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CHAPTER 7 - CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL DEFENSE

SECTION 1 - REQUIRED INFORMATION

- Ref: (a) NTTP 3-20.31, (series) Surface Ship Survivability
(b) NSTM Chapter 070, Radiological Recovery of Ships after Nuclear Weapons Explosions
(c) NSTM Chapter 470, Shipboard BW/CW Defense and Countermeasures
(d) NAVMED P-5041, Treatment of Chemical Agent Casualties and Conventional Military Chemical Injuries
(e) NAVMED P-5059 NATO Handbook on the Medical Aspects of NBC Defense Operations

7100. REQUIRED TABS.

- a. TAB A, Self Aid Buddy Aide for Nerve Poisoning
- b. TAB B, Self-Aid for Blistering Agent
- c. TAB C, Self-Aid Buddy Aide for Blood Agent
- d. TAB D, Self-Aid Buddy Aide for Choking Agent
- e. TAB E, CBR-Defense Bill

NOTE: The CBR Defense Bill provides important, time sensitive information to the entire damage control organization.

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SECTION 2 - CHEMICAL WARFARE

7200 CLASSIFICATION OF CHEMICAL AGENTS.

a. The following are a brief description of the common types of chemical agents.

(1) Nerve agents inhibit a chemical neurotransmitter called cholinesterase enzyme, disrupting the normal transmission of nerve impulses.

(2) Blister agents produce pain and injury to the eyes, reddening and blistering of the skin, and when inhaled, irritates the respiratory tract. Some blister agents like mustard may produce major destruction of the top (epidermal) layer of skin.

(3) Choking agents injure the lungs and irritate the eyes and burn the entire respiratory system. They may also cause uncontrollable pulmonary edema and predispose to secondary pneumonia.

(4) Blood agents are transported by the blood to all body tissues, where the agent blocks the oxidative processes, preventing tissue cells from utilizing oxygen. This results in cellular suffocation or anoxia.

7201 CHEMICAL AGENT DETECTION AND IDENTIFICATION.

a. Identification of chemical agents will greatly assist the diagnosis and treatment of injuries. The following are means of detecting and identifying chemical agent contamination.

(1) Chemical agent detector paper or tape can be used to detect/identify liquid chemical agents.

(2) The VGH ABC-M8 Chemical Agent Detector Paper can be used to detect and identify liquid V- and G-type nerve agents L- and H-type blister agents. It does not detect chemical agent vapors. Some solvents and standard decontaminating solutions cause the M8 paper to falsely react positive.

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(3) The M9E1 Chemical Agent Detector Paper (tape) (which can be worn on the uniform) detects liquid nerve agents (V and G) and blister agents (H/HD, HN, and L). M9 paper will detect the presence of agent(s); it can neither distinguish between agent types nor detect chemical agent vapors. Extremely high temperatures, scuffs, or certain types of organic liquids and decontaminating solution number 2 (DS2) can produce unreliable or false positive test results. (DS 2 is not authorized for use on Naval vessels.) M9 paper is much more sensitive than M-8 paper.

b. Chemical warfare directional detector (CWDD), AN/KAS-1 is a manually operated passive sensor that can detect nerve agent vapor at distances of several nautical miles from the ship, but cannot determine the range to the vapor to the vapor cloud. The CWDD can detect the infrared signature of GA, GD, GB, GF, and VX but cannot discriminate among these agents.

c. Installed automatic chemical agent alarm systems, such as the Chemical Agent Point Detection System (CAPDS) and the Improved (Chemical Agent) Point Detection System (IPDS), detect agent aerosol and vapor contamination consistent with their designed specifications and operational limitations.

d. Portable detection devices, such as the M256 Chemical Agent Detector Kit, the Shipboard Automated Chemical Agent Detector and Alarm (ACADA) and the Joint Chemical Agent Monitor (JCAD) (future fielding), detect and identify vapor concentrations of nerve, blister, and blood agents. Shipboard ACADA does not detect blood agents. Chocking agent, Phosgene (CG) can be detected by using chemical detector tubes carried for gas free engineering purposes.

7202 EMERGENCY PERSONNEL DECONTAMINATION.

a. Chemical agent contamination of the skin should be neutralized and removed with the M291 Skin Decontamination Kit (SDK).

b. Procedures for Decontamination Kit Use:

(1) M291 Skin Decontamination Kit (SDK)

(a) Open the kit container and remove a mylar packet.

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(b) Tear open the mylar packet and remove the decontamination pad. Unfold the pad and place two fingers inside the strap, with the pad on the inside of the hand. Thoroughly scrub the contaminated area until it is covered with the dark granules. Gently rub the area toward the center. Discard the used decontamination pad.

NOTE: Detailed procedures for decontaminating the eyes are found in ref (d).

c. Any suspected chemical agent contamination of your eyes or face must be removed immediately. In most cases, you will not be able to identify the agent before decontamination. Quickly obtain overhead shelter to protect yourself while performing the following:

- (1) Remove and open your canteen.
- (2) Take a deep breath and hold it (keep mouth closed).
- (3) Loosen the cheek straps on the mask, then lift your mask away from your face. Do not take the mask off.
- (4) Flush (irrigate) your eye or eyes immediately with copious amounts of water. To irrigate the eyes with water (from a canteen or other container of uncontaminated water) tilt your head to one side, open the eyelids as wide as possible, and slowly pour water into the eye so that it will run off the side of your face to avoid spreading the contamination. You must irrigate your eyes despite the presence of toxic vapors in the atmosphere. Hold your breath and keep your mouth closed to prevent contamination and absorption through the mucous membranes. Neutralize chemical agent residue along the flush path on the face.
- (5) When the breath can no longer be held, remove the hand from behind the mask and with the palm of the hand cover the outlet valve assembly and push the mask against the face to make a seal. Exhale sharply to purge the mask of contamination by forcing it out around the seal. Uncover the outlet valve assembly but maintain the pressure on the mask to keep a seal. Resume breathing, repeat this procedure until the eyes have been flushed .

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(6) When the eyes have been thoroughly flushed use M291 wipes to decontaminate both the face and that portion of the mask which has come into contact with the facial contamination. Reseal the mask and seek medical treatment.

7204 DIAGNOSIS OF NERVE AGENT POISONING.

a. Nerve agent poisoning may be identified from the characteristic signs and symptoms. If exposure to vapor has occurred, the pupils will be very small, usually pinpointed. If exposure has been cutaneous, or has followed ingestion of a nerve agent in contaminated food or water, the pupils may be normal or, in the presence of severe systemic symptoms, slightly to moderately reduced in size. In this event, one must rely on other symptoms of the nerve agent poisoning for proper diagnosis. No other known chemical agent produces muscular twitching and fasciculation, rapidly developing pinpoint pupils, or the characteristic train of muscarinic, nicotinic, and CNS manifestations.

b. It is important that all service members know the following MILD and SEVERE signs of nerve agent poisoning. Service members who have most or all of the symptoms listed below must IMMEDIATELY receive first aid (self-aid or buddy aid).

(1) MILD poisoning (self-aid). Casualties with MILD symptoms may experience most or all of the following:

- (a) Unexplained runny nose.
- (b) Unexplained sudden headaches.
- (c) Sudden drooling.
- (d) Difficulty seeing (dimness of vision and miosis).
- (e) Tightness in the chest or difficulty breathing.
- (f) Localized sweating and muscular twitching in the area of the contaminated skin.

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- (g) Stomach cramps.
 - (h) Nausea with or without vomiting.
 - (i) Tachycardia (fast heartbeat) followed by bradycardia (slow heartbeat).
- (2) SEVERE symptoms (buddy aid). Casualties with SEVERE symptoms may experience most or all of the MILD symptoms, plus most or all of the following:
- (a) Strange or confused behavior.
 - (b) Wheezing, dyspnea (difficulty breathing) and coughing.
 - (c) Severely pinpointed pupils.
 - (d) Red eyes with tearing.
 - (e) Vomiting.
 - (f) Severe muscular twitching and general weakness.
 - (g) Involuntary urination and defecation.
 - (h) Convulsions.
 - (i) Unconsciousness.
 - (j) Respiratory failure.
 - (k) Bradycardia (abnormally slow heartbeat).

NOTE: Casualties with severe symptoms WILL NOT be able to treat themselves and MUST RECEIVE prompt buddy aid and prompt follow-on medical treatment if they are to survive.

c. Casualties with MODERATE poisoning will experience an increase in the severity of most or all of the MILD symptoms. Especially prominent will be fatigue, weakness, and muscle fasciculation. The progress of symptoms from MILD to MODERATE indicates either inadequate treatment or continuing exposure to the agent.

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7205 SYMPTOMS OF BLISTERING AGENT.

a. Blister agents will likely be used to produce casualties and force opposing troops to wear full protective equipment. Blister agents are used to degrade fighting efficiency rather than kill, although exposure to such agents can be fatal. Blistering agents include sulphur mustard (H and HD), nitrogen mustards (HN), lewisite (L), and halogenated oximes (such as phosgene oxime (CX)). The following symptoms are for the sulphur mustard (HD) agents. For symptoms of all blistering agents see reference (d).

b. In a single exposure, the eyes are more susceptible than either the respiratory tract or the skin to mustard. Symptoms are: tears, irritation, and sensitivity to light.

c. Ingestion of mustard produces puss and swelling of the lining of the gastrointestinal tract, with eventual hemorrhaging. Absorption of the mustard from the intestinal lumen results in damage to the blood-forming organs such as bone marrow, lymph nodes, and spleen. Such damage will induce blood disorders such as leukopenia, thrombocytopenia and anemia.

d. Inhalation of mustard vapor causes damage primarily to the lining of the lungs. A single exposure to a small amount of mustard vapor ordinarily does not produce significant injury. More exposure received will result in more lung damage ultimately leading to respiratory failure.

7206 SYMPTOMS FOR BLOOD AGENT.

a. Inhalation is the usual route of entry for blood agents. Examples of blood agents are hydrogen cyanide (AC) and cyanogen chloride (CK). All blood agents are nonpersistent (agents disperse rapidly).

b. Hydrogen cyanide

- (1) Rapid deep breathing and slow pulse rate
- (2) Odor of bitter almond oil

c. Cyanogen chloride

- (1) Irritation of eyes, nose, or throat
- (2) Slow breathing

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7207 SYMPTOMS OF CHOKING AGENT.

a. Choking agents are classified as lung-damaging agents. They include phosgene (CG) and diphosgene (DP). CG is the most well known of these agents. Persons exposed to CG need not be withdrawn during combat, unless signs of pulmonary distress appear. Following are examples of symptoms. For a complete list see ref (d).

- (1) Coughing
- (2) Dry throat
- (3) Feeling of tightness in the chest
- (4) Nausea
- (5) Vomiting
- (6) Headache
- (7) Tears

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TAB A - SELF AID FOR NERVE POISONING

_____ IMMEDIATELY DON protective mask and hood at the first signs of a chemical attack.

_____ Stop breathing, put on your mask, clear and seal the mask, and resume breathing. Secure the mask hood. The mask and protective clothing are worn until the "all clear" signal is given.

NOTE: All liquid nerve agents must be removed from the skin and/or clothing as described in section 7202 before donning the over garment.

_____ Identify your symptoms of nerve agent poisoning from section 7204.

_____ Administer one atropine injection and one 2-PAM-Cl injection into the outside mid-lower part of the thighs.

_____ Wait 10-15 minutes. During this time the mild nerve agent poisoning symptoms should diminish, or the signs of atropinization will appear (rapid pulse, dry mouth, dry skin).

_____ Repeat self-administration IF no change in symptoms. Use the 2nd atropine injector and the 2nd 2-PAM-Cl injector.

_____ Wait 10-15 minutes. If no change in symptoms, repeat procedure with 3rd and last atropine and 2-PAM-Cl.

_____ If situation permits, proceed to decon/triage area.

BUDDY AID FOR NERVE AGENT

_____ Correctly identify the severe symptoms of nerve agent exposure in another individual, and determine if the individual is able to administer self-aid.

_____ If vapor hazard still exists make sure the casualty's mask is properly adjusted and sealed to the extent practical.

_____ Locate the casualty's atropine and 2-PAM-Cl automatic injectors. DO NOT USE YOUR INJECTORS!

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- _____ Inject the casualty with all 6 injections (or the remainder).

- _____ Move the casualty to a triage area or decon/treatment station as soon as practical. Buddy aid may be performed en route and at the decon station if the situation warrants.

- _____ Artificial respiration is required when the diaphragm and intercostals muscles are stimulated to exhaustion resulting in a physical inability to breathe. DO NOT perform in a chemical hazard environment.

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TAB B - SELF AID FOR BLISTERING AGENT

___ Set MOPP 4 when liquid or vaporized agents are known to be present.

___ Liquid vesicants in eyes or on skin require immediate decontamination.

___ Perform section 7202 (Emergency Personnel Decontamination).

___ Go to triage/decon area as soon as practical.

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TAB C - SELF AID FOR BLOOD AGENT

_____ IMMEDIATELY don protective mask while holding breath.

NOTE: Speed is absolutely essential; the effects of this agent are so rapid that within a few seconds you will not be able to don your mask.

_____ Go to triage/decon area as soon as practical.

BUDDY AID FOR BLOOD AGENT

_____ IMMEDIATELY don your protective mask while holding your breath.

_____ If nearest person is unable to don their protective mask, help them.

_____ Take buddy to triage/decon area.

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TAB D - SELF AID FOR CHOKING AGENT

_____ IMMEDIATELY don protective mask.

_____ Move out of contaminated environment, if possible.

BUDDY AID FOR CHOKING AGENT

_____ IMMEDIATELY don your protective mask while holding breath.

_____ If nearest person is unable to don their protective mask help the person.

_____ Take buddy to triage/decon area. Have victim remain seated in an upright position while awaiting treatment. Do not lie victim down.

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SECTION 3 - BIOLOGICAL WARFARE

7300 BIOLOGICAL WARFARE.

a. Biological agents can be divided into two general classes: pathogens and toxins. A pathogen is a microorganism that causes disease in humans, animals or plants. A biological toxin is an organic substance that is poisonous to humans or animals. Toxins are not living organisms. When a biological agent is used against a ship, the purpose is to render the crew unable to effectively carry out the ship's mission.

7301 DETECTION OF BIOLOGICAL ATTACK.

a. Interim Biological Agent Detection System (IBADS) is an installed sensor that provides point detection of several airborne biological warfare agents on a near real-time basis. The IBADS continuously samples outside air and detects changes in the amount of airborne particles in several size ranges. When a suspicious increase occurs in the number of particles of respirable size, IBADS prepares a sample for testing to identify selected biological agent. The number of IBADS available is currently limited.

b. Biological survey is another method of detection. If a biological attack is suspected because of a large number of breakouts or other indications, biomedical and environmental samples can be collected and sent to laboratories. The Medical Department is responsible for biomedical samples. Repair Party Monitoring Teams perform environmental samplings. For detailed instruction on biological sampling and surveying see ref (c).

c. The Dry Filter Unit (DFU) is an environmental air sampling system designed to be used with Biological Agent Assays and Confirmatory Laboratories to provide a "Detect to Threat" capability for Naval Forces ashore and afloat. The DFU system may be utilized for external or internal air sampling. It may be portable or fixed and may be installed on ships' or buildings' vent systems.

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7302 CONFIRMATION OF BIOLOGICAL ATTACK.

a. Positively determining that a biological attack has occurred is difficult. It is normal for a small percentage of the crew to be ill from naturally occurring pathogens. Occasionally, there are outbreaks of illness that affect more personnel. This, too, could be attributable to natural causes, but the following developments could indicate that a biological warfare agent is responsible.

b. The number of casualties reaches epidemic portions within hours to three days, most within a 24-hour period.

c. The infection rate or death rate is higher than normally expected for the disease.

d. A disease outbreak occurs that is not normally encountered in the area of the world where the ship is operating.

e. Personnel working in a protected environment do not contract the disease.

f. Outbreak of multiple diseases occurs.

NOTE To confirm that a biological attack was responsible, samples collected by a biological detection system, environmental samples collected by repair parties or biomedical samples collected by medical personnel are crucial.

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a. Proper personal and shipboard hygiene is important defense against both biological weapons and naturally occurring biological organisms. The protective mask is the most important element in biological protection. Most pathogens can enter the body only by inhalation, ingestion or breaks in the skin. With early warning, the chemical protective ensemble (CPE), protective mask, Advanced Chemical Protective Garment (ACPG) boots and gloves provide effective protection against biological warfare agents. Thus, if the CPE is required based on chemical threat, protection against biological agents is provided as well. If the threat is limited to biological agents, use of the ACPG is not warranted. IAW ref (e), standard uniform clothing of good quality offers reasonable protection against biological agent aerosols. Complete body coverage is required if the threat includes toxins. A protective mask is required in any case.

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SECTION 4 - RADIOLOGICAL WARFARE

7400 RADIOLOGICAL WARFARE.

a. A nuclear explosion involves the fission (splitting) of complex radioactive isotopes. These fission fragments are radioactive. This means that these isotopes are unstable forms of certain elements that emit ionizing radiation as they decay to a more stable state. The radiation from fission fragments consists primarily of gamma rays and beta particles. Shipboard instruments are calibrated to measure gamma radiation at the energy levels associated with fallout. The energy levels associated with prompt or initial gamma radiation are higher and not normally measured by the ship's CBR organization. Current shipboard instruments can detect, but not measure, beta radiation.

7401 DETECTION.

a. Human senses are incapable of detecting nuclear radiation, so Radiation Detection, Indication, And Computation (RADIAC) instruments are needed. RADIACs measure different forms of radiation:

(1) AN/PDR-27 is the standard low-range beta-gamma RADIAC set for use in low level surveys and for personnel monitoring. It has a handheld Gamma/Beta probe and an audio output which make the unit ideal for personnel surveys.

(2) AN/PDR-43 is a battery powered, high range, beta-gamma RADIAC set used for low and high level surveys, and possibly personnel monitoring.

(3) AN/PDR-65 is a very high-range gamma survey instrument. Onboard ship it is normally mounted permanently and used with an external probe, but it could be used as portable meter. The primary location for the AN/PDR-65 is the ship's bridge with a second set normally mounted in DCC. For early warning of the arrival and cessation of fallout, the detector unit for the bridge should be mounted on the aft side of the main mast. It should be positioned as high as possible without being located in a radar beam.

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(4) AN/PDQ-1 Multi-Function RADIAC (MFR) with OA-9449/PDQ Gamma/Beta Probe measures beta-gamma radiation. This RADIAC is being phased into the fleet as a replacement for AN/PDR 27 and 43. The PDQ-1 may be used without the probe for Gamma surveys. With the probe attached the PDQ-1 may be used for Gamma/Beta survey or personnel surveys.

(5) Dosimeters are devices that measure total dose or exposure. A personal dosimeter measures the accumulated dose of the wearer. There are two types of dosimeter that are commonly used in the military.

(a) IM 143 PD or Self Indicating Pocket Dosimeter is an ionization chamber pocket dosimeter. Measures gamma radiation and X-ray radiation. Since ships are outfitted with only enough for approximately 10% of the crew, these dosimeters should be issued to the senior member of any group of people (e.g. a watchsection,) this person can then be tasked with real time monitoring of the groups dose.

(b) DT-60 is a radioluminescent dosimeter worn like a necklace. Also measures X-ray and gamma radiation. Sufficient quantities should be carried to issue on to every crewmember. The dosimeter must be read using a CP-95/PD RADIAC Computer Indicator, because the dose measured by a DT-60 is cumulative, these dosimeters must be read and logged upon initial issue. Changes in photoluminescence require 16-24 hours to take effect, thus these dosimeters cannot be used for real time management of personnel rotation. An individual's final dose should be read at least 24 hours after leaving a radiological environment.

7402 PROTECTION FROM RADIOLOGICAL WARFARE.

a. Initial nuclear radiation and thermal radiation arrive instantaneously. Other effects arrive sequentially at intervals depending on range to surface. The deposition of fallout may not begin until hours after the detonation and the radiation hazard created by it may last until the ship receives depot level decontamination.

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b. Protective clothing and respiratory protection are required in a radiological environment. The MCU-2/P with C-2 canister can be used for respiratory protection, while protective clothing shall consist of durable clothing made from fine weave cloth or a plastic or rubber material. Shipboard work uniforms and battle dress items satisfy this requirement. In wet spray conditions, rain gear shall be worn as the outer layer.

(1) If possible, no one should be allowed topside while the ship is enveloped in the initial blast. In an emergency, personnel topside must have full body coverage and respiratory protection. This will minimize personnel exposure, not guarantee their survival.

(2) All personnel inside the skin of the ship will wear full body coverage and respiratory protection regardless of status of ventilation (i.e. even when Circle William is set). When beta radiation is confirmed absent, full body coverage can be relaxed but the mask shall be worn.

c. To increase the chances of survival for radiological attack utilize the philosophy of time, distance and shielding. Minimize time spent in area of radiation. Individuals should distance themselves from the radiation area (i.e. move ship away from the blast area). As for shielding, stay inside the skin of the ship or in area where large dense material provides protection. Senior members of the Damage Control organization must be proficient in the calculation of Radiation Absorbed Doses to accurately determine stay times and rotation times. See reference (b) for procedures.

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TAB A - CBR BILL

Insert applicable Annex per reference (a).

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