

## 15.7 Mines And Smoke Pots

Munitions listed in this section begin with the Department of Defense Identification Code (DODIC) letter “K.” Almost all munitions included in this category are mines or smoke pots. Examples include antipersonnel mines, antitank mines, ground smoke pots, and floating smoke pots.

### 15.7.1 K010, M4 Field Incendiary Burster

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

The M4 Field Incendiary Burster (DODIC K010) is used primarily to ignite field improvised incendiary munitions. The burster consists of a tubular steel container that contains a burster charge and an incendiary charge. It can be initiated by a fuze, blasting cap, detonating cord, or any standard booby-trap firing device. This ammunition is used during combat and on firing ranges during training.

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

The primary emissions from the use of the M4 Field Incendiary Burster 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 15.7.1-1 presents emission factors for CO<sub>2</sub>, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.7.1-2 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 15.7.1-1 EMISSION FACTORS FOR THE USE OF DODIC K010,  
M4 FIELD INCENDIARY BURSTER - 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> <sup>f</sup>                       | 3.4 E-01    | 1.7                        |
| 630-08-0           | Carbon monoxide (CO)                               | 4.2 E-03    | 2.0 E-02                   |
| 74-82-8            | Methane  | 1.3 E-05    | 6.1 E-05                   |
| --                 | Oxides of nitrogen (NO <sub>x</sub> ) <sup>f</sup> | 4.2 E-03    | 2.0 E-02                   |
| --                 | PM-2.5 <sup>d</sup>                                | 1.7 E-02    | 8.3 E-02                   |
| --                 | PM-10 <sup>e,g</sup>                               | 5.1 E-02    | 2.5 E-01                   |
| 12789-66-1         | TSP <sup>g</sup>                                   | 5.7 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 2.04 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 A.

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Table 15.7.1-2 EMISSION FACTORS FOR THE USE OF DODIC K010,  
M4 FIELD INCENDIARY BURSTER -  
HAZARDOUS AIR POLLUTANTS AND TOXIC CHEMICALS<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> |
|--------------------|---|-------------|----------------------------|
| 83-32-9            | Acenaphthene <sup>d</sup>                   | 4.3 E-09    | 2.1 E-08                   |
| 208-96-8           | Acenaphthylene <sup>d</sup>                 | 3.1 E-08    | 1.5 E-07                   |
| 75-07-0            | Acetaldehyde <sup>e</sup>                   | 1.5 E-05    | 7.1 E-05                   |
| 75-05-8            | Acetonitrile <sup>e</sup>                   | 3.7 E-06    | 1.8 E-05                   |
| 107-02-8           | Acrolein <sup>e,h</sup>                     | 2.0 E-05    | 9.9 E-05                   |
| 107-13-1           | Acrylonitrile <sup>e</sup>                  | 1.5 E-06    | 7.1 E-06                   |
| 7429-90-5          | Aluminum <sup>f</sup>                       | 1.8 E-04    | 8.8 E-04                   |
| 120-12-7           | Anthracene <sup>e</sup>                     | 9.4 E-09    | 4.6 E-08                   |
| 7440-39-3          | Barium <sup>f,h</sup>                       | 9.6 E-06    | 4.7 E-05                   |
| 71-43-2            | Benzene <sup>e</sup>                        | 5.8 E-06    | 2.8 E-05                   |
| 56-55-3            | Benzo[a]anthracene <sup>e,h</sup>           | 5.2 E-09    | 2.6 E-08                   |
| 205-99-2           | Benzo[b]fluoranthene <sup>e,h</sup>         | 2.2 E-09    | 1.1 E-08                   |
| 191-24-2           | Benzo[g,h,i]perylene <sup>d,h</sup>         | 3.5 E-09    | 1.7 E-08                   |
| 192-97-2           | Benzo[e]pyrene <sup>d,h</sup>               | 2.4 E-09    | 1.2 E-08                   |
| 74-87-3            | Chloromethane <sup>e</sup>                  | 7.9 E-08    | 3.9 E-07                   |
| 7440-47-3          | Chromium <sup>e</sup>                       | 1.8 E-05    | 8.7 E-05                   |
| 18540-29-9         | Hexavalent chromium <sup>e,h</sup>          | 1.1 E-07    | 5.6 E-07                   |
| 218-01-9           | Chrysene <sup>e,h</sup>                     | 5.9 E-09    | 2.9 E-08                   |
| 7440-50-8          | Copper <sup>f</sup>                         | 1.2 E-04    | 6.0 E-04                   |
| 84-74-2            | Dibutyl phthalate <sup>e,g</sup>            | 1.6 E-06    | 7.8 E-06                   |
| --                 | Total dioxin/furan compounds <sup>e,h</sup> | 3.5 E-12    | 1.7 E-11                   |
| 100-41-4           | Ethylbenzene <sup>e</sup>                   | 6.2 E-07    | 3.0 E-06                   |
| 74-85-1            | Ethylene <sup>f</sup>                       | 1.3 E-05    | 6.2 E-05                   |
| 117-81-7           | bis(2-Ethylhexyl)phthalate <sup>e,g</sup>   | 8.5 E-06    | 4.2 E-05                   |
| 206-44-0           | Fluoranthene <sup>e</sup>                   | 1.6 E-08    | 8.1 E-08                   |
| 86-73-7            | Fluorene <sup>d</sup>                       | 1.8 E-08    | 8.9 E-08                   |
| 50-00-0            | Formaldehyde <sup>e,h</sup>                 | 4.7 E-05    | 2.3 E-04                   |
| 74-90-8            | Hydrogen cyanide <sup>e,h</sup>             | 1.6 E-04    | 7.8 E-04                   |
| 7439-96-5          | Manganese <sup>e</sup>                      | 1.5 E-04    | 7.5 E-04                   |
| 75-09-2            | Methylene chloride <sup>e</sup>             | 2.7 E-06    | 1.3 E-05                   |

Table 15.7.1-2 (cont.)

| CASRN <sup>b</sup>    | Pollutant   | lb per item | lb per lb NEW <sup>c</sup> |
|-----------------------|---|-------------|----------------------------|
| 108-10-1              | Methyl isobutyl ketone <sup>e,h</sup>                 | 4.7 E-07    | 2.3 E-06                   |
| 91-20-3               | Naphthalene <sup>e</sup>                              | 1.6 E-07    | 7.9 E-07                   |
| 7440-02-0             | Nickel <sup>e</sup>                                   | 2.9 E-05    | 1.4 E-04                   |
| 39001-02-0            | 1,2,3,4,6,7,8,9-Octachlorodibenzofuran <sup>e,h</sup> | 2.7 E-12    | 1.3 E-11                   |
| 85-01-8               | Phenanthrene <sup>e</sup>                             | 6.7 E-08    | 3.3 E-07                   |
| 129-00-0              | Pyrene <sup>d</sup>                                   | 3.0 E-08    | 1.5 E-07                   |
| 7440-22-4             | Silver <sup>f,h</sup>                                 | 8.2 E-06    | 4.0 E-05                   |
| 100-42-5              | Styrene <sup>e,h</sup>                                | 7.3 E-07    | 3.6 E-06                   |
| 51207-31-9            | 2,3,7,8-Tetrachlorodibenzofuran <sup>e,h</sup>        | 7.6 E-13    | 3.7 E-12                   |
| 108-88-3              | Toluene <sup>e</sup>                                  | 2.4 E-06    | 1.2 E-05                   |
| 95-63-6               | 1,2,4-Trimethylbenzene <sup>f</sup>                   | 1.3 E-06    | 6.4 E-06                   |
| 106-42-3,<br>108-38-3 | m-Xylene, p-Xylene <sup>e</sup>                       | 1.6 E-06    | 7.7 E-06                   |
| 95-47-6               | o-Xylene <sup>e</sup>                                 | 1.3 E-06    | 6.5 E-06                   |
| 7440-66-6             | Zinc <sup>f</sup>                                     | 6.7 E-05    | 3.3 E-04                   |

<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 2.04 E-01 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 A.

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

References for Section 15.7.1

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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## 15.7.2 K051, M604 Anti-Tank Practice Mine Fuze

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

The M604 Anti-Tank Practice Mine Fuze (DODIC K051) is an instantaneous, mechanical pressure-actuated fuze used to activate the M12, M12A1, and M20 antitank practice mines. The fuze is issued separately from the practice mine. Once fired, the fuze is replaced by a new one, allowing for the practice mines to be reused. This ammunition is used on firing ranges during training; it is not used during combat.

The M604 Anti-Tank Practice Mine Fuze is a steel body containing a firing pin assembly, cover assembly, initiator, and flash/rapport charge. Upon activation, the initiator ignites the flash/rapport charge which generates a flash, smoke, and a loud rapport.

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

Particulate matter is the primary emission from the use of the M604 Anti-Tank Practice Mine Fuze. 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 15.7.2-1 presents emission factors for carbon dioxide (CO<sub>2</sub>), criteria pollutants, methane, and total suspended particulate (TSP). Table 15.7.2-2 presents emission factors for hazardous air pollutants and toxic chemicals. In both tables, the emission factors are presented in units of pounds of emissions per item (lb per item) and in units of pounds of emissions per pound net explosive weight contained in the item (lb per lb NEW).

TABLE 15.7.2-1 EMISSION FACTORS FOR THE USE OF DODIC K051,  
M604 ANTI-TANK PRACTICE MINE FUZE - CARBON DIOXIDE, CRITERIA POLLUTANTS,  
METHANE, AND TOTAL SUSPENDED PARTICULATE<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> |
|--------------------|------------------------|-------------|----------------------------|
| 124-38-9           | CO <sub>2</sub>        | 3.6 E-03    | 9.6 E-02                   |
| 630-08-0           | Carbon monoxide (CO)   | 2.2 E-04    | 5.8 E-03                   |
| 7439-92-1          | Lead <sup>d</sup> (Pb) | 1.5 E-05    | 3.9 E-04                   |
| --                 | PM-2.5 <sup>e</sup>    | 1.5 E-02    | 4.1 E-01                   |
| --                 | PM-10 <sup>f</sup>     | 2.0 E-02    | 5.2 E-01                   |
| 12789-66-1         | TSP                    | 1.9 E-02    | 5.1 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 3.81 E-02 pounds per item. Reference 5.

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

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

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

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Table 15.7.2-2 EMISSION FACTORS FOR THE USE OF DODIC K051,  
M604 ANTI-TANK PRACTICE MINE FUZE -  
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> |
|--------------------|--|-------------|----------------------------|
| 75-05-8            | Acetonitrile <sup>d</sup>                              | 6.1 E-08    | 1.6 E-06                   |
| 107-13-1           | Acrylonitrile <sup>d,e</sup>                           | 3.6 E-07    | 9.4 E-06                   |
| 7429-90-5          | Aluminum <sup>f</sup>                                  | 3.9 E-04    | 1.0 E-02                   |
| 120-12-7           | Anthracene <sup>d</sup>                                | 3.2 E-09    | 8.4 E-08                   |
| 7440-36-0          | Antimony <sup>d</sup>                                  | 9.0 E-06    | 2.4 E-04                   |
| 7440-39-3          | Barium <sup>f</sup>                                    | 1.6 E-06    | 4.3 E-05                   |
| 71-43-2            | Benzene <sup>d,e</sup>                                 | 2.0 E-07    | 5.2 E-06                   |
| 56-55-3            | Benzo[a]anthracene <sup>d</sup>                        | 5.6 E-09    | 1.5 E-07                   |
| 205-99-2           | Benzo[b]fluoranthene <sup>d</sup>                      | 1.4 E-08    | 3.6 E-07                   |
| 207-08-9           | Benzo[k]fluoranthene <sup>d</sup>                      | 5.2 E-08    | 1.4 E-06                   |
| 191-24-2           | Benzo[g,h,i]perylene <sup>d</sup>                      | 1.1 E-08    | 2.9 E-07                   |
| 50-32-8            | Benzo[a]pyrene <sup>d</sup>                            | 5.6 E-09    | 1.5 E-07                   |
| 192-97-2           | Benzo[e]pyrene <sup>g</sup>                            | 6.0 E-09    | 1.6 E-07                   |
| 7440-43-9          | Cadmium <sup>d</sup>                                   | 5.8 E-05    | 1.5 E-03                   |
| 218-01-9           | Chrysene <sup>d</sup>                                  | 1.0 E-08    | 2.6 E-07                   |
| 7440-50-8          | Copper <sup>f</sup>                                    | 4.9 E-06    | 1.3 E-04                   |
| --                 | Total dioxin/furan compounds <sup>d</sup>              | 1.4 E-10    | 3.6 E-09                   |
| 74-85-1            | Ethylene <sup>e,f</sup>                                | 1.0 E-06    | 2.6 E-05                   |
| 206-44-0           | Fluoranthene <sup>d</sup>                              | 4.2 E-08    | 1.1 E-06                   |
| 86-73-7            | Fluorene <sup>g</sup>                                  | 5.7 E-10    | 1.5 E-08                   |
| 50-00-0            | Formaldehyde <sup>d</sup>                              | 3.7 E-08    | 9.7 E-07                   |
| 35822-46-9         | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin <sup>d</sup> | 1.2 E-12    | 3.0 E-11                   |
| 67562-39-4         | 1,2,3,4,6,7,8-Heptachlorodibenzofuran <sup>d</sup>     | 1.9 E-11    | 5.1 E-10                   |
| 55673-89-7         | 1,2,3,4,7,8,9-Heptachlorodibenzofuran <sup>d</sup>     | 4.6 E-12    | 1.2 E-10                   |
| 118-74-1           | Hexachlorobenzene <sup>d,e</sup>                       | 8.6 E-06    | 2.2 E-04                   |
| 39227-28-6         | 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin <sup>d</sup>    | 1.3 E-13    | 3.5 E-12                   |
| 57653-85-7         | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin <sup>d</sup>    | 2.3 E-13    | 6.1 E-12                   |
| 19408-74-3         | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin <sup>d</sup>    | 4.5 E-13    | 1.2 E-11                   |
| 70648-26-9         | 1,2,3,4,7,8-Hexachlorodibenzofuran <sup>d</sup>        | 5.6 E-12    | 1.5 E-10                   |
| 57117-44-9         | 1,2,3,6,7,8-Hexachlorodibenzofuran <sup>d</sup>        | 2.1 E-12    | 5.6 E-11                   |

Table 15.7.2-2 (cont.)

| CASRN <sup>b</sup> | Pollutant   | lb per item | lb per lb NEW <sup>c</sup> |
|--------------------|---|-------------|----------------------------|
| 72918-21-9         | 1,2,3,7,8,9-Hexachlorodibenzofuran <sup>d</sup>         | 1.9 E-13    | 5.1 E-12                   |
| 60851-34-5         | 2,3,4,6,7,8-Hexachlorodibenzofuran <sup>d</sup>         | 1.9 E-12    | 4.9 E-11                   |
| 7647-01-0          | Hydrochloric acid <sup>d</sup>                          | 2.0 E-04    | 5.3 E-03                   |
| 193-39-5           | Indeno[1,2,3-cd]pyrene <sup>d</sup>                     | 1.9 E-08    | 4.9 E-07                   |
| 7439-92-1          | Lead <sup>d,e</sup>                                     | 1.5 E-05    | 3.9 E-04                   |
| 7439-96-5          | Manganese <sup>d</sup>                                  | 8.3 E-07    | 2.2 E-05                   |
| 75-09-2            | Methylene chloride <sup>d</sup>                         | 6.4 E-08    | 1.7 E-06                   |
| 80-62-6            | Methyl methacrylate <sup>d,e</sup>                      | 2.7 E-08    | 7.0 E-07                   |
| 91-20-3            | Naphthalene <sup>d</sup>                                | 3.0 E-09    | 7.8 E-08                   |
| 3268-87-9          | 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin <sup>d</sup> | 2.1 E-11    | 5.5 E-10                   |
| 39001-02-0         | 1,2,3,4,6,7,8,9-Octachlorodibenzofuran <sup>d</sup>     | 6.3 E-11    | 1.7 E-09                   |
| 40321-76-4         | 1,2,3,7,8-Pentachlorodibenzo-p-dioxin <sup>d</sup>      | 1.6 E-12    | 4.3 E-11                   |
| 57117-41-6         | 1,2,3,7,8-Pentachlorodibenzofuran <sup>d</sup>          | 1.2 E-12    | 3.2 E-11                   |
| 57117-31-4         | 2,3,4,7,8-Pentachlorodibenzofuran <sup>d</sup>          | 1.6 E-12    | 4.1 E-11                   |
| 85-01-8            | Phenanthrene <sup>d</sup>                               | 3.3 E-08    | 8.6 E-07                   |
| 129-00-0           | Pyrene <sup>g</sup>                                     | 2.5 E-08    | 6.5 E-07                   |
| 1746-01-6          | 2,3,7,8-Tetrachlorodibenzo-p-dioxin <sup>d</sup>        | 1.1 E-11    | 2.8 E-10                   |
| 51207-31-9         | 2,3,7,8-Tetrachlorodibenzofuran <sup>d</sup>            | 3.0 E-12    | 7.8 E-11                   |
| 108-88-3           | Toluene <sup>d</sup>                                    | 4.8 E-08    | 1.3 E-06                   |
| 7440-66-6          | Zinc <sup>f</sup>                                       | 1.3 E-03    | 3.5 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 3.81 E-02 pounds per item. Reference 5.

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

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

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

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

References For Section 15.7.2

1. *Report No. 6 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, March 2005.
2. *Detailed Test Plan No. 6 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, November 2002.

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 6 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 May 2005.

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### 15.7.3 K145, M18A1 Antipersonnel Mine

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

The M18A1 Antipersonnel Mine (DODIC K145) is a fixed directional fragmentation mine that is used for the defense of bivouac areas and outposts, to defend against infiltration tactics, and against thin-skinned vehicles. When the mine is detonated, steel spheres are projected at the target. This ammunition is used during combat and on firing ranges during training.

The M18A1 Antipersonnel Mine is constructed of a fiberglass-filled plastic case. The back portion of the case contains a bursting charge, while the front portion of the case is lined with steel spheres. The M18A1 also includes an initiator charge and a booster charge.

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

Carbon dioxide (CO<sub>2</sub>) is the primary emission from the use of the M18A1 Antipersonnel Mine. 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 15.7.3-1 presents emission factors for CO<sub>2</sub>, criteria pollutants, methane, and total suspended particulate (TSP). Table 15.7.3-2 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).

#### 15.7.3.3 Updates Since July 2006

Section 15.7 was created during July 2006. Revisions to this section since that date are summarized below.

##### Revision 2, September 2006

- Section 15.7.2, which presents emission factors for DODIC K051, the M604 Anti-Tank Practice Mine Fuze, was added.

##### Revision 1, July 2006

- Section 15.7.1, which presents emission factors for DODIC K010, the M4 Field Incendiary Burster, was added.

TABLE 15.7.3-1 EMISSION FACTORS FOR THE USE OF DODIC K145,  
M18A1 ANTIPERSONNEL MINE - 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> <sup>f</sup>                       | 1.6         | 1.0                        |
| 630-08-0           | Carbon monoxide (CO)                               | 2.0 E-02    | 1.3 E-02                   |
| 7439-92-1          | Lead (Pb) <sup>g</sup>                             | 5.7 E-05    | 3.8 E-05                   |
| 74-82-8            | Methane  | 3.8 E-04    | 2.5 E-04                   |
| --                 | Oxides of nitrogen (NO <sub>x</sub> ) <sup>f</sup> | 1.8 E-02    | 1.2 E-02                   |
| --                 | PM-2.5 <sup>d</sup>                                | 2.6 E-02    | 1.7 E-02                   |
| --                 | PM-10 <sup>e,g</sup>                               | 4.9 E-02    | 3.2 E-02                   |
| 7446-09-5          | Sulfur dioxide <sup>g</sup>                        | 9.1 E-05    | 6.1 E-05                   |
| 12789-66-1         | TSP <sup>g</sup>                                   | 5.4 E-02    | 3.6 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 1.5 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 A.

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

Table 15.7.3-2 EMISSION FACTORS FOR THE USE OF DODIC K145,  
M18A1 ANTIPERSONNEL MINE -  
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,h</sup>               | 6.3 E-08    | 4.2 E-08                   |
| 208-96-8           | Acenaphthylene <sup>d,h</sup>             | 1.6 E-06    | 1.1 E-06                   |
| 75-07-0            | Acetaldehyde <sup>e,h</sup>               | 5.4 E-05    | 3.6 E-05                   |
| 75-05-8            | Acetonitrile <sup>e,h</sup>               | 4.5 E-05    | 3.0 E-05                   |
| 98-86-2            | Acetophenone <sup>e,i</sup>               | 2.6 E-06    | 1.8 E-06                   |
| 107-13-1           | Acrylonitrile <sup>e,h</sup>              | 9.7 E-06    | 6.5 E-06                   |
| 7429-90-5          | Aluminum <sup>f,h</sup>                   | 6.3 E-04    | 4.2 E-04                   |
| 120-12-7           | Anthracene <sup>e,h</sup>                 | 2.0 E-07    | 1.3 E-07                   |
| 7440-39-3          | Barium <sup>f</sup>                       | 2.4 E-04    | 1.6 E-04                   |
| 71-43-2            | Benzene <sup>e,h</sup>                    | 1.3 E-04    | 8.9 E-05                   |
| 56-55-3            | Benzo[a]anthracene <sup>e</sup>           | 5.1 E-08    | 3.4 E-08                   |
| 205-99-2           | Benzo[b]fluoranthene <sup>e</sup>         | 2.6 E-08    | 1.7 E-08                   |
| 207-08-9           | Benzo[k]fluoranthene <sup>e</sup>         | 2.6 E-08    | 1.7 E-08                   |
| 50-32-8            | Benzo[a]pyrene <sup>e</sup>               | 1.6 E-08    | 1.0 E-08                   |
| 192-97-2           | Benzo[e]pyrene <sup>d</sup>               | 2.5 E-08    | 1.7 E-08                   |
| 100-44-7           | Benzyl chloride <sup>e</sup>              | 3.3 E-06    | 2.2 E-06                   |
| 85-68-7            | Butylbenzylphthalate <sup>d,g</sup>       | 2.7 E-06    | 1.8 E-06                   |
| 7440-43-9          | Cadmium <sup>e</sup>                      | 1.1 E-04    | 7.4 E-05                   |
| 108-90-7           | Chlorobenzene <sup>e</sup>                | 3.3 E-07    | 2.2 E-07                   |
| 74-87-3            | Chloromethane <sup>e,h</sup>              | 1.3 E-06    | 8.7 E-07                   |
| 7440-47-3          | Chromium <sup>e,h</sup>                   | 1.0 E-04    | 6.7 E-05                   |
| 18540-29-9         | Hexavalent chromium <sup>e</sup>          | 2.9 E-06    | 2.0 E-06                   |
| 218-01-9           | Chrysene <sup>e</sup>                     | 6.7 E-08    | 4.5 E-08                   |
| 7440-50-8          | Copper <sup>f,h</sup>                     | 1.3 E-04    | 8.8 E-05                   |
| 98-82-8            | Cumene <sup>e,h</sup>                     | 1.8 E-06    | 1.2 E-06                   |
| 84-74-2            | Dibutyl phthalate <sup>e,g</sup>          | 6.6 E-06    | 4.4 E-06                   |
| 75-71-8            | Dichlorodifluoromethane <sup>d,h</sup>    | 5.3 E-09    | 3.5 E-09                   |
| 107-06-2           | 1,2-Dichloroethane <sup>e</sup>           | 3.4 E-05    | 2.3 E-05                   |
| 121-14-2           | 2,4-Dinitrotoluene <sup>e</sup>           | 7.3 E-07    | 4.9 E-07                   |
| --                 | Total dioxin/furan compounds <sup>e</sup> | 2.5 E-10    | 1.7 E-10                   |

Table 15.7.3-2 (cont.)

| CASRN <sup>b</sup> | Pollutant   | lb per item | lb per lb NEW <sup>c</sup> |
|--------------------|---|-------------|----------------------------|
| 100-41-4           | Ethylbenzene <sup>e,h</sup>                             | 1.0 E-05    | 6.7 E-06                   |
| 74-85-1            | Ethylene <sup>d,h</sup>                                 | 1.2 E-04    | 8.3 E-05                   |
| 117-81-7           | bis(2-Ethylhexyl)phthalate <sup>e,g</sup>               | 6.3 E-06    | 4.2 E-06                   |
| 206-44-0           | Fluoranthene <sup>e,h</sup>                             | 4.0 E-07    | 2.6 E-07                   |
| 86-73-7            | Fluorene <sup>d,h</sup>                                 | 5.8 E-07    | 3.9 E-07                   |
| 50-00-0            | Formaldehyde <sup>e</sup>                               | 1.7 E-04    | 1.1 E-04                   |
| 35822-46-9         | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin <sup>e</sup>  | 2.3 E-11    | 1.5 E-11                   |
| 67562-39-4         | 1,2,3,4,6,7,8-Heptachlorodibenzofuran <sup>e</sup>      | 2.9 E-12    | 1.9 E-12                   |
| 55673-89-7         | 1,2,3,4,7,8,9-Heptachlorodibenzofuran <sup>e</sup>      | 3.9 E-13    | 2.6 E-13                   |
| 57653-85-7         | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin <sup>e</sup>     | 8.2 E-13    | 5.5 E-13                   |
| 19408-74-3         | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin <sup>e</sup>     | 8.8 E-13    | 5.9 E-13                   |
| 57117-44-9         | 1,2,3,6,7,8-Hexachlorodibenzofuran <sup>e,i</sup>       | 3.6 E-13    | 2.4 E-13                   |
| 74-90-8            | Hydrogen cyanide <sup>e</sup>                           | 3.6 E-04    | 2.4 E-04                   |
| 193-39-5           | Indeno[1,2,3-cd]pyrene <sup>e</sup>                     | 7.4 E-09    | 4.9 E-09                   |
| 7439-92-1          | Lead <sup>e</sup>                                       | 5.7 E-05    | 3.8 E-05                   |
| 7439-96-5          | Manganese <sup>e,h</sup>                                | 7.3 E-05    | 4.9 E-05                   |
| 75-09-2            | Methylene chloride <sup>e,h</sup>                       | 3.8 E-07    | 2.5 E-07                   |
| 80-62-6            | Methyl methacrylate <sup>e,i</sup>                      | 1.7 E-07    | 1.1 E-07                   |
| 95-48-7            | 2-Methylphenol <sup>e</sup>                             | 1.4 E-06    | 9.6 E-07                   |
| 91-20-3            | Naphthalene <sup>e,h</sup>                              | 5.4 E-06    | 3.6 E-06                   |
| 7697-37-2          | Nitric acid <sup>f,h</sup>                              | 8.5 E-04    | 5.6 E-04                   |
| 88-75-5            | 2-Nitrophenol <sup>f</sup>                              | 5.5 E-06    | 3.7 E-06                   |
| 100-02-7           | 4-Nitrophenol <sup>e</sup>                              | 7.3 E-06    | 4.8 E-06                   |
| 3268-87-9          | 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin <sup>e</sup> | 2.2 E-10    | 1.4 E-10                   |
| 39001-02-0         | 1,2,3,4,6,7,8,9-Octachlorodibenzofuran <sup>e</sup>     | 5.7 E-12    | 3.8 E-12                   |
| 57117-41-6         | 1,2,3,7,8-Pentachlorodibenzofuran <sup>e</sup>          | 4.5 E-13    | 3.0 E-13                   |
| 57117-31-4         | 2,3,4,7,8-Pentachlorodibenzofuran <sup>e</sup>          | 8.4 E-13    | 5.6 E-13                   |
| 85-01-8            | Phenanthrene <sup>e,h</sup>                             | 1.8 E-06    | 1.2 E-06                   |
| 108-95-2           | Phenol <sup>e</sup>                                     | 3.9 E-06    | 2.6 E-06                   |
| 115-07-1           | Propylene <sup>f,h</sup>                                | 2.2 E-05    | 1.5 E-05                   |
| 129-00-0           | Pyrene <sup>d,h</sup>                                   | 4.1 E-07    | 2.7 E-07                   |
| 51207-31-9         | 2,3,7,8-Tetrachlorodibenzofuran <sup>e</sup>            | 1.3 E-12    | 8.6 E-13                   |

Table 15.7.3-2 (cont.)

| CASRN <sup>b</sup>    | Pollutant                             | lb per item | lb per lb NEW <sup>c</sup> |
|-----------------------|---------------------------------------|-------------|----------------------------|
| 108-88-3              | Toluene <sup>e,h</sup>                | 2.0 E-05    | 1.3 E-05                   |
| 75-69-4               | Trichlorofluoromethane <sup>f</sup>   | 3.7 E-09    | 2.4 E-09                   |
| 95-63-6               | 1,2,4-Trimethylbenzene <sup>f,h</sup> | 7.2 E-06    | 4.8 E-06                   |
| 7440-62-2             | Vanadium <sup>f</sup>                 | 5.4 E-04    | 3.6 E-04                   |
| 75-01-4               | Vinyl chloride <sup>e</sup>           | 3.0 E-06    | 2.0 E-06                   |
| 106-42-3,<br>108-38-3 | m-Xylene, p-Xylene <sup>e,h</sup>     | 4.0 E-06    | 2.6 E-06                   |
| 95-47-6               | o-Xylene <sup>e,h</sup>               | 1.9 E-06    | 1.3 E-06                   |
| 7440-66-6             | Zinc <sup>f,h</sup>                   | 8.2 E-04    | 5.5 E-04                   |

<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 1.5 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 A.

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

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

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1. *Report No. 2 for the Exploding Ordnance Emission Study Phase II*, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD, December 2003.
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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 2 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.