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USAF OPERATIONS IN A CHEMICAL AND BIOLOGICAL (CB) WARFARE ENVIRONMENT, DEFENSE EQUIPMENT

DEPARTMENT OF THE AIR FORCE

BY ORDER OF THE SECRETARY OF THE AIR FORCE

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Civil Engineer

USAF OPERATIONS IN A CHEMICAL AND BIOLOGICAL WARFARE ENVIRONMENT, DEFENSE EQUIPMENT

This handbook implements AFPD 32-40, Disaster Preparedness and AFMAN 32-4005, Personnel Protection and Attack Actions. AFH 32-4014, Volume 3, provides Civil Engineer Readiness Flight personnel with general information and technical data concerning fielded chemical and biological warfare defense equipment. The information contained in this guide was extracted from various Air Force Technical Orders and/or equipment manuals. The information contained herein does not supersede any published Technical Order (T.O.), Readiness Training Package (RTP), or equipment manual. Information on planning and analysis, hazards, and defense procedures can be found in Volumes 1, 2, and 4, respectively.

OPR: HQ AFCESA/CEXR (MSgt Steve Reed)
Certified by: HQ AFCESA/CEX (Colonel Randall L. Turner)
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CHAPTER 1 - GENERAL INFORMATION

1.1. Introduction.
The threat of the use of chemical and biological weapons occurs across the spectrum of military operations. The number of nations capable of developing and possessing these weapons is steadily increasing. Nations are receiving these weapons, or means to develop them, through technological transfer, overt or covert direct transfer, or support to belligerent groups or governments. The potential for their use ranges from blackmail or acts of terrorism during peace to escalation during conflict or war.

1.2. Historical Precedence and the Threat Today.
Chemical and biological (CB) operations are not new. Historical records show use of chemicals, smoke, and flame in warfare. During World War I, the Allies and the Germans used them extensively. Many nations developed and manufactured agents during World War II, and some have used these agents since then. CB weapons capabilities, once available to only a select few of the world's most militarily powerful nations, today are in the hands of several emerging and developing nations.

1.2.1. It is increasingly likely the United States could encounter the use of CB at the operational and tactical levels in a regional conflict. Use of these weapons at the operational level could be against rear area targets such as air bases, considered critical to US efforts but far enough removed to permit the use without seriously jeopardizing the attacker's forces. The objective of a CB attack against USAF forces would likely be to cause casualties and degrade operations, greatly reducing sortie generation rates and denying the US the critical advantage of air superiority.

CHAPTER 2 - INDIVIDUAL PROTECTIVE EQUIPMENT

2.1. Groundcrew Chem-Defense Ensemble (GCE)

BDO 8415-01-137-1704 (Medium)

2.1.1. Purpose. The GCE provides the user with whole body protection from solid, liquid, and vapor wartime chemical agents.

2.1.2. Technical Reference. T.O. 14P3-1-141

2.1.3. Training Reference. RTP C11

2.1.4. General Description. Several variations are currently in the USAF inventory. The basic overgarment has two pieces: jacket and pants. The inner layer is charcoal impregnated foam and the outer layer is water repellent nylon/cotton twill.

2.1.5. Components. The GCE includes the overgarment, protective gloves, glove inserts, and footwear covers.

2.1.5.1. BDO: Battle Dress Overgarment.
2.1.5.1.1. 8 sizes available, Woodland Pattern.
2.1.5.1.2. BDO, Desert Pattern (six color).
2.1.5.1.3. BDO, Desert Pattern (three color).

2.1.5.2. Protective gloves: butyl rubber, gauntlet style. Two types: 7 mil and 14 mil thickness. There are four sizes available (small, medium, large, extra large)
2.1.5.2.1. 7 mil provides more dexterity.
2.1.5.2.2. 14 mil are standard issue.

2.1.5.3. Glove inserts: cotton, gauntlet style, three sizes available (small, medium and large).

2.1.5.4. Footwear covers: come in three types: four eyelet, five eyelet, and green or black vinyl overshoes (GVOs/BVOs).
2.1.5.4.1. Four eyelet type, two sizes: small and large.
2.1.5.4.2. Five eyelet type, two sizes: small and large.
2.1.5.4.3. GVO/BVO, available in 12 full sizes (3-14) -- no half sizes available.

2.1.5.3. Multipurpose Overboot (MULO): A one-piece overboot worn over combat or field boots utilizing an integrated strap/clip closure system.
2.1.5.3.1. Future fielding item that will replace current overboots.

2.1.6. Wartime User. All personnel in, or deploying to, a CB threat area.

2.1.7. Fit. Proper size of GCE components is essential to provide whole body protection. The table below describes proper fit of overgarment:

Waist sizes.	Sizes.
Up to 19 inches	XXX Small
19 to 23 inches	XX Small
23.1 to 27 inches	X Small
27.1 to 31 inches	Small
31.1 to 35 inches	Medium
35.1 to 39 inches	Large
39.1 to 43 inches	X Large
43.1 inches Up	XX Large

2.1.8. Service Life. Service life is the amount of time the GCE will provide protection once taken from protective bag. It is influenced by wear, not exposure to air.
2.1.8.1. *BDO*: 22 days once removed from its protective bag. 24 hours after contact with liquid chemical agents.
2.1.8.2. *GVO/BVO*: 14 days once removed from protective bag, provided the bag is free from cracks, tears, and punctures. 12 hours after contact with liquid chemical agents.

2.1.9. Shelf Life. Shelf life is 14 years after date of manufacturer.

2.1.10. Inspection. The individual user is responsible for inspection of the GCE. Inspection must be done prior to use and every 12 months. ***Do Not*** remove any item from its factory bag for the sole purpose of inspection or sizing. Complete inspection of all components is identified in T.O. 14P3-1-141, Table 5-1. As a minimum ensure:
2.1.10.1. Absence of wetting, holes, tears. Check for cleanliness.
2.1.10.2. All fasteners operate properly.
2.1.10.3. Absence of dry rot, brittleness, holes, or tears in the gloves and boots.

2.1.11. Operating Temperatures. All temperatures and humidities.

2.1.12. Donning/Doffing, Decontamination, Operational Use. Complete procedures are identified in T.O.14P3-1-141. Failure to follow T.O. procedures could result in contamination to the individual.

2.2. Joint Service Lightweight Integrated Suit Technology Overgarment (JSLIST OG)
8415 01 444 1238 (Medium regular coat, woodland)
8415 01 444 2310 (Medium regular trousers, woodland)

2.2.1. Purpose. The JSLIST OG provides the user with whole body protection from both liquid and vapor wartime chemical agents.

2.2.2. Technical Reference. T.O. 14P3-1-171

2.2.3. Training Reference. C14 (when published)

2.2.4. General Description. The JSLIST OG is a two-piece, coat and trousers, overgarment with an integral hood that is compatible with existing protective masks. The coat and trousers are issued separately, but worn together as a uniform. The overgarment is made of permeable materials.

2.2.5. Components. The ensemble includes the JSLIST OG, protective gloves, glove inserts, and footwear covers.
2.2.5.1. JSLIST OG Coat: 7 sizes available, Woodland Pattern. 7 sizes available, Desert Pattern.
2.2.5.2. JSLIST OG Trousers: 7 sizes available, Woodland Pattern. 7 sizes available, Desert Pattern.

2.2.5.3. Protective gloves: butyl rubber, gauntlet style. Two types: 7 mil and 14 mil thickness. 7 mil provides more dexterity. 14 mil are standard issue. There are four sizes available (small, medium, large, extra large)
2.2.5.4. Improved CB Protective Glove (ICBPG): A semi-permeable glove in an integrated glove design. Future fielding item that will replace rubber glove/Inserts by attrition.
2.2.5.5. Glove inserts: cotton, gauntlet style, three sizes available (small, medium and large)
2.2.5.6. Footwear covers: come in three types: four eyelet, five eyelet, and green or black vinyl overshoes (GVOs/BVOs): Four eyelet type, two sizes: small and large. Five eyelet type, two sizes: small and large. GVO/BVO, available in 12 full sizes (3-14) -- no half sizes available.
2.2.5.7. Multipurpose Overboot (MULO): A one-piece overboot worn over combat or field boots utilizing an integrated strap/clip closure system. Future fielding item that will replace current overboots.

2.2.6. Wartime User. All personnel in, or deploying to, a CB threat area.

2.2.7. Service Life. Service life is the amount of time the JSLIST will provide protection once taken from protective bag. It is influenced by wear, not exposure to air.

Uncontaminated wear time Whichever comes first:			
After 6 launderings	45 day wear	60 day service life	10 year shelf life
Contaminated wear time:			
24hrs (regardless of type of contamination).			
GVO/BVO: 14 days once removed from protective bag, provided the bag is free from cracks, tears, and punctures. 12 hours (extendible to 24) after contact with liquid chemical agents.			

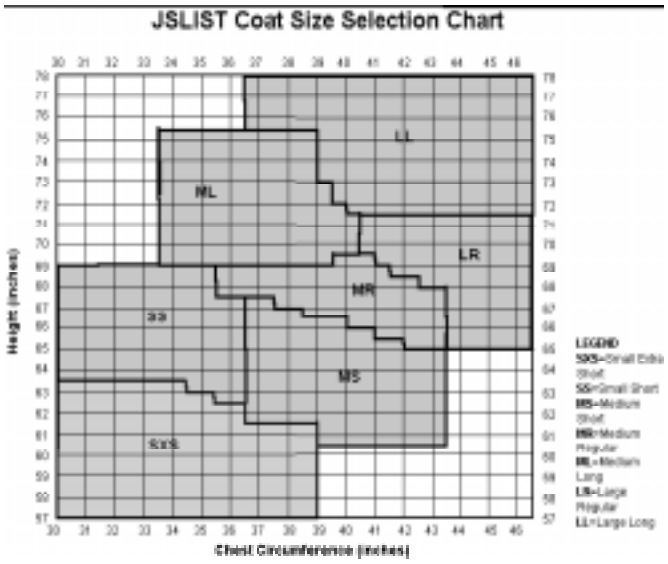
2.2.8. Inspection. The individual user is responsible for inspection of the GCE. Inspections must be done prior to use and every 12 months. ***Do Not*** remove any item from its factory bag for the sole purpose of inspection or sizing. As a minimum ensure:

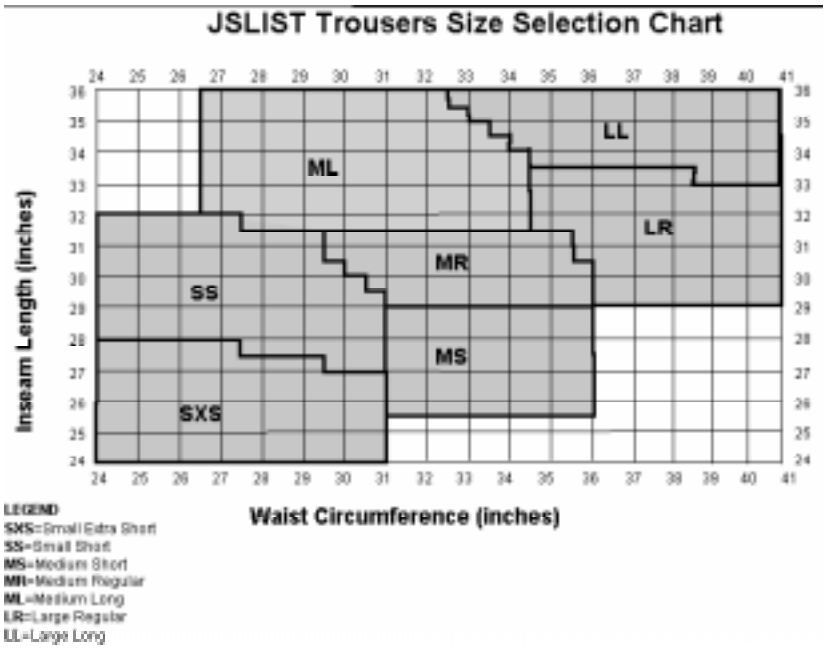
2.2.8.1. Absence of wetting, holes, tears. Check for cleanliness.
2.2.8.2. All fasteners operate properly.
2.2.8.3. Brittleness, holes, or tears in the gloves and boots.
2.2.8.4. Complete inspection of all items listed in T.O. 14P3-1-171.

2.2.9. Operating Temperatures. All temperatures and humidities.

2.2.10. Donning/Doffing, Decontamination, Operational Use. Complete procedures are identified in T.O.14P3-1-171. Failure to follow T.O. procedures could result in contamination to the individual.

2.2.11. Fit. Proper size of JSLIST components is essential to provide whole body protection. The tables below describes proper fit of overgarment:


JSLIST Coat Size Selection Chart
LL
ML
LR
MR
MS
Height (inches)
Chest Circumference (inches)
LEGEND
SS=Small Short
MS=Medium Short
MR=Medium Regular
ML=Medium Long
LR=Large Regular
LL=Large Long


JSLIST Trousers Size Selection Chart
Inseam Length (inches)
Waist Circumference (inches)
SXS
SS
MS
MR
ML
LR
LL
LEGEND
SXS=Small Extra Short
SS=Small Short
MS=Medium Short
MR=Medium Regular
ML=Medium Long
LR=Large Regular
LL=Large Long

2.3. Mask, MCU-2A/P
2A/P: 4240-01-284-3615 thru 3617

2.3.1. Purpose. The MCU-2A/P mask with a serviceable canister filter installed protects the faces, eyes, and respiratory tract from chemical and biological warfare agents and radioactive dust particles. A properly worn mask provides a gas-tight face seal which prevents unfiltered air from reaching the wearer's respiratory system.

2.3.2. Technical Reference. T.O. 14P4-15-1 and T.O. 14P4-1-151

2.3.3. Training Reference. RTP C10

2.3.4. Operational Limitations. This mask is not authorized for use during industrial chemical spills. Chemicals of this nature normally require a self-contained breathing apparatus. For example, the mask would not be effective against chemicals such as ammonia, chlorine, or even carbon monoxide fumes. The mask is not effective in confined spaces when there is insufficient oxygen to support life. The MCU-2A/P mask is simply a filter respirator; it does not supply or produce oxygen.

2.3.5. Features. The MCU-2A/P has the following features:

2.3.5.1. Two voicemitters: the front one is for face-to-face speech and the side one is for use with communications equipment.
2.3.5.2. Flexible lens: permits use of binoculars, a gunsight, or other optical equipment.
2.3.5.3. Drinking tube: enables the user to drink from a canteen having an M1 canteen cap.

2.3.6. Mask Size. The mask comes in three sizes (short, medium, long). Correct mask size is determined by facial measurements. A spring caliper, vernier dial, and/or the M-41 Protection Assessment Test System (PATS) is required to determine proper fit. Proper mask size will be determined upon issue.

2.3.7. Inspection and Documentation. The user must inspect the mask upon issue, every six months during peacetime, and every seven days during wartime. Document the mask's inspection on a DD Form 1574 (Serviceability Tag) or data automated product. When a serviceable C-2 canister is installed, annotate the canister lot number and the date it was installed in the remarks section of the DD Form 1574 or in an area designated on the data automated form.

2.3.8. Familiarization and Inspection of Components. The MCU-2/AP mask consists of the following components:
2.3.8.1. Facepiece: The facepiece is molded of silicone rubber which forms an effective seal on the face. Ensure it's not cracked or deteriorated.
2.3.8.2. Head Harness: The head harness holds the mask to the face. It has six elastic straps, a headpad, and a quick-don pull tab. Ensure the head harness has elasticity for a proper seal.
2.3.8.3. Voicemitters: Voicemitters are located on the center and either side of the facepiece. The voicemitters transmit the user's voice outside the mask. The side voicemitter is useful when using phones, radios, or other communications equipment. Always make sure these voicemitters aren't damaged and are tightly seated.

2.3.8.4. Outlet Valve Assembly: The outlet valve assembly has a one-way valve at the bottom of the facepiece. The valve should be replaced if it's damaged or doesn't seat properly.
2.3.8.5. Outlet Valve Cover: The outlet valve cover is a rubber cover that holds the drinking tube coupling. It fits over the end of the outlet valve body and can be easily replaced if torn, dry rot or otherwise damaged.
2.3.8.6. Drinking Tubes: The external and internal drinking tubes are rubber tubes used with the M1 canteen cap to provide water to the wearer. The tubes shouldn't have any breaks or leaks in it.
2.3.8.7. Nosecup: The nosecup is made of silicone rubber and is located inside the facepiece. The nosecup helps prevent the mask from fogging by allowing air to enter through two nosecup valves and keeping warm air off the eyelens. This is not a replacement item.
2.3.8.8. Inlet Valve Assembly: The inlet valve assembly consists of a one-way valve disc and an air deflector assembly. As always, when inspecting any disks make sure they're flat; not ripped or curled.
2.3.8.9. Lens: The lens is made of transparent urethane and provides a wide field of vision. The lens must be free from stains, excessive scratches, and cracks.
2.3.8.10. Outsert: Check for scratches and damage.
2.3.8.11. Canister. The C-2 canister is made with layers of impregnated charcoal which provide the filtration. The canister must be free from dirt, debris, and water. Check it for physical damage around the seams and threads.

2.3.9. Accessories. The mask also has the following accessories:
2.3.9.1. Mask carrier.
2.3.9.2. Protective hood.
2.3.9.3. Mask outsert. The outserts are clear or tinted polycarbonate shells. The outserts protect the lens from scratches, chemical droplets, and oil and petroleum products.
2.3.9.4. Special canteen cap. The MCU-2A/P is designed to allow the wearer to drink from a canteen while wearing the mask. The canteen must have the M1 cap installed in order to use the drinking system.

2.3.9.5. Waterproofing bag. The waterproofing bag will be used to store the mask when operating in extremely wet areas. This will protect the filter elements from getting wet.
2.3.9.6. Spectacles inserts.

2.3.10. Wartime User. All personnel in, or deploying to, a CB threat area.

2.3.11. Care and Use. When the MCU-2A/P series mask is issued, all maintenance is the responsibility of the user.

2.3.12. Operational Factors. The MCU-2A/P series mask remains serviceable as long as it meets operational inspection IAW T.O. 14P4-15-1. C2 canister(s) must be replaced after CB contamination or shelf life expiration.
2.3.12.1. When directed by higher authority or a clear indication of chemical use.
2.3.12.2. 15 days have elapsed after exposure to chemical-biological agents (except blood agent)
2.3.12.3. Exposure to BLOOD agent has occurred.
2.3.12.4. Shows evidence of mechanical damage such as breaks or cuts in material or edge of seal, a bent or split connector, etc.
2.3.12.5. Immersed in water or wetted in anyway.
2.3.12.6. Excessive breathing restriction is experienced.
2.3.12.7. Filters have been exposed for two months in tropical climates. (Panama, Puerto Rico, etc.)
2.3.12.8. Filters have been exposed for 12 months in temperate climates. (Korea, Europe, etc.)
2.3.12.9. Filters have been exposed for 24 months in arctic climates. (Alaska, etc.)

2.3.13. Fitting. With the mask ready for fitting (canister installed, head harness straps loose and reversed over the front of the mask, and the outsert removed) you can fit the mask as follows:

2.3.13.1. Place mask on face, keeping the hair out of the way and pull the head harness over the head using the quick don tab.
2.3.13.2. Tighten temple straps, one at a time, using small jerking pulls until the mask feels snug.
2.3.13.3. Check that the headpad is centered at the high point of rear of head. Adjust if necessary.
2.3.13.4. Tighten the neck straps then the forehead straps in the same manner.
2.3.13.5. The mask should be comfortable on the face with no straps cuttings or pinching. The mask should not be so tight the nosecup presses painfully on the nose.
2.3.13.6. While wearing the mask, with the head harness properly adjusted, check the internal and external drinking tubes for a secure fit.
2.3.13.7. The last thing to check when fitting the mask is to perform a negative pressure check ("leak check") by pressing your palm over the end of the canister and inhaling. The mask will deflect and you shouldn't feel any air entering your mask. You will have to check and adjust your mask if leaks occur.
2.3.13.8. You can now remove the mask. Loosen ONLY the mask neck straps. Grasp mask by pulling outlet valve assembly and remove by pulling down, outward, and up.

2.3.14. Donning And Doffing Mask (With Hood Attached). Due to the short time it takes for toxic agents to affect you, becoming an expert in donning the mask and getting an air tight seal is imperative. With suspected contamination, every step in donning the mask is important and must be done quickly and accurately. You must put the mask on before you take another breath.

WARNING

Perform the steps for putting on our mask quickly. You must put the mask on before you take another breath. Toxic agents may be in the surrounding air and cause sickness or death.

2.3.14. Donning. Donning the mask with hood attached should take place in 15 seconds. This allows you to don the mask and get an airtight seal in nine seconds with an additional six seconds to pull the hood over the head and tighten the neck cord. Follow these steps in this order:

2.3.15.1. STOP BREATHING!

2.3.15.2. Close eyes tightly.

2.3.15.3. Remove headgear.

2.3.15.4. Remove mask and hood from carrier.

2.3.15.5. Hold outlet valve assembly in palm of one hand. Using free hand, push forehead hair aside. Place mask on face forcing the chincup very tightly against chin. Pull headharness over head using the quick-don tab.

2.3.15.6. Grasp a neck strap in each hand and tighten with small jerking motions. The neck straps should be the only straps adjusted. Temple and forehead straps are adjusted when you fit the mask and then left in position.

2.3.15.7. Expel air held in the lungs.

2.3.15.8. Press palm of one hand over the canister opening. Inhale to determine whether an airtight seal of mask against face has been obtained.

2.3.15.9. Open eyes and RESUME NORMAL BREATHING.

2.3.15.10. Pull back of hood over your head so the hood covers your head. Drape cape over shoulders. Make sure the cape is under neck cord.

2.3.15.11. Use neck cord fastener to tighten neck cord until hood is held snugly around neck.

2.3.15.12. Pass straps under arms. Fasten ends to front of cape.

2.3.15.13. Replace headgear and close the carrier.

WARNING

You must check the mask for leaks when it is fitted and each time you put it on. A leaky mask will not protect you from toxic agents which can cause sickness or death.

2.3.16. Doffing. Doffing the mask involves these five steps:
2.3.16.1. Unfasten underarm straps and loosen neck cord.
2.3.16.2. Pull back of cape forward over head and leave hood suspended from front of mask.
2.3.16.3. Loosen ONLY the mask neck straps. Grasp mask by pulling outlet valve assembly and remove by pulling down, outward, and up.
2.3.16.4. Shake or wipe any moisture or frost accumulations from inside of hood and mask.
2.3.16.5. Properly stow mask in carrier.

2.3.17. Hood. To increase operational efficiency, you must make sure certain adjustments to the hood based on temperatures. In moderate temperature (between 30^{o} to 90^{o} degrees Fahrenheit), place the hood over the voicemitter/outlet valve cover. The exhausted air inflates the hood and helps prevent contaminated air from entering the hood. In extreme weather -- cold (below 30^{o} F) or hot (above 90^{o} F), uncover the voicemitter/outlet valve cover. In cold weather, this prevents condensed moisture from freezing inside the hood or from dripping into your clothing. In hot weather, it prevents extreme heat and humidity buildup inside the hood.

2.3.18. Repair. The mask has no repair parts. All repair is accomplished using replacement parts. Defective parts other than those listed in the T.O. are cause for mask replacement. If mask replacement is required keep all serviceable parts – replacement masks only include the facepiece.
2.3.18.1. Have the proper size. Ensure you have a proper size mask by using the proper measuring caliper. A leaking mask will not protect against toxic agents.
2.3.18.2. Don't over tighten the mask. Over tightening may actually cause leaks.
2.3.18.3. Check the mask for leaks every time you put it on by performing your negative pressure or "leak" check.

2.3.18.4. Don the mask quickly. Remember it should be on and sealed before you take another breath.
2.3.18.5. Remember the limitations. The MCU-2/P Series Mask is not intended for industrial chemical use and is not effective in confined spaces where there is not enough oxygen to support life.
2.3.18.6. When wearing the mask with the hood over the outlet valve do not loosen the straps of the head harness for comfort. If the straps are loosened, the wearer is in danger of suffocation by carbon dioxide and unprotected against toxic agents.
2.3.18.7. If you become overheated in cold weather, do not remove your mask outdoors until your head cools and sweat has dried. Frostbite may result if the mask is removed while your face is still wet.
2.3.18.8. A serviceable C-2 canister must be installed in the MCU-2/P Series Mask prior to use in a toxic chemical or biological environment.

2.3.19. Cleaning. Clean the mask with mild liquid detergent and warm water. Alcohol towelettes may be used for expedient sanitation. Do not place the mask in boiling water. Do not wash the canister. Do not dry wipe the mask lens to avoid scratching.

2.3.20. Decontamination. The mask and hood should be decontaminated as soon as practical after CB contamination has occurred. Perform immediate decontamination using the M258A1 or M295 decontamination kits. Perform operational and thorough decontamination in accordance with the T.O.

2.4. Mask, M17A2
4240-01-143-2017

2.4.1. Purpose. The M17A2 mask, with serviceable M13A2 filters installed, protects the faces, eyes, and respiratory tract from chemical and biological warfare agents and radioactive dust particles. A properly worn mask provides a gas-tight face seal which prevents unfiltered air from reaching the wearer's respiratory system.

2.4.2. Technical Reference. T.O. 14P4-9-31 and T.O. 14P4-1-151

2.4.3. Training Reference. RTP C9

2.4.4. Operational Limitations. This mask is not authorized for use during industrial chemical spills. Chemicals of this nature normally require a self-contained breathing apparatus. For example, the mask would not be effective against chemicals such as ammonia, chlorine, or even carbon monoxide fumes. The mask is not effective in confined spaces when there is insufficient oxygen to support life. The M17A2 mask is simply a filter respirator; it does not supply or produce oxygen.

2.4.5. Mask Size. The M17A2 X-small is the only mask of this type still being fielded. The M-41 Protection Assessment Test System (PATS) is required to determine proper fit.

2.4.1. Inspection and Documentation. The user must inspect the mask upon issue, every six months during peacetime, and every seven days during wartime. Document the mask's inspection on a DD Form 1574 (Serviceability Tag) or data automated product. When serviceable M13A2 filters are intsalled, annotate the lot number and the date it was installed in the remarks section of the DD Form 1574 or in an area designated on the data automated form.

2.4.2. Familiarization and Inspection of Components. The M17A2 mask consists of the following components:

2.4.7.1. Faceblank: Provides the sealing surface of the mask. Pouches molded in the cheeks hold the filter elements. Deflector tubes direct filtered air across the eyelenses. Inspect it for damage and dryrot and serviceable lot numbers.

2.4.7.2. Nosecup: Prevents fogging of the eyelenses by diverting air through the outlet valves. Two nosecup valve assemblies, consisting of valve discs and seats, permit filtered air to enter nosecup, but prevent exhaled air from contacting the eyelenses. Inspect for damage, distortion, proper attachment, and positioning.

2.4.7.3. Eyelenses and Outserts: The eyelenses are made of clear glass and are held in place by aluminum alloy eyerings. The outserts protect the glass eyelenses from damage and reduces exterior fogging. Inspect for condition of the lenses, looseness, and leakage.

2.4.7.4. Head Harness: Holds the faceblank to the wearer to provide an airtight seal. Inspect for tears and/or lack of elasticity.

2.4.7.5. Voicemitter Outlet Valve Assembly: Permits the wearer to communicate and to exhale air while preventing unfiltered air from entering. A cover surrounds the voicemitter outlet valve assembly to protect the valve seat and disk. Exhaled air passes through four holes molded in

the lower edge of the cover. Inspect for damage, condition of valve disc, and leakage.
2.4.7.6. Clip And Buckle Assembly: Provides adjustable mounts for the headharness at six locations. Inspect for condition and operation.
2.4.7.7. Flap Buttons: Fastens the filter pouch flaps so that filtered air will not escape into the main cavity of the mask except through the deflector tubes.
2.4.7.8. Inlet Valve Assemblies: Air enters the filter elements through the inlet caps and discs and prevents air from flowing back out through the filter element. They also protect the filter elements from rain, snow, course particles, and physical damage. They fit over the connectors on the filter elements. Inspect for damage to caps and discs, curling, tears, proper functioning.
2.4.7.9. Filters: Are located in pouches inside the mask. Filters have different capabilities depending on their type.
2.4.7.10. Carrier - you may carry the mask in its carrier strapped to your waist or hung over your shoulder. Inspect for damage, wear, and missing components.

2.4.8. Accessories. There are some basics accessories associated with the M17A2:
2.4.8.1. Special canteen cap. The M17A2 is designed to allow the wearer to drink from a canteen while wearing the mask. The canteen must have the M1 cap installed in order to use the drinking system.
2.4.8.2. Waterproofing bag. The waterproofing bag will be used to store the mask when operating in extremely wet areas. This will protect the filter elements from getting wet.
2.4.8.3. Spectacles inserts.
2.4.8.4. Winterization kit. The winterization kit is installed only when field operations in subzero temperatures are anticipated. Once installed, the winterized discs are not removed when the ambient temperature rises above freezing.

2.4.9. Wartime User. All personnel in, or deploying to, a CB threat area.

2.4.10. Care and Use. When the M17A2 mask is issued, all maintenance is the responsibility of the user.

2.4.11. Operational Factors. The M17A2 series mask remains serviceable as long as it meets operational inspection IAW T.O. 14P4-9-31. M13A2 filters are the serviceable filters for the M17A2 mask. GREEN colored connector ring can visually identify the M13A2s. Other colors may be used for training, but are not considered serviceable. M13A2 filters must be replaced after CB contamination or shelf life expiration.
2.4.11.1. When directed by higher authority or a clear indication of chemical use.
2.4.11.2. 15 days have elapsed after exposure to chemical-biological agents (except blood agent)
2.4.11.3. Exposure to BLOOD agent has occurred.
2.4.11.4. Shows evidence of mechanical damage such as breaks or cuts in material or edge of seal, a bent or split connector, etc.
2.4.11.5. Immersed in water or wetted in anyway.
2.4.11.6. Excessive breathing restriction is experienced. Excessive breathing resistance is experienced (clogged filter element will increase breathing resistance, but will not impair the ability of filter to remove agents)
2.4.11.7. Filters have been exposed for two months in tropical climates. (Panama, Puerto Rico, etc.)
2.4.11.8. Filters have been exposed for 12 months in temperate climates. (Korea, Europe, etc.)
2.4.11.9. Filters have been exposed for 24 months in arctic climates. (Alaska, etc.)

2.4.12. Fitting. The mask will be fitted using the following procedures:
2.4.12.1. Loosen the head harness straps and don the mask.
2.4.12.2. Hold the mask firmly against the chin and center the head harness pad in the middle of the back of the head.
2.4.12.3. Hold it there with one hand.

2.4.12.4. Remove the hand from the chin position and tighten each of the forehead straps with a rapid pull or jerk (just enough to remove any slack).
2.4.12.5. Tighten bottom straps with a rapid pull or jerk, followed by the middle straps with steady, simultaneous pull toward the back of head.
2.4.12.6. Examine eye positions to see that the eyes are centered in the eyelenses.
2.4.12.7. Check to see that the nosecup does not press painfully on the nose of the edge or that the mask does not cut into the wearer's throat.
2.4.12.8. Check to be sure that the edge of the mask does not touch the ears.
2.4.12.9. Proper fit is attained when the mask comes well up on the forehead and the edge of the facepiece is close to the ears.

2.4.13. Sealing. Test for a proper seal of the mask. This will determine if there are leaks. Test for leaks by pressing the palms of the hands firmly over the inlet valve cover openings. Do not press too hard as to distort the mask. Block the inlets, inhaling normally and holding your breath for 10 seconds. If the facepiece collapses and remains collapsed during this test period, you should have an effective airtight seal. Locate the leak and eliminate the cause if the mask does not properly seal.

2.4.14. Donning And Doffing. Your mask should already be fitted to your face; therefore, it's just a matter of quickly donning your mask to ensure survivability. Due to the short time from agent detection to mask donning, the wearer must become an expert in donning the mask and getting an airtight seal in only nine seconds with an additional six seconds to adjust the hood when attached.

WARNING

Perform the steps for putting on our mask quickly. You must put the mask on before you take another breath. Toxic agents may be in the surrounding air and cause sickness or death.

2.4.15. Donning. Don the mask in the following order:
2.4.15.1. Stop breathing and close eyes.
2.4.15.2. Remove headgear and place between knees.
2.4.15.3. Remove Mask. With the left hand, open the carrier. Reach into the carrier and, with the right hand, grasp the carrier by the voicemitter-outlet valve assembly and remove the mask.
2.4.15.4. Don Mask. Grasp the lower head harness straps near the buckles. With the hands on the headharness straps, pull the mask up onto the face. Settle the chin snugly in the chin pocket of the facepiece and place the head pad in the middle of the back of the head.
2.4.15.5. Clear Mask. Place the palm of one hand firmly over the openings in the bottom of the voicemitter-outlet valve assembly cover. Clear the mask by forcing exhaled air to escape around the facepiece and clearing the mask of contaminated air.
2.4.15.6. Seal Mask. Press the palms of the hands over the inlet valve assemblies and inhale to ensure an airtight seal.
2.4.15.7. Open eyes and resume breathing.

WARNING

You must check the mask for leaks when it is fitted and each time you put it on. A leaky mask will not protect you from toxic agents which can cause sickness or death.

2.4.15.8. Once the mask is on, pull the back of the hood over the head so that the hood covers the head. Drape the cape over the shoulders and make sure the cape is under the neck cord. Fasten the neck cord and underarm straps. Don your headgear and close the carrier.

2.4.16. Doffing. To doff the mask:
2.4.16.1. Unfasten the underarm straps, loosen the neck cord, pull the hood over in front of the mask, and remove the mask.
2.4.16.2. Shake or wipe the moisture or frost accumulation from the inside of the hood and mask.

2.4.16.3. Gather the cape of the hood to one side of the facepiece and replace the mask and hood in the carrier.

2.4.17. Hood. To increase operational efficiency, you must make sure certain adjustments to the hood based on temperatures. In moderate temperature (between 30^{o} to 90^{o} degrees Fahrenheit), place the hood over the voicemitter/outlet valve cover. The exhausted air inflates the hood and helps prevent contaminated air from entering the hood. In extreme weather -- cold (below 30^{o} F) or hot (above 90^{o} F), uncover the voicemitter/outlet valve cover. In cold weather, this prevents condensed moisture from freezing inside the hood or from dripping into your clothing. In hot weather, it prevents extreme heat and humidity buildup inside the hood.

2.4.18. Repair. The mask has no repair parts. All repair is accomplished using replacement parts. Defective parts other than those listed in the T.O. are cause for mask replacement.

2.4.19. Operational Safety Tips. Safety is paramount when using any protective equipment.

2.4.19.1. Ensure you have a proper fit on your mask. A leaking mask will not protect against toxic agents. Don't over tighten the mask. Over tightening may actually cause leaks.

2.4.19.2. Check the mask for leaks every time you put your mask on.

2.4.19.3. Don the mask quickly. Remember it should be on and sealed before you take another breath. It should only take you nine seconds to don, clear, and seal the mask.

2.4.19.4. The M17A2 is not intended for industrial chemical use and is not effective in confined spaces where there is not enough oxygen to support life.

2.4.19.5. When wearing the mask with the hood over the outlet valve, do not loosen the straps of the head harness for comfort. If the straps are loosened, the wearer is in danger of suffocation by carbon dioxide and unprotected against toxic agents.

2.4.19.6. If you become overheated in cold weather, do not remove your mask outdoors until your head cools and sweat has dried. Frostbite may result if the mask is removed while your face is still wet.
2.4.19.7. Serviceable M13A2 filters must be installed in the M17A2 prior to use in a toxic chemical or biological environment.

2.4.20. Cleaning. Clean the mask with mild liquid detergent and warm water. Alcohol towelettes may be used for expedient sanitation. Do not place the mask in boiling water. Do not wash the filters. To clean the mask, prepare a solution of warm soapy water (ideally 110^{o} to 125^{o} degrees Fahrenheit.)
2.4.20.1. Remove the hood and eyelens outserts.
2.4.20.2. Remove the filter elements.
2.4.20.3. Remove the headharness.
2.4.20.4. Remove the voicemitter cover.
2.4.20.5. Wash the mask thoroughly inside and out with the warm soapy water using a sponge or soft cloth.
2.4.20.6. Rinse thoroughly with clear water.
2.4.20.7. Allow the mask to dry ensuring all water is gone (Especially inside the filter pouches.).
2.4.20.8. Replace everything you took off the mask.
2.4.20.9. You can use warm soapy water as well to clean the hood.
2.4.20.10. Soiled carriers should be cleaned by dry brushing or by brushing with a wet brushed dipped in water.

2.4.21. Decontamination. The mask and hood should be decontaminated as soon as practical after CB contamination has occurred. Perform immediate decontamination using the M258A1 or M295 decontamination kits. Perform operational and thorough decontamination in accordance with the T.O.

CHAPTER 3 - INDIVIDUAL DETECTION EQUIPMENT

3.1. M8 Paper, Chemical Agent Detection

NSN 6665-00-050-8529

3.1.1. Purpose. The M8 paper will detect liquid G and V nerve agents and H blister agents. M8 paper provides the user with a manual liquid detection capability.

3.1.2. Technical Reference. T.O. 11H2-14-5-1

3.1.3. Training Reference. RTP F1

3.1.4. General Description. M8 paper comes with 25 sheets of chemically treated paper bound into a cardboard cover booklet. The cover shows a color comparison chart and describes general instructions for use. The booklet is four inches by two inches in size.

3.1.5. Wartime User. All personnel in, or deploying to, a CB threat area.

3.1.6. Inspection. Inspect M8 paper prior to use. Discard any M8 paper that shows signs of wetness, wrinkling, dirt, damage, or discoloration. If M8 paper is out of its original plastic package, and the immediate user did not remove it from the package, discard the M8 paper.

3.1.7. Operation. When liquid nerve or blister agents contact M8 paper, a color change takes place. This color change is used to make an initial assessment of the presence of liquid nerve or blister agent. **Never** use the results from M8 paper as the sole indicator that liquid nerve or blister agents are present.

GOLD	**RED**	**GREEN**
G-Series Nerve	H-Series Blister	V-Series Nerve
If the paper turns red brown, it is an indication that a certain nerve (G) agent is present. This positive indication is not represented on the color comparison chart inside the cover. Do not check M8 paper with a colored light, because you will not see liquid chemical agent red spots.		

3.1.8. Operational Use. M8 paper detects either through an active or passive method.

3.1.8.1. Active - Remove a sheet of M8 paper and dip the paper into the liquid, or blot the area, to be tested. ***Do Not*** scrub or rub M8 paper on suspected contaminated surfaces as false positives may result. Observe the paper for color changes. Compare the color changes against those on the inside booklet cover. ***Do Not*** touch paper to booklet.

3.1.8.2. Passive - Remove a sheet of M8 paper. Secure the sheet to any object in an area that would most likely receive contamination (building, vehicle). Periodically check paper for color changes. Compare the color changes against those on the inside booklet cover. ***Do Not*** touch paper to booklet.

3.1.9. Operational Limitations. M8 paper will function in snow, rain, and sleet. However, if the M8 paper becomes saturated with water, false color changes can occur. M8 paper reaction is immediate at temperatures above 32°F. At temperatures below 32°F, reaction time may take up to two minutes. The B1 dye that M8 paper is treated with will deteriorate rapidly at temperatures above 125°F.

3.1.10. Decontamination. Discard as contaminated waste.

3.2. M9 Chemical Agent Detector Paper

NSN 6665-01-049-8982

3.2.1. Purpose. The M9 paper will detect G and V Nerve agents and H and L blister agents. M9 paper manually provides a visual image of liquid chemical agent droplets. When worn on protective clothing or attached to equipment, M9 paper provides one rapid assessment of detection.

3.2.2. Technical Reference. T.O. 11H2-2-21

3.2.3. Training Reference. RTP F1

3.2.4. General Description. M9 paper comes in a dispenser with one 30-foot roll of 2-inch paper. The dispenser is 2.5 inches long, 3.5 inches wide and 3.25 inches high. Each dispenser comes with a resealable plastic storage bag.

3.2.5. Wartime User. All personnel in, or deploying to, a CB threat area.

3.2.6. Operating Range. 32°F to 125°F, with relative humidity between 0 - 99%.

3.2.7. Operational Life. 1 year in temperate, tropic, and desert regions. 2 years, in frigid zones after removal from the shipping bag.

3.2.8. Shelf Life. The shelf life is six years from manufacturer's date, non-extendible.

3.2.9. Inspection. Inspection is a user responsibility. Inspect equipment to include:
3.2.9.1. Shipping bag and dispenser. If shipping bag is torn or open, discard roll.
3.2.9.2. Check for shelf life date that is stamped on the dispenser. Discard if shelf life has expired.
3.2.9.3. If dispenser is crushed, wet or cutting edge is missing, discard.
3.2.9.4. Check paper for discoloration, tears, creases, or dirt. If paper comes apart from backing, discard.
3.2.9.5. Detector paper is serviceable unless the paper will not stick or the paper is dirty or greasy.
Note: ***Do Not*** open shipping bag until ready for use; operational life of detector paper will be shortened.

3.2.10. Operational Procedures. Tear open shipping bag and remove dispenser and reusable storage bag. (Store M9 paper in plastic bag when not in use.) Write the current date on dispenser. This date determines the paper's operational life. Remove cutting edge cover and discard. Start paper through slot on dispenser with thumb or finger. Separate backing from paper; backing should be exposed on one end of the dispenser and paper on the other. Tear paper off about an inch from dispenser. Dispenser is now ready for the next use.

3.2.11. Operational Use. M9 paper can be attached to protective overgarment or equipment.
3.2.11.1.Overgarment: Attach paper to arm, wrist and ankle. Use the buddy system to place paper on clothing. Configuration for wear is in T.O. 11H2-2-21. Overlap paper about an inch around each limb to prevent paper

from coming loose. Paper must not be too tight around clothing or tears will appear.
3.2.11.2. Equipment: Attach to vehicles, equipment, or supplies where it can be seen. Attach detector paper on horizontal surfaces. For easy removal, make a tab by folding adhesive side to adhesive side. When attaching to equipment items, wrap detector paper around some part of the equipment where it can attach adhesive side to adhesive side.

3.2.12. Paper Detection. M9 paper will turn different colors if liquid agent comes in contact with paper. Color changes to M9 paper identify agent presence, Not Agent Type. Positive liquid agents: pink, red, red-brown, red-purple. Blue, yellow, green, gray, or black spots are not from a liquid chemical agent.

3.2.13. Operational Limitations. The following is a list of items that cause false responses to M9 paper. Refer to T.O. 11H2-2-21 for complete list.
3.2.13.1. Temperatures above 125°F.
3.2.13.2. Brake fluid, hydraulic fluid, gasoline, aircraft and automotive grease.
3.2.13.3. DS-2 decontamination solutions.
3.2.13.4. Insect repellent.

3.2.14. Decontamination. Discard as contaminated waster.

3.3. M256A1 Chemical Agent Detector Kit

NSN 6665-01-133-4964

3.3.1. Purpose. The M256A1 kit manually detects and classifies nerve, blister, and blood agents in vapor or liquid form. The M256A1 sampler-detectors are capable of detecting and identifying vapors only. The M8 paper provided is to identify liquid agents.

3.3.2. Technical Reference. T.O. 11H2-21-1

3.3.3. Training Reference. RTP F2

3.3.4. General Description. The M256A1 kit contains 12 individually wrapped sampler-detectors, one book of M8 detector paper, and a set of operational instruction cards packaged in a plastic carrying case. The olive drab plastic carrying case is 7 inches wide, 3 inches deep, and 5 inches high.

3.3.5. Components.

3.3.5.1. Carrying case: Plastic shell, with a shoulder strap attached to bottom of case.

3.3.5.2. Sampler-detectors: 12 individually wrapped packets. The detectors consist of: Blood and Nerve agent detector spots and ampoules with a protective strip; Blister agent detector spots, ampoules, and a heating assembly used in the testing process; Lewisite detecting tablet and rubbing tabs.
3.3.5.3. M8 Paper: 1 booklet of chemically treated paper.
3.3.5.4. Operational instruction cards: 4 cards.

3.3.6. Wartime User. M256A1 kits are normally limited to those personnel assigned to chemical detection duties such as reconnaissance and shelter management teams. Prior to using the kit assume the proper MOPP level.

3.3.7. Operating Range. Between -25°F and 120°F.

3.3.8. Agents Detected.

Cyanogen Chloride	CK	Blood
Mustard	H	Blister
Nitrogen Mustard	HN	Blister
Distilled Mustard	HD	Blister
Phosgene Oxime	CX	Blister
Hydrogen Cyanide	AC	Blood
Nerve Agents	V and G Series	Nerve
Lewisite	L	Blister

3.3.9. Operational Limitations. The detector packages are a one-time use item. If any of the following conditions exist, ***Do Not*** use: outdated detector packages, discolored detector samples, open detector packages, or water soaked samplers. Avoid direct sunlight on sampler when operating. Avoid sampling in smoke and do not touch individual detector test spots.

3.3.10. Inspection: Inspect prior to use and annually. Verify the manufacture's date, stamped on cover of carrying case, prior to use.

M256A1 kits are serviceable for 5 years from manufacture date. Complete inspection procedures identified in T.O. 11H2-21-1.

3.3.11. Operational Use. Keep in mind the **Cautions** and **Warnings** identified in the T.O. before using this kit. Complete procedures are identified on the Operational Instruction Cards. Prior to using the kit assume the proper MOPP level. Testing with the M256A1 takes about 20 minutes and is just one of a number of sources used to determine the presence and extent of chemical contamination. When you conduct testing, it is just as important to provide negative as well as positive results. However, when checking for blood agents, a re-check is necessary if the first results are positive. This is due to mercuric cyanide used in the blister agent testing which could possibly be mistaken for hydrogen cyanide, a type of blood agent. If the blood agent test is positive both times, call in a positive result. When performing chemical testing, one ideal place to monitor is around or above suspected areas of liquid agents. By using a box or can, you can trap the vapors above the liquid for a better concentration.

3.3.12. Operating the M256A1 Detector Kit. Breaking the ampoules spreads the liquid contained in them over the separate testing spots. When in contact with a chemical agent vapor, the liquid will react and change colors on the test spot. This color change indicates a positive or negative result. The lewisite tab works the same except it uses a tablet instead of liquid. An initial rub mark is made on the tab for a color comparison, against a second rub mark. The following indications summarize the test results:

Lewisite	After ten minutes of exposure time Remember, your first rub mark was a tan color	1. Positive if the mark is olive drab after rerub. 2. Negative if mark is tan after rerub
Blister	Square test spot (immediately after all ampoules are broken)	3. Positive for H agent if purple or blue. 4. Positive for CX agent if red or purple. 5. Negative if colorless (if temperature is high it may be faint blue).
Blood	Round test spot (after ten minutes of exposure time)	6. Positive if pink or blue. 7. Negative if yellow, orange, tan, or colorless.
Nerve	Star test spot (wait about three minutes after exposure)	8. Positive if colorless or peach. 9. Negative if blue.

3.3.13. Unusual Conditions. There are some special considerations based on weather conditions. The procedures vary when using the kit in cold weather as well as using the kit in a tropical climate.

3.3.13.1. Extend the wait times for the test spot by six minutes when temperatures are between 32° and 50° degrees Fahrenheit or 0° and 10° degrees Celsius.

3.3.13.2. Below 32 degree Fahrenheit (0°C) the reagent solution may freeze. You must thaw it prior to use.

3.3.13.3. Retain a small amount of reagent after crushing ampoule marked "3" in desert conditions, defined as high temperature and low humidity. Rewet the nerve agent test spot after five minutes by squeezing the remaining reagent from the ampoule "3" onto the nerve agent test spot.

3.3.13.4. For tropic conditions, a faint blue color may appear in ABSENCE of blister agents H and HD. Otherwise, operation of the kit is the same as it is for usual conditions. When judging the results, special

care must be taken with the Lewisite rub marks. Since changes in color may be vary slight, check the results with a second rub mark before making a decision.

3.3.13.5. Protect the sampler-detector from rain or snow as much as possible. Cover the detector with your body or use it under a roof or cover. You could also use the same can or box that you used to trap vapors.

3.3.14. Decontamination. The carrying case is the only component that can be decontaminated. All the internal components must be destroyed as hazardous waste if contaminated. Decontaminate carrying case with standard M258A1 or M295 kits. Follow procedures listed for use of the decontaminating kits.

CHAPTER 4 - DECONTAMINATION EQUIPMENT

4.1. M258A1 Personal Decontamination Kit

NSN 4230-01-101-3984

WARNING

The solutions are poisonous and caustic. Never allow solutions to contact eyes, mouth, or wounds.

4.1.1. Purpose. The M258A1 kit provides the individual with a portable, expedient, method of decontaminating the skin of liquid nerve and blister agents.

4.1.2. Technical Reference. T.O. 11D1-1-111

4.1.3. Training Reference. RTP F5

4.1.4. General Description. The M258A1 kit contains six olive drab foil packets in a plastic olive drab case. Three are numbered 1 and three are numbered 2. The case is 2 inches by 4.25 inches in size. The lid is molded to the case with a rubber o-ring. A nylon carrying strap with metal clip is secured to the outside of the case.

4.1.5. Wartime User. All personnel in, or deploying to, a CB threat area.

4.1.6. Operating Ranges. Temperatures up to 110°F.

4.1.7. Storage Ranges. Temperatures up to 110°F. Store in clean, dry, areas out of direct sunlight.

4.1.8. Operational Limitations. The packets are a one-time use item. ***Do Not*** use if any of the following conditions exist: outdated or open packets, seeping or swollen packets, or packets with dried residue. Packets that have been subjected to direct sunlight or temperatures of 110°F should not be used. Discard all defective packets as hazardous waste. Solutions in packets are flammable; ***Do Not*** use around open flame.

4.1.9. Inspection. Inspection of M258A1 kit is the individual user's responsibility. Follow all procedures to prevent injuries.
4.1.9.1. Inspect the M258A1 prior to use.
4.1.9.2. Wear rubber gloves while inspecting kits.
4.1.9.3. Inspect for holes in packets.
4.1.9.4. Verify glass ampoules in packet 2 are not crushed.
4.1.9.5. Check if the case/packets is deformed, or packets have deteriorated.
4.1.9.6. Minor cracks in case, rubber O-ring missing, or nylon strap missing do not constitute unserviceability.

4.1.10. Operational Use. When contamination is found or suspected on skin, act immediately. If chemical protective clothing is not on put on your mask and hood. Do not zip the hood. Do not pull the draw strings. Do not fasten the shoulder straps. The M258A1 kit may be used to decontaminate small equipment and the protective mask.
4.1.10.1. Follow the procedures below for **skin** decontamination:
4.1.10.1.1. Rubber gloves must be worn unless agent is on hand.

4.1.10.1.2. Open lid, remove packet “1”.
4.1.10.1.3. Fold packet “1” in half at solid line, tear open at notches and remove pad.
4.1.10.1.4. Unfold pad fully, wipe skin for 1 minute, discard pad.
4.1.10.1.5. Remove packet “2”, crush glass ampoules inside packet “2”.
4.1.10.1.6. Fold packet ”2” in half, tear open at notches, remove pad letting screen fall.
4.1.10.1.7. Unfold the pad fully, wipe skin for 2-3 minutes, discard pad.
4.1.10.2.Follow these procedures if you have or suspect contamination on your **face**:
4.1.10.2.1. Open lid, remove packet “1”.
4.1.10.2.2. Fold packet “1” in half at solid line, tear open at notches and remove pad.
4.1.10.2.3. Unfold pad fully, wipe skin for 1 minute, discard pad.
4.1.10.2.4. Using pad “1”, wipe your hands.
4.1.10.2.5. Take a deep breadth and hold it, close your eyes, lift the mask from the chin only far enough to get your hand inside. Quickly wipe the lower part of the face and interior surfaces of the mask which contact the skin.
4.1.10.2.6. Don mask, open eyes, and resume normal breathing.
4.1.10.2.7. Using the same “1” pad, wipe neck and ears.
4.1.10.2.8. Remove packet “2”, crush glass ampoules inside packet “2”.
4.1.10.2.9. Fold packet ”2” in half, tear open at notches, remove pad letting screen fall.
4.1.10.2.10. Unfold the pad fully, Using pad “2”, wipe your hands.
4.1.10.2.11. Take a deep breadth and hold it, close your eyes, lift the mask from the chin only far enough to get your hand inside. Quickly wipe the lower part of the face and interior surfaces of the mask which contact the skin.
4.1.10.2.12. Don mask, open eyes, and resume normal breathing.
4.1.10.2.13. Using the same “2” pad, wipe neck and ears.

WARNING

Some skin reaction (reddening, itching) may result from the decontamination process. The treated skin area should be washed with soap and water as soon as practical after use.

4.1.11. Decontamination. The carrying case is the only component that could require decontamination. If contaminated, destroy all internal components as hazardous waste. Decontaminate carrying case with another M28A1 or M291 kit. Follow procedures listed for use of the decontaminating kits.

4.1.12. Special Note. The M258A1 kit is not for training. A training kit (M58A1) is available for training, NSN 6910-01-101-1768. Refill packets are also available, NSN 6910-01-113-2434.

4.2. M291 Skin Decontaminating Kit

NSN 6850-01-276-1905

4.2.1. Purpose. The M291 Skin Decontaminating Kit provides the user capability to completely decontaminate through physical removal, absorption, and neutralization of chemical agents on the skin.

4.2.2. Technical Reference. T.O. 11D1-1-131

4.2.3. Training Reference. RTP F7

4.2.4. General Description. The M291 kit consists of 6 individual decon packets in a wallet sized carrying pouch. Each packet contains an applicator pad filled with decon powder. Each kit will do three complete skin decontaminations.

4.2.5. Wartime User. All personnel in, or deploying to, a CB threat area.

4.2.6. Operating Ranges. -50°F to 120°F.

4.2.7. Storage Ranges. -60°F to 160°F.

4.2.8. Inspection. The user must do the following inspection prior to use:
4.2.8.1. Inspect kit for loose black powder. If no loose powder is present, the kit is serviceable.
4.2.8.2. If powder is detected, inspect each packet for leaks.
4.2.8.3. Discard all leaking packets.
4.2.8.4. Replace bad packets with new ones. Six total packets make a complete kit.
Note: The M291 kit is for external use only. Powder may be slightly irritating to skin or eyes. Keep powder out of eyes, cuts and wounds.

4.2.9. Operational Use. When contamination is found on skin, act immediately. Put on your mask and hood. Do not zip the hood. Do not pull the draw strings. Do not fasten the shoulder straps. Seek overhead cover or use a poncho for protection against further contamination.

4.2.10. Skin Decontamination. Follow these procedures:
4.2.10.1. Remove one packet, tear open at notch.
4.2.10.2. Remove applicator pad from packet.
4.2.10.3. Unfold applicator pad and slip gloved hand into handle.
4.2.10.4. Thoroughly scrub exposed skin until completely covered with black powder.
4.2.10.5. If gross contamination exists, two pads may be required.
4.2.10.6. Scrub gloved hand with powder.
4.2.10.7. Place protective clothing on exposed skin.
4.2.10.8. Discard contaminated pads as hazardous waste.
4.2.10.9. Remove powder with soap and water when conditions permit.

4.2.11. Face Decontamination. If contamination is suspected on face or neck, complete procedures for removal are identified in T.O. 11D1-1-131. Contamination around face or eyes requires detailed removal procedures.

Some assistance may be required to remove the contamination. Buddy care or buddy assistance may be needed. Follow these steps:

4.2.11.1. Hold your breath, close your eyes, grasp your mask beneath the chin, and pull the hood and mask away from your chin enough to allow one hand between the mask and your face. Hold the mask in this position while accomplishing the remaining steps.

4.2.11.2. Starting at the front of one of your ears, scrub the pad across your face to the corner of your nose. Scrub extra strokes at the corner of your nose. Then scrub across your nose, to include the tip, to the other corner of your nose. Again, scrub extra strokes at the corner of your nose. Then scrub across your face to the front of your other ear.

4.2.11.3. Scrub across your cheek to the corner of your mouth. Keep your mouth closed. Make extra strokes at the corner of your mouth. Then scrub across your closed mouth to the center of your upper lip. Scrub extra strokes above your upper lip. Continue to scrub across your closed mouth to the other corner of your mouth. Again, scrub extra strokes at the corner of your mouth.

4.2.11.4. Finish up by scrubbing across your cheek to the end of your jawbone.

4.2.11.5. Scrub across and under your jaw to your chin, cupping the chin. At the center of your chin, scrub extra strokes. Continue to scrub across and under your jaw to the end of your jawbone.

4.2.11.6. Turn your hand out and quickly wipe the inside of your mask that touches your face.

4.2.11.7. Discard the applicator pad and immediately seal, clear, and check your mask.

4.2.11.8. Remove the second skin decon packet from its carrying pouch. At the notch, tear open quickly. Remove the applicator from its packet and discard the empty packet. Unfold the applicator pad and slip your finger(s) into the handle.

4.2.11.9. Without breaking the seal between your face and mask, thoroughly scrub your neck and ears until they are completely covered with black powder.

4.2.11.10. Redo your hands until they are completely covered with black powder.
4.2.11.11. Discard the applicator pad and, if you are not wearing protective gloves, put them on at this time. Fasten your hood.
4.2.11.12. Remove the black powder with soap and water when conditions permit.

4.2.10. Decontamination. Discard carrying pouch and decontaminate remaining kits with M295 or other M291 kits.

4.3. M295 Individual Equipment Decontamination Kit
NSN 6850-01-357-8456

4.3.1. Purpose. The M295 Kit allows the individual to decontaminate their equipment through physical removal and absorption of chemical agents.

4.3.2. Technical Reference. Technical Manual TM-3-4230-235-10

4.3.3. Training Reference. RTP F9

4.3.4. General Description. Each M295 Kit consists of a carrying pouch containing four individual decon packets. Each packet contains a decon mitt filled with decon powder. The packet is designed to fit comfortably in the pocket of the ground crew ensemble. Each individual mitt is comprised of absorbent resin contained within a nonwoven polyester material.

4.3.5. Wartime User. All personnel in, or deploying to, a CB threat area. Contamination Control Teams (CCT) and Contamination Control Area (CCA) monitors may have additional decontamination requirements.

4.3.6. Operating Ranges. -25°F to 180°F

4.3.7. Storage Ranges. -60°F to 180°F

4.3.8. Inspection. Inspect kit for loose black decon powder. If no powder is detected, the kit is operational. If powder is detected, inspect each packet for leaks. Discard all leaking packets. A complete kit consists of 4 serviceable packets.

4.3.9. Operational Use. This kit is intended for equipment and may be slightly irritating if used on the skin. To use, follow these procedures in sequence:

4.3.9.1. Remove decontamination packet.
4.3.9.2. Tear open packet.
4.3.9.3. Remove decon mitt.
4.3.9.4. Discard empty packet.
4.3.9.5. Unfold decontamination mitt.
4.3.9.6. Grasp green (non pad) side of decontamination mitt with one gloved hand, pat the other gloved hand until completely covered with powder.
4.3.9.7. Insert decontaminated gloved hand into mitt, tighten wristband on glove.
4.3.9.8. Decontaminate individual equipment by rubbing with mitt.
4.3.9.9. Decontaminate gloved hand that was holding equipment.
4.3.9.10. Discard mitt.
4.3.9.11. If more contamination is present, use another mitt following procedures above.
4.3.9.12. All personal equipment can be decontaminated with the mitt.

4.3.10. Operational Limitations. The contaminated mitt must be destroyed as chemical hazardous waste.

4.4. M17 Decontaminating Apparatus
NSN: 4230-01-251-8702
NSN: 4230-01-346-1778 (M17 A2)

WARNING

The M17 uses a variety of fuels and produces water pressure in excess of 100psi. To prevent death, injury, fire or explosion, follow all rules established in T.O. 11D1-3-9-1.

4.4.1. Purpose. The M17 Decontamination Apparatus provides the user with a portable decontaminating capability. Decontamination at an airbase is essential to sustain operations once an airbase has been contaminated. Fixed site decontamination is not supportable or practical once chemical or biological agents are introduced on an airbase.

4.4.2. Technical Reference. T.O. 11D1-3-9-1, 11D1-3-9-2, and 11D1-3-9-1CL-1

4.4.3. Training Reference. RTP F8

4.4.4. General Description. The M17 decontamination apparatus is comprised of seven major component systems: engine, engine fuel system, electronic control system, air system, heater system, heater fuel system and water system. These systems provide a supply of pressurized, temperature controlled water. The apparatus weighs 360 lbs, is 40.2 inches long, 23.2 inches in width and is 33.9 inches in height.

4.4.5. Wartime User. The M17 requires special training to operate. Due to its complexity of parts, handling requirements, and special operating procedures, the M17 should be used only by personnel trained in its operation. CCT team members are the primary users of this equipment.

4.4.6. Components. The following is a list of major components:
4.4.6.1.Engine: Single cylinder, two cycle, 197 cc, 7.3 hp, air cooled. Fuel mixture: 2 cycle oil and unleaded gas, 1qt of oil to 5 gallons of gas.
4.4.6.2.Heater: Convection, jet fired, igniter plug ignition, 700,000 BTU. Runs on leaded or unleaded gasoline and will run on diesel (DF2), jet fuel (JP4), or kerosene.

4.4.7. Accessory Kit. Box weighs 143 lbs, 41.8 inches long, 20.5 inches wide, 15.4 inches in height.
4.4.7.1. Suction hose, 33 feet long with quick disconnect.
4.4.7.2. Branch hose, 3 feet long with quick disconnect.
4.4.7.3. Pressure hoses, 50 feet in length quick disconnect.
4.4.7.4. Shower sets (2 each), 3-section with 6 jets each, 8 feet in length with quick disconnect.
4.4.7.5. Spray wands, 3 foot single sections, trigger actuator with quick disconnect.
4.4.7.6. Injector, 80/20 siphon, with cam coupling.
4.4.7.7. Water tank, 1580 gallon, collapsible, self-erecting rubberized-nylon, weight 70 lbs (empty) and 5.8 feet in height (full). Stored separately.

4.4.8. Power Requirements. No external power is required to operate this system. Only a source of water and fuel is needed.

4.4.9. Operating Ranges. Two operating ranges for operation:
4.4.9.1. Usual conditions: Above 32°F, refer to Section III of T.O.
4.4.9.2. Unusual conditions: Below 32°F, refer to section IV of T.O.

4.4.10. Operational Limitations. The M17 will operate in all environments; however, extra care of the M17 components must be properly maintained in weather below 32° to prevent failure. The M17 is limited only by its water and fuel supply. The unit is heavy and moving it requires at least four people.

4.4.11. Inspection. The inspection of the M17 requires Preventive Maintenance Checks and Services (PMCS). These procedures are described in detail in section II of T.O. 11D1-3-9-1, which gives user actions for before, during, and after operations. The T.O. outlines unit maintenance and specifies the semi-annual, annual, biennial, and hourly PMCS actions.

4.4.12. Decontamination. The M17 and its components can be decontaminated using spray wands. Mixtures and pressures for decontamination are identified in the T.O.

CHAPTER 5 - SPECIALIZED DETECTION EQUIPMENT

5.1. Automatic Liquid Agent Detector (ALAD)

NSN 6665-01-314-2086
AN/PSR-2 System and Auxiliary Alarms

5.1.1. Purpose. The ALAD provides the user with an automatic liquid chemical agent detector. ALADs are intended for use with existing vapor detectors.

5.1.2. Technical Reference. T.O. 11H2-22-1

5.1.3. Training Reference. RTP F10

5.1.4. General Description. The AN/PSR-2 system is a self-contained, battery powered, portable liquid chemical agent detector. It will detect 200 micron-size droplets or larger of liquid GD, VX, Mustard, or Lewisite chemical agents on the sensor within 60 seconds.

5.1.5. Components. The AN/PSR-2 Detector unit assembly consists of one detector and five sensors. The detector is 12.62 inches long, 8.5 inches

wide and weighs 9 pounds without battery. The auxiliary alarm is 15 inches long, 12 inches wide and weighs 23 pounds. The ALAD is compatible with the M42A1 Auxiliary Alarm. Refer to Army technical manual 3-665-302-34 for the care and use of the M42A1 alarm. The detector unit has the following controls and features:

5.1.5.1. Sensor Pins: mate detector unit to chemical agent sensor.

5.1.5.2. Horn: gives a 75 decibel sound alarm (at 3 feet) in all directions from unit.

5.1.5.3. Power Switch: applies AC or DC power to detector unit.

5.1.5.4. Lamp: gives a flashing light alarm that can be seen 25 feet from unit.

5.1.5.5. Signal Post: allows connection to external alarms with field wire.

5.1.5.6. Sensor Mounting Plate: allows mounting of sensor and contains sensor heater for cold weather operations.

5.1.5.7. Sensor Holder Clamp: assists in correct positioning of sensor.

5.1.5.8. Horn Enable/Off Switch: allows operator to enable/disable detector unit horn.

5.1.5.9. Lamp Enable/Off Switch: allows operator to enable/disable detector unit lamp.

5.1.5.10. Alarm/BIT Instructions: provides operator with signal codes and instructions for alarm activation and unit Built-In-Test.

5.1.6. Theory of Operation. The ALAD theory of operation is divided into five circuit groups: power, controller board, sensor, internal alarms, and external alarms.

5.1.6.1. The ALAD operates on battery or AC power. A nonrechargeable BA-5588/U lithium sulfur dioxide battery provides DC power to the ALAD. It provides power for at least 30 days. A power switch controls both AC and DC power to the detector unit. When the power is set to [ON] the unit starts a self-diagnostic test.

5.1.6.2. A microprocessor controls all functions of the detector unit. The detector unit also has built-in protection from electro-magnetic pulses (EMP).

5.1.6.3. The sensor is a one time use item. When the sensor is placed on the mounting plate, an electrical current is passed from contact to contact through the metallic paint on the grooved surface. If attached to AC power, the system will heat the sensor plate to 70°F if needed. (This occurs when the outside temperature is less than 70°F.) When a 200 micron droplet or more of chemical agent falls on the sensor, it causes the metallic paint in the groove to swell. When the paint swells, the resistance of the sensor changes, and the detector unit recognizes that a chemical agent is present. This sends a signal to the alarm. It detects GD, VX, Mustard, Lewisite, and simulant DEM type chemical agents. The sensor is not sensitive to most flight-line chemicals.

5.1.6.4. The system has an internal horn and lamp alarm. The horn sounds either, when chemicals are present, or when signals faults occur in the system. The lamp alarm provides continuous flashing light when an alarm signal is received from the ALAD. A low battery LED provides continuous warning light when battery voltage is low. The test push-button provides self-test to ensure the horn and lamp are working.

5.1.6.5. The unit is capable of operating with remote auxiliary alarms. Two different auxiliary alarms can be connected to the detector unit, the BZ-90/PSR-2 and the chemical agent automatic alarm unit ABCA-M42. When a chemical agent is detected it sends a signal to these alarms. The BZ-90/PSR-2, commonly referred to as the BZ-90 alarm comes with the ALAD. The ABCA-M42, commonly referred to as the M42 is compatible with the ALAD.

5.1.6.6. External alarms may be connected with field wire up to a distance of 1000 feet from the detector unit assembly. Signal posts on the system provides quick connections between the ALAD detector unit and auxiliary alarms.

5.1.7. Wartime User. The ALAD can be operated by anyone trained in the use of chemical agent detectors. NBC recon and shelter teams are the primary users.

5.1.8. Power Requirements. The ALAD will operate on both AC/DC power.
5.1.8.1. *AC*: 110/220 VAC, 60/50 Hz, single phase.
5.1.8.2. *DC:* Non-rechargeable lithium sulfur dioxide battery. BA-5588/U
5.1.8.3. *Battery Service Life*: 30 days.
5.1.8.4. The auxiliary alarm will only operate on DC power.
5.1.8.5. *DC:* Two rechargeable, sealed, lead-acid batteries, GC 1245-1.
5.1.8.6. *Battery Service Life*: 100 to 1000 recharges.
5.1.8.7. *Recharge Time*: 12 to 16 hours**.**

5.1.9. Operating Ranges. ALAD Operation: -30 to 125°F - Storage -75 to 165°F. Auxiliary Alarm Operation: -30 to 125°F Storage -75 to 165°F

5.1.10. Sensor Disc Service Life. 30 days after removal from package if not contaminated. The Shelf life is 5 years. Expired sensor discs can be used for training. If they are not available, simulated reading can be obtained by making an electrical connection between the inner and outer posts on the ALAD.

5.1.11. Sensor Disc Operating Ranges. -30 to 125°F.

5.1.12. Sensor Disc Storage Ranges. -30 to 160°F**.**

5.1.13. Special Tools. No special tools are required.

5.1.14. Operational Limitations. The sensor discs are a one-time use only item. After removal from packaging, the discs are good for 30 days. The sensor must be replaced if dirt or debris is visible on the sensor surface.

5.1.15. Inspection/Use. Refer to T.O. 11H2-22-1 before inspection and use.

5.1.16. Operations and Employment. Prior to operation, the ALAD detector unit assembly must be setup. This includes an inspection of the unit, battery installation, sensor card installation, and connection to AC power.

5.1.16.1. After you prepare the unit for operations, the Built-In-Test (BIT) will self-check the internal electronic circuitry, sensor, and battery as soon as the power switch is set turned [ON]. The lamp will light during BIT and, when the lamp goes off, all testing is complete and the unit is ready.

5.1.16.2. Faulty units will indicate failure signals. Corrective actions for the following failure signals are listed in the technical order:

bad unit: three beeps	lamp on
bad sensor: 2 beeps	lamp on
bad battery: 1 beep	lamp off

5.1.16.3. Prior to operation, the remote alarms must be prepared for operation. This includes an inspection of the unit, installation of the batteries, and a test of the unit.

5.1.16.4. Employment. When both the detector unit assembly and the auxiliary alarm are prepared for use, they may be deployed into the field. The detector unit should be placed on a level surface free from overhead cover. The auxiliary alarm should also be placed on a level or stable surface and can be used both outside or indoors.

5.1.17. Calibration. None required.

5.1.18. Decontamination. The ALAD system is painted with a Chemical Agent Resistant Coating (CARC). All components of the system **except** the sensor disc can be cleaned with standard decontaminants (M295, soap and water).

5.2. Chemical Agent Monitor (CAM)

NSN 6665-01-199-4153

WARNING
RADIATION HAZARD

The CAM contains a beta radiation source. The source is a plated cylinder of 10 millicuries of Nickel-63 radiation. ***Do Not*** attempt to open the CAM.

5.2.1. Purpose. The CAM is a hand held point monitor capable of detecting and identifying nerve and mustard agent vapors, giving a rough indication of concentration within 1 minute of agent exposure. CAMs are intended for use to search out clean areas, and to identify contaminated personnel, equipment, aircraft, vehicles, buildings and terrain. CAMs will determine the effectiveness of decontamination and can be used in collective protection shelters.

5.2.2. Technical Reference. T.O. 11H2-20-1

5.2.3. Training Reference. RTP F19

5.2.4. General Description. CAMs utilize Ion Mobility Spectrometry (IMS) technology to detect GA, GB, GD, VX, HN, and L. The CAM weighs a little over three pounds with battery and is 15.5 inches in length.

5.2.5. Wartime User. The CAM can be operated by anyone trained in the use of chemical agent detectors. NBC recon, CCA, and shelter teams are the primary users.

5.2.6. Components. The basic CAM comes with the following components: carrying case assembly, CAM, carrying harness assembly, filtered nozzle package assembly, spare battery, large handle strap, small handle strap, confidence sample, spare nozzle protective cap assembly, nozzle protective cap assembly, nozzle assembly, battery, battery cap assembly and environmental cap. Available auxiliary equipment includes an optional battery used for operational check-out and training, and a buzzer to provide audible alarm when the detector reads three bars or more.

5.2.7. Power Requirements. The CAM uses one internal 6-volt lithium sulfur dioxide battery (BA-5800/U). ***Do Not*** immerse battery in water or decontamination solution, crush, or burn batteries. ***Do Not*** attempt to recharge batteries. Batteries are considered hazardous waste; dispose of IAW local hazardous waste procedures. Battery life varies with frequency of use and temperature. The following are benchmarks for temperature versus battery life:

113°F	(45°C)	14 hours
68°F	(20°C)	12 hours
32°F	(0°C)	10 hours
-13°F	(-25°C)	2 hours

5.2.1. Operating Ranges. -13 to 113°F.

5.2.2. Storage Ranges. -67 to 158°F.

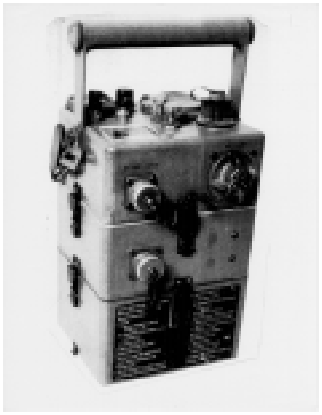
5.2.3. Operational Limitations. The CAM is a monitor, not a detector, and can become contaminated or overloaded (saturated) if not used properly. The CAM can only detect vapors at the inlet nozzle. It will not give the vapor hazard over an area from a single point.

5.2.4. Inspection. The inspection of the CAM requires Preventive Maintenance Checks and Services (PMCS). These procedures are described in detail in T.O. 11H2-20-1.

5.2.5. Decontamination. ***Do Not*** decontaminate the CAM or its accessories with the M258A1 Decontamination kits. False readings may occur and render the CAM inoperative. To decontaminate, discard the filtered nozzle standoff. Turn the CAM off. Wipe the nozzle assembly, using a cloth dampened with water only. Install the nozzle protective cap on the CAM nozzle. Turn the CAM on. The display should clear within 15 minutes. If the CAM does not clear within 15 minutes, repeat procedures. If problems still exist, turn CAM in for replacement.

5.3. M8A1 Chemical Agent Alarm

NSN 6665-01-105-5623



WARNING
RADIATION HAZARD

The cell module of the M43A1 Detector contains a radioactive source: Americium-241. The cell module is potentially dangerous if broken. ***Do Not*** attempt to remove the cell or pump modules.

5.3.1. Purpose. The M8A1 Detector provides an automatic detection capability for nerve agent vapors (GA, GB, GD and VX). The M8A1 can be used at fixed sites, hand carried, carried on a backpack, or mounted on a vehicle.

5.3.2. Technical Reference. T.O. 11H2-17-1

5.3.3. Training Reference. RTP F3

5.3.4. General Description. The M8A1 alarm consists of two components: an M43A1 detector and an M42 Alarm unit. Major components are listed below separately.

5.3.5. Wartime User. The M8A1 can be operated by anyone trained in the use of chemical agent detectors. NBC recon, CCA, and shelter teams are the primary users.

5.3.6. Components. The following components make up the M8A1 system. The system provides the user the option of deciding what components are needed. They are:

5.3.6.1. M43A1 Detector: Automatically detects nerve agent vapors. It will alarm and send a signal to a connected M42 Alarm. (weight 7 pounds, length 7 inches, width 7.75 inches, height 10.75 inches)

Power requirements.
18 volt DC to 36 volt DC
BA3517/U Battery *or*
BB501/U Battery (M253 Winterization kit) *or*
M10 Power supply (115/220 volt AC, 50-400 Hz) *or*
Vehicle Power

5.3.6.2. M42 Alarm Unit: Provides a warning light and horn at a remote location (up to 400 meters away) when the M43A1 detects nerve agent vapors. (weight 4 pounds, length 8 inches, width 6 inches, height 2.25 inches)

Power requirements
Battery, dry, 1.5 volt, BA3030/U (4 each)

5.3.6.3. M10A1 Power Supply: Converts power from an AC source to DC power for the M43A1 Detector. It accepts 115 or 220 VAC, 50 to 400 HZ and switches automatically to the standby battery if output drops below

18 VDC. The M10A1 attaches directly to the bottom of the M43A1 Detector. (weight 6.5 pounds, length 7.5 inches, width 6.5 inches, height 3.2 inches)

5.3.6.4. M10 Power Supply: Provides DC power to the M43A1 detector by converting 115/220 volt AC, 50-400 Hz power. (weight 18 pounds, length 12 inches, width 6 inches, height 7 inches)

5.3.6.5. BA3517/U Battery: Supplies 36 volt DC power to M43A1 Detector weight (7.5 pounds, length 6.3 inches, width 7.7 inches, height 5 inches). Non-rechargeable

5.3.6.6. M273 Maintenance Kit: Contains 10 air filters and 10 test paddles.

5.3.6.7. Probe Assembly: Contains 5 probes, 5 rubber bands, and 5 instruction cards. Enables the M43A1 detector to monitor equipment, vehicles and personnel for vapor contamination.

5.3.7. Operating Ranges. -40°F to 120°F, 3 to 99% relative humidity

5.3.8. Operational Limitations. The M8A1 is limited by both battery power life and airfield interference. Refer to T.O. 11H2-17-1 for guidance.

5.3.9. M8A1 Assembly And Operation. The M8A1, used as a fixed emplacement alarm system, can be assembled and used in any of three power configurations and with or without an M42 alarm connected. The three power configurations are:

5.3.9.1. M43A1 Detector with the BA3517/U Battery.

5.3.9.2. M43A1 Detector with the M10A1 Power Supply.

5.3.9.3. M43A1 Detector with both the BA3517/U Battery and M10A1 Power Supply.

WARNING.

Do not operate M43A1 detector indoors unless an outlet filter is installed. Do not operate inside moving vehicle with or without filter. Radiation exposure could occur.

CAUTION

To prevent damage to the electronics component, do not use power sources above 125 VAC or 230 VAC when operating the power supply.

5.3.10. Operating The M8A1 In Cold Weather. When the outside temperature reaches 20°F or below, the M8A1 must be operated in a cold weather configuration. To help accomplish this task, an M253 Winterization Kit is available. The M253 Winterization Kit provides DC power when temperature ranges from 20°F to -40°F. The kit contains two BB501/U rechargeable batteries and one M168 cable.

5.3.11. M8A1 Malfunctions. The M8A1 may malfunction. You may correct some of the common malfunctions that can include:

M43A1 DETECTOR MALFUNCTIONS ARE:	
Flowmeter	☑ Doesn't register in green band. Low airflow can be caused by a clogged filter. Make sure that the air filter plug is screwed tight, outlet cap removed, and air outlet clean.
Detector	☑ Doesn't register in black area with battery test and reset press button depressed. This may be a problem with the power connectors.
Detector meter doesn't register in green band.	☑ Install flowmeter and adapter in air inlet. With the detector operating, wait 5 to 60 minutes and read detector meter. If it does not read in the green band send the unit to maintenance.
Detector meter doesn't register in green area when temperature is below 20°F.	☑ Attach the M253 Winterization Kit and test the system.

M42 alarm	☑ Does not sound during tests or when nerve agent is detected by M43A1 detector. Check the batteries, power connections, and wires to the M43A1.
M43A1 detector doesn't register in the black area with battery test and reset press button depressed.	☑ Check the fuses and power connectors.

5.3.12. Employment of M43A1s. M43A1 Detectors may be employed at widespread indoor and outdoor locations around the installation in a DICE 5 pattern. The M10A1 Power Supply should be used whenever possible.

5.3.13. Employment of M42s. M42 Alarms should be installed primarily in work centers (preferably ones with collective protection) to remotely monitor the M43A1s. NOTE: The M42 alarm may not be heard in high noise areas. Also, the M43A1 may falsely alert to some aftershaves and smokes.

5.3.14. Inspection/Use/Calibration/Decontamination. Due to the complexity of the M8A1 system, detailed procedures must be followed to use this system. Because of the radioactive source inside the unit, a "wipe test" must also be performed to ensure that the units are not leaking any radioactive sources. Technical Order procedures in all phases of use, maintenance, calibration and decontamination must be followed to prevent detector system failure. USAF M8A1s do not require calibration.

5.4. M90 Chemical Agent Detector

NSN 6665-01-408-5108

WARNING
RADIATION HAZARD

The M90 utilizes a small sealed radioactive source, AM-241, as a part of the detection system. The unauthorized repair or disassembly of the M90 may result in Alpha radiation contamination and exposure.

5.4.1. Purpose. The M90 Detector provides the Air Force with stand-alone nerve and blister agent detection. The M90 will detect nerve and blister agent vapors at levels that prevent over exposure to personnel. The M90 can be networked to provide airfield chemical detection and warning, as well as a shelter monitoring device. The M90 is a multi-application instrument which is capable of operating as a point detector to provide early warning of approaching toxic chemicals or as a chemical agent monitor to identify and monitor personnel, vehicles, and equipment for contamination.

5.4.2. Technical Reference. M90 Users Manual, no technical order assigned.

5.4.3. Training Reference. RTP F4

5.4.4. General Description. The M90 uses Ion Mobility Spectrometry (IMS) to determine the presence of toxic vapors. The detector is portable or can be vehicle mounted. Weight with battery is 15 pounds. Dimensions are length 11 inches x width 4 inches x height 11 inches.

5.4.5. Wartime User. The M90 can be operated by anyone trained in the use of chemical agent detectors. NBC recon, CCA, and shelter teams are the primary users.

5.4.6. Components. The M90 does not come in a kit. Various components are available to allow different uses in the field. Following is a complete list of all components:

M90 detector unit	Battery case
M90-RH2 Remote alarm unit	M90-MP1 Main power supply
M90-BC Battery charger	M90-VP1 Vehicle power supply
M90-IT2 Inlet tube	M90-FT/S Filter tool
M90-CC Communications cable	Sample kit containing 2 stimulants, nerve and blister
M90-CB Carrying bag	

5.4.7. Power Requirements. The M90 is capable of being powered by several different batteries and power supplies. The batteries must be capable of providing at least 11 volts of power. Different power requirements are based on intended usage. The following list describes the various requirements:

5.4.7.1. M90-NB NiCd rechargeable D-cell battery, comes standard with detector; 8 hours use.

5.4.7.2. M90-LB Lithium non-rechargeable battery, BA-5598/U; 16 hours use.

5.4.7.3. M90-MB Magnesium non-rechargeable battery, BA-4386; 16 hours use.
5.4.7.4. M90-MP1 Main power supply, 115/240 volt AC, 60Hz.
5.4.7.5. M90-VP1 Vehicle power supply, AC/DC converter 10-32 volt DC.
5.4.7.6. M90-VP2 Vehicle power supply, 24-34 volt DC converter.

5.4.8. Battery Life. This is dependent on climatic conditions. Cold temperatures degrade battery life and decrease battery voltage. At room temperature, the NiCd battery will last about 8 hours. Operational tests show a realistic battery life of about 4-6 hours for NiCd batteries in the field.

5.4.9. Battery Recharge. The M90-BC battery charger only recharges one NiCd battery pack at a time. The battery charger requires 6 hours to charge one battery pack. The NiCd batteries will only take a charge when temperatures are between 32°F and 104°F.

5.4.10. Operating Ranges. M90 will operate in temperatures between -22°F and 131°F with 10 to 95% humidity.

5.4.11. Care and Use. The M90 has a specific set of operational procedures to make the unit ready for use. Complete details on these procedures are outlined in the "M90 Users Manual". Failure to adhere to these procedures will render this device inoperable.

5.4.12. Inspection. Refer to chapter 2 of the M90 Users Manual for complete details. Preventive maintenance checks and services include preparation for operation, starting, testing the detector, alarms, operations under unusual conditions, shutdown procedures, and troubleshooting. The operator must perform the following checks to insure proper operation of the M90 and avoid failure of alarms:

5.4.12.1. Inspect both the air inlet and outlet are open and free from blockage.
5.4.12.2. Check that the internal air filter and the external pump port caps are tightly closed.
5.4.12.3. Visually inspect that a serviceable battery or power supply is connected.
5.4.12.4. The detector sensor should be tested with the stimulant after every startup, or if in continuous operation, once a month. The testing is done with the simulant tube once startup is completed. The simulant tub contains nerve agent simulant. The simulant needs to be warmed to at least +50 F(+10 C) to react correctly. Ensure testing is conducted away from strong wind or drafts.

5.4.13. Concept of Employment. The M90 should be employed around an air base in a DICE 5 pattern for early detection and warning of chemical agent vapors.
5.4.13.1. Because it is a point source detector, every effort must be made to place a sufficient number of detectors upwind of the air base and mission-critical areas.
5.4.13.2. Place M90 units no closer than 500 meters apart within the confines of the base. This placement can change due to the prevailing winds, likely attack routes, threat assessment, proximity to major lines of travel, work-area noise levels, etc.
5.4.13.3. Place the M90 units no closer than 25 feet from any major structure to ensure maximum exposure to prevailing winds and limit interference caused by buildings.
5.4.13.4. Be sure to avoid place the M90 around smoke, jet fuel vapors, and diesel exhaust. The M90 has shown sensitivity to these interferents and will possibly detect them as chemical agents.
5.4.13.5. The M90 should be at least 3 feet, but no higher than 6 feet, off the ground to ensure maximum exposure to the contaminating environment.

5.4.14. Inclement Weather Conditions. To prevent damage to the instrument from inclement weather, place the M90 in a protective cage.

The cage should be made out of wood or sheet metal with air slots and a locking, front door.
5.4.14.1. The top of the cage should prevent rain or falling particulates from affecting the M90's operation.
5.4.14.2. The M90 can suffer adverse effects if operated unprotected during inclement weather conditions (e.g. constant rainfall, dust, etc.)
5.4.14.3. If the rain caps on the M90 are not properly positioned, water can be sucked in the inlet valve and damage the instrument.
5.4.14.4. Do not place the units in low lying areas where the alarm cannot be seen or heard. Likewise, do not place units on tops of buildings since most chemical warfare agents are heavier than air.

5.4.15. Detector Maintenance and Decontamination. Refer to chapter 3 of the M90 User Manual for complete details. Topics covered include Cleaning, Decontamination (both external and internal), Internal Filter Replacement, External Filter Replacement, and Battery Replacement. The M90 CAD can be decontaminated internally and externally. Before decontaminating the detector check that all air and electric protector caps are tightly closed and the power is turned off.
5.4.15.1. Internal. If the internal parts have been contaminated two options are possible:
5.4.15.2. Use the M90 chemical filter adapter with a charcoal filter fitted to the air inlet port, and operate until the alarm light is extinguished.
5.4.15.3. Use the UIP and run the decontamination option.
5.4.15.4. The outside casing and top panel of the detector can be decontaminated by using a decontamination solution of mild soap and water.

5.5. M22 Automatic Chemical Agent Detector Alarm

NSN: 6665-01-438-6963

WARNING
RADIATION HAZARD

The sensor assembly inside the M88 detector, a sub-component of the ACADA, contains two Nickel-63 sources of radioactive material. **Do Not** attempt to open the M88 Detector.

5.5.1. Purpose. The M22 system will determine the presence of nerve and blister agent vapors. The system provides the user with a stand alone, automatic vapor agent detector.

5.5.2. Technical Reference. T.O. 11H2-23-1

5.5.3. Training Reference. RTP F18

5.5.4. General Description. The M88 Detector is the main piece of equipment in the M22 System. The M88 is an automatic air sampling

chemical detector for G and H series agents. The M-88 draws air into a port and samples the air for nerve and blister agents. The M-88 provides both visible and audible alarms (such as the M42 alarm) when chemical agent vapors are present.

5.5.5. Wartime User. The ACADA can be operated by anyone trained in the use of chemical agent detectors. NBC recon, CCA, and shelter teams are the primary users.

5.5.6. Components.

M88 DETECTOR	6.5 inches in length, 7.0 inches in width, 10.75 inches in height and 10.63 pounds in weight, without battery.
Operating temperature	-22°F to 125°F
Storage temperature	-80°F to 160°F
Operating relative humidity	5 to 99%
Power requirements	24Volt DC at 0.6 amps at 20°C
BATTERY BOX.	6 inches in length, 7 inches in width, 3 inches in height and 3.3 pounds in weight, with battery.
Operating temperature	-40°F to 125°F
Storage temperature	-80°F to 160°F
Operating relative humidity	5 to 99%
Power requirements	24 volt DC at 7.2 amps
	Holds one BA5590/U non-rechargeable lithium sulfur dioxide battery, weight 2.2 pounds.

BATTERY LIFE.	Approximately 15 hours at normal temp; in cold temperatures -22°F, 3-4 hours.
M42 REMOTE ALARM.	8.8 inches in length, 6 inches in width, 6 inches in height and 3.8 pounds in weight, with battery.
Operating temperature	-40°F to 125°F
Storage temperature	-80°F to 160°F
Operating relative humidity	5 to 99%
Power requirements	Battery, dry, 1.5 volt, BA3030/U (4 each)
M28 POWER SUPPLY.	4.5 inches in length, 7 inches in width, 4.3 inches in height and 12.9 pounds in weight. NSN 6120-01-438-6960
Operating temperature	-40°F to 125°F
Storage temperature	-67°F to 158°F
Operating relative humidity	5 to 99%
Power requirements	96 to 136 volt AC, or 190 to 256 volt AC, 47 to 60 Hz at 200 watts maximum.
	M28 will supply 24 volt DC +/- 1 volt DC at 2 Amps.
A confidence sample is used to determine the operational state of the M88 detector. The sample was designed to have both agent vapor modules in one device. One end is for blister agents and the other end for nerve agents. Complete procedures for use and care are identified in T.O. 11H2-23-1.	

5.5.7. Operational Limitations. The M22 system is limited by both battery power life and airfield interference. Refer to T.O. 11H2-23-1 for guidance.

5.5.8. Concept of Employment. The M22 should be employed around an air base in a DICE 5 pattern for early detection and warning of chemical agent vapors.

5.5.8.1. Because it is a point source detector, every effort must be made to place a sufficient number of detectors upwind of the air base and mission-critical areas.

5.5.8.2. Place M22 units no closer than 500 meters apart within the confines of the base. This placement can change due to the prevailing winds, likely attack routes, threat assessment, proximity to major lines of travel, work-area noise levels, etc.

5.5.8.3. Place the M22 units no closer than 25 feet from any major structure to ensure maximum exposure to prevailing winds and limit interference caused by buildings.

5.5.8.4. Be sure to avoid place the M22 around smoke, jet fuel vapors, and diesel exhaust. The M22 has shown sensitivity to these interferents and will possibly detect them as chemical agents.

5.5.8.5. The M22 should be at least 3 feet, but no higher than 6 feet, off the ground to ensure maximum exposure to the contaminating environment.

5.5.9. Inspection/Use/Calibration/Decontamination. Due to the complexity of the M22 system, detailed procedures must be completed in order to use this system. Technical Order procedures in all phases of use, maintenance, calibration and decontamination must be followed to prevent detector system failure.

5.6. Biological Warfare Agent Detection

Advance Concept Technology Demonstration - Portal Shield
NSN: NA

5.6.1. Purpose. Portal Shield provides the user with a biological detection system with a chemical add-on consisting of the ACADA. The system is hard-wired with comm back up to provide continuous information through a computer terminal located at the command and control centers chosen by the installation. The computer terminal indicates when an agent is detected and can identify the specific biological agent triggered upon in near real time.

5.6.2. Technical Reference. Pending

5.6.3. Training Reference. Pending

5.6.4. General Description. The Portal Shield Advanced Concept Technology Demonstration provides an interim capability for a limited number of installations until Joint Biological Point Detector System (JPBDS) are developed and fielded. The system is able to detect biological agents in 5 minutes or less, identifies the agent in 20 minutes or less and can currently identify 8 biological agents delivered with wet aerosol or dry powder dissemination systems.

5.6.5. Components. The system consists of a Global Positioning System, weather station, particle counter, CPU radio modem, optical immunoassay ticket reader, and cyclone sampler. It is fielded in a quadcon configuration with environmental control unit. It has several leave behinds most notably a decontamination unit for sensitive equipment items to include the unit itself, and hand held assays known as SWUBE's. The chemical add on is the addition of the ACADA's integrated into the system to allow both biological and chemical sampling and notification.

5.6.6. Wartime User. The wartime users of the system are those bases in Korea and South West Asia that are currently programmed to receive the systems in FY 98-99.

5.6.7. Power Requirements. Total power requirements for each quadcon unit (this includes the power to run the ECU and the UPS and sensor) is approximately 3200 watts.

5.6.8. Operating Ranges. The sensors normal operating range (without cooling) is 32-80 degrees F. The antibodies in the optical ticket reader (used for ID of the BW agents) needs to be kept at a fairly constant temperature resulting in the need for the ECU.

5.6.9. Operational Limitations. The only known limitation is the number of units available for the United States Air Force. Two bases in Korea, a limited number of sites in SWA and the potential for the addition of additional sites makes the capability useful but not available to all required sites.

5.6.10. Inspection/Use. The Portal Shield ACTD comes with a two year contractor support. At the end of those two years all maintenance and support is scheduled to revert to the bases possessing the systems. The support of the systems in the out years is expected to be substantial and requires advanced planning to ensure the capability is maintained.

5.7. Charger CDV-750/750-5/750-6
NSN 6665-00-856-8813

5.7.1. Purpose. The charger provides the user with a portable unit designed to provide the necessary voltage to charge, illuminate, and read the IM-143 dosimeter.

5.7.2. Technical Reference. T.O. 11H4-2-12-1

5.7.3. Training Reference. RTP F11

5.7.4. General Description. The CDV-750 charger is approximately 4 inches square, 3 inches high and weighs 1.25 pounds with battery. The charger has two bulbs, one on the circuit card inside and one in the charging pedestal. The charger has one large knob (left side) that is for dosimeter adjustment and one cap (right side), that is for charging and reading the dosimeter. The CDV 750-6 (pistol grip) is also available in the field. All references in this handbook, however, will refer to the CDV 750.

5.7.5. Power Requirements. The CDV-750 charger is powered by one 1.5 volt, D-cell battery. Battery life is dependent upon use and freshness of battery.

5.7.6. Operational Use. Unscrew center screw and open the case. Install the battery, observing the correct polarity and replace lid. Remove cap on left side. Place thumb or finger nail on the charging pedestal and apply slight pressure downward; a 1.5 volt bulb should illuminate. Two procedures follow:

5.7.6.1. Reading a Dosimeter: Depress the charging pedestal with thumb or finger nail to activate the bulb. Orient the charging end of the dosimeter on or near the pedestal, close enough to read the dosimeter. Do not apply pressure. Discharge may occur if the dosimeter is used to apply pressure, and the reading may be lost.

5.7.6.2. Charging the Dosimeter: Press it down on the charging pedestal and hold (at least 8 pounds of pressure) until the dosimeter body touches the threaded portion of the charging pedestal. Slowly move the knob left or right until the dosimeter hairline indicates zero. Remove the dosimeter, hold up to a light source, and read dosimeter. If not on zero, repeat previous steps.

5.7.7. Special Tools. Refer to T.O. 11H4-2-12-1 for specific tools.

5.7.8. Wartime User. Primary users are SMT members or anyone using the IM-143 Dosimeter.

5.7.9. Preventive Maintenance (PM). Accomplish PM every 28 days when charger is in use and 180 days when charger is in storage. Documentation to support PM should accompany charger. The following procedures apply:

5.7.9.1. Clean the battery contacts and battery terminals to remove any corrosion. Use denatured alcohol and a soft cloth, no water.

5.7.9.2. Check the battery and the two bulbs. Replace the spare bulb if it is missing from its holder.

5.7.9.3. If the battery has leaked, remove the case bottom and fill with warm water. The corrosion will be loosened in a short time and can be

rinsed out. Dry the case bottom, replace the battery, and check the electrical operation by charging a dosimeter.

5.7.10. Calibration. None; however, field level repair is authorized but some restrictions do apply. See T.O. 11H4-2-12-1, chapter 2 for instructions.

5.7.11. Decontamination. Wash the outside with a damp cloth.

5.7.12. CDV 750-6: The CDV 750-6 is the latest version of dosimeter charger. It's advantages over older models include: easier handling, faster loading, charging, and zeroing, and it uses no batteries. It has a pistol grip handle with rapid dosimeter loading using the short yellow trigger. Instead of battery power, this model uses a magneto to charge the dosimeter. This is done by loading a dosimeter and squeezing the black lever repeatedly until the light located near the top of the pistol grip flashes. To zero the dosimeter, the operator looks through the dosimeter at the scale and squeezes the black lever to move the hairline down to zero. The small black button is used for fine adjustment (moves the hairline upscale in small increments with every press)

5.8. Dosimeter, IM 143PD

NSN 6665-01-134-9714

5.8.1. Purpose. The dosimeter detects and measures cumulative exposure to X-ray and gamma-ray radiation. The dosimeter can be used for individual or area measurement for total radiation exposure. This survey meter is designed for large area surveying to find the extent and intensity of radioactive contamination. It can also be used for area and personnel monitoring to determine the presence and intensity of residual radiation.

5.8.2. Technical Reference. T.O. 11H4-6-1-1

5.8.3. Training Reference. RTP F11

5.8.4. General Description. The dosimeter is a sealed assembly in a metal barrel. A magnifying optical system is contained within the metal barrel for reading the image on a calibrated scale. The dimensions and weight are approximately 4.5 inches in length, .5 inches in diameter and 1.5 ounces in weight. The dosimeter has two distinct ends, one for charging and one for viewing. The charging end has a metal charging post located in the center of the barrel. A protective rubber dust cap should be mounted over the charging end to protect the charging post. The dosimeter will

operate with or without the dust cap. The viewing end has a glass window and does not require a dust cap.

5.8.5. Wartime User. dosimeters are worn by anyone operating in or near radiation.

5.8.6. Power Requirements. None

5.8.7. Operation. Two phases of operation are applicable to the dosimeter, preoperational and operational:
5.8.7.1. Preoperational: The dosimeter must be charged before use. To charge the dosimeter, a "charger" must be used. The standard charger for the dosimeter is the CDV-750 charger. Operation of the charger is identified in T.O. 11H4-2-12-1. Charging the dosimeter realigns the scale and clears any readings on the scale.
5.8.7.2. Operational: Once charged, the dosimeter is worn in clothing (pocket), or attached to clothing (vest), for personal use. If used in a shelter, it is usually placed in occupied rooms. To read the dosimeter, a light source is required. Hold dosimeter in hand and look at a light. Rotate the dosimeter to a horizontal position to align the internal scale. Read the hairline on the scale. The reading obtained is the accumulative amount of radiation received from the time the dosimeter is charged to when it is read.

5.8.7. Operational Limitations. Once charged, do not subject the dosimeter to severe shock, excessive dampness or high temperatures.

5.8.8. Preventive Maintenance (PM). Charging must be done every 28 days in standby and every 14 days in operational status. If dosimeters are not maintained in operational status, leakage could occur and dosimeters may be unserviceable. Three phases of maintenance are required for the dosimeter; preventive, verification of leakage rate and calibration. Refer to T.O. 11H4-6-1-1 for complete procedures.

5.8.9. Calibration. Annually through Precision Measurement Equipment Laboratory (PMEL).

5.8.10. Decontamination. Decontamination of the dosimeter consists of washing the dosimeter in a solution of detergent and clean water. Wash thoroughly in solution but ***Do Not*** use brushes or sharp objects. Air dry and replace dust cap on charging end.

5.9. ADM 300, Multi Functional RADIAC Meter (MFR)

ADM 300, Kit B - NSN 6665-01-342-7747
ADM 300, Kit C - NSN 6665-01-320-4712

5.9.1. Purpose. The ADM-300 RADIAC meter will locate and measure low and high intensity gamma rays or detect beta particles. When used with external probes, it will locate and measure alpha, gamma, x-ray and neutron radiation, and detect the presence of beta.

5.9.2. Technical Reference. T.O. 11H2-2-31

5.9.3. Training Reference. RTP 14

5.9.4. General Description. The ADM-300 is a battery operated, self diagnostic, multiple function instrument. The ADM-300 meter has a Liquid Crystal Display (LCD), a programmable meter and is RS-232 serial computer port compatible. The meter has a internal probe and is configured to use optional external probes. The meter can be vehicle powered and mounted and has both audible and visible alarm displays. Meter weight 3 pounds, height 1.88 inches, width 4.38 inches and length 8.5 inches.

5.9.5. Wartime User. Due to the complexity and severity of nuclear radiation, training in nuclear detection, identification, and radiation hazards

is required to operate this device. NBC recon team members are the primary users.

5.9.6. Components. The ADM-300A radiological assessment kit is configured several ways to provide user-specific requirements. The following are basic pieces; refer to T.O. 11H2-2-31, chapter 5 for itemized components by kit type:

ADM-300A - Multi-function survey meter, part # 702454-001/2
AP-100A - Alpha probe, part # 801473-001
BP-100 - Beta probe, part # 702456
KC-100 - Probe cable, part # 702459
XP-100 - X-ray probe, part # 702461
CC-100 - Carry Case, part # 702464
HG-100 - Gun Handle, part # 703231
EM-100 - Headset, part # 702463

5.9.7. Power Requirements. The ADM-300A will operate on both AC/DC power. AC: 100 to 240 VAC, 50 or 60 Hz. DC: Two standard 9-volt batteries, 100 hours battery life. Vehicle Power: 12-24 volts.

5.9.8. Operating Ranges.

5.9.8.1. Altitude operating range: Up to 15,000 feet above sea level.
5.9.8.2. Humidity: 0 to 95%.
5.9.8.3. Operating Temperature: -22^{o}F to 122^{o}F.
5.9.8.4. Storage Temperature: -40^{o}F to 140^{o}F.

5.9.9. Unit of Measurement and Range. The radiation range and units of measurement adjust automatically depending on the MODE selected and the probe attached. The ADM-300A detects, measures, and digitally displays levels of gamma radiation from 10 µR/h (micro roentgen per hour) to 10,000 R/h. The analog display is a bar graph which covers 10µR/h to 1,000 R/h. The Alpha and X-ray probes use a different unit of measurement than the basic meter.

5.9.9.1. Three units of measurement are available:

Curie/MxM (μCi/MxM)
DPM/Cm x Cm (disintegrations per minute/cpm)
C/mn ALPHA (counts per minute)

5.9.9.2. The survey meter will automatically provide and display the proper readings and units of measurement over its entire operating range.

Survey Meter. The survey meter will automatically select one of four operating modes (2 low and 2 high)	
The low-range detector in the dose RATE mode	Detects and measures gamma and detects beta radiation. Ranges from 10 μR/h to 5 R/h.
The low-range detector in the accumulated DOSE mode	Measures gamma and detects beta radiation. Ranges from 1 μR/h to 1,000 R.
The high-range detector in the dose RATE mode	Detects and measures gamma radiation only. Ranges from 3 R/h - 10,000 R/h. **Note**: Detects and measures up to 10,000 R, but only displays 1,000 R.
The high range detector in the accumulated DOSE mode	Detects and measures gamma radiation only. Ranges from 1 μR to 1,000 R.
Alpha Probe. The range of the Alpha probe is 0 - 1,200,000 counts per minute.	

5.9.10. Capabilities and Limitations. The instrument will display both a dose rate as well as an accumulated dose amount. With additional auxiliary probes, the ADM-300A has extended capability such as detecting and measuring alpha radiation. In its stand alone configuration it detects and measures gamma and detects beta radiation.

5.9.10.1. Highly Resistant. The ADM-300A operates in temperatures from -25^{O} to 50^{O}C (-14^{O} to 122^{O}F) and in humidity up to 100%. It is highly resistant to most harsh environmental conditions. For example, it is engineered to operate even after being accidentally immersed in water. **NOTE.** The unit will not operate under water.
5.9.10.2. Operates On Two 9 Volt Batteries. The meter primarily operates on two standard 9 volt alkaline batteries and will last about 100 hours at 25^{O}C (76^{O}F).

5.9.11. Electromagnetic Pulse. The instrument is also electromagnetic pulse (EMP) hardened and will not saturate at a dose rate of up to 100,000 R/h.

5.9.12. Principles Of Operation. The ADM-300A is microprocessor-based. This means that the internal electronics control all functions including detection, calculation, compensation, and display. The central processing unit (CPU) control both low range and high range Geiger - Mueller (GM) tubes. The two GM detectors produce electrical signals when exposed to gamma rays and beta particles.

5.9.13. Normal Operating Procedures.
5.9.13.1. Install batteries.
5.9.13.2. Turn unit on by pressing **and holding** the POWER ON/OFF switch for 2 seconds. The display indicates **"PLEASE WAIT."** The meter will conduct the programmed self-diagnostic test. The “RATE” display will appear and ambient gamma rates will be indicated.
5.9.13.3. Power Off. Press **and hold** POWER ON/OFF for 2 seconds.

5.9.14. Modes of Operation. Press the MODE switch until the desired reading is displayed. The mode is displayed as follows:

MODE	**DISPLAY**
DOSE Rate	RATE
Dose	DOSE
Dose Rate Alarm	RaAlm
Dose Alarm	DoAlm
Scaler (used for accumulation over a preset period of time)	Scaler
Survey (used for tracking up to 100 pre-designated monitoring points)	Survey

5.9.15. Alarm Set Points. To see the current alarm set points, repeatedly press the MODE switch until **RaAlm** or **DoAlm** is displayed. The default point for rate alarm is 600 µR/h and the dose alarm default is 100 mR. The unit memory retains the last setting when the power is turned off. To adjust the desired **RaAlm** or **DoAlm**, use the **MODE** switch to select the appropriate alarm. Then use the **UP ARROW** ↑ to set the desired points before the display stops flashing. After selecting the desired adjustment points, reset the accumulated dose. To reset accumulated dose:

5.9.15.1. Move to **DOSE** display (using the MODE switch).

5.9.15.2. Press and hold **SET** switch.

5.9.15.3. While holding **SET** press **UP ARROW** ↑ for at least 3 seconds. **"CLEAR DOSE"** will be displayed.

5.9.15.4. Release all switches.

5.9.16. Alarm Display. When the survey meter has detected radiation above the preset alarm levels, the audible and flashing visual alarms are activated. The display shows the type of alarm.

5.9.17. Gamma Surveying. To perform gamma surveys with the ADM-300A, the beta window on the meter's rear panel must be closed. The survey meter will auto range to detect gamma radiation without interruption. During ground radiological reconnaissance the instrument

should be at a consistent angle to the ground to assure accuracy and uniformity of readings.

5.9.18. Beta Monitoring. To monitor for beta, hold the ADM-300A in your hand or by the handle, if attached. Open the window cover and point window towards the suspected contaminated area. In the "low range" mode, the beta particles will enter the window if contamination is present. If the reading is 15 or higher with the window cover open, then Beta particles are present. Gamma reading can be observed while the window is closed.

5.9.19. External Probe Operation. Both the Alpha and Beta external probes lend themselves to convenient personnel and material contamination checks. The X-ray probe is designed to find gross contamination under cover of dust, snow etc., where alpha detectors would have no sensitivity. When the X-ray probe is attached the internal detectors and alarm set points are de-activated and the accumulation of Dose is suspended. The neutron probe is an accessory to the ADM-300A kit and is used to measure neutrons in a nuclear environment. The probe is not a standard component to the kit; it must be ordered as a separate component.

5.9.20. Preventive Maintenance. Preventive maintenance or routine checks include a visual inspection, operational check, cleaning, and storing the unit. When turned on, the ADM-300A automatically runs a diagnostic test. It will display any malfunctions if they occur. Any problems other than low batteries will be displayed as FAILURE and then the type of failure. If this occurs, turn unit off, retry unit after 30 seconds. If failure still exists, turn unit off and contact NRC or box unit and return to NRC for repair.

5.9.21. Calibration. The ADM-300A requires an annual calibration. A performance test on the instrument and probe accuracy should be accomplished prior to use and every 180 days. Accuracy verification of the meter and probes is done using a test set containing test sources and a fixture to position the test sources.

5.9.22. Repair. The ADM-300 meter is not field level repairable. The only parts to replace are the batteries. However, the various probes can be repaired. Each probe is identified in T.O.11H2-2-31 with its repair procedures. Repairs should be made only if no additional probes are available. Only personnel trained in RADIAC repair should work on this item.

5.9.23. Decontamination. Surface contamination can be decontaminated with a cloth or brush.

CHAPTER 6 - SUPPORT EQUIPMENT

6.1. M41 Protection Assessment Test System

NSN: 4240-01-365-8241

6.1.1.Purpose. Provides the user with a standard device for correctly fitting the protective masks. Mask fit procedures for the M17 series masks greatly differ from the procedures of the MCU2A/P series masks. Variations in training, procedures, and fit equipment will be eliminated, resulting in protective masks that provide proper fit and protection.

6.1.2. Technical Reference. T.O. M41 Operators Manual.

6.1.3. General Description. The M41 refers to the whole system or kit. The test instrument is called the Protection Assessment Test Instrument (PATI). The PATI is 9.5 in. x 7.5 in. x 5.5 in. and weighs 4.2 pounds. Total weight for the M41 with carrying case is 22 pounds.

6.1.4. User. Qualified operators using this equipment during NBC defense training, are the primary users.

6.1.5. Power Requirements. 115 VAC to 230 VAC or lithium-sulfur dioxide battery. Hours of operation per battery charge are 8 hours at 70°F.

6.1.6. Operating Ranges. 35 to 100°F.

6.1.7. Storage Ranges. -40 to 160°F.

6.1.8. Set-Up. Detailed procedures are explained in Chapter 2 of the Operator's Manual.

6.1.9. Operational Use. Complete the procedures in Chapter 2, Set-up before any fit testing. can be accomplished, the procedures in Chapter 2, Set-Up, must be completed. Chapter 3 of the Operator's Manual describes in detail these procedures for proper fit test.

6.1.10. Operational Limitations. Operate inside at ambient temperatures between 35 and 100°F. Inaccurate readings will result if the M41 PATS is operated in temperatures below 35°F and temperatures above 100°F. Do not smole in the immediate area and with in 30 minutes prior to the test. For valid results, the airman should not talk during the mask fit test.

6.1.11. Calibration. The PATI should be calibrated every 18 months or 500 hours of operation, whichever comes first. It is the operator's responsibility to track and maintain the usage hours of the device. Refer to Chapter 6 of the Operator's Manual for cleaning and calibration instructions.

Decontamination. Decontamination of the PATI and most of the components of the M41 system is not authorized. The carrying case can be decontaminated using the M258A1 or M295 kits. Procedures for their use are in their respective technical orders.

6.2. NBC Contamination Marking Set

NSN 9905-01-346-4716

6.2.1. Purpose. The marking kit provides the user with a lightweight, portable, easy to use marking set to mark the presence of Nuclear, Biological, and Chemical (NBC) contamination.

6.2.2. Technical Reference. Technical Manual 3-9905-001-10

6.2.3. Training Reference. RTP F6

6.2.4. General Description. The marking set is green plastic with two carrying straps for backpack or frontal wear. The set has three individual rollers integrated in the plastic case. Basic weight with components is less than 10 pounds, length is 13.6 inches, width is 9.3 inches, and height is 3.6 inches.

6.2.5. Wartime User. All personnel involved with identification and marking of NBC hazards.

6.2.6. Components. The marking set consists of:

Carrying container		
60 marking flags, 20 for each type of NBC hazard:		
• **20 white (Nuclear)**	• **20 blue (Biological)**	• **20 yellow (Chemical)**
48 metal stakes each 11.4 inches in length.		
2 red marking crayons		
13 s eparate rolls (66 feet in length) of yellow marking ribbon		

6.2.7. Operating Ranges. Operates in all climatic conditions.

6.2.8. Operational Limitations. None.

6.2.9. Inspection. Inspection of this equipment is the user's responsibility. All components are expendable. Inspect the kit to ensure all required components are present.

6.2.10. Operational Use. Technical Manual 3-9905-001-10 describes general instructions for use, and how the components of the marking set work. Air Force procedures for identifying and marking NBC hazards are listed in AFMAN 32-4005, *Personnel Protection and Attack Actions*.

6.2.11. Decontamination. The marking set can be decontaminated with the M258A1 or M295 kit. Basic decontamination consists of wiping or washing the carrying case and the components. Hot soap and water will also remove the contamination from the surfaces. If straps become contaminated, remove and replace straps.

6.3. Multi-Man Intermittent Cooling System (MICS)

NSN: 4240-01-298-4140

6.3.1. Purpose. The MICS provides cooling to alleviate heat stress to personnel performing moderate to high intensity work such as Integrated Combat Turn-arounds (ICTs) and some Base Recovery After Attack (BRAAT) functions while wearing chemical protective clothing.

6.3.2. Technical Reference. T.O. 35EA4-7-6-1

6.3.3. Training Reference. RTP C13

6.3.4. General Description. MICS consists of two major components:

6.3.4.1. Air Distribution Unit (ADU). The ADU is an external adapter to a standard flight line ground air conditioner equipped with an eight-inch duct flange adapter. The ADU receives cool air from the air conditioner, removes CB agents through two gas particulate filters (M-48s), and distributes the air to ten outlets. Each ADU, including filters, hoses and connectors, weighs 360 pounds. Dimensions are 36 inches long x 32 inches wide x 42 inches high.

6.3.4.2. Air Cooling Vest (ACV). The ACV is a lightweight (30 oz.) nylon vest with hose attachment to distribute cool, dry air to both the front and rear of the torso. The ACV is worn over the undershirt.

6.3.5. Wartime User. Anyone performing high intensity tasks during times when heat stress conditions exceed an ambient temperature/moisture combination of 70° F with 50% relative humidity.

6.3.6. Components. The Air Distribution Unit (ADU) consists of:

Gas particulate filter (M048)	2 each.
Chemical resistant rubber hose, 10 feet long x 1 inch in diameter	10 each
Y connector with regulator	10 each
Silicon hose, extendible, 24 inches long x ¾ inch in diameter	10 each
MCU-2/P connectors	10 each

6.3.7. Power Requirements. The air conditioning source and power generator will be operated and maintained by aerospace ground equipment (AGE) technicians. A standard flight line generator and any air conditioning unit producing at least 200 cfm of air, with an 8-inch duct flange adapter can operate the ADU.

6.3.8. Replacement parts. The M-48 filter is the only expendable part of the MICS.

6.3.9. Special Tools. No special tools are required to service the ADU. A common wrench set and screw drivers are the only tools required.

6.3.10. Maintenance. Three levels of maintenance exist for the ADU: Organization, Intermediate and Depot:

Organization	Consists of servicing the ADU, removal/replacement of the M-48 filters and repair to the structure. Procedures for M-48 filter replacement are found in T.O. 35EA4-7-6-1
Intermediate	Consists of replacement accessories, ACV and similar items. No intermediate repair to the ADU is required.
Depot	Consists of major component replacement to the ADU, performed by AFMC.

6.3.11. Inspection. Air Conditioner inspection will be performed by unit personnel owning the equipment IAW technical guidance. ADUs will be performed by using personnel IAW T.O. 35EA4-7-6-1.

6.3.12. Use. Refer to T.O. 35EA4-7-6-1 for detailed instructions on use.

6.3.13. Calibration. None.

6.3.14. Decontamination. Normal decontamination procedures for AGE equipment will apply to the ADU. The ACV will be decontaminated using procedures established for the Ground Crew Ensemble (GCE).

6.4. AN/PSN-11 Navigation Set Global Positioning System

NSN: 5825-01-374-6643

6.4.1. Purpose. The Global Positioning System (GPS) provides the user with global positioning and siting capabilities. The AN/PSN-11 will provide data for missions such as general navigation, siting/surveying, tactical reconnaissance, close air support, engineer surveying, electronic warfare (EW) operations, and ground-based forward air control.

6.4.2. Technical Reference. T.O. 31R4-2PSN11-1

6.4.3. Training Reference. RTP H6

6.4.4. General Description. The GPS is a sealed, watertight, hand held receiver. It is less than 9.5 inches long, 4.1 inches wide, and 2.6 inches deep. It weighs 2.75 pounds with batteries.

6.4.5. Wartime User. Personnel who have been trained in its use. Primarily members of any type of reconnaissance or damage assessment teams.

6.4.6. Components. The GPS set contains 16 parts. Following are the major components:

Navigation set, Part # 822-0077-002	Case nylon, Part # 021-0706-010
Battery memory, Part # LS6 BA	Helmet antenna, Part # AU72611GPS-RW
Power adapter (AC to DC), Part # 218-0325-020	External power cable assembly, Part # 4C-6196
Battery holder, Part # 221-0135-020	

6.4.7. Configurations. The GPS can be used:

6.4.7.1. By itself (internal battery and integral antenna)

6.4.7.2. With an external antenna; remote RA or helmet HA

6.4.7.3. With external DC power cable, or AC power adapter

6.4.7.4. With the vehicle mount

6.4.7.5. Any combination of AN/PSN-11, external antenna, external power cable/adapter, or mount

6.4.8. Power Requirements. The GPS will operate with both battery and external power. The internal power adapter is hardwired for a 110/220 volt AC power source via an external AC power adapter. The following are battery specifications and battery life estimates:

6.4.8.1. Lithium (nonrechargeable), BA-5800/U, >10 hours life

6.4.8.2. Nickel Cadmium (rechargeable), Rockwell part# 221-0134-010, >1.5 hours life

6.4.8.3. AA-alkaline (nonrechargeable), WB101, 8 each, >4.0 hours life

6.4.8.4. AA-lithium (nonrechargeable), L-91, 8 each, TBD

6.4.8.5. Lithium (nonrechargeable) (memory battery), LS6 BA, 1 year (change annually)

6.4.9. Operating Ranges. -4 to 158°F and 0 to 100% relative humidity. Elevations from -1312 to 29,856 feet at Mean Sea Level.

6.4.10. Storage Ranges. -76 to 158°F (without batteries). Elevations from -1312 to 49,213 feet.

6.4.11. Interface. The GPS is designed to interface with several types of external equipment, including:
6.4.11.1. Other GPS
6.4.11.2. HAVE QUICK radios
6.4.11.3. SINCGARS radios
6.4.11.4. RS-232 serial port
6.4.11.5. RS-422 serial port

6.4.12. Operational Use. Due to the complexity of the GPS and its many functional capabilities, training in specific use is required. Sections 2 through 7 and 9 through 10 of T.O. 31R4-2PSN11-1 will provide detailed procedures for operation.

6.4.13. Maintenance/Inspection. Refer to chapters 1 through 3 and chapter 8 of T.O. 31R4-2PSN11-1 for complete details.

6.4.14. Decontamination. No decontamination procedures are identified in the technical order for the AN/PSN11; however, the unit is sealed and could be decontaminated. Restrict decon to surface areas of the receiver and its components. Use M258A1, M295 kits to decontaminate the equipment.

WILLIAM P. HALLIN, Lt General, USAF
DCS/Installation & Logistics

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