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Chapter 9

Chemical, Biological, Radiological, and Nuclear (CBR-N) Defense

Topics

1.0.0 Effects of CBR-N Weapons
2.0.0 CBR-N Contamination Detection and Identification
3.0.0 CBR Defense Responsibilities
4.0.0 CBR Unit Equipment
5.0.0 CBR Marking of Contaminated Areas

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Overview

Although chemical and biological warfare has been outlawed by international agreements, the potential for such warfare is real. Likewise, radiological or nuclear warfare is an ever-present concern to the Seabees as well as all other U.S. military personnel. In this chapter, you will learn about the effects of Chemical, Biological, Radiological, and Nuclear (CBR-N) weapons on personnel and equipment. This information includes the symptoms of CBR poisoning and its first-aid treatment. You will also learn about Seabee CBR defense responsibilities, individual protective measures, and CBR defense equipment. Finally, you will learn about completing the Seabee’s mission while under CBR conditions, CBR defense training, and how to mark contaminated areas.

Objectives

When you have completed this chapter, you will be able to:

1. Describe the effects of Chemical, Biological, Radiological and Nuclear (CBR-N) weapons.
2. Recognize the symptoms and effects of CBR-N agents.
3. Recognize Seabee CBR defense responsibilities.
4. Recognize and describe Seabee CBR defensive equipment.
5. Describe the MOPP and its limitations.
6. Recognize the markers used in CBR contaminated areas.

Prerequisites

There are no prerequisites for completing this manual.
Features of this Manual

This manual has several features which make it easy to use online.

- Figure and table numbers are italicized within the handbook text. Figure and table reference numbers are conveniently located next to (or near) the applicable handbook text.

- Audio and video clips are included in the text, with italicized instructions telling you where to click to activate the appropriate link.

- Review questions are included at the end of this chapter as the chapter assignment. To submit assignments log into https://www.courses.netc.navy.mil, go to “Student Services”, in the drop down click on “Active Courses”, go to "View/Submit Answers" next to the course you wish to submit answers for. Assignments may be submitted to the above Web site as they are completed, and instant scoring is available. Your completion letter is available as soon as you pass all assignments.

- A form at the end of each chapter allows your input for improving the manual or correcting errors to be brought to the attention of CSFE’s Technical Review Committee. Your input is important and will help keep this manual up to date and free of technical errors.
1.0.0 EFFECTS OF CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR (CBR-N) WEAPONS

CBR-N training needs to be integrated into all facets of individual and unit training. Sufficient training time must be allocated to ensure that actions required for initial survival and subsequent mission accomplishment are conditioned responses. Chemical agents are used to produce death, injury, temporary incapacitation, or irritating effects. (Screening smokes are not toxic unless they are inhaled in large amounts. Incendiaries are used primarily to start fires. These two agents are not discussed further.) Broadly speaking, there are three types of antipersonnel agents: casualty, incapacitating, and harassing.

Casualty agents are highly poisonous and are intended to kill or seriously injure. Included in this group are nerve, blister, choking, and blood agents. Nerve agents, as a group, are probably the most effective because only small doses are needed to produce death. Some agents are so persistent (when dispersed as a liquid) that they can remain effective for several days. They enter the body by the victim’s breathing or swallowing or through the skin of the victim. Blister agents cause severe burns, blisters, and general destruction of body tissue. When they are inhaled, the lungs are injured. Choking agents inflame the nose, throat, and particularly the lungs. Blood agents interfere with the distribution of oxygen by the blood.

Some casualty agents have a cumulative effect, which means that successive doses add to the effect of each preceding dose. You might receive a nonlethal dose of a nerve agent, for example, followed within a few hours by another nonlethal dose. The cumulative effects of the two exposures, however, could be sufficient to cause death.

A new development is the Nonlethal Incapacitating Agent. It renders personnel incapable of performing their duties by interfering with the mental processes that control bodily functions. Reactions vary among individuals. One person might go into shock, and still another might have a feeling of extreme fatigue. These agents are difficult to detect because most of them are colorless, odorless, and tasteless.

Harassing agents include tear and vomiting gases that cause temporary disability. Tear gases are used mainly for controlling riots, but they have been used in warfare with varying degrees of success. Without a gas mask, the individual is rapidly incapacitated, but the effects disappear in 5 to 10 minutes after the person dons a protective mask or gets to fresh air.

Vomiting gases are useful when the enemy intends to launch an attack with casualty agents. They cause extreme nausea and vomiting, requiring those who have been exposed to remove their masks, thus exposing personnel to the casualty agents.

1.1.0 Effects of Biological Weapons

Biological operations use living organisms to cause disease or death. They act on living matter only. Most organisms that produce disease enter the body of the victim and grow in the human tissues. Some organisms produce toxins (poisons) in food or water, and the poisons cause disease after the victim eats or drinks it.

Large scale biological attacks by an enemy are as yet an untried weapon. As far as it is known, there has been no open attempt by any country to use this form of attack. Biological agents, however, have certain characteristics that favor them over other types of warfare, and the possibility of their use in the future must be anticipated. Only small amounts of the agents are needed, because the organisms are alive and multiply in the
victims. Moreover, they are difficult to detect and slow to identify. A whole ship’s company might be infected before the medical department realized a disease existed on board.

The most efficient means of delivering biological agents on a large scale is through aerosols, which generally are invisible and odorless. Aerosols can be released from aircraft in bombs or direct sprays, from surface vessels on onshore winds, or from any number of explosive munitions, such as projectiles, guided missiles, and rockets. Animals and insects can be used as carriers to spread biological agents.

Another method of quickly infecting large numbers of people is for saboteurs to contaminate a water supply. Diseases, such as typhoid fever, cholera, and influenza, can be spread by infecting water, milk, and food supplies with the proper microorganisms.

1.2.0 Effects of Nuclear Weapons

Nuclear weapons produce explosions of great force and heat and release nuclear radiation. Their primary purpose is the mass destruction of property and personnel. Their effects are divided into three categories: blast, heat, and nuclear radiation.

1.2.1 Blast

Injuries caused by blast can be divided into primary (direct) injuries and secondary (indirect) injuries. Primary blast injuries result from the direct action of the air shock wave (overpressure) on the human body. The greater the size of the weapon, the greater the effective range of the blast wave will be with a subsequent increase in casualties.

Secondary blast injuries are caused mainly by collapsing buildings and by timber and other debris flung about by the blast. Personnel may also be hurled against stationary objects or thrown to the ground by high winds accompanying the explosion. Injuries sustained are similar to those resulting from a mechanical accident, such as bruises, concussions, cuts, fractures, and internal injuries.

At sea, the shockwave or base surge accompanying an underwater burst will produce various secondary injuries. Casualties resemble those caused by more conventional underwater weapons, such as mines and depth charges; but instead of being localized; they extend over the entire ship. Injuries also will result from personnel being thrown against fixed objects or structures. Equipment, furniture, boxes, and similar gear, when not secured properly, can act as missiles and cause many injuries.

Frequently, hemorrhage and shock are serious complications of blast injuries. The importance of shock cannot be overemphasized, because it is often the main consideration in determining the fate of the patient.

1.2.2 Heat

Heat from nuclear weapons causes burns. These burns can be grouped into two categories: primary and secondary. Primary burns are a direct result of the thermal radiation from the bomb. Secondary burns are the result of fires caused by the explosion.

As with blast injuries, shock is commonly associated with extensive burns. Burns are also subject to infection, which may produce serious consequences.

Flash burns are likely to occur on a large scale as a result of an air or surface burst of a nuclear weapon. Because thermal radiation travels in straight lines, it burns primarily on
The side facing the explosion; but under hazy atmospheric conditions, a large proportion
of the thermal radiation may be scattered, resulting in burns received from all directions.
Depending on the size of the weapon, second-degree burns may be received at
distances of 25 miles or more.

The intense flash of light that accompanies a nuclear burst may produce flash
blindness, even at a range of several miles. Flash blindness is normally of a temporary
nature since the eyes can recover in about 15 minutes in the daytime and in about 45
minutes at night. A greater danger lies in receiving permanent damage to your eyes
caused by burns from thermal radiation, which may occur 40 miles or more from a
large-yield nuclear weapon.

1.2.3 Nuclear Radiation

Nuclear radiation consists of four types: alpha particles, beta particles, neutrons, and
gamma rays.

Alpha and beta particles can be ignored as initial radiation because they are very short-
range; however, they can be a hazard as residual radiation. Alpha particles have little
penetrating power; but if they are ingested into the body, they can cause serious harm.
Beta particles also are of little concern unless they are on the body (in dust, dirt, etc.) or
get into the body.

Neutrons are a direct hazard only during the initial radiation phase and then only in the
general area of ground zero. In the residual phase, however, they cause whatever
material absorbs them to become radioactive and emit gamma rays and beta particles.

Gamma rays (similar to, but more powerful than, x-rays) are the most hazardous form of
radiation. They can travel long distances in air and have great penetrating power,
making it difficult to provide sufficient shielding to protect personnel.

Radiation hazards are of three types: penetration dose, skin dose and internal
contamination.

Penetration doses and internal contamination have the most serious effects. You can be
protected against penetration doses by proper shelter.

Internal contamination can be avoided by wearing the protective mask and not eating or
drinking food and water until they are declared safe.

Skin doses, which cause injuries similar to burns, can be reduced by wearing proper
battle dress.

2.0.0 CBR-N CONTAMINATION DETECTION AND
IDENTIFICATION

For Seabees to carry out their mission, they must be able to detect and identify CBR
agents immediately. The very nature of CBR agents, however, makes it difficult to
detect and identify them.

In a nuclear attack for instance, you know an attack is taking place because you can
see it, hear it, and feel it. However, you cannot see the nuclear radiation that can be just
as deadly over a period of time as the blast itself. In the same invisible way, biological
agents can be present with the possibility of no one knowing until it is too late. Recent
developments in chemical operations make some of the chemical agents colorless and
odorless.
You must learn the symptoms of each type of attack so you can take the proper action when exposed and you can apply the correct self-aid and first-aid measures.

2.1.0 Symptoms of Chemical Agent Contamination

Chemical agents make you a casualty when your body comes in contact with a bigger dose than it can withstand. The limits of tolerance of the human body extend from short periods of exposure and low concentrations of certain agents to extended periods of exposure and high concentrations of certain other agents. Furthermore, the limits of tolerance to specific agents vary with individuals. In any event, your principal concern is recognizing the symptoms and relieving the effects of exposure before the limit of exposure is exceeded.

2.1.1 Nerve Agent Symptoms

Symptoms of nerve agent contamination are a runny nose; tightness of chest with difficulty in breathing; contraction of eye pupils; and nausea, cramps, headache, coma, and convulsions. All of these symptoms can take place in 30 seconds when the dose is sufficiently heavy.

Vapors of the G- (GA=Tabun, GB=Sarin and GD=Soman) or V- (VX gas) series nerve agents, even in low concentrations, cause contraction of the eye pupils. This action affects the sight, especially in dim light, and induces a headache. After a brief exposure to the vapors, a feeling of tightness in the chest may be noticed. The liquid substance does not injure the skin but penetrates it and poisons the body. Contraction of the pupils, in such an instance, may not appear as a warning sign.

A 1- to 5-minute exposure of personnel not wearing protective masks for low concentrations of G- or V-agent vapors causes difficulty in vision. Slightly greater exposure causes headache, nausea, pain in the chest, and more serious visual difficulties. Exposure of unbroken skin to vapor alone, however, entails little danger of serious injury.

Liquid contamination from a nerve agent to the skin is a real hazard. One of the first signs of exposure when liquid contaminates the skin may be excessive sweating and twitching of the muscles at the site of contamination. Small amounts of liquid left undisturbed on the skin can cause death in a matter of a few minutes. The entrance to the body is even more rapid through the surface of the eyes and through the linings of the mouth and nose. A lethal dose can be absorbed as rapidly by getting liquid in the eyes as by inhaling concentrated vapor. When poisonous vapors are swallowed, the first symptoms are excess flow of saliva, intestinal cramps, nausea, vomiting, and diarrhea. When the nerve agent is absorbed into the system after the victim is exposed to liquid or vapor, the symptoms may be generalized sweating, difficulty in breathing, muscular weakness, and eventually convulsions, paralysis, and unconsciousness.

2.1.2 Blister Agent Symptom

Immediate contact with liquid mustard or mustard vapor causes no eye or skin pain or any other immediate symptoms. Exposure to mustard gas for more than half an hour, however, produces these symptoms: Half an hour to 12 hours after exposure, the contaminated eyes water, feel gritty, and become progressively sore and bloodshot. The eyelids become red and swollen. Infection frequently results.

Mustard vapor will burn any area of the skin, but the burn will be most severe in moist areas (neck, private parts, groin, armpits, bends of knees, and elbows). Redness of the skin follows in one half hour to 36 hours after exposure. This condition may be
accompanied by intense itching, and blisters may then appear. Stiffness, throbbing pain, and swelling may also be observed.

A few hours after breathing mustard vapor, a victim may experience irritation of the throat, hoarseness, and coughing. After severe exposure, the lining of the respiratory system swells and interferes with breathing. Frequently, pneumonia develops.

When the whole body is exposed to mustard vapor, the body goes into a state of shock. This reaction is accompanied by nausea and vomiting.

Nitrogen mustards irritate the eyes before they affect the skin or respiratory system. The action of nitrogen mustards on the eyes occurs in a shorter time than does mustard. Even low concentrations of these agents may seriously decrease vision during or shortly after exposure. Later effects are similar to those of mustard. Contact of these agents with the skin produces damage like that produced by mustard, and their effects on the respiratory system are also similar.

2.1.3 Blood Agent Symptom

Symptoms produced by blood agents, such as Hydrogen Cyanide, depend upon the concentration of the agent and the duration of the exposure. Typically, either death occurs rapidly or recovery takes place within a few minutes after removal of a victim from the contaminated area. When the victim inhales a high concentration of a blood agent, the victim begins to breathe more deeply within a few seconds, has violent convulsions after 20 to 30 seconds, stops breathing regularly within 1 minute, then gives occasional shallow gasps, and finally the heart stops only a few minutes after the onset of exposure. After moderate exposure, giddiness, nausea, and headache appear very early, followed by convulsions and coma. Long exposure to low concentrations may result in damage to the central nervous system. Mild exposure may produce headache, giddiness, and nausea, but usually recovery is complete.

The effects of Cyanogen Chloride combine the properties of two agents: chlorine and cyanogen. The chlorine properties induce coughing, dryness of the nose and throat, tightness across the chest, and smarting and watering of the eyes, resulting finally in the accumulation of fluid in the lungs. Cyanogen is similar to hydrogen cyanide and, like that agent, causes giddiness, headaches, unconsciousness, convulsions, and death.

2.1.4 Choking Agent Symptom

In low concentrations, choking agents produce an action on the respiratory system that results in the accumulation of fluid in the lungs. This effect may lead to death. High concentrations produce death for the same reason, but the upper respiratory tract may be involved as well. Exposure to choking agents may produce immediate dryness of the throat, coughing, choking, tightness across the chest, headache, nausea, and at times, smarting and watering of the eyes. Symptoms usually are delayed, however, and it is possible that no immediate symptoms will appear when you are exposed to a fatal dose.

Even mild exposure to a choking agent that is accompanied by immediate symptoms may cause fluid to accumulate in the lungs within 2 to 24 hours after exposure. Shallow and rapid breathing, hacking and painful cough, frothy saliva, and an ashen-gray color of the skin indicate the presence of this fluid.

2.1.5 Vomiting Agent Symptom

Exposure to vomiting agents is followed soon by a pepper-like burning of the eyes, nose, throat, and air passages. The burning sensation is accompanied by a flow of tears and repeated coughing and sneezing. These symptoms increase in severity for several
minutes, even after the victim dons a mask. The victim becomes sick to the point of vomiting. When the mask is removed, the victim is then exposed to even more hazardous agents.

2.1.6 Tear Agent Symptom

Tear agents (also called riot control agents) are local irritants which, in low concentration, act primarily on the eyes, causing intense pain and a considerable flow of tears, stinging of moist, warm skin, and irritation of the nose. High concentrations affect the upper respiratory tract and lungs and cause nausea and vomiting. The agents may be either solids or liquids and may be dispersed as vapors or smokes. o-chlorobenzylidene malononitrile (CS) is the most effective, causing incapacitation 20 to 60 seconds after exposure. Recovery can be expected 5 to 10 minutes after the victim is breathing fresh air.

2.1.7 Incapacitating Agent Symptom

Incapacitating agents can cause mental symptoms and may also produce physical symptoms, such as a staggering gait, dizziness, and blurred vision. Some of these agents cause fainting spells, and others cause severe muscle weakness. The mental symptoms often resemble alcoholic drunkenness; for example, individuals may act silly, giggle, or become angry and belligerent similar to a “fighting drunk.” Sometimes incapacitating agents can cause hallucinations. (Victims may imagine that they see snakes or enemy soldiers, or they may imagine that colors have changed.) Many of these incapacitating gases prevent sleep. Some people may stay wide-awake for 4 days and be mentally confused for the whole period. These agents do not kill, but they can make you unfit for duty. Many of them do not produce effects until several hours after inhalation. These effects can last from 8 hours to 4 days.

2.2.0 Symptoms of Biological Contamination

In the early stages of any biological disease, the general symptoms are fever, malaise, and inflammation.

The degree of fever varies with the individual, depending on their resistance, and serves as a rough guide to the severity of infection. Often a violent chill precedes the fever. Whether the victim gets the chill or not, the fever is usually one of the earliest symptoms.

Malaise is a feeling of bodily discomfort and weakness. There may be nausea, dizziness, loss of appetite, and general aches and pains.

Inflammation is caused by the reaction of body tissues combating and sealing off an infection. In almost every case there is pain, redness, and swelling. Some types of infection result in a characteristic rash, making it possible for the doctor to make an early diagnosis.

2.3.0 Symptoms of Nuclear Radiation

The first symptoms of exposure to nuclear radiation are nausea and vomiting. Later (2 weeks or more) symptoms are diarrhea, loss of hair, loss of weight, sore throat, and skin hemorrhage. Death rates depend on the amount of the dose and the general physical condition of the victim. Unless a very heavy dose is received, ultimate recovery can be expected in most instances.
3.0.0 CBR DEFENSE RESPONSIBILITIES

The battalion commander is responsible for planning the overall CBR defensive measures for a Seabee’s encampment. The battalion commander then presents to the battalion those requirements for defense measures that should be provided by other forces.

Protective measures used against other weapons give only partial protection against CBR attacks. Provisions must be made for CBR defense, such as the following:

- Greater emphasis on unit separation, dispersion, and mobility
- Increased air and ground reconnaissance
- Training and indoctrination of personnel
- Warning, reporting, detection, and identification of CBR agents and hazards
- Individual and collective protection
- Decontamination of personnel, equipment, supplies, and terrain, when directed
- Plans for handling mass casualties, to include medical operations and first aid

3.1.0 Chemical defense

The best defense against a chemical attack is constant monitoring with equipment to detect chemical agents as soon as possible. To provide adequate time to take protective measures, commanders should use all available chemical detection equipment.

The protective measures taken by individuals and units when operating under the threat of chemical attack or in a chemical environment are governed by the nature of the threat, mission, situation, and weather. Movement of troops and supplies should be planned so contaminated terrain is avoided to the maximum extent possible. Contaminated terrain is crossed only when absolutely necessary and then as quickly as possible. Preferably, you should move in vehicles at speeds and intervals that minimize contamination. When the situation and mission permit, heavy work-rate activities of personnel dressed in chemical protective clothing and equipment should be minimized. Essential work should be planned for the coolest part of the day, when possible.

3.2.0 Protective Measures before Chemical Attack

In any combat situation, the commander should designate a level of Mission Oriented Protective Posture (MOPP) for the unit. MOPP is discussed in detail later in this chapter. The following protective measures must be taken before a chemical attack.

3.2.1 Extended Wear of Protective Clothing

Based on the MOPP level designated by the commander, the individual may have to adapt to requirements for wearing their protective clothing and equipment for extended periods. The amount of time required to put all of these items on during a chemical attack exceeds the amount of time required to receive a casualty-producing dose of chemical agent.
3.2.2 Chemical Detector Paper/Kits

The M8 Chemical Agent Detector Paper is used to detect the presence of liquid V type nerve, G type nerve, and H type blister agents. When a sheet is brought in contact with liquid nerve or blister agents, it reacts with chemicals in the paper to produce agent-specific color changes. The paper is blotted on a suspected liquid agent and observed for a color change (liquid agent absorption). V type nerve agents turn the paper dark green; G type nerve agents turn it yellow, and blister agents (H) turn it red. The paper cannot be used to detect chemical agents in water, vapor, or aerosols.

The M9 Chemical Agent Detector Paper (Figure 9-1) is placed on personnel and equipment to identify the presence of liquid chemical agent aerosols. It will turn pink, red, reddish brown, or red-purple when exposed to liquid agents. It can detect (but not identify) the specific agent. As soon as it indicates the presence of chemical agents, protective action must be taken.

The M256A1 Chemical Agent Detector Kit is a portable, expendable item that is capable of detecting and identifying hazardous concentrations of chemical agents. It is used after a chemical attack to determine if it is safe to unmask or reduce the protective posture level. It also determines the type of agent present and helps confirm the presence or absence of hazardous concentrations of an agent. Each kit can be used to test for blister agents, blood agents, nerve agents, and lewisite. Each test spot or detecting tablet develops a distinctive color that indicates whether a chemical agent is or is not present in the air.

3.2.3 Alertness and Proficiency

Individuals must remain alert and constantly aware of the chemical threat, especially when duty requirements preclude the wearing of full protective equipment. Individuals must understand the chemical alarms and signals and be proficient in attaining the maximum level of protection when alerted to a chemical attack.

3.2.4 Protection of Individual Equipment

To the extent possible, individuals must protect equipment and supplies against liquid chemical agent contamination by keeping them organized and covered. Hastily constructed fighting position covers, ponchos, shelter halves, or other suitable materials can be used for protection. Individuals should wear full protective clothing and equipment when sleeping and, to the extent possible, cover themselves and their equipment before they go to sleep.

3.3.0 Protective Measures during Chemical Attack

A chemical attack may come directly in the area in which individuals are located or upwind from that area. In either case, when alerted to a chemical attack the following immediate defensive actions must be taken:

Figure 9-1 — M9 chemical agent detector paper.
• Stop breathing.
• Don protective mask.
• Give the alarm.
• Don MOPP level 4 unless otherwise directed.
• Continue the mission and wait for further orders.
• When the situation permits, assist others who need help.

For MOPP level 4, personnel should completely encapsulate themselves by closing their overgarments, adjusting all drawstrings to minimize the likelihood of any openings, and putting on their protective gloves. MOPP level 4 is used when the highest degree of protection is required, or if CB agents are present but the actual hazard is not determined. Once the hazard is identified and risk assessment measures are employed, the overgarment may be left open.

3.4.0 Protective Measures after Chemical Attack

If an adversary uses an air-bursting chemical munition, mission permitting, personnel will avoid outside activities to the maximum extent possible after an attack during the chemical droplet fall phase. Additionally, the chemical droplet fall phase could last up to approximately 60 minutes. The length of time depends on factors such as meteorological data and the weapon’s height of burst. Outside activities could result in erroneous initial reconnaissance results and unnecessarily contaminated personnel and equipment.

To avoid contaminated surfaces/areas, personnel should minimize contact with potentially contaminated surfaces until there are indications that surface contamination is no longer a hazard. Obtain and report observations or evidence of an attack. Personnel should also provide reconnaissance and assessment information for all types of damage, hazards, and chemical agents.

Personnel should survey, control, and mitigate health hazards (treat and evaluate casualties) and unit commanders should adjust MOPP to the lowest possible level consistent with identified hazards. Medical staffs should clearly document exposure in the medical records of those personnel who have been exposed.

Once the situation permits, the detection efforts determine the extent and duration of the residual hazards. Plan and implement decontamination and contamination containment actions. These actions are planned and implemented to minimize the operational impacts of contamination.

When the area has been determined to be all clear to conduct unmasking procedures, unit commanders should revert to an appropriate MOPP level based on the current threat in conjunction with the all-clear signal. Personnel engaged in passive-defense functions should repair and resupply defense equipment in preparation for follow-on attacks.

3.4.1 Procedure When a Detector Kit is Available

Chemical detector kits may not detect all agents. You should consider also using unmasking procedures listed below in paragraph 3.4.2, even if the detector is available.

These procedures take approximately 15 minutes. After all tests with the kit, including a check for liquid contamination, have been performed and the results are negative, the senior person should select one or two individuals to start the unmasking procedures. If
possible, move to a shady place. Bright, direct sunlight can cause pupils in the eyes to constrict, giving false signs of nerve agent exposure. The selected individuals unmask for 5 minutes and then reseal and clear their masks. Observe them for 10 minutes. If no symptoms appear, the commander/leader considers issuing the all-clear signal for unmasking. Continue to watch the personnel for possible delayed symptoms. Always have first aid treatment immediately available in case it is needed.

3.4.2 Procedure When a Detector Kit is Not Available

Unmasking procedures if a Chemical Detector Kit is not available takes at least 35 minutes. Find a shady area. Use M8/M9 paper to check the area for possible liquid contamination. When a reasonable amount of time has passed after the attack, the senior person should select one or two individuals. They take a deep breath, hold it, and break the seal for 15 seconds, keeping their eyes wide open. They then clear and reseal their masks and are observed for 10 minutes. If no symptoms appear, the selected individuals break the seal of their mask, take two or three breaths (keeping their eyes wide open), and clear and reseal their masks. Observe them for 10 minutes. If no symptoms appear, the selected individuals unmask for 5 minutes and then remask. If no symptoms appear in 10 minutes after remasking, the commander considers issuing a directive for an all-clear. This process takes a minimum of 35 minutes. Continue to observe the selected personnel in case delayed symptoms develop.

3.5.0 Protection of Unit Equipment and Supplies

Because contaminated equipment and supplies pose a threat to personnel, covers should be used to protect equipment and supplies stored outdoors, if possible. The following guidance is appropriate for combat, combat support, and combat service support units.

3.5.1 Equipment

Important items of equipment must be covered. Plastic sheets serve as excellent covers because they are nonporous. If plastic material is not available, tarpaulins or other suitable material may be used. If nothing else is available, dense foliage will provide some protection.

3.5.2 Packaged Food Items

Vapor, aerosol spray, or liquid chemical agents can contaminate food. The type of food, type and amount of agent, and effectiveness of protective measures influence the edibility of food. Food not in protective packages generally presents the major problem. Chemical agents may penetrate packaged food when it is left exposed over an extended period of time.

3.5.3 Unpackaged Food Items

Oily and fatty unpackaged foods are particularly vulnerable to chemical contamination. These foods are protected from contamination when stored in containers, such as field iceboxes and refrigerators, if the sealing gaskets are serviceable. Contaminated unpackaged food must NOT be eaten!
3.5.4 Water

Medical personnel are responsible for recommendations on the potability of water. Water that is not in sealed containers may become contaminated. Water suspected of contamination should not be consumed until tested and declared safe.

3.6.0 First Aid and Self-Aid

First aid includes the immediate actions required to prevent further injury or complications from the effects of chemical agents. First aid necessarily includes the prompt removal of agents from the eyes and decontamination of the skin to avoid casualties from lethal liquid agents. Therefore, first aid must include performing self-aid or personal decontamination, automatically and without orders when it is required. First aid also includes the use of appropriate medications or actions to reduce the effects of the agent, such as the use of the nerve agent antidote injector for nerve agent poisoning. Each individual must be thoroughly trained in both first aid and personal decontamination so they can perform these actions quickly.

When the skin of an individual becomes contaminated, it must be decontaminated immediately. Skin decon is the neutralization or removal of contamination from exposed portions of the skin. If the contaminated person is incapacitated, another person must perform the decontamination.

For decontaminating skin, each Seabee receives Reactive Skin Decontamination Lotion (RSDL). The lotion removes chemical agents or the T-2 toxin and also reacts with the chemical agents, rapidly neutralizing them so they are non-toxic. RSDL must be applied to exposed skin (intact) as soon as possible after exposure to a chemical agent. The lotion is impregnated in a sponge pad packaged as a single unit in a heat-sealed foil pouch.

Protect the kit from temperatures above 110°F (43°C) and below 32°F (0°C). The solutions are flammable and unstable in storage at temperatures above 110°F (43°C) or for prolonged periods of time in sunlight.

Shelter is necessary to prevent further contamination during the decontamination process. If no overhead cover is available, throw a poncho or tarp over your head before beginning decontamination.
3.6.1 Nerve Agents

If you are told that your pupils are getting very small or if you are having trouble breathing and your chest feels tight, use the atropine Nerve Agent Antidote Kit (NAAK), Mark I (Figure 9-2).

![Nerve agent antidote kit](image)

**Figure 9-2 — Nerve agent antidote kit.**

The injectors contain medications to treat the initial symptoms of nerve agent poisoning. But, most importantly, it will resolve the more serious effects of nerve agent sickness. The injectors are antidotes, not a preventive device; therefore, only use the injectors when you actually experience symptoms of nerve agent poisoning. The directions for use are as follows:

1. Put on the protective mask.
2. Remove a NAAK, Mark I, from the protective mask carrier.
3. Inject the thigh with the first injector (Figure 9-3) from the kit (atropine, small auto injector). Hold the injector against the thigh for at least 10 seconds.
4. Remove the injector.
5. Follow immediately with the second injector (2-PAM chloride, large injector) and inject the thigh. Hold the injector against the thigh for at least 10 seconds.
6. Remove the injector and place each injector needle through the pocket flap of the over garment. Bend each needle to form a hook.
7. Massage the injection site, if time permits.
8. The interval between injecting each set of auto injectors is 10 to 15 minutes when symptoms persist or recur. A Seabee must not administer more than three NAAK sets. The administration of more than three sets must be authorized by medical support personnel.
WARNING

If within 5 minutes after the administration of any set of injections, your heart beats very rapidly AND your mouth becomes very dry, do NOT give yourself another set of injections.

When an individual experiences severe symptoms from nerve agent poisoning and is unable to administer self-aid, a buddy must perform the following aid measures:

1. Mask the casualty.
2. Using the NAAK belonging to the victim, administer three sets of injections immediately and in rapid succession in the thigh muscle of the leg.
3. After the third dose has been administered, give the single dose of Diazepam, this is also known as the Convulsive Antidote, Nerve Agent (CANA).
4. Hook the expended auto injectors to the over garment pocket flap of the victim.
5. Administer the back pressure arm-lift method of artificial ventilation if breathing is difficult or has ceased.
6. Seek medical attention as soon as possible. Continue to perform your duties if you feel relief from the atropine and can breathe freely again. Dryness of the
mouth is a good sign. It means that you have had enough atropine to overcome the dangerous effects of the nerve agent.

If you should get a splash of liquid nerve agent in your eyes, instant action is necessary to avoid serious injury. Obtain water as fast as possible, tilt your head back so your eyes look straight upward, slowly pour water into the your eyes, and flush them out. Hold your eyes open with your fingers, if necessary. Pour the water slowly so the irrigation lasts not less than 30 seconds. This irrigation must be done in spite of the danger of breathing nerve gas vapor. Don your mask quickly after irrigation is complete. Then, if the symptoms of nerve gas poisoning develop, give yourself an injection from the NAAK, Mark I.

If liquid nerve gas gets on your skin or clothing, fast action is needed to get rid of it. Immediately use the M291 decontamination kit. Then carry on with your combat duties. Meanwhile, watch for muscles twitching in the contaminated area. If twitching does not develop in the next half hour and there is no tightness in your chest, you have been decontaminated successfully.

If twitching of the muscles in the area of contamination does develop, do not wait for other symptoms to appear. Give yourself the injections from the NAAK, Mark I, at once. If no other symptoms develop, one series of injections is enough.

### 3.6.2 Blister Agents

Casualties of blister agents, such as HD (distilled mustard); will exhibit redness and inflammation of the eyes. Usually several hours after exposure, reddening of the skin appears, followed by the appearance of blisters. There is NO first aid for blister agents, only decontamination. Blister agent effects are delayed for several hours to days. To decontaminate your eyes, flush with plain water repeatedly. Any blister agents on the skin and clothing should be removed using the M291 decontamination kits. Seek medical care as soon as possible. If evacuation to a medical facility is required, blister agent casualties receive the same treatment given other burn victims.

### 3.6.3 Blood Agents

Agents, such as AC and CK, enter the body by inhalation and produce symptoms ranging from convulsions to coma. They act on the body by interfering with the ability of oxygen-carrying cells to transfer oxygen to other body tissue. They agents may also have an irritating effect on nasal passages.

There is currently no self-aid or buddy aid treatment for blood agent symptoms. Affected personnel should seek medical attention.

### 3.6.4 Choking Agents

This agent produces coughing, choking, nausea, and headaches in casualties. Delayed effects include rapid and shallow breathing, painful cough, discomfort, fatigue, and shock. First aid includes immediate masking. Masking may prevent further damage. No specific first aid, other than efforts to prevent shock, is available.

### 3.6.5 Vomiting Agents

For protection against vomiting agents, put on your mask and wear it in spite of coughing, sneezing, salivating, or nausea. If necessary, briefly lift the mask from your face to permit vomiting or to drain saliva from the face piece. Clear your mask each time you adjust it to your face and before you resume breathing. Carry on with your duties as
vigorously as possible; this helps to lessen and shorten the symptoms. Combat duties can usually be performed in spite of the effects of vomiting agents.

3.6.6 Tear Agents

When liquid or solid agents have entered your eyes, force your eyes open and flush them with water. Put on your protective mask, cover the outlet valve and voice meter, and blow hard to clear the mask. Keep your eyes open as much as possible. When your vision clears, continue to perform your duties. When it is safe to remove your mask, blot away tears, but do not rub your eyes. Face into the wind to evaporate all traces of the chemical.

3.6.7 Incapacitating Agents

By the time a victim who is exposed to an incapacitating agent realizes something is wrong, that person may be too confused mentally to handle their own decontamination. These victims should be taken to medical personnel immediately. If several people are affected, it may be necessary to confine them temporarily under guard to prevent accidents. These personnel must not be allowed to enter critical or dangerous spaces until complete recovery is achieved, because these victims may not be responsible for their actions. In addition, some of these agents prevent sweating, which increases the danger of heat stroke on hot days.

3.7.0 Personnel Decontamination

Decontamination can be accomplished by the removal, neutralization, absorption, or weathering of the chemical agent. The primary purposes of decontamination are to prevent casualties and to remove obstacles that may prevent mission accomplishment.

Individual decontamination or self-aid is performed by an individual with materials on hand. It is performed by the individuals on themselves and the equipment they use. It is performed as soon as practical and is usually sufficient to allow the individual to carry on with their assigned mission.

Unit decontamination is an organized effort performed by personnel of the unit, with equipment available to the unit, when directed by the commander, and under the supervision of trained CBR specialists. All officers and qualified CBR specialists should be prepared to act as supervisors of decontamination teams when required.

3.8.0 Support Level Equipment Decontamination

Equipment decontamination stations are located as far forward upwind as possible and are normally run by a specialized decontamination team or unit.

3.9.0 Biological Defense

Protective measures against a biological threat include training, immunization of personnel, and strict personal hygiene.

3.10.0 Biological Defense Training

Training for defense against biological agents must stress the necessity for an alert and questioning attitude toward any indication that biological agents may have been used. Although knowledge of these agents is important, there must be no unreasonable fear of disease from a suspected biological attack. Personnel should be instructed not to
repeat or exaggerate rumors. Seabees should also know the following facts about a biological attack.

- It is normally impossible to recognize or detect.
- It may be used to supplement other types of attack.
- It may be used to cause either delayed death or incapacitation for strategic purposes.

### 3.11.0 Prevention of Disease

Casualties from a biological attack can be reduced by using the following preventive measures:

- Strict personal hygiene
- Immunization
- Quarantine of contaminated structures and areas
- Instruction in the proper care of cuts or wounds
- Use of approved sources of food and drink
- High standards of personal hygiene and, when practical, avoidance of practices that produce a run-down condition; assisting personnel in fighting an infection; importance of good protective mask discipline and proper field sanitation measures must be emphasized

### 3.12.0 Indications of a Biological Attack

The following are indications that a biological attack has occurred:

- Low-flying aircraft that appear to be producing a mist or spray
- The function of any type of spray device
- Unusual types of bomblets found in the area
- Swarms of insects, such as mosquitoes, suddenly appearing after an aircraft has dropped containers that did not appear to have immediate effect

### 3.13.0 Defensive Measures after a Biological Attack

Units are not equipped with devices to indicate a biological hazard. After a suspected biological attack, individuals must continue wearing their protective masks until authorized to remove them by competent authority.

#### 3.13.1 Decontamination of Personnel

After a suspected biological warfare attack individuals can decontaminate themselves by showering with soap and hot water. The fingernails and toenails should be thoroughly cleaned and the hairy parts of the body should be thoroughly scrubbed. Contaminated clothing must be washed in hot soapy water when it cannot be sent to a field laundry for decontamination. Cotton items may be boiled.
3.13.2 Decontamination of Outdoor Areas
Sunlight kills most microorganisms and usually decontaminates areas that are outdoors in direct sunlight. However, shaded areas may remain hazardous from several hours to several days. Decontamination of a large area is not feasible.

3.13.3 Decontamination of Indoor Areas
Personnel in a shelter or building that is suspected of being contaminated with biological agents should wear their protective masks until they leave the building.

3.13.4 Guarding Against Contamination
All exposed surfaces are assumed to be contaminated. Sealed containers, such as bottles and cans containing food and water, should be washed down and boiled before opening.

3.13.5 Report Sickness Promptly
Prompt reporting of sickness serves two major purposes:

1. It gives medical personnel the opportunity to identify the biological agent to which the individuals were exposed. Once the disease has been identified, effective medical measures can be taken.

2. It helps to prevent the spread of disease from person to person.

3.13.6 Treatment of Casualties
There are no self-aid measures for the diseases that are caused by agents. In comparison to measles, the symptoms of biological warfare diseases appear in a like manner. Although it may be a matter of days before the types of biological warfare agents are identified, medical personnel will direct the decontamination of these casualties.

Even though the Navy provides preventive shots for some diseases, additional shots have been developed that will be given to all hands if biological warfare ever occurs. If you contract a disease from biological warfare in spite of the shots, the sickness should be mild, and medical personnel will ensure that you receive the best treatment available.

3.14.0 Nuclear Defense
On a nuclear battlefield, units must be dispersed to the greatest extent possible consistent with the situation and the mission. Dispersed units present smaller targets and, hence, are less vulnerable. In contingency planning, the positioning, movement, and missions of units may require adjustment by the commanders to minimize the effects of nuclear bursts while maintaining the ability to continue construction operations and hold defensive positions. Defensive measures for individuals and units should include protection from blast, heat, and initial and residual radioactive fallout.

3.15.0 Defensive Measures Before a Nuclear Attack
When a nuclear attack is imminent, the best defense is to dig in. Earth is one of the best shielding materials available in the field. Seabee defensive positions, which vary from individual fighting positions to improved defensive positions, should be prepared whenever the tactical situation permits.
3.16.0 Fighting Positions
A properly constructed fighting position provides excellent protection against initial radiation. The deeper the fighting position, the more protection it provides. An overhead covering of earth or other material will help reduce the amount of thermal and initial nuclear radiation and fallout material from reaching the individual. However, this cover must be sturdily constructed to withstand the blast wave.

3.17.0 Field Shelters
Tunnels, caves, and storm drains provide effective shelter. Culverts and ditches can be used in an emergency, although they offer only partial protection. Vehicles made of steel, such as tank and armored personnel carriers, provide some protection. Buildings usually are not strong enough to provide effective shelter, but the middle floors or basement of a reinforced concrete or steel-frame building offers protection from all effects except the blast. Personnel should avoid the areas around windows and other openings.

3.18.0 Supplies and Equipment
Individual equipment and supplies not being worn should be placed in the fighting position. None of this equipment should be left unsecured because the blast wave converts them into lethal missiles. Unit supplies, particularly explosives and flammables, should be dispersed within the unit area and protected or shielded. Debris must be kept to a minimum and not be allowed to collect because it could become a fire hazard. Objects, such as radios, generator tools, and gas cans must always be secured to minimize the danger of flying debris caused by the blast wave.

3.18.1 Defensive Measures during a Nuclear Attack
A nuclear attack may come without warning. The first indication will be an intense light. Heat and initial nuclear radiation come with the light and the blast follows. There is little time to take protective measures since the blast wave travels at the speed of sound (about 1,000 feet per second). Individual defensive actions must be automatic and instinctive. Unit activities will be suspended for a short period while all personnel take cover. When a surprise attack is a possibility, all personnel not engaged in essential activities should remain undercover as much of the time as possible. Individuals who are exposed when a nuclear detonation occurs should do the following:

1. Immediately drop flat on the ground (facedown) or to the bottom of a fighting position.
2. Close your eyes.
3. Protect exposed skin from heat by putting hands and arms near or under your body. Keep your helmets on.
4. Remain down until after the blast has passed and debris has stopped falling.
5. Stay calm, check for injury, check weapons and equipment for damage, and prepare to continue the mission.

3.18.2 Defensive Measures after a Nuclear Attack
Following a nuclear attack, designated individuals should begin fallout monitoring, so fallout arriving in the unit area can be detected quickly. When warned of the arrival of
fallout and the tactical situation permits, individuals should take cover and remain protected until instructed otherwise.

A handkerchief or similar cloth may be worn over the nose and mouth if dust particles make breathing difficult or cause discomfort. The protective masks should not be used as a dust respirator. If it is necessary to remain in an area having fallout, individuals should dig in quickly, sweep fallout particles away from the area around fighting positions, and remain covered until fallout stops.

The skin and clothing of individuals exposed to fallout or who have traveled through a radiologically contaminated area may experience a skin rash. If the situation prohibits complete decontamination, then field expedient methods should be used to reduce the radiation hazard. Some of these methods that remove alpha and beta emitting particles include the following:

- Removal and vigorous shaking of clothing or brushing the clothing with brushes (avoid breathing dust)
- Removing dust from the hair and from under the fingernails
- Wiping exposed skin with a damp cloth

All personnel should bathe and change clothing as soon as the tactical situation permits. Remember that runoff water is contaminated, and appropriate defensive measures should be taken.

The requirement for decontamination of individual equipment, vehicles, weapons, and ammunition can be reduced, if, before fallout arrives, they are covered with materials such as tarpaulins or ponchos. An effective way to remove radiological contamination is to wash it with soap and water.

3.18.3 Contamination Avoidance

Contamination avoidance can help minimize exposure by doing the following:

1. Limiting the duration of exposure by reducing the amount of time in the hazardous area
2. Delaying entry time until radiation decays enough to permit safe passage or occupancy or both
3. Avoiding and bypassing contaminated areas

3.18.4 First Aid Treatment

The casualty-producing effects of a nuclear explosion are blast, heat, and nuclear radiation. First aid measures are limited to those for burns caused by thermal radiation and injuries caused by the blast. There are no immediate lifesaving measures for the treatment of radiation sickness or blindness caused by the intense light.

When the tactical situation prohibits you from going to a decontamination station, you must remove most of the radioactive material with whatever you have on hand. If you become heavily contaminated, the following measures are recommended:
1. You must remove your outer garments. Shake them vigorously or brush them off. Be sure the clothing is held downwind. This will remove most of the radioactive material unless it is wet and muddy.

2. When it is too cold or wet to remove your outer clothing, brush or scrape them carefully.

3. The same procedure should be used to decontaminate your equipment.

3.18.5 Personnel Decontamination Station

Complete personnel decontamination is conducted at the Personnel Decontamination Station (PDS). The PDS is setup in a secure, uncontaminated area, located as far forward as the tactical situation permits. Personnel from both the decontamination and the supported unit operate the PDS under the supervision of the Chemical, Biological, and Radiological Defense Officer (CBRDO), NOBC 2765 or the Disaster Preparedness Operations and Training Specialist, NEC 9598.

3.19.0 Seabee CBR Defense Equipment

Individual CBR defense equipment consists of permeable protective clothing, protective footwear covers, protective masks, skin decontamination kits, and atropine.

3.19.1 CBR Permeable Protective Clothing

The Joint Service Lightweight Integrated Suit Technology (JSLIST), as shown in Figure 9-4, is a common chemical protective clothing ensemble that includes a lightweight chemical/biological protective garment, multi-purpose over boots and gloves. The JSLIST was designed to reduce heat stress, provide compatibility with all interfacing equipment, have a longer wear period, and be washable.

The JSLIST is a lightweight, two-piece suit that can be worn as an over garment or as a primary uniform over underwear. It has an integral hood, high waist trousers, adjustable suspenders, adjustable waistband and a waist length jacket.

The JSLIST is an air permeable fabric that is lighter, cooler, and provides a higher level of protection without blocking the movement of air and perspiration through the suit. The suit weighs just less than 6 pounds. It is available in 4-color woodland or a 3-color desert camouflage pattern.

The JSLIST can be worn in an uncontaminated environment for 45 days with up to six launderings or for over 120 days with no launderings. The JSLIST can be worn in a contaminated environment for 24 hours.

Figure 9-4 — JSLIST.
NOTE
Garments are good for 120 consecutive days after removal from package. Resealing in the bag provided does not stop the counter.

3.19.2 Chemical Protective Footwear Covers (Over Boots)
The Multipurpose, Lightweight Over boot (MULO) replaces the older black vinyl over boot/ green vinyl over boot (BVO/GVO). The MULO is made by injection molding an elastomer blend, compounded to provide the characteristic chemical and environmental protection required. It incorporates two quick-release side buckles and is designed to be worn over the standard issue combat boot, jungle boot, and intermediate cold/wet boot. The MULO provides 60 days of durability and 24 hours of protection against liquid chemical agents. The MULO is capable of being decontaminated to an operationally safe level using standard field decontaminates. Environmental protection is provided against water, snow, and mud, in addition to Petroleum, Oil, and Lubricant (POL). The MULO is also flame resistant.

3.19.3 The M40 Chemical Field Protective Masks
These masks—when properly fitted and worn with the hood—will provide protection against field concentrations of all known enemy chemical agents in vapor or aerosol form. They do so by filtering contaminated air to remove the agents—not by producing oxygen. When the air has low oxygen content or when individuals are in tunnels or caves with a heavy concentration of aerosolized particles, such as burning smoke mixtures, the protective mask does not provide breathable air. These masks also do not protect against ammonia vapors or carbon monoxide.

The M40 mask (Figure 9-5) is the standard field protective mask. Masks are shipped from the manufacturer with the following components:

1. **Face-piece Assembly**—foundation of the protective mask. Everything else is attached to it. The face-piece fits closely against your face to form a seal. It is made of silicone rubber. Visually inspect interior and exterior surfaces of face-piece for dirt, mud, and greasy or oily substances. Check face-piece for holes, tears, and splits by holding it in front of a light source. Look closely at edges of face-piece. Check for soft or sticky spots. Check silicone rubber next to eye lenses to be sure they will not pull away from the face-piece. Also check all face-piece housings to be sure silicone is not pulling away.

![Figure 9-5 — M40 chemical field protective mask.](image-url)
2. **Head Harness** – these adjustable straps are attached to the face-piece. When adjusted properly, they will secure the face-piece to your face creating an airtight seal. It consists of a head pad; forehead straps, temple straps, cheek straps, and donning tab. Check the head harness for loss of elasticity and dirt. Check straps for cuts, tears, missing parts, or deterioration such as mildewing or fraying. Look at the buckles for bends, cracks, or corrosion. Check for missing or broken buckles. Make sure finish on buckles is not chipped or scratched exposing bare metal.

3. **Eye-lenses, Eye-rings and Out-serts** – made of clear plastic or ballistic glass and enable you to see clearly while wearing the mask. Check eye-lenses for cracks, scratches, or discoloration that affect vision. Check eye-rings for distortion or corrosion. Clear and neutral gray eye lenses out-serts are provided with the mask. The purpose of the out-sert is to protect the eye-lens from damage and to reduce fogging in cold weather. Neutral gray out-serts reduce glare. There are separate out-serts for left and right eye-lenses. To install the out-sert, fold back the rubber apron, place it over the eye-lens, and fold the apron back into place. Check both sets of out-serts for cracks, chips, or discoloration that affect your vision. Check rubber aprons for tears, looseness, brittle spots, soft or sticky spots, or cracked rims.

4. **Canister** – filters chemical and biological agents and other particles from contaminated air. It can be quickly and easily replaced and may be installed on either side of the face-piece to allow use by left-handed or right-handed shooters. Do not allow the inside of the canister to become wet. A wet canister is useless. Check the canister, especially around the seams, for cracks, dents, holes, and damaged threads. Ensure the air intake is not clogged with dirt. Shake the canister and listen for any signs of loose absorbent particles. The canister is installed into the side port of the face-piece, over the inlet valve. Tighten the canister hand tight by turning clockwise.

5. **Outlet Valve Disk and Outlet Valve Cover** – releases exhaled air and prevents unfiltered air from entering the face-piece. Do not use the mask if the outlet valve disk is missing or damaged because the face-piece will leak. The outlet valve cover protects the outlet valve disk and secures the external drinking tube. To check the outlet valve disk, grasp the tab on the bottom of the outlet valve cover and lift. Check to see if the outlet valve disk is present and is not curled or distorted. Place your thumb on the disk and rotate it to make sure it is not sticking. Do not remove the outlet valve disk from the outlet valve. Look at the disk for nicks, tears, or rips. Wipe off any moisture with a clean cloth. Check the outlet valve seat for dirt. Smooth the outlet valve disk so it lies flat on the outlet valve seat. Check the outlet valve cover for cuts, tears, or holes. Look at the inside of the outlet valve cover for dirt or moisture.

6. **Internal/External Drink Tubes** – the M40 Field Protective Mask is equipped with a system which allows the wearer to drink while wearing the face-piece. The internal tube is grasped by the person’s mouth. The external tube has a quick disconnect coupling which connects the face-piece to the NBC Canteen Cap. Check that both tubes are present and are free of cracks or cuts. Ensure the internal drink tube has proper alignment and the external drink tube has solid connections. Connect the coupling to the canteen cap and blow air through the system to ensure it is not clogged.
7. **Airflow Deflector** – located on the inside of the face-piece below either the left or right eye-lens depending on the canister location. It directs inhaled air over the eye-lenses to prevent fogging. Check that the airflow deflector is securely mounted inside the face-piece and that both flanges are in the mounting holes of the face-piece and are not broken. Check the mounting holes for cuts or tears.

8. **Inlet Valve Disk** – allows filtered air to enter the face-piece and prevents moist exhaled air from entering the canister. Do not use the mask if the valve body or inlet valve disk is missing. Check that the inlet valve disk and valve body are properly mounted on the airflow deflector post. Blow on the disk to make sure it is not stuck to the valve body. Ensure the disk is free of cuts, holes, tears, or dirt.

9. **Nose-cup Assembly** – inside the face-piece is the nose-cup. It has one nose-cup valve disk on each side. The nose-cup allows filtered air to pass through the nose-cup valve disks and into your respiratory system from the upper part of the face-piece and directs exhaled air out through the outlet valve in the bottom of the face-piece. This ensures good airflow, which prevents moist exhaled air from fogging the eye-lenses in cold weather. Check that the nose-cup and nose-cup valve seats are free of dirt, cracks, cuts, holes, or tears. Check that the nose-cup is securely attached to the back of the face-piece by gently pulling it away. Rotate the nose-cup valve disks to be sure they are not stuck and check them for curling or tears. Smooth the nose-cup valve disks over the nose-cup valves.

10. **Voicemitter** – the face-piece is equipped with a front voicemitter, which transmits the user’s voice outside the face-piece, and a side voicemitter, located opposite the inlet valve, which aids in the use of communications equipment. Check the retaining rings around both for corrosion, cracks, or nicks. Try to tighten the retaining rings by hand to check for looseness. Ensure both voicemitters are free of dents, cracks, punctures, or dirt and that the four beads in the center of each voicemitter are facing outward.

11. **Carrier** – provides for storage, protection, and carrying of the mask and additionally authorized items. Check carrier for dirt, sharp edges, torn straps, broken stitches on seams, or missing hardware. Make sure there are no pencil or pen markings on the carrier. Mildew, solvents, or abrasive materials on carrier may harm the face-piece. Check the hook and look fastener for dirt or debris. Check metal hooks and D-rings for bends or breaks that make them unusable.

12. **Waterproof Bag** – keeps the mask dry when required by climate or mission. It includes rubber bands for sealing and instructions for use. Storage of the mask in waterproof bag can degrade the protective capabilities of the face-piece. You must remove the face-piece as soon as protection of the mask is no longer required. Check the waterproof bag for cracks, tears, holes, and brittleness. Food should not come in contact with the waterproof bag because of possible toxic effects. It is stowed in the left end pocket of the carrier.

The following are accessories of the M40 FPM:

1. **M1 Canteen Cap** – contains a hole that allows the external drinking tube to be connected to the canteen. Always check that the surfaces are free of contamination before connecting the drinking system.

2. **Decontaminating Kit** – used for personal decontamination.

3. **Optical Inserts** – available by medical prescription for personnel who must wear glasses. Do not wear eyeglasses or contact lenses with your mask. Check your
inserts for broken lenses, broken frame, loose screws, or becoming disconnected from the face-piece.

3.19.4 Skin Decontamination Kit
The M291 kit consists of a wallet-like carrying pouch containing six individual decontamination packets—enough to do three complete skin decontaminations. The kit allows personnel to decontaminate their skin through physical removal, absorption, or neutralization of toxic agents with no long-term harmful effects. The kit is used for external use only and may be slightly irritating to eyes or skin. Personnel must ensure that they keep the decontamination powder out of eyes, cuts, or wounds and avoid inhalation of the powder.

3.19.5 Individual Equipment Decontamination Kit
The M295 kit allows personnel to decontaminate their individual equipment through physical removal and sorption of chemical agents. The kit can decontaminate approximately 1,200 square feet. Decontamination is accomplished through sorption of contamination by both the kit nonwoven polyester pad and by the decontaminating powder. It is not approved for skin decontamination. Decontaminating the CB protective mask/hood, gloves, footwear, weapon, helmet, and Load-Bearing Equipment (LBE) preclude agent transfer during the overgarment exchange and entry or exit procedures.

3.19.6 Nerve Agent Antidote Kit (NAAK), Mark I
Three NAAK, Mark I, injectors are carried by the individual in the top outside pocket of the mask carrier. These injectors are used for nerve agent first aid. This solution has a relatively high freezing point and should be removed from the carrier and placed inside the field uniform in cold weather (below 45°F).

There is also one more auto injector located with the NAAK; it is the CANA auto injector. This auto injector contains 10mg of diazepam. It is given after the third dose of the NAAK. It has the same characteristics as the NAAK, Mark I.

4.0.0 CBR UNIT EQUIPMENT
Each Seabee unit should have the equipment discussed below.

4.1.0 M4 Joint Chemical Agent Detector (JCAD)
The M4 Joint Chemical Agent Detector (JCAD) (Figure 9-6) is a portable, battery operated point sampling detector that continuously samples the air for gases and vapors. This unit is the primary means of detecting chemical agents arriving in a unit area from an upwind chemical attack. It can detect

Figure 9-6 — M4 Joint Chemical Agent Detector (JCAD).
chemical agents in vapor and aerosol form and can alert personnel by audible and visual signals. It is issued to platoons, companies, and similar units. The detector unit detects and identifies Chemical Warfare Agents (CWAs) or Toxic Industrial Chemicals (TICs) and issues visual and audible alarms in the event of a detection. Visual displays provide the class and concentration of the hazard detected.

Capabilities and features:

- Lightweight, hand portable design
- Three user-selectable operating modes
  1. CWA 5-Second Mode (default)
  2. CWA 1-Second Mode
  3. TIC Mode
- Powered by four 1.5V AA-size batteries
- Two audible indications:
  1. Alarm for agent detection
  2. Alert for equipment status faults (i.e., low battery)
- Earpiece for use in tactical situations
- Detection cycle designed to conserve battery life
- Can be operated in Personnel Protective Equipment (PPE)

After a positive detection, the detector issues visual and audible alarms. The Light Emitting Diodes (LEDs) on the front display of the detector show the class and concentration of the CWA detected.

The JCAD can be set up in a remote location and wired to an M42 remote alarm. The M42 remote alarm unit provides both an audible and visual alarm when connected by wire to the JCAD.

The M42 audible alarm can be turned off manually. Up to five M42s can be connected to the JCAD (Figure 9-7). Maximum cable length must not exceed 400 meters from the detector to the farthest alarm.

*Figure 9-8, frame 1,* shows a situation where four detectors are emplaced with three platoons online. Note the orientation on the wind direction. The detector is oriented on wind direction, not on the direction of the enemy. When the automatic chemical agent alarms are mounted on vehicles, consideration must be given to wind direction for the protection of the main body.
Figure 9-8, frame 2, shows an array using four detectors with the wind direction coming from the right flank of the unit. A significant difference between a four-detector and a six-detector array is that with only four detectors they must be shifted when the wind direction shifts greater than 20 degrees.

Figure 9-8, frame 3, shows a company in a defensive position with six detectors deployed. The actual number of alarm systems per unit varies depending upon the Table of Allowance (TOA). The 400-meter distance between the M4 JCAD detectors reduces the possibility that agent clouds might drift through holes in the array. This array provides a high probability of detecting an off-target attack within a reasonable warning time.

![Figure 9-8 — Deployment of the automatic chemical agent alarms.](image)

**NOTE**

Remember that the detector is oriented on wind direction, **NOT** on the direction of the enemy.

### 4.2.0 IM-270/PD Dosimeter

The IM-270/PD (*Figure 9-9*) is an electronic dosimeter designed for use during a nuclear event. It provides real time measurement and indication of personnel dose and does not require a separate reader to evaluate the dose. It measures radiation dose from exposure to x-rays and gamma rays both pulsed and continuous. The total dose is instantly displayed on a Liquid Crystal Display (LCD) screen. The dynamic range of the dosimeter is from 10-1000 rads in 1 rad increments. Any dose less than 10 rads is displayed as zero. The dosimeter is designed in a wrist watch style and is worn on the wrist or forearm. It has a hook and loop type fastener wristband of

![Figure 9-9 — IM-270/PD.](image)
adjustable length to accommodate different wrist sizes (with over garments) from a minimum of 8.5 inches to a maximum of 14 inches. It contains a battery with an expected life of 10 years. No preventive maintenance is required.

4.3.0 AN/PDQ-1 Radioactive Detection Identification and Computation (RADIAC) Set

These are hand-held electronic monitoring devices containing an internal gamma detector, and an interface to a family of radiation measurement probes for alpha, beta, gamma, neutron, and x-ray. The measurement is displayed on an LCD screen for visual monitoring. The multi-function RADIAC has been designed to replace the existing RADIACs in use today.

The AN/PDQ-1 has a Built in Test (BIT) function that verifies the equipment is in operating standards within all modes of operation. The single line LCD screen displays either the interior detector reading or the external probe reading, when attached. It also provides information on battery condition, alarm thresholds, audio and alarm status, BIT status, and probe type. The device uses two “D” cell batteries that provide 200 hours of operation without the use of a probe and only 100 hours of operation with a probe installed.

4.4.0 M100 Sorbent Decontamination System (SDS)

The M100 Sorbent Decontamination System (SDS) (Figure 9-10) is intended for operator wipe down on vehicles utilized by the Naval Construction Force (NCF). The wipe down should be performed within 15 minutes of exposure. Operators use the M100 to decontaminate the surfaces they need to touch or contact to operate the equipment. Radiological contamination in the form of dust particles may be wiped, scraped, or brushed off. The M100 contains two packs of reactive sorbent powder, two wash mitt-type sorbent applicators, a case, two straps and detailed instructions. It allows two operators to perform simultaneous decontamination operations. The use of the M100 SDS decreases decontamination time and eliminates the need for water.
4.5.0 Mission Oriented Protective Posture (MOPP)

MOPP is a flexible system of protection against chemical agents, used to facilitate mission accomplishment in chemical warfare. MOPP requires the individual to wear protective equipment consistent with the chemical threat, the work rate imposed by the mission, and the temperature. (See Table 9-1 for MOPP levels.)

<table>
<thead>
<tr>
<th>MOPP Level</th>
<th>Description</th>
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<tr>
<td>0</td>
<td>Carry mask and ensure that Individual Protective Equipment (IPE) is available</td>
</tr>
<tr>
<td>1</td>
<td>Don over garment</td>
</tr>
<tr>
<td>2</td>
<td>Don protective boots</td>
</tr>
<tr>
<td>3</td>
<td>Don protective mask</td>
</tr>
<tr>
<td>4</td>
<td>Don protective gloves</td>
</tr>
</tbody>
</table>

All combat operations are conducted under the MOPP system. Of course, when there is no threat, there is no protection requirement, but this is still a MOPP. At the other extreme, when there is a continuing, immediate threat of chemical attack and the enemy has the capability to produce an unacceptable casualty level among unprotected troops, the troops may be required to wear protective clothing and equipment for extended periods. In this case, some form of safe area must be provided so troops can perform the necessary functions that require removal of some or all of the protective gear.

4.6.0 MOPP Flexibility-Limiting Factors

The flexibility of MOPP in providing individual protection is limited by the temperature of the surrounding area, fatigue level of the troops, the degree to which the troops need to use their senses, and personal needs.

4.6.1 Heat Exhaustion

Individuals operating a moderate-to-heavy work rate while in chemical protective gear may experience heat exhaustion (dizziness and fainting) at any time, especially during periods of high temperature.

4.6.2 Fatigue

Individuals in full chemical protective clothing and equipment tend to experience fatigue resulting from such factors as mask breathing resistance, increase in body temperature from work energy and solar heat, and psychological and physiological stress. This condition of fatigue increases the need for rest and sleep to maintain individual alertness and efficiency.

4.6.3 Senses

Individuals required to perform duties involving their senses or related functions, such as manual dexterity, visual activity, and voicing communication, operate at varying levels of efficiency, depending on training and proficiency while in full protective gear.
4.6.4 Personal Needs

Individuals cannot be in full chemical protection for indefinite periods and still attend to certain personal needs, such as eating, caring for wounds, shaving, and eliminating of bodily wastes.

5.0.0 MARKING OF CONTAMINATED AREAS

The markers (Figure 9-11), or signs, are used in areas containing radiological, biological, and chemical contamination. The base of the triangle should be about 11 inches (28 cm) and the opposite sides about 8 inches (20 cm). The signs are in the shape of a right isosceles triangle (90 degrees by 45 degrees by 45 degrees) and are made of soft plastic with “ears” that are used for hanging them above the ground. They are placed on wire boundary fences, poles, trees, or rocks.

5.1.0 Chemical Contamination Markers

The chemical contamination marker (Figure 9-11, frame 1) is a triangle that is yellow on both sides. The word “GAS” in red 2-inch (5 cm) block letters is placed on the side of the markers facing away from the contamination (front). Fluorescent paint is used, when available. The name of the agent, if known, and the date and time of detection are also placed on the front of the marker at the time of emplacement with paint, marking pencil, or grease pencil.

5.2.0 Biological Contamination Markers

The biological contamination marker (Figure 9-11, frame 2) is a triangle that is blue on both sides. The letters “BIO” in red (fluorescent paint, if available) 2-inch (5 cm) block letters are placed on the side of the marker facing away from the contamination (front). The name of the agent, if known, and the date and time of detection are also placed on the front of the marker at the time of emplacement.

5.3.0 Radiological Contamination Markers

The radiological contamination marker (Figure 9-11, frame 3) is a triangle that is white on both sides. The word “ATOM” in black 2-inch (5 cm) block letters is placed on the side of the markers facing away from the contamination (front). The dose rate, date, and time of reading, and the date and time of burst, if known, are also placed on the front of the marker at the time of emplacement.

Figure 9-11 — Chemical markers.
5.4.0 Chemical Minefield Markers

To properly mark a chemical minefield (*Figure 9-11, frame 4*), use the chemical markers and attach them to guy wires surrounding the entire area at risk. The chemical agent in the mines and the date of emplacement may also be inscribed on the front of the marker if desired by the commander.

Summary

In this chapter, you were introduced to chemical, biological and radiological weapons. You learned about the effects, symptoms defense, and decontamination of each type. You learned about the different types of equipment utilized to detect and decontaminate after being exposed to the agents. You learned the different MOPP levels and how to properly wear the JSLIST. Finally you learned about how to properly mark the contaminated area.
Assignment 9

Objectives
1. Describe the effects of Chemical, Biological, Radiological, and Nuclear (CBR-N) weapons.
2. Recognize the symptoms and effects of CBR-N agents.
3. Recognize Seabee CBR defense responsibilities.
4. Recognize and describe Seabee CBR defensive equipment.
5. Describe the MOPP and its limitations.
6. Recognize the markers used in CBR contaminated areas.

Questions
1. Chemical agents can be used to produce what type of incapacitation?
   1. Temporary
   2. Permanent
   3. Local
   4. Centralized

2. What chemical agent is the most effective and lethal?
   1. Blood
   2. Choking
   3. Blister
   4. Nerve

3. What type of chemical agent interferes with mental processes that control body functions?
   1. Harassing
   2. Cumulative nerve
   3. Nonlethal incapacitating
   4. Nontoxic blister

4. What method of transmission is the most efficient for delivering biological agents?
   1. Contamination
   2. Animals
   3. Insects
   4. Aerosols
5. The effects of a nuclear explosion are divided into what categories?
   1. Direct, indirect, and heat
   2. Blast, heat, and nuclear radiation
   3. Primary and secondary
   4. Primary radiation and nuclear radiation

6. Secondary blast injuries from nuclear weapons can be caused by which of the following forces?
   1. Flying debris
   2. Blinding light
   3. Air shock wave
   4. Blast wave

7. Permanent damage to your eyes can occur from thermal radiation at a distance of how many miles from a large-yield nuclear weapon?
   1. 10 to 20
   2. 20 to 30
   3. 30 to 40
   4. 40 or more

8. What type of nuclear radiation has little penetrating power?
   1. Alpha
   2. Beta
   3. Neutron
   4. Gamma

9. What method provides protection of internal contamination from radiation?
   1. Use a concrete bunker
   2. Wear battle dress
   3. Wear a protective mask
   4. Use a handkerchief

10. What symptoms indicate that you have been exposed to a nerve agent?
    1. Irritation to the throat
    2. Tightness of the chest
    3. The eyes feel gritty
    4. Intense itching

11. What areas of the body are most sensitive to burns from mustard vapor?
    1. Moist
    2. Ear
    3. Scalp
    4. Exposed skin only
12. The severity of the symptoms produced by blood agents depend on what factors?

1. Concentration and Development of the agent
2. Duration and Condition of exposure
3. Concentration of the agent and duration of exposure
4. Time and duration of exposure to agent

13. Exposure to what agent causes Pepper like burning of the eyes, nose, and air passages, followed by flow of tears and repeated coughing and sneezing?

1. Blister
2. Choking
3. Vomiting
4. Blood

14. Exposure to what agent will cause your eyes to water, feel gritty, become sore and bloodshot; eyelids become red and swollen?

1. Blister
2. Choking
3. Vomiting
4. Blood

15. Exposure to what agent will cause dryness of the throat, coughing, choking, tightness across the chest, nausea, and smarting and watering of the eyes

1. Blister
2. Choking
3. Vomiting
4. Blood

16. The tear agent CS causes incapacitation within how many seconds?

1. 1 to 2
2. 3 to 8
3. 10 to 20
4. 20 to 60

17. A CBR victim that appears drunk is suffering from what type of agent?

1. Choking
2. Nerve
3. Incapacitating
4. Vomiting
18. The planning of the overall CBR defensive measures for an encampment is the responsibility of what individual?

1. Chief of staff  
2. Security officer  
3. Battalion commander  
4. Operations officer

19. What measure is considered the best defense against a chemical attack?

1. Protective equipment maintenance  
2. CBR training  
3. Decontamination of personnel and equipment  
4. Constant monitoring with detection equipment

20. When should you cross contaminated terrain?

1. During the hottest part of the day  
2. Approximately 24 hours after the initial attack  
3. Only when absolutely necessary  
4. After rainfall

21. MOPP stands for what CBR defense term?

1. Mission, orientation, planning, and preparation  
2. Mission-oriented protective posture  
3. Military operation protective plan  
4. Mobile-oriented protective posture

22. When the M9 chemical agent detector paper turns red, it is indicating the presence of what type of agent?

1. Liquid nerve  
2. Vapor nerve  
3. Liquid blood  
4. Vapor blood

23. To what part of the body should you attach the self-adhesive M9 paper?

1. Upper part of the left arm  
2. Upper part of the right arm  
3. Lower part of the left leg  
4. Lower part of the right leg

24. You are the first person to learn of a chemical attack. You immediately stop breathing. What action should you take next?

1. Sound the alarm  
2. Assist stricken buddies  
3. Don your protective mask  
4. Wait for instructions from your squad leader
25. (True/False) After a chemical agent attack, you should not unmask until authorized by your immediate commander.

1. True
2. False

26. To neutralize or remove chemical contamination from exposed skin, you should use what kit?

1. M251
2. M295
3. M258
4. M291

27. If you develop the symptoms of nerve-agent poisoning, what medication, if any, should you use?

1. Amyl-nitrite Mod 1
2. Morphine
3. Atropine Nerve Agent Antidote Kit (NAAK), Mark I
4. None

28. A Seabee may use a maximum of how many NAAK injectors without authorization from medical personnel?

1. One
2. Two
3. Three
4. Four

29. After taking atropine to overcome the effects of a nerve agent, what symptom is a good sign of recovery?

1. Dryness of the mouth
2. Appetite returns
3. Limber arms and legs
4. Double vision clears up

30. When an enemy aircraft flies low over your area and produces a mist, more than likely this is an indication of what type of warfare?

1. Biological
2. Chemical
3. Radiological
4. Organic

31. What is the best defense before a nuclear attack?

1. Get inside a building
2. Wear full clothing
3. Dig in
4. Don your mask
32. What is the first indication of a nuclear attack?

   1. Loud noise
   2. Intense light
   3. Intense heat
   4. Shock wave

33. The two-piece permeable protective clothing may be worn for a maximum of how many days?

   1. 45
   2. 60
   3. 110
   4. 120

34. The CBR field protective mask does **NOT** protect you from which of the following agents?

   1. Mustard gas
   2. G-vapors
   3. Carbon monoxide
   4. Hydrogen cyanide

35. The filter on the M40 mask must be replaced under what circumstance?

   1. Every 20 days of prolonged use
   2. When directed by your squad leader
   3. Only after immersion in water
   4. When the lot number series is expired

36. The automatic chemical agent alarm alerts personnel in what manner?

   1. An audio signal only
   2. Changing colors of its chromate paper
   3. Both audio and visual signals
   4. A digital readout of the air content

37. What standard tactical dosimeter is used by the Seabees?

   1. IM-174/PD
   2. CD-316/PD
   3. IM-270/PD
   4. AN126/PD

38. **(True/False)** Combat operations are conducted under the MOPP system except when there is no CBR threat.

   1. True
   2. False
39. What CBR hazard is indicated by the use of a blue triangle with red letters on the side facing away from the contamination?

1. Gas
2. Biological
3. Radiological
4. Chemical minefield

40. What CBR hazard is indicated by the use of a white triangle with black letters?

1. Gas
2. Biological
3. Radiological
4. Chemical minefield

41. What CBR hazard is indicated by the use of a yellow triangle with red letters?

1. Gas
2. Biological
3. Radiological
4. Chemical minefield

42. What CBR hazard is indicated by the use of a red triangle with yellow letters?

1. Gas
2. Biological
3. Radiological
4. Chemical minefield
Assignment 9

Chemical, Biological, and Radiological (CBR) Defense

Directions: Select the correct answer from the list of alternates below each question in the end of chapter assignment. Write in the answer next to the corresponding question number below. Use this answer sheet as a reference to completing the online assignment related to this assignment.

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Additional Resources and References

This chapter is intended to present thorough resources for task training. The following reference works are suggested for further study. This is optional material for continued education rather than for task training.

NTTP 3-11.26, Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination

NTTP 3-11.27, Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NCB) Protection

NTTP 3-11.25, Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance

NTTP 3-11.29, Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical Reconnaissance

TM 3-4230-236-10, Operator's Manual for Decontamination System, Sorbent: M100


TM EE700-AD-MMO-010, Operation Instructions Organization Maintenance, Radiac Sets AN/PDQ-1 and AN/PDQ-2


Trainee Feedback

Center for Seabees and Facilities Engineering (CSFE) makes every effort to keep their courses up-to-date and free of technical errors. If you have a suggestion, found an error or inaccuracy, please write, FAX or email us by using the form below. Use one form for each comment and be sure to fill in the information as accurately and detailed as possible. Thank you for your assistance.

Write: CSFE
   NCF Training Division (N7B)
   3502 Goodspeed St.
   Port Hueneme, CA  93043-4337
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E-mail: CSFE_CBCH@navy.mil

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Course: Seabee Combat Handbook, Volume ____, Navedtra: __________

Course Date: _______  Chapter Number: _____  Page: ______

Paragraph: _____  Sentence: _____  Figure: ______  Frame/View: ______

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(optional) Corrective action: _____________________________________

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(optional) Supporting reference(s): _________________________________

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Your email address, if a response is requested: _____________________