

CHAPTER III

MUNITIONS AND EXPLOSIVES OF CONCERN (MEC) ENCOUNTERED DURING USACE ACTIVITIES

III.A REQUIREMENTS

III.A.01 All Munitions and Explosives of Concern (MEC) or Material Presenting a Potential Explosive Hazard (MPPEH) encountered on jobsites shall be treated as extremely dangerous and must be reported immediately. MEC can be Unexploded Ordnance (UXO), Discarded Military Munitions (DMM), or Munitions Constituents (MC) in sufficient amounts or concentrations to pose an explosive hazard. MPPEH is material potentially containing explosives or munitions (e.g., munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris), or material potentially containing a high enough concentration of explosives such that the material presents an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization or disposal operations). Excluded from MPPEH are munitions within DoD's established munitions management system and other hazardous items that may present explosion hazards (e.g., gasoline cans, compressed gas cylinders) that are not munitions and are not intended for use as munitions.

III.A.02 MEC or MPPEH, regardless of age or condition, shall be handled by UXO-qualified personnel (Ref. Technical Paper (TP) No. 18), UXO Technicians Level 1 when under supervision of UXO-qualified, OESS, or EOD personnel.

III.A.03 This section was developed because we recognize the potential hazard associated with MEC and MPPEH encountered during Corps operations or activities.

EM 385-1-97
15 Sep 08

III.A.04 Activities performed by Corps employees or its contractors could be subject to encountering MEC or MPPEH if the land was used for military activities.

a. Due to weapons training, testing, manufacturing and demilitarization (including OB/OD) activities required to maintain a highly trained and ready military force to protect US national interests, thousands of acres of our Nation's land is known or suspected to contain MEC.

b. Even though DoD made an effort to remove/cleanup the explosives hazards before releasing the land from its control, some may remain.

c. Explosives hazards may have been pushed into depressions and covered with dirt or water or intentionally buried in pits. As such, explosive hazards may be found on land surface or subsurface, or bodies of water.

III.A.05 Where has MEC been found?

a. Areas currently or formerly under DoD jurisdiction [Formerly Used Defense Sites (FUDS)] used by the military (ranges, ammunition storage locations, munitions manufacturing areas, demilitarization and disposal sites or facilities).

b. In waters of the US [e.g., dredging, beach replenishment, clam harvesting (or recycled for use as roads and landscaping)].

c. Unauthorized disposal sites.

d. On private property (e.g. souvenirs or buried in private residence yards).

e. Other Federal Lands (transferred from DoD control).

f. Combat operation areas (civil war, e.g., cannon balls).

g. Recycling companies (e.g., lead smelters).

III.A.06 If you encounter or suspect to have encountered MEC or MPPEH, **DON'T TOUCH IT. Follow the 3Rs: RECOGNIZE, RETREAT AND REPORT.** Mark the location, keep people out of the area and report it. The site is now considered a potential munitions response site (MRS). **> Note: The general location of the MEC hazard should be marked with tape, colored cloth, or colored ribbon. If available, attach the marker to a branch, structure or other existing object so that it is about 3 ft (.9 m) off the ground and visible from all approaches. Place the marker no closer than the point where you first recognized the MEC hazard and do not drive stakes into the ground or otherwise disturb the surface.**

III.A.06.01 If not on a DoD installation, anytime suspected MEC is encountered, immediately call the local emergency response authority (e.g., local police, sheriff, or 911) to report the finding. The Government Designated Authority (GDA) and Corps PM shall be notified immediately as well.

III.A.06.02 If on DoD installation, immediately notify your supervisor, GDA and Corps PM, installation POC (who shall contact and facilitate EOD response) or local emergency response authority (e.g., local police, sheriff, or 911) if not on DoD property.

III.A.06.03 Appendix H contains emergency POCs.

III.B ENCOUNTERING MEC

III.B.01 Prior to beginning construction operations or other activities, every effort shall be made to determine whether munitions-related activities ever occurred on the land/waters on which USACE operations or activities will take place. Installation or responsible authority will, based on available historical documents or prior environmental response actions, make an assessment determination for encountering MEC. This determination will be documented and used to plan the level of support required (e.g., no support, standby or on-call support, or a removal action within the footprint).

EM 385-1-97
15 Sep 08

III.B.02 If the site has a negligible probability of encountering MEC (e.g., current or previous land use leads to an initial determination that MEC or MPPEH is not present), no support is required. However, if MEC or MPPEH is discovered, **STOP WORK**, mark the location, retreat from the area and report it to the appropriate personnel. Once MEC or MPPEH is found, the probability assessment will be re-evaluated.

III.B.03 If the site has a low probability of encountering MEC (e.g., current or previous land use leads to an initial determination that MEC or MPPEH may be present), only MEC standby support will be required. See EP 75-1-2, chapter 6 for details. If MEC or MPPEH is discovered – **RECOGNIZE, STOP WORK**, mark the location, **RETREAT** from the area and **REPORT** it to the appropriate personnel. Once MEC or MPPEH is found, the probability assessment will be re-evaluated.

III.B.04 If the probability of encountering MEC is moderate to high (e.g., current or previous land use leads to a determination that MEC was employed or disposed of in the area of concern) UXO-qualified personnel must conduct a subsurface removal for the known construction footprint. Before the removal action begins, an explosives safety submission [ESS (EPs 385-1-95b and 75-1-3)] will be prepared and approved by USACE, the U.S. Army Technical Center for Explosives Safety (USATCES) and the DOD Explosives Safety Board (DDESB), see DOD 6055.09-STD, Chapter 12. Contact the USACE Environmental and Munitions Center of Expertise, Military Munitions Division (CEHNC-EM-CX-MM, 256-895-1586) for guidance or assistance processing the required plan for the project.

III.B.05 Safety requirements for conducting MEC operations are also found in ER 385-1-95, EM 385-1-97, EP 385-1-95a, EP 385-1-95b, EP 75-1-2 and EP 75-1-3.

III.B.06 MEC authorization. Only authorized USACE Military Munitions Design Centers are permitted to design response actions. Design Centers or Remedial Action Districts are the only

authorized to execute response actions (see Table III.1). Requirements for government safety oversight are provided in ER 385-1-95, Appendix C.

III.B.07 Anomaly avoidance. Anomaly avoidance techniques are implemented to avoid any potential surface MEC or MPPEH and any subsurface anomalies. Anomaly avoidance techniques are primarily implemented during Hazardous, Toxic, and Radioactive Waste (HTRW) project activities, for example, in support of soil sampling or well installation activities where the specific site of the activity can be moved to another location. Any intrusive work in areas known or suspected to contain MEC or MPPEH must consider the type of activities to be performed and whether anomaly avoidance is sufficient or if construction support is required. Site escort support is required and provided by UXO-qualified or OESS personnel.

III.B.08 Dredging projects. Planning for dredging projects must consider the possibility of encountering MEC or MPPEH during operations, reference paragraph III.B.01. Plans shall include equipment (maintenance), material screening, and disposal procedures. The selected MM Design Center should be contacted to determine requirements on a case-by-case basis. General considerations include:

a. If a hydraulic dredge is used, it shall be equipped with a screen on the suction/intake end to prevent unwanted objects from reaching the removed sediment. The screen shall be capable of removing the smallest MEC item expected to be encountered. Additionally, screening mechanism of the same or smaller size is recommended at the outfall point of the dredge material.

b. If a mechanical dredge is used in a moderate to high probability dredging area, a plan to screen the oversize material shall be developed and approved.

c. Blast protection and shielding of equipment and personnel may be required.

EM 385-1-97
15 Sep 08

III.B.09 If suspect Chemical Warfare Materiel (CWM) is encountered **STOP WORK IMMEDIATELY. RECOGNIZE, RETREAT AND REPORT.** Project personnel will withdraw along cleared path upwind from the discovery until appropriate responders arrive (reference paragraph III.A.06).

III.C EXAMPLES OF MEC ITEMS. This section contains examples of MEC items that may be found on a USACE project site. These items include:

III.C.01 GRENADES. There are three types of grenades discussed here: hand grenades; rifle grenades; and projectile grenades.

**FIGURE III.1-a
HAND GRENADES**

Hand grenades are small explosives or chemical-type munitions that are designed to be thrown at a short distance. Various types of hand grenades may be encountered as UXO, including fragmentation, smoke, and illumination grenades. All hand grenades have three main parts: a body, a fuze and filler.



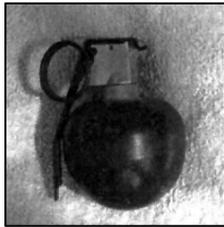
Mk-II Fragmentation grenade

Hazards: Cocked Striker, High Explosives (HE) & Fragmentation (Frag)

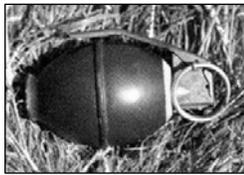
Weight: 1.3 lbs
Length: 4.5 in

**FIGURE III.1-b
FRAGMENTATION GRENADES**

Fragmentation grenades are the most common type of hand grenade used. They have metal or plastic bodies filled with an explosive material. Other types of hand grenades may be made of metal, plastic, cardboard, or rubber and may contain, white phosphorus (WP), chemical agents (CA), or illumination flares, depending on their intended use. Most use a burning (pyrotechnic) delay fuze that functions 3 to 5 seconds after the safety lever is released, but some are activated instantly when the lever is released.



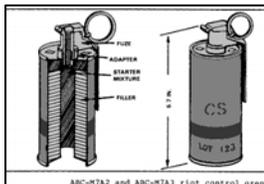
M33/67 Fragmentation Grenade
Hazards: Cocked Striker, HE & Frag
Weight: 0.875 lbs
Height: 3.530 in



M-26 Fragmentation Grenade
Hazards: Cocked Striker, HE & Frag
Weight: 1.00 lb
Length: 3.33 in



M34 - WP Grenade
Hazards: Cocked Striker, HE & Frag, WP, Smoke & Fire
Weight: 1.5 lbs
Length: 5.5 in



M7 Chemical Grenade (Riot Control) CS-Filled
Hazards: Cocked Striker, Chemical & Fire
Weight: 1.2 lbs
Length: 4.5 in

EM 385-1-97
15 Sep 08

**FIGURE III.1-c
RIFLE GRENADES**

Rifle grenades look like small mortars and range from 9 to 17 in (22.86-43.18 cm) in length. They may be filled with high explosives (HE), WP, CS, illumination flares, or chemicals that produce colored screening/signal smoke. Rifle grenades are fired from standard infantry rifles. They have an opening at the tail end of a fin assembly that allows the rifle grenade to be placed on the barrel of a rifle.



M17 Fragmentation Rifle Grenade

Hazards: Impact/Inertia, HE & Frag

Weight: 2.2 lbs

Length: 9.4 in



M19 Rifle Grenade, Smoke WP

Hazards: HE, Frag, Fire, WP,
Smoke/Incendiary, & Impact/Inertia

Weight: 1.50 lbs

Length: 11.31 in

**FIGURE III.1-d
PROJECTED GRENADES**

The most commonly used projected grenade is the 40 mm grenade. This grenade is also among the most commonly found UXO item. The 40mm grenade is about the same size and shape as a chicken egg. It can contain a variety of fillers such as HE, CS, illumination flares, or various colored screening/signal smoke mixtures. Because of their relatively small size, they are easily concealed by vegetation. They are extremely dangerous because of their sensitive internal fuzing systems and can be detonated by simple movement of if handled.



Projected Grenade M406 – 40MM HE
(New Unfired)

Hazards: HE, Frag & Movement

Weight: 0.503 lbs

Length: 3.894 in



Projected Grenade M406 – 40MM HE
(Fired)

Hazards: HE, Frag & Movement

Weight: 0.31 lbs

Length: 3.08 in

EM 385-1-97
15 Sep 08

III.C.02 PROJECTILES. Projectiles can range from approximately 1 in (2.54 cm) to 16 in (40.64 cm) in diameter and from 2 in (5.08 cm) to 4 ft (1.22 m) in length. Projectiles can be fuzed either in the nose or the base of the projectile. A wide variety of fuzes and fillers can be found in the various types of projectiles. Some projectile fuzes are extremely sensitive to movement and will detonate if jarred or accidentally moved.

**FIGURE III.2
PROJECTILES**



Miscellaneous Projectile Fuzes

Hazards: Electromagnetic Radiation (EMR), HE, Frag, Cocked Striker, Movement & Static



Projectiles Ranging from 20MM and Up

Hazards: EMR, HE, Frag, Movement & Missile



M1 105MM HE Projectile

Hazards: HE & Frag

Weight: 39.92 lbs
Length: 28.60 in

**FIGURE III.2
PROJECTILES (CONTINUED)**



M456 105MM Heat Projectile

Hazards: EMR, HE, Frag, Jet (Shaped Charge), Lucky (Piezoelectric), Movement & Static

Weight: 20 lbs

Length: 26 in



Miscellaneous Spin Stabilized Projectiles

Hazards: EMR, HE, Frag, Jet (Shaped Charge), Cocked-Striker, Movement & Static



M371 90MM HEAT Recoilless Rifle Projectile

Hazards: EMR, HE, Frag, Jet (Shape Charge), Lucky (Piezoelectric), Movement & Static

Weight: 9.25 lbs

Length: 27.78 in

III.C.03 MORTARS. Mortars range from approximately 2 in (5.98 cm) to 11 in (27.94 cm) in diameter and can be filled with explosives, WP, or illumination flares. Mortars generally have thinner metal casing than artillery projectiles. They normally use fin stabilization but, some types can be found that use spin stabilization.

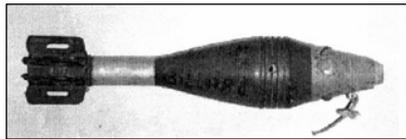
**FIGURE III.3
MORTARS**



M374 81MM HE Mortar

Hazards: HE, Frag & Movement

Weight: 9.340 lbs
Length: 20.838 in



M49 60MM HE Mortar (New)

Hazards: HE, Frag & Movement

Weight: 3.07 lbs
Length: 9.61 in



M3 4.2", 107MM HE Mortar

Hazards: HE, Frag & Movement

Weight: 26.20 lbs
Length: 23.05 in



81 mm M301A3 Illumination Mortar Projectile

Hazards: Ejection & Fire

Weight: 10.1-10.7 lbs
Length: 24.73 in

III.C.04 ROCKETS. A rocket uses gas pressure from rapidly burning material (propellant) to propel a payload (warhead) to a desired location. Rockets can range from 1 ½ (3.81 c m) to more than 15 in (38.1 cm) in diameter, and that can vary from 1 ft (.3 m) to over 9 ft (2.74 m) in length. All rockets consist of a warhead section and a motor section. Rockets are unguided after launch and are stabilized during flight by fins attached to the motor section or by canted nozzles built into the base of the motor section. The warhead section can be filled with explosives, WP, submunitions, or illumination flares.

FIGURE III.4
ROCKETS

Warning: Fired rockets may still contain residual propellant that could ignite and burn violently!



M72 Law 66MM Rocket

Hazards: Cocked Striker, HE, Frag, Jet (Shaped Charge), Lucky (Piezoelectric) & Missile

Weight: 2.300-lbs
Length: 19.987-inches



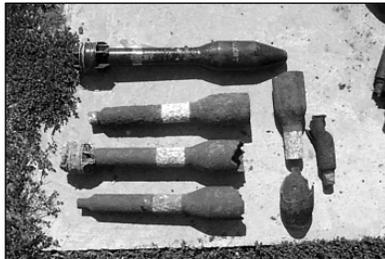
M7A2 2.36" Rocket Heat (Bazooka)

Hazards: EMR, HE, Fire, Frag, Jet (Shaped Charge), & Movement

Weight: 3.5 lbs
Length: 21.5 in

EM 385-1-97
15 Sep 08

**FIGURE III.4
ROCKETS (CONTINUED)**



M28 3.5 in Heat Rocket

Hazards: EMR, HE, Frag, Jet (Shaped Charge), & Movement

Weight: 9 lbs
Length: 23.55 in



2.75 in Aerial Rocket System

Hazards: EMR, HE, Frag, Jet (Shaped Charge), Static, Movement, Missile, Cock Striker, Submunitions, White Phosphorus, & Fire

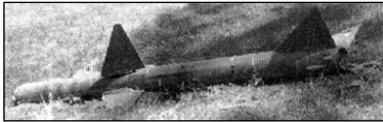
Weight: 18.1 lbs
Length: 70 in

III.C.05 GUIDED MISSILES. Guided missiles are similar to rockets; however, they are guided to their target by various guidance systems. Some are wire-guided, and internal or external devices guide others. Fins controlled by internal electronics usually stabilize guided missiles. Guided missiles vary in size from man-portable, shoulder launched to very large intercontinental ballistic missiles.

FIGURE III.5
GUIDED MISSILES

Warning: Some guidance systems contain toxic materials, do not touch or handle missile components!

Warning: Fired guided missiles may still contain residual propellant that could ignite and burn violently!



AIM-7 Sparrow Missile (Air to Air)

Hazards: EMR, HE, Frag, Fire, High Pressure (Accumulator), Mechanical, Electrical & Missile

Weight: 319 lbs

Length: 12 ft

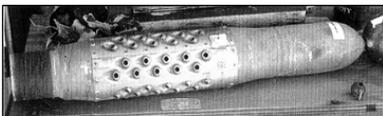


BGM-71 TOW (Surface to Surface)

Hazards: EMR, HE, Frag, Fire, High Pressure (Accumulator), Mechanical, Electrical & Missile

Weight: 39.60 lbs

Length: 45.67 in



M47 Dragon Missile

Hazards: EMR, HE, Frag, Fire, High Pressure (Accumulator), Electrical, Missile, Static, & Unexpended Rocket Motors May Exist After Impact

Weight: 22.1 lbs

Length: 33.3 in

EM 385-1-97
15 Sep 08

III.C.06 BOMBS. Bombs are dropped from aircraft and vary in weight from 100 (45.36 kg) to 20,000-lbs (9.07 MT), with lengths ranging from 6 in (15.24 cm) to 10-feet (3.05 m). Bombs consist of a bomb body and some form of stabilizing device (fin assembly) and may be fuzed in either the nose or the tail. There are two general types of bombs, "Old-Style" which date from the early 1920's to the 1950's and what are know as "Mk-80-Series" which date from the late 1950's to the present.

**FIGURE III.6
BOMBS**



Bomb Fuzes

Hazards: EMR, HE, Frag,
Electrical, & Movement



Old Style Series of Aerial Bomb

Hazards: HE, Frag, Movement, & Cock-
Striker

Weight: From 100 to 2000-lbs
Length: Varied



Mk-80 Series New Style Aerial Bombs

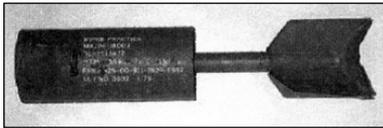
Hazards: HE, Frag, Movement, EMR,
Static, Cock-Striker, & Influence
(Magnetic/Acoustic)

Weight: 250 lb, 500 lb, 2000-lb, & 3000 lb
Length: Varied

III.C.07 PRACTICE BOMBS. Practice bombs are used to simulate the explosive filled bomb and will duplicate the same weight and dimensions of those bombs. They can also be found with very distinctive shapes and sizes. All practice bombs contain a “Spotting Charge” consisting of in some cases up to 23-lbs (11.34 kg) of HE. Although most practice bombs contain pyrotechnic charges that consist of red/white phosphorus and a propellant such as smokeless or black powder.

FIGURE III.7
PRACTICE BOMBS

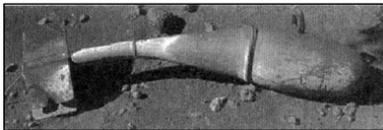
Warning: Practice bombs contain very dangerous pyrotechnic charges!



MK106 5 Practice Bomb

Hazards: Ejection, HE, Movement, & Smoke/Incendiary

Weight: 4.56 lbs
Length: 8.25 inches



BDU-33 Practice Bomb

Hazards: Ejection, HE, & Smoke/Incendiary

Weight: 23.8 lbs
Length: 22.5 in



Mk 5 Mod 0 Practice Bomb

Hazards: Ejection, Smoke, & Incendiary

Weight: 2.68 lbs
Length: 8 in

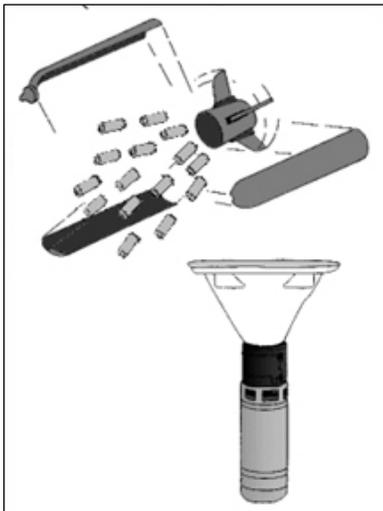
EM 385-1-97
15 Sep 08

III.C.08 DISPENSERS. Dispensers are used to carry and dispense submunitions payloads. They can be found either as aircraft dispensers or as artillery projectiles that eject (dispense) their submunition payloads.

a. Aerial dispensers generally look like medium size aerial bombs, except the construction of dispenser body is normally out of lightweight aluminum.

b. Projectiles that are designed to eject their submunition payload generally appear like any other projectile except there are some design features that allow the projectile body to eject its payload.

**FIGURE III.8
DISPENSERS**



When the fuze in the dispenser functions above the target area, a length of explosive det-cord opens the dispenser container. When that occurs the individual submunitions within the container are spread-out over a large area.

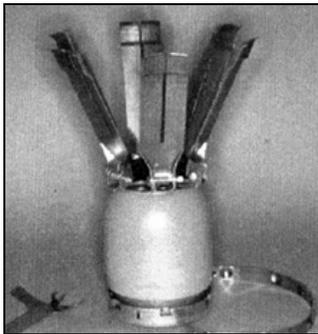


SUU-30H/H (Dispenser) loaded on the wing of an attack aircraft.

III.C.09 SUBMUNITIONS. Submunitions are delivered in a container such as a projectile body or a dispenser that will dispense the submunitions in-flight over a target area. Submunitions come in a variety of sizes and shapes. Submunitions include bomblet, grenades, and mines that can be filled with explosives or chemical agent. They may be anti-personnel, anti-material, anti-tank, dual-purpose, incendiary, or chemical submunitions. Submunitions are activated in a variety of ways, depending on their intended use. Some are activated by pressure, impact, or movement/disturbance. Others are activated in flight or when they come near metallic objects. Some submunitions contain a self-destruct fuze as a backup. The self-destruct time can vary from a couple of hours to several days.

FIGURE III.9
SUBMUNITIONS

Warning: Submunitions are extremely hazardous because even very slight movement can cause them to detonate.



BLU-3 Aerial Dispersed Anti-Personnel
Frag Bomb (New)

Hazards: HE, Frag, & Movement



MK118 Aerial Dispersed Anti-Tank Shape
Charge (Field)

Hazards: EMR, HE, Jet (Shaped
Charge), Lucky (Piezoelectric), &
Movement

EM 385-1-97
15 Sep 08

**FIGURE III.9
SUBMUNITIONS (CONTINUED)**



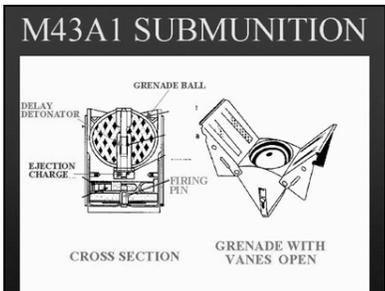
BLU-26 Aerial Dispersed Anti-Personnel Submunition.

Hazards: HE, Frag,
& Movement



M42 Projectile Dispersed Dual-Purpose Submunitions.

Hazards: HE, Frag, Jet (Shape Charge),
& Movement



Projectile Dispersed M43 Anti-Personnel Submunition

Hazards: HE, Frag, Ejection, &
Movement

III.C.10 PYROTECHNICS. Pyrotechnics and pyrotechnic devices contain chemical compounds that when ignited will burn at extreme temperatures. They are primarily designed to produce either illumination (light) and/or various colors of smoke for signaling or screening purposes. Pyrotechnic devices can be found in a wide variety of sizes and shapes ranging from small hand held signal flares to large aerial illumination flares.

**FIGURE III.10
PYROTECHNICS**



155MM Illumination Candles

Hazards: Ejection, EMR, HE, &
Smoke/Incendiary

Weight: 4.3 - 5.8 lbs
Length: 23 in



MK-45 Parachute Flare (Field)

Hazards: Ejection, EMR, HE, &
Smoke/Incendiary

Weight: 28.6 lbs
Length: 3 ft



M18A1 White Star Cluster

Hazards: Ejection, & Incendiary

Weight: 17.49 oz
Length: 10.14 in

EM 385-1-97
15 Sep 08

III.C.11 ITEMS THAT MIGHT CONTAIN CHEMICAL WARFARE
MATERIEL.

FIGURE III.11-a
4 IN (10.16 CM) STOKES MORTAR

4 in (10.16 cm) Stokes mortar, an example of a round that could have an unknown filler. The differences between the chemical mortar and the smoke-filled and the high explosive filled mortars are in the length.

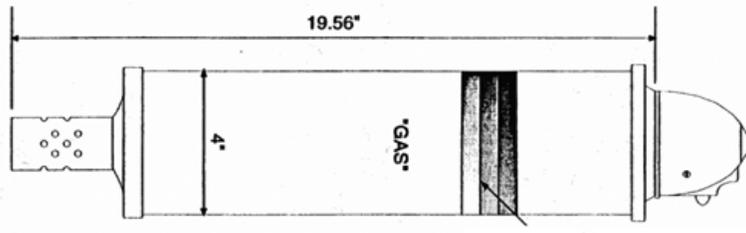


FIGURE III.11-b
8 IN (20.32 CM) LIVENS PROJECTILE

8 in (20.32 cm) Livens projectile, an example of a round that could have an unknown filler. There are virtually no external differences between the chemical projectile and the smoke-filled projectile.

Front View

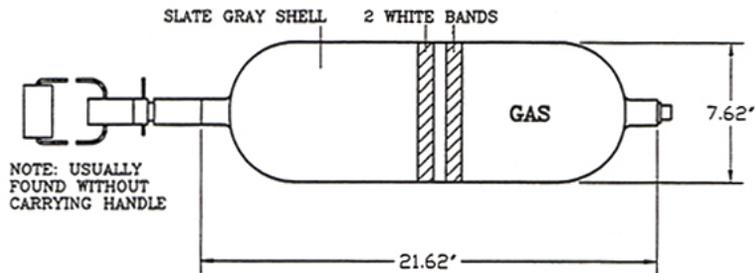


FIGURE III.11-c
4.2 IN (10.67 CM) GAS MORTAR

4.2 in (10.67 cm) Gas Mortar, an example of an item that might have an unknown filler. This model of mortar can have CA, WP smoke, and tearing agent, to mention a few. There are virtually no external differences, except possible fuzing combinations.

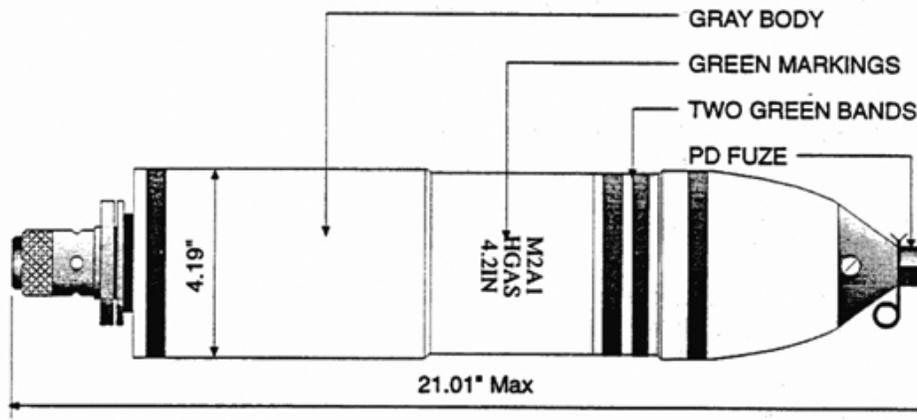
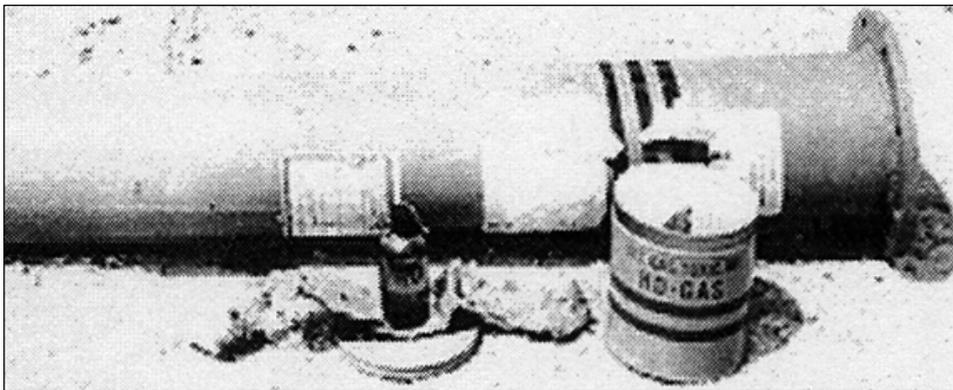


FIGURE III.11-d
K941 CHEMICAL AGENT IDENTIFICATION SET (CAIS)

This is an example of a suspect chemical item. It typically contains 24 bottles (2.5 liters (2500 ml) total weight) of distilled mustard (HD) or mustard (H and HS) agent.



EM 385-1-97
15 Sep 08

FIGURE III.11.e
K951/K952 CAIS

This is an example of a suspect chemical item. This could typically contain 48 pyrex, flame sealed ampules, 12 each containing 1.4 oz (2.66 ml) Zunce solution of mustard (H), a 5% solution in chloroform, Lewisite (L), a 5% solution in chloroform, Chloropicrin (PS), 50% solution in chloroform, and Phosgene (CG), 40 ml, full strength.



Table III.1: USACE Authorized MM Design Centers and Remedial Action Districts

Center of Expertise, MM Division, Huntsville Center, Phone: 256-895-1334

Design Centers

South Pacific Division
Phone: 505-235-4061

Omaha District
Phone: 402-995-2727

Baltimore District
Phone: 410-962-2252

Huntsville Center
Phone: 256-895-1709

Huntsville Center
RCWM
Phone: 256-895-1543

Remedial Action Districts

Sacramento District
Phone: 505-235-4061

Los Angeles District
Phone: 505-235-4061

Honolulu District
Phone: 808-438-6931

Baltimore District
Phone: 410-962-6728

Savannah District
Phone: 256-682-7546

Mobile District
Phone: 256-682-7546

Omaha District
Phone: 402-221-7709

Fort Worth District
Phone: 817-886-1872

Louisville District
Phone: 502-315-6300

Huntsville Center
Phone: 256-895-1709

**Military Munitions Support Services (M²S²), Huntsville Center,
Phone: 256-895-1563**

EM 385-1-97
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