR THE USE OF DODIC N286,  
M582 MECHANICAL TIME AND SUPER QUICK (MTSQ) FUSE –  
HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS<sup>a</sup>

EMISSION FACTOR RATING: C (except as noted)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
208-96-8	Acenaphthylene <sup>d</sup>	4.8 E-08	9.0 E-07
75-07-0	Acetaldehyde <sup>e,g</sup>	3.7 E-06	6.9 E-05
75-05-8	Acetonitrile <sup>e</sup>	7.6 E-06	1.4 E-04
107-13-1	Acrylonitrile <sup>e</sup>	5.2 E-07	9.9 E-06
7429-90-5	Aluminum <sup>f</sup>	1.8 E-03	3.4 E-02
7664-41-7	Ammonia <sup>f</sup>	1.3 E-04	2.4 E-03
7440-36-0	Antimony <sup>e</sup>	4.0 E-06	7.5 E-05
7440-39-3	Barium <sup>f</sup>	2.6 E-06	5.0 E-05
71-43-2	Benzene <sup>e</sup>	1.0 E-06	1.9 E-05
207-08-9	Benzo[k]fluoranthene <sup>e</sup>	1.1 E-08	2.0 E-07
7440-43-9	Cadmium <sup>e</sup>	1.5 E-07	2.8 E-06
74-87-3	Chloromethane <sup>e</sup>	5.7 E-08	1.1 E-06
7440-47-3	Chromium <sup>e</sup>	8.6 E-06	1.6 E-04
7440-48-4	Cobalt <sup>e</sup>	3.1 E-07	6.0 E-06
7440-50-8	Copper <sup>f</sup>	6.3 E-05	1.2 E-03
--	Total dioxin/furan compounds <sup>e</sup>	6.6 E-12	1.3 E-10
74-85-1	Ethylene <sup>f</sup>	3.2 E-06	6.0 E-05
206-44-0	Fluoranthene <sup>e</sup>	2.3 E-08	4.3 E-07
86-73-7	Fluorene <sup>f</sup>	1.1 E-08	2.2 E-07
50-00-0	Formaldehyde <sup>e</sup>	2.0 E-06	3.8 E-05
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin <sup>e</sup>	3.6 E-13	6.8 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran <sup>e,g</sup>	3.4 E-13	6.4 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin <sup>e</sup>	2.6 E-14	4.9 E-13
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran <sup>e</sup>	3.9 E-13	7.5 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran <sup>e</sup>	1.5 E-13	2.9 E-12
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran <sup>e</sup>	1.4 E-13	2.7 E-12
7647-01-0	Hydrochloric acid <sup>e</sup>	2.2 E-06	4.1 E-05
74-90-8	Hydrogen cyanide <sup>e</sup>	7.7 E-05	1.5 E-03
7439-92-1	Lead <sup>e</sup>	5.0 E-04	9.4 E-03
7439-96-5	Manganese <sup>e</sup>	1.1 E-05	2.2 E-04

Table 15.10.3-2 (cont.)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
91-20-3	Naphthalene <sup>e</sup>	1.9 E-07	3.5 E-06
7440-02-0	Nickel <sup>e</sup>	2.8 E-06	5.3 E-05
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran <sup>e</sup>	1.7 E-13	3.2 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran <sup>e</sup>	2.5 E-13	4.7 E-12
85-01-8	Phenanthrene <sup>e</sup>	4.3 E-08	8.1 E-07
115-07-1	Propylene <sup>f</sup>	9.2 E-07	1.7 E-05
129-00-0	Pyrene <sup>d</sup>	2.1 E-08	3.9 E-07
7440-22-4	Silver <sup>f</sup>	1.7 E-07	3.3 E-06
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran <sup>e</sup>	1.2 E-13	2.3 E-12
108-88-3	Toluene <sup>e</sup>	2.1 E-07	4.0 E-06
7440-62-2	Vanadium <sup>f</sup>	4.4 E-07	8.3 E-06
7440-66-6	Zinc <sup>f,g</sup>	2.1 E-04	4.0 E-03

<sup>a</sup> Factors represent uncontrolled emissions. References 1, 2, 4, and 5.

<sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.

<sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 5.27 E-02 pounds per item. References 1 and 3.

<sup>d</sup> Hazardous air pollutant under CAA Section 112(b).

<sup>e</sup> Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).

<sup>f</sup> Reportable chemical under EPCRA Section 313.

<sup>g</sup> EMISSION FACTOR RATING D.

#### References For Section 15.10.3

1. *Report No. 7 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, February 2006.
2. *Detailed Test Plan No. 7 for the Exploding Ordnance Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, August 2003.
3. *Munitions Items Disposition Action System (MIDAS) website*, <https://midas.dac.army.mil/>, U.S. Army Defense Ammunition Center, McAlester, OK, May 2007.
4. *Background Document, Report on Revisions to 5<sup>th</sup> Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Exploding Ordnance Emission Study Phase II Series 7 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, February 2008.

5. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team - Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, January 2007.

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## 15.10.4 N335, M557 Point Detonating Fuse

### 15.10.4.1 Ordnance Description<sup>1</sup>

The M557 Point Detonating Fuse (DODIC N335) is designed for use in ammunition for 75-mm through 155-mm guns, 75-mm through 105-mm rifles, 75-mm through 8-inch howitzers, and 4.2-inch mortars. The M557 Point Detonating Fuse is a selective super quick (SQ) or 0.05-second delay impact fuse. 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 fuse; emissions associated with the use of the ammunition to which the fuse is attached are not addressed in this section.

The M557 Point Detonating Fuse is comprised of an M48A3 fuse assembled with an M125A1 booster. The M48A3 fuse contains an M24 detonator, an M54 primer, a delay assembly, and an intermediate charge.

### 15.10.4.2 Emissions And Controls<sup>1-5</sup>

The primary emissions from the use of the M557 Point Detonating Fuse are carbon dioxide (CO<sub>2</sub>) 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 15.10.4-1 presents emission factors for CO<sub>2</sub>, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.10.4-2 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 15.10.4-1 EMISSION FACTORS FOR THE USE OF DODIC N335,  
M557 POINT DETONATING FUSE – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE,  
AND TOTAL SUSPENDED PARTICULATE<sup>a</sup>

EMISSION FACTOR RATING: C

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
124-38-9	CO <sub>2</sub>	2.8 E-02	5.4 E-01
630-08-0	Carbon monoxide (CO)	4.5 E-03	8.6 E-02
7439-92-1	Lead (Pb)	3.0 E-04	5.7 E-03
74-82-8	Methane	1.0 E-05	2.0 E-04
--	Oxides of nitrogen (NO <sub>x</sub> )	7.7 E-04	1.5 E-02
--	PM-2.5 <sup>d</sup>	8.4 E-03	1.6 E-01
--	PM-10 <sup>e</sup>	1.4 E-02	2.6 E-01
12789-66-1	TSP	1.5 E-02	2.8 E-01

<sup>a</sup> Factors represent uncontrolled emissions. References 1, 2, and 5.

<sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.

<sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 5.22 E-02 pounds per item. Reference 1.

<sup>d</sup> PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).

<sup>e</sup> PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.

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Table 15.10.4-2 EMISSION FACTORS FOR THE USE OF DODIC N335,  
M557 POINT DETONATING FUSE –  
HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS<sup>a</sup>

EMISSION FACTOR RATING: C (except as noted)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
83-32-9	Acenaphthene <sup>d</sup>	5.3 E-10	1.0 E-08
208-96-8	Acenaphthylene <sup>d</sup>	2.7 E-09	5.2 E-08
75-07-0	Acetaldehyde <sup>e</sup>	6.2 E-07	1.2 E-05
75-05-8	Acetonitrile <sup>e</sup>	1.6 E-06	3.1 E-05
98-86-2	Acetophenone <sup>e,f</sup>	2.7 E-08	5.2 E-07
107-13-1	Acrylonitrile <sup>e</sup>	1.3 E-06	2.4 E-05
7429-90-5	Aluminum <sup>g</sup>	1.1 E-03	2.1 E-02
120-12-7	Anthracene <sup>e</sup>	7.4 E-10	1.4 E-08
7440-36-0	Antimony <sup>e</sup>	7.1 E-06	1.4 E-04
7440-39-3	Barium <sup>g</sup>	5.2 E-05	9.9 E-04
71-43-2	Benzene <sup>e</sup>	2.1 E-07	4.1 E-06
205-99-2	Benzo[b]fluoranthene <sup>e</sup>	7.4 E-10	1.4 E-08
7440-43-9	Cadmium <sup>e</sup>	4.9 E-05	9.4 E-04
75-15-0	Carbon disulfide <sup>e,f</sup>	4.3 E-08	8.3 E-07
74-87-3	Chloromethane <sup>e</sup>	2.3 E-08	4.3 E-07
7440-47-3	Chromium <sup>e</sup>	3.3 E-06	6.4 E-05
18540-29-9	Hexavalent chromium <sup>e</sup>	2.8 E-07	5.4 E-06
7440-48-4	Cobalt <sup>e</sup>	4.7 E-07	9.0 E-06
7440-50-8	Copper <sup>g</sup>	3.6 E-04	6.9 E-03
--	Total dioxin/furan compounds <sup>e</sup>	7.0 E-12	1.3 E-10
74-85-1	Ethylene <sup>g</sup>	1.3 E-06	2.4 E-05
117-81-7	bis(2-Ethylhexyl)phthalate <sup>e</sup>	8.5 E-06	1.6 E-04
206-44-0	Fluoranthene <sup>e</sup>	1.2 E-09	2.4 E-08
86-73-7	Fluorene <sup>d</sup>	4.7 E-10	9.0 E-09
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin <sup>e</sup>	5.1 E-13	9.8 E-12
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran <sup>e</sup>	6.8 E-13	1.3 E-11
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran <sup>e</sup>	2.6 E-13	4.9 E-12
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin <sup>e</sup>	1.1 E-13	2.1 E-12
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran <sup>e</sup>	5.6 E-13	1.1 E-11
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran <sup>e</sup>	2.5 E-13	4.7 E-12

Table 15.10.4-2 (cont.)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran <sup>e</sup>	2.0 E-13	3.7 E-12
74-90-8	Hydrogen cyanide <sup>e</sup>	1.6 E-05	3.1 E-04
7439-92-1	Lead <sup>e</sup>	3.0 E-04	5.7 E-03
7439-96-5	Manganese <sup>e</sup>	7.0 E-06	1.3 E-04
80-62-6	Methyl methacrylate <sup>e</sup>	7.6 E-08	1.5 E-06
91-20-3	Naphthalene <sup>e</sup>	8.1 E-09	1.5 E-07
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin <sup>e</sup>	2.6 E-12	5.0 E-11
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran <sup>e</sup>	8.7 E-13	1.7 E-11
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin <sup>e</sup>	8.5 E-14	1.6 E-12
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran <sup>e</sup>	2.3 E-13	4.4 E-12
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran <sup>e</sup>	4.0 E-13	7.6 E-12
85-01-8	Phenanthrene <sup>e</sup>	3.7 E-09	7.1 E-08
129-00-0	Pyrene <sup>d</sup>	2.0 E-09	3.9 E-08
7440-22-4	Silver <sup>g</sup>	1.4 E-06	2.7 E-05
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran <sup>e</sup>	1.9 E-13	3.5 E-12
108-88-3	Toluene <sup>e</sup>	5.6 E-08	1.1 E-06
95-63-6	1,2,4-Trimethylbenzene <sup>g</sup>	1.8 E-08	3.4 E-07
7440-62-2	Vanadium <sup>g</sup>	1.3 E-06	2.5 E-05
106-42-3, 108-38-3	m-Xylene, p-Xylene <sup>e,f</sup>	2.0 E-08	3.8 E-07
7440-66-6	Zinc <sup>g</sup>	5.9 E-04	1.1 E-02

<sup>a</sup> Factors represent uncontrolled emissions. References 1, 2, and 5.

<sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.

<sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 5.22 E-02 pounds per item. Reference 1.

<sup>d</sup> Hazardous air pollutant under CAA Section 112(b).

<sup>e</sup> Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).

<sup>f</sup> EMISSION FACTOR RATING D.

<sup>g</sup> Reportable chemical under EPCRA Section 313.

#### References For Section 15.10.4

1. *Report No. 5 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, January 2005.

2. *Detailed Test Plan No. 5 for the Exploding Ordnance Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, May 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 5<sup>th</sup> Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Exploding Ordnance 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, October 2004 and March 2005.

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## 15.10.5 N340, M739A1 Point Detonating Fuse

### 15.10.5.1 Ordnance Description<sup>1</sup>

The M739A1 Point Detonating Fuse (DODIC N340) is designed for use in all standard high explosive artillery, 4.2-inch mortar, 105-mm through 8-inch howitzers, and 175-mm guns. It is a selective super quick (SQ), 0.05-second delay, or auto-delay impact fuse. 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 fuse; emissions associated with the use of the ammunition to which the fuse is attached are not addressed in this section.

The M739A1 Point Detonating Fuse includes a solid aluminum alloy body, booster charge, and five subassemblies: a crossbar and holder assembly, a firing pin and detonator assembly, a setting sleeve assembly, an impact delay module assembly, and a safe and arming assembly. The detonator assembly contains an intermediate charge and primer mix. The safe and arming assembly contains multiple charges and primer mix.

### 15.10.5.2 Emissions And Controls<sup>1-5</sup>

The primary emissions from the use of the M739A1 Point Detonating Fuse are carbon dioxide (CO<sub>2</sub>) 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 15.10.5-1 presents emission factors for CO<sub>2</sub>, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.10.5-2 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 15.10.5-1 EMISSION FACTORS FOR THE USE OF DODIC N340,  
M739A1 POINT DETONATING FUSE – CARBON DIOXIDE, CRITERIA POLLUTANTS,  
METHANE, AND TOTAL SUSPENDED PARTICULATE<sup>a</sup>

EMISSION FACTOR RATING: C

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
124-38-9	CO <sub>2</sub>	2.5 E-02	5.5 E-01
630-08-0	CO	3.5 E-04	7.7 E-03
7439-92-1	Lead (Pb)	1.0 E-04	2.2 E-03
--	Oxides of nitrogen (NO <sub>x</sub> )	5.3 E-04	1.1 E-02
--	PM-2.5 <sup>d</sup>	1.0 E-02	2.2 E-01
--	PM-10 <sup>e</sup>	1.6 E-02	3.6 E-01
12789-66-1	TSP	1.6 E-02	3.6 E-01

<sup>a</sup> Factors represent uncontrolled emissions. References 1, 2, and 5.

<sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.

<sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 4.59 E-02 pounds per item. Reference 1.

<sup>d</sup> PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).

<sup>e</sup> PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.

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Table 15.10.5-2 EMISSION FACTORS FOR THE USE OF DODIC N340,  
M739A1 POINT DETONATING FUSE –  
HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS<sup>a</sup>

EMISSION FACTOR RATING: C (except as noted)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
208-96-8	Acenaphthylene <sup>d</sup>	1.6 E-09	3.4 E-08
75-07-0	Acetaldehyde <sup>e</sup>	6.5 E-07	1.4 E-05
75-05-8	Acetonitrile <sup>e</sup>	4.1 E-07	8.9 E-06
107-13-1	Acrylonitrile <sup>e</sup>	4.9 E-07	1.1 E-05
7429-90-5	Aluminum <sup>f</sup>	9.6 E-04	2.1 E-02
7440-36-0	Antimony <sup>e</sup>	2.2 E-06	4.9 E-05
7440-39-3	Barium <sup>f</sup>	9.1 E-06	2.0 E-04
71-43-2	Benzene <sup>e</sup>	3.7 E-07	8.1 E-06
7440-43-9	Cadmium <sup>e</sup>	4.9 E-05	1.1 E-03
74-87-3	Chloromethane <sup>e</sup>	2.3 E-08	5.1 E-07
7440-47-3	Chromium <sup>e</sup>	1.1 E-06	2.4 E-05
7440-50-8	Copper <sup>f</sup>	2.3 E-04	5.1 E-03
--	Total dioxin/furan compounds <sup>e</sup>	1.0 E-12	2.3 E-11
100-41-4	Ethylbenzene <sup>e</sup>	4.9 E-08	1.1 E-06
74-85-1	Ethylene <sup>f</sup>	9.3 E-07	2.0 E-05
117-81-7	bis(2-Ethylhexyl)phthalate <sup>e</sup>	5.4 E-06	1.2 E-04
206-44-0	Fluoranthene <sup>e</sup>	1.7 E-09	3.7 E-08
86-73-7	Fluorene <sup>d</sup>	4.8 E-10	1.0 E-08
50-00-0	Formaldehyde <sup>e</sup>	9.7 E-07	2.1 E-05
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran <sup>e</sup>	2.8 E-13	6.2 E-12
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran <sup>e</sup>	2.2 E-13	4.7 E-12
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran <sup>e</sup>	1.0 E-13	2.2 E-12
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran <sup>e</sup>	1.1 E-13	2.4 E-12
74-90-8	Hydrogen cyanide <sup>e</sup>	2.0 E-06	4.4 E-05
7439-92-1	Lead <sup>e</sup>	1.0 E-04	2.2 E-03
7439-96-5	Manganese <sup>e</sup>	1.2 E-05	2.6 E-04
80-62-6	Methyl methacrylate <sup>e</sup>	4.6 E-08	1.0 E-06
1634-04-4	Methyl tert-butyl ether <sup>e,g</sup>	7.1 E-09	1.6 E-07
91-20-3	Naphthalene <sup>e</sup>	1.4 E-08	3.1 E-07
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran <sup>e</sup>	1.5 E-13	3.3 E-12

Table 15.10.5-2 (cont.)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran <sup>e</sup>	1.8 E-13	4.0 E-12
85-01-8	Phenanthrene <sup>e</sup>	3.3 E-09	7.2 E-08
129-00-0	Pyrene <sup>d</sup>	7.8 E-10	1.7 E-08
100-42-5	Styrene <sup>e</sup>	5.6 E-07	1.2 E-05
108-88-3	Toluene <sup>e</sup>	5.0 E-08	1.1 E-06
75-69-4	Trichlorofluoromethane <sup>f</sup>	1.0 E-08	2.3 E-07
95-63-6	1,2,4-Trimethylbenzene <sup>f</sup>	8.3 E-08	1.8 E-06
7440-62-2	Vanadium <sup>f</sup>	4.5 E-07	9.8 E-06
106-42-3, 108-38-3	m-Xylene, p-Xylene <sup>e</sup>	1.6 E-08	3.5 E-07
95-47-6	o-Xylene <sup>e</sup>	4.1 E-08	8.9 E-07
7440-66-6	Zinc <sup>f</sup>	3.0 E-03	6.5 E-02

<sup>a</sup> Factors represent uncontrolled emissions. References 1, 2, and 5.

<sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.

<sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 4.59 E-02 pounds per item. Reference 1.

<sup>d</sup> Hazardous air pollutant under CAA Section 112(b).

<sup>e</sup> Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).

<sup>f</sup> Reportable chemical under EPCRA Section 313.

<sup>g</sup> EMISSION FACTOR RATING D.

#### References For Section 15.10.5

1. *Report No. 5 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, January 2005.
2. *Detailed Test Plan No. 5 for the Exploding Ordnance Emission Study, Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, May 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 5<sup>th</sup> Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Exploding Ordnance 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, October 2004 and March 2005.

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## 15.10.6 N464, M732 Proximity Fuse

### 15.10.6.1 Ordnance Description<sup>1,2</sup>

The M732 Proximity Fuse (DODIC N464) is designed for use on conventional, high explosive ammunition; specifically, 105-mm, 155-mm, 175-mm, and 8-inch artillery ammunition and 4.2-inch mortar ammunition. 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 fuse; emissions associated with the use of the ammunition to which the fuse is attached are not addressed in this section.

### 15.10.6.2 Emissions And Controls<sup>1-4</sup>

The primary emissions from the use of the M732 Proximity Fuse are carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), and particulate matter. Other criteria pollutants, hazardous air pollutants as defined by the *Clean Air Act* (CAA), and toxic chemicals (i.e., those chemicals regulated under Section 313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are emitted at low levels. As this ordnance is typically used in the field, there are no controls associated with its use.

Table 15.10.6-1 presents emission factors for CO<sub>2</sub>, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.10.6-2 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).

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Table 15.10.6-1 EMISSION FACTORS FOR THE USE OF DODIC N464,  
M732 PROXIMITY FUSE – CARBON DIOXIDE, CRITERIA POLLUTANTS, METHANE, AND  
TOTAL SUSPENDED PARTICULATE<sup>a</sup>

EMISSION FACTOR RATING: B (except as noted)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
124-38-9	CO <sub>2</sub>	5.7 E-03	4.1 E-01
630-08-0	CO <sup>f</sup>	1.1 E-03	8.0 E-02
7439-92-1	Lead (Pb) <sup>f</sup>	1.5 E-05	1.1 E-03
74-82-8	Methane <sup>f</sup>	1.8 E-05	1.3 E-03
--	Oxides of nitrogen (NO <sub>x</sub> )	2.6 E-04	1.9 E-02
--	PM-2.5 <sup>d</sup>	2.0 E-03	1.4 E-01
--	PM-10 <sup>e</sup>	2.8 E-03	2.0 E-01
12789-66-1	TSP <sup>f</sup>	3.1 E-03	2.3 E-01

<sup>a</sup> Factors represent uncontrolled emissions. References 1-4.

<sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.

<sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 1.37 E-02 pounds per item. Reference 1.

<sup>d</sup> PM-2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers (µm).

<sup>e</sup> PM-10 = particulate matter with an aerodynamic diameter equal to or less than 10 µm.

<sup>f</sup> EMISSION FACTOR RATING C.

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Table 15.10.6-2 EMISSION FACTORS FOR THE USE OF DODIC N464,  
M732 PROXIMITY FUSE –  
HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS<sup>a</sup>

EMISSION FACTOR RATING: C (except as noted)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
83-32-9	Acenaphthene <sup>d</sup>	7.8 E-09	5.7 E-07
208-96-8	Acenaphthylene <sup>d</sup>	6.6 E-08	4.8 E-06
75-07-0	Acetaldehyde <sup>e,g</sup>	5.3 E-07	3.9 E-05
107-13-1	Acrylonitrile <sup>e</sup>	1.1 E-07	7.9 E-06
7429-90-5	Aluminum <sup>f,h</sup>	1.9 E-04	1.4 E-02
7664-41-7	Ammonia <sup>f</sup>	9.2 E-05	6.7 E-03
120-12-7	Anthracene <sup>e</sup>	5.8 E-09	4.2 E-07
7440-36-0	Antimony <sup>e,h</sup>	1.3 E-06	9.4 E-05
7440-38-2	Arsenic <sup>e</sup>	3.4 E-08	2.5 E-06
7440-39-3	Barium <sup>f</sup>	1.2 E-05	8.4 E-04
71-43-2	Benzene <sup>e,g</sup>	2.4 E-07	1.8 E-05
207-08-9	Benzo[k]fluoranthene <sup>e</sup>	1.2 E-08	8.6 E-07
192-97-2	Benzo[e]pyrene <sup>d</sup>	3.3 E-09	2.4 E-07
7440-43-9	Cadmium <sup>e</sup>	2.0 E-04	1.5 E-02
74-87-3	Chloromethane <sup>e,g</sup>	2.8 E-08	2.0 E-06
7440-50-8	Copper <sup>f,h</sup>	6.8 E-05	5.0 E-03
--	Total dioxin/furan compounds <sup>e</sup>	2.8 E-12	2.1 E-10
74-85-1	Ethylene <sup>f,g</sup>	3.1 E-06	2.2 E-04
117-81-7	bis(2-Ethylhexyl)phthalat <sup>e,g</sup>	4.1 E-07	3.0 E-05
206-44-0	Fluoranthene <sup>e</sup>	3.1 E-08	2.3 E-06
86-73-7	Fluorene <sup>d</sup>	1.2 E-08	8.7 E-07
50-00-0	Formaldehyde <sup>e</sup>	5.8 E-07	4.2 E-05
74-90-8	Hydrogen cyanide <sup>e</sup>	1.1 E-05	8.2 E-04
7439-92-1	Lead <sup>e</sup>	1.5 E-05	1.1 E-03
7439-96-5	Manganese <sup>e,h</sup>	1.8 E-06	1.3 E-04
74-95-3	Methylene bromide <sup>f,g</sup>	4.9 E-09	3.6 E-07
75-09-2	Methylene chloride <sup>e,g</sup>	2.1 E-06	1.5 E-04
91-20-3	Naphthalene <sup>e</sup>	1.4 E-07	1.0 E-05
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin <sup>e</sup>	1.9 E-12	1.4 E-10
85-01-8	Phenanthrene <sup>e</sup>	4.6 E-08	3.3 E-06

Table 15.10.6-2 (cont.)

CASRN <sup>b</sup>	Pollutant	lb per item	lb per lb NEW <sup>c</sup>
115-07-1	Propylene <sup>f,g</sup>	2.5 E-07	1.8 E-05
129-00-0	Pyrene <sup>d</sup>	3.0 E-08	2.2 E-06
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran <sup>e</sup>	1.2 E-13	9.0 E-12
108-88-3	Toluene <sup>e,g</sup>	7.1 E-08	5.2 E-06
7440-62-2	Vanadium <sup>f</sup>	1.2 E-07	8.8 E-06
7440-66-6	Zinc <sup>f</sup>	1.3 E-04	9.8 E-03

<sup>a</sup> Factors represent uncontrolled emissions. References 1-4.

<sup>b</sup> CASRN = Chemical Abstracts Service Registry Number.

<sup>c</sup> NEW = net explosive weight. The NEW for this ordnance is 1.37 E-02 pounds per item. Reference 1.

<sup>d</sup> Hazardous air pollutant under CAA Section 112(b).

<sup>e</sup> Reportable chemical under EPCRA Section 313 and a hazardous air pollutant under CAA Section 112(b).

<sup>f</sup> Reportable chemical under EPCRA Section 313.

<sup>g</sup> EMISSION FACTOR RATING D.

<sup>h</sup> EMISSION FACTOR RATING B.

#### References For Section 15.10.6

1. *Report No. 9 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, September 2006.
2. *Detailed Test Plan No. 9 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, October 2003.
3. *Background Document, Report on Revisions to 5<sup>th</sup> Edition AP-42 Chapter 15 - Ordnance Detonation, Emission Factors Developed Based on Exploding Ordnance Emission Study Phase II Series 9 Testing Conducted at Aberdeen Proving Ground, Maryland*, MACTEC Federal Programs, Inc., Research Triangle Park, NC, June 2008.
4. Supporting information including Excel spreadsheets, analytical results, field notes, and case summaries supplied upon request by the Applied Science Test Team – Chemistry Unit, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, June 2007.

### 15.10.7 Updates Since January 2007

Section 15.10 was created during January 2007. Revisions to this section since that date are summarized below.

Revision 3, October 2008

- Section 15.10.1, which presents emission factors for DODIC N278, the M564 Mechanical Time and Super Quick (MTSQ) Fuse, was added.

Revision 2, June 2008

- Section 15.10.2, which presents emission factors for DODIC N285, the M577A1 Mechanical Time and Super Quick (MTSQ) Fuse, was added.
- Section 15.10.6, which presents emission factors for DODIC N464, the M732 Proximity Fuse, was added.

Revision 1, February 2008

- Section 15.10.3, which presents emission factors for DODIC N286, the M582 Mechanical Time and Super Quick (MTSQ) Fuse, was added.

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