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Manual of Preventive Medicine

Chapter 9

Preventive Medicine
for
Ground Forces

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CHAPTER 9 PREVENTIVE MEDICINE FOR GROUND FORCES

Section I. INTRODUCTION

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9-1. Scope. This chapter provides technical guidance to preserve the combat readiness of Naval operational forces ashore by preventing illness and injury. When used with other chapters in this manual, this chapter provides valuable information for unit commanders and medical department personnel operating in field environments.

9-2. Mission. The primary mission of preventive medicine (PREVMED) personnel including unit Medical Officers (MO), Senior Medical Department Representatives (SMDR), Environmental Health Officers (EHO), and Preventive Medicine Technicians (PMT), is to preserve unit combat effectiveness by providing informed technical information to the Commanding Officer or Officer in Charge concerning preventive medicine and environmental health. This entails conducting sanitation and habitability inspections, advising the command concerning health risks affecting the command or unit, recommending actions to reduce health risks, and providing training to personnel in preventive medicine and other related topics. The primary mission remains the same regardless of the size of the operation.

9-3. Responsibility.

1. Unit commanders are ultimately responsible for the health and safety of their personnel.

2. Preventive medicine personnel are responsible for fulfilling their primary mission and providing additional general medical services to the supported element as operational situations dictate. Specific preventive medicine tasks include:

- a. Assist individual units to recognize and eliminate existing or potential health hazards.
- b. Perform or assist with epidemiological investigations of outbreaks or suspected outbreaks of communicable diseases.
- c. Arrange for laboratory support for epidemiologic investigations.
- d. Conduct sanitary surveys to identify potential sanitation problems and recommend corrective action.
- e. Establish an alert posture toward the early signs of communicable disease, particularly those endemic to the area of operation, and take immediate steps to isolate and treat cases.

f. Provide inservice training to medical and non-medical personnel concerning relevant preventive medicine topics.

g. Provide assistance consistent with the PREVMED personnel expertise and resources in the event of an emergency or disaster.

h. Conduct limited preventive medicine studies consistent with operational commitments.

i. Draft instructions, notices, and other directives as appropriate, to convey preventive medicine and environmental health information and requirements.

j. Establish and maintain liaison with other military, governmental and civilian agencies as appropriate to accomplish the mission.

k. Provide consultation, training, and supervision for mass immunization programs.

1. Compile and provide relevant medical intelligence briefings to the unit commander and to command personnel as appropriate.

m. Provide unit commanders with timely status reports of preventive medicine programs and after action reports at the conclusion of operations or exercises.

3. All personnel must do all they can to preserve their own well being and promote the health of their unit or command by practicing good personal hygiene and following sound camp/field sanitation procedures.

9-4. Field Conditions. Medical department personnel must be aware of specific health problems that may arise due to the unique nature of conditions in which operational forces of the Navy and Marine Corps are involved. Field conditions vary greatly from one geographic locale to the next. From hot, dry desert climates to cold alpine or arctic conditions, necessities for the prevention of illness and injury in deployed troops may change dramatically. Requirements and methods for providing safe water, food, and waste disposal often change according to the specified environment. Field conditions in modern warfare can be altered rapidly and require foresight in order to deal with environmental stresses. Urban warfare may require troops to deploy into an area which previously had modern public utilities such as potable water lines, sanitary sewers and waste disposal. Overnight, an area such as this can change to an urban disaster area where all water, food, and services are suspect of contamination or do not exist.

9-5. Importance of Preventive Medicine.

1. Prevention of disease is one of the most important functions of any military medical service. In every war for which statistics are recorded, military forces have lost more personnel to disease than to direct combat with opposing forces. Table 9-1 illustrates the severe impact of disease on combat forces as a percentage of total admissions due to disease/non battle injuries (DNBI).

a. Heat and cold injuries can take heavy tolls on the battlefield. During the 1967 Arab-Israeli War, 20,000 deaths due to heat were reported when troops were isolated from their sources of water. Cold injuries caused over 90,000 hospital admissions in WWII. During the 24 day British invasion of the Falkland Islands in 1982, 14% (109) of the 777 British casualties were from cold injuries.

b. Arthropod borne diseases alone were responsible for the loss of over 16.5 million man-days among U.S. Armed Forces during WWII. Malaria incidence threatened the entire Asian-Pacific campaign, and in one instance in the Solomon Islands, caused eight times more casualties than the enemy.

c. Diarrheal diseases were influential in the defeat of Rommel's Army at El Alamein, North Africa in WWII. His top generals were medically evacuated just before and during the battle due to amoebic dysentery. Rommel himself was not present when the battle began due to hepatitis.

d. When U.S. Marines were first used as a stabilizing force in Lebanon in 1958, the force was almost completely incapacitated with dysentery within 2 weeks of entering that country. However, when U.S. Marines were reintroduced into Lebanon in 1982-83, the morbidity among Navy and Marine Corps personnel was dramatically reduced by application of environmental health controls. These controls included restricted access to local foods, close adherence to good food sanitation practices, extensive use of Meals, Ready to Eat (MRE), aggressive fly control programs, and application of proper water sanitation practices.

e. The significant benefits of preventive medicine were manifested again in the 1991 "Desert Storm" operations in Iraq and Kuwait. Preventive measures resulted in record low morbidity. Heat, increased need for water, arthropod risks, and geographical isolation posed great

dangers to troops. Predeployment education of the troops prepared individuals for the struggle against disease and non-battle injuries. The rate of hospital admission due to disease during Desert Storm was reported to be less than 50 per 1,000 patients. This is extremely low when compared to the 917 per 1,000 admissions attributed to disease in the Middle East theater during World War II. In stark contrast, Iraqi troops were found undernourished, without water, and covered with various lesions from insect bites and disease.

2. As the evidence shows, personnel operating in the field are at greater risk of communicable diseases and injury than in garrison. This can generally be attributed to three reasons:

a. Increased exposure to hazards. Military operations or exercises often take place in locations where personnel are exposed to disease carrying insects, polluted water and food sources, contagious local populations, hot conditions or extremely cold environments. Personnel must be prepared to function under such conditions.

b. Reduced resistance to disease. Personnel deployed to distant locations may experience loss of sleep, irregular meals, and external stresses which make them more susceptible to illness and injury.

c. Disruption of basic hygiene and sanitation. Good personal hygiene and provision of sanitary food, water, and waste disposal become more challenging in the field. All personnel must know how to function under these conditions and discipline themselves to maintain high standards of hygiene and sanitation.

3. History is clear; environmental health and preventive medicine can make a difference. The outcome of a mission, conflict or war may depend on how well we reduce DNBI. By applying lessons learned from past experience, future problems can be prevented.

9-6. Medical Planning.

1. Medical planning is where good preventive medicine starts. PREVMED personnel must take the initiative to become actively involved in the pre-deployment planning phase of all unit deployments. Once operations begin, it is difficult, if not impossible, to alter plans set in the medical appendix to the operational plan (OP-LAN). Involvement in the planning phase will enable

CAUSE ↓ WARS →	WW II 1941-1945	KOREA 1950-1953	VIETNAM 1965-1970
DISEASE/ NONBATTLE INJURIES	95.9%	82.4%	62.4%
BATTLE INJURIES	4.1%	17.6%	27.6%

Table 9-1. Disease Nonbattle Injuries (DNBI) Matrix
(Distribution of Casualties)

the PREVMED personnel to interact effectively with unit leaders, become knowledgeable about the operation/exercise and logistics, and to provide medical advice to prevent DNBI during the deployment. Specific pre-deployment activities should include as a minimum the following:

a. Compile preventive medicine information relevant to the area of operations (AO) and present it to the unit surgeon or commander along with recommendations for minimizing casualties due to preventable health threats.

b. Confer with other unit departments including engineering, intelligence (G-2/S-2), operations (G-3/S-3) and supply/logistics (G-4/S-4) to ensure adequate support for provisions, potable water, and availability of protective clothing and equipment, netting, repellent, and other necessities.

c. Provide preventive medicine briefs/training on expected health threats in the AO to deploying personnel.

d. Assist with health record reviews during pre-deployment medical preparation to ensure maximum readiness of unit personnel. Of particular interest to PREVMED personnel are the status of prophylactic immunizations and regimes, screening tests (PPDs, HIV, G6PD, sickle cell trait, etc.) and factors that would predispose any person to disease or injury.

2. *The Health Services Appendix to the Logistics/Combat Service Support Annex* of the OPLAN is the document which contains all the information necessary for providing health service support during the operation. The health services appendix has the following types of information:

a. Task organization of the medical service including attachments to specific combat units.

b. Specific missions for the next subordinate medical echelon and any broad missions which apply to the medical service as a whole.

c. Methods, supplies, and personnel to implement sanitation programs and information about health hazards peculiar to the operation or operating area, and precautions to minimize those hazards.

d. Plans for hospitalization and medical evacuation (MEDEVAC) of military personnel, prisoners of war, and displaced persons or civilians.

e. Amount of medical supplies to be carried by all units and medical supply distribution centers and details of medical resupply.

f. Information concerning augmentation, organization, and functions of Mobile Medical Augmentation Readiness Teams (MMARTs).

g. Methods, supplies, and personnel required to process casualties contaminated with chemical, biological, or radioactive substances. Special health hazards peculiar to handling contaminated casualties and precautions needed to minimize those hazards.

h. Procedures for obtaining medical information relevant to the AO.

3. Medical information or intelligence may be obtained from departments within the operating unit or from other commands prepared to provide such support. Marine Corps sources include G2/4, S2/4, the unit surgeon's office, and the medical battalion preventive medicine service (PMS). Sources of medical intelligence

outside the Marine Corps are listed in Appendix A.

The Navy Disease Vector Ecology and Control Centers (NAVDISVECTECOLCONCENS) prepare in-depth Disease Vector Risk Assessment Profiles (VECTRAPS) and the Navy Environmental and Preventive Medicine Units (NAVENPVNTMEDUs) prepare Disease Risk Assessment Profiles (DISRAPS). These informative reports can be obtained by contacting the cognizant NAVDISVECTECOLCONCEN or NAVENPVNTMEDU for the AO.

4. A Preventive Medicine Journal is the key document in which all occurrences, actions and results are recorded. The journal is to be started by the PMT at the time of assignment to a unit. The journal format consists of two sections:

a. The opening page should identify points of contact for support units within the command structure.

b. The narrative summary section is as lengthy as is necessary and is intended for recording pertinent entries including daily routines, meetings, problems reported to the PMT, assistance requests, conversations, visits, phone calls, and correspondence received or sent.

5. After Action Report (AAR): This report provides information to the CO about the course of events during the deployment and presents problems as they occurred. It also includes observations, recommendations, recognition of above-par or below-par areas, and conclusions. Comments should be focused or made on those conditions which had the most impact upon the operation. Suggestions on standardizing methods or avoiding problems in the next deployment should be included. The AAR should be submitted to the CO of the unit via the unit's Medical Officer. A copy should be sent to the cognizant NAVENPVNTMEDU. All journal entries and correspondence considered relevant to the report should be copied and included as enclosures. This will assist the next PMT deployed to the same AO during the pre-deployment phase.

a. The AAR should be separated into three phases:

- (1) Predeployment
- (2) Deployment
- (3) Post-Deployment

b. Personnel deployed for less than 6 months must submit their AAR within 15 days of mission completion.

c. Personnel deployed for 6 months or more must submit their AAR within 30 days of mission completion.

9-7. Equipment and Supplies.

1. A complete inventory of equipment and supplies is essential for PREVMED personnel to carry out their mission in the field. It is important that the equipment and supplies be well stocked, maintained and ready for use in a moment's notice. Responsibilities for this equipment are given below:

a. The Force Service Support Group of the Marine Expeditionary Force (MEF) maintains Preventive Medicine and Vector Control Authorized Medical Allowance List (637/638 AMALs) for use in MEF size operations.

b. MMART AMALs are maintained by NAVENPVNTMEDUs and NAVDISVECTECOLCONCENS.

c. Equipment and supplies needed to support all other operations will be obtained at the local level and

maintained by the cognizant PREVMED personnel in a “miniblock” configuration. Refer to local Preventive Medicine Departments or NAVENPVNTMEDUs for suggested equipment and supply needs specific to the AO.

2. PREVMED personnel must carry their own equipment and supplies on all operations. Do not expect Preventive Medicine Departments or units located in the vicinity of the deployment to have sufficient supplies and equipment to support your operation.

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Section II. WATER SUPPLY SANITATION IN THE FIELD

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9-8. Importance of Potable Water. Safe water, in sufficient quantities, is essential to every living organism. Insufficient quantity or quality of water is not only debilitating to the individual but will have a significant impact on unit operational readiness. Water which is not properly treated and disinfected can spread bacterial diseases such as cholera, shigellosis, typhoid, and paratyphoid fever. Untreated water can also transmit viral hepatitis, gastroenteritis and parasitic diseases such as amoebic dysentery, giardiasis and schistosomiasis.

9-9. Responsibilities.

1. Unit commanders are ultimately responsible to ensure there are sufficient quantities of safe water for their personnel. Commanders must take actions necessary to maintain an adequate supply of potable water. Such actions include properly treating raw water supplies to remove unacceptable levels of organic and inorganic substances and harmful microbes, and enforcing water discipline. Furthermore, commanders must ensure that their personnel are familiar with the dangers of consuming untreated water and know the proper methods for disinfecting their personal drinking water supplies if necessary.

2. Engineers are responsible for providing sufficient potable water for the population to be served. This includes selecting sources of raw water and construction, operation, and maintenance of all the structures and facilities used for collection, treatment, and distribution of potable water. The treatment process usually includes one or more of the following processes: coagulation, sedimentation, filtration, and disinfection. Although engineers will not normally deliver water to units in the field, they do establish, operate, and maintain water points where potable water is provided.

3. The medical department advises the commanding officer on water quality issues. This entails assisting the engineers in selecting water sources, surveying the potable water system, conducting routine bacteriological examination of the potable water supplies, testing the water for halogen levels and informing engineers of water quality and type of treatment required. The need

for chemical analysis of field water supplies is made on a case by case basis by assigned medical and engineer personnel.

4. All personnel must be familiar with, and follow, proper water discipline. This includes consuming only water that has been properly treated and conserving and protecting the potable water supply. Every individual is responsible for ensuring that potable water does not become contaminated from careless or improper handling.

9-10. Sources of Water.

1. All water sources in the field should be considered unsafe until they have been evaluated and approved by the medical department.

2. Water maybe obtained from various sources in the field including rivers, streams, ponds, lakes, wells, ice, snow, oceans, etc. In choosing a raw water source, consider the following factors:

a. Quantity. Will the source provide an adequate supply of potable water for all hands for the expected length of stay? See paragraph 9-14 for computation of water requirements.

b. Quality
 (1) Is the water free of significant contamination such as sewage, naturally occurring toxic elements or compounds or chemical, biological, or radiological (CBR) warfare agents?

(2) Is the water objectionable due to turbidity, color, odor, or taste?

(3) Is the water source protected from possible organic contamination by sewage fallout or runoff from latrines, showers, motor pools, etc.? Are there sources of inorganic contamination by mining wastes or runoff, etc.?

(4) Can the water be treated adequately with the resources available?

c. Accessibility. Is the source accessible to water purification and transport equipment?

3. Potential Sources of Water
 a. Existing public water systems. These are the easiest and, in most cases, the safest sources because this water has been treated to some extent. This does not,

however, preclude the necessity for evaluating the water and requiring additional treatment to make it safe.

b. Surface water. Surface water includes lakes, rivers, streams, and ponds. This source is usually more accessible than other sources and capable of supplying adequate quantities; however, water quality can be a problem. In lakes and ponds, place the intakes as far from shore as possible and neither too close to the bottom nor too near the surface to avoid picking up mud and other debris. In rivers and streams, collect the water as far from known sources of contamination as possible.

c. Ground water. Ground water (wells and springs) is usually less contaminated than surface water. However, it is sometimes difficult to determine what quantities are available. The use of ground water by combat personnel is usually limited to existing wells and springs. Ground water sources must be located at least 100 feet from all existing sources of contamination and situated so that the drainage is away from the well or spring.

d. Salt water. When a salt water source is used the water must be desalinated and disinfected before it is consumed. Desalinization is usually accomplished with a reverse osmosis water purification unit (ROWPU) and the water is disinfected after desalinization.

e. Other sources. Rain, snow or ice may be used in circumstances when other sources are not available. This water will also require disinfection, particularly when large quantities are stored for later use. A more detailed discussion of water sources is presented in Chapter 5 of this manual.

9-11. Water Treatment.

1. Water treatment is the process of purifying water to make it potable. It may include one or all of the following processes:

- a. Aeration, coagulation, flocculation (clarification), and filtration to remove suspended solids.
- b. Reverse osmosis to remove suspended and

dissolved matter including organic and inorganic contaminants.

c. Disinfection to eliminate microbial contaminants too small to be removed by filtration.

2. Equipment Used to Purify Water:

a. Two examples of equipment currently in use are:

(1) The ROWPU is the most common field purification system in use. This versatile unit will produce potable water from contaminated sources including fresh, brackish, or sea water. The finished water must be disinfected to eliminate viruses and protect the water from microbial contamination. Figure 9-1 illustrates a typical ROWPU setup. Figure 9-2 shows a basic water flow diagram through the various components of the ROWPU.

(2) The ERDLATOR is a transportable quick-response water purification system capable of aerating, clarifying, filtering and disinfecting contaminated water.

b. Routine inspection of units such as these should include checking the location of raw water intake and backwash filter waste. Ensure the intake is located away from sources of contamination and sediment and is upstream from waste water. Leaks, cross connections and other sources of contamination should be inspected for and guarded against. Engineering personnel use gauge readings to ensure the unit's components are operating properly. Medical personnel should familiarize themselves with normal readings for the type of unit in use. Table 9-2 lists normal and trouble point readings for the 600 Gallon per Hour ROWPU.

3. Disinfection. Disinfection destroys harmful organisms (pathogenic viruses, bacteria, and protozoans) present in the water by exposing them to specific concentrations of disinfecting agents or to heat. The basic procedures for disinfecting water are given below. These procedures may be modified in the field environment by the unit medical department to adapt to the local conditions or circumstances. Such factors as the quality of the water source, diseases endemic to the area of operation,

ROWPU FIELD SET-UP

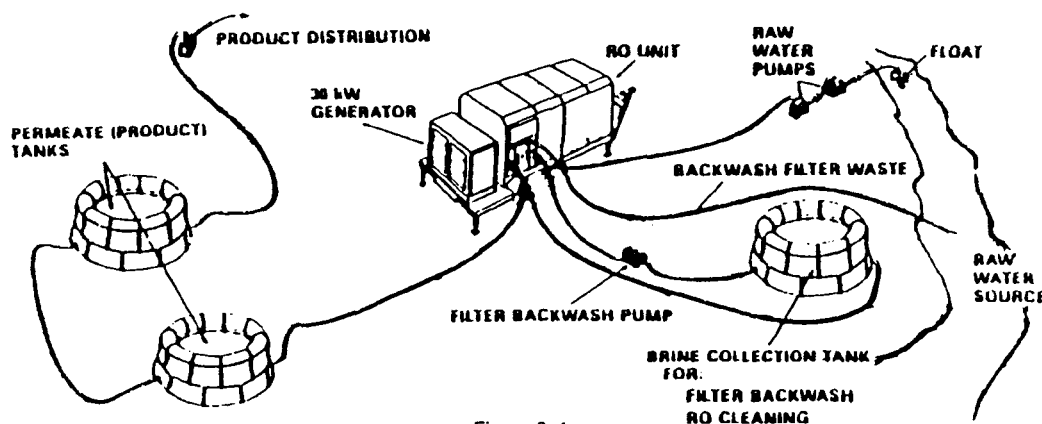
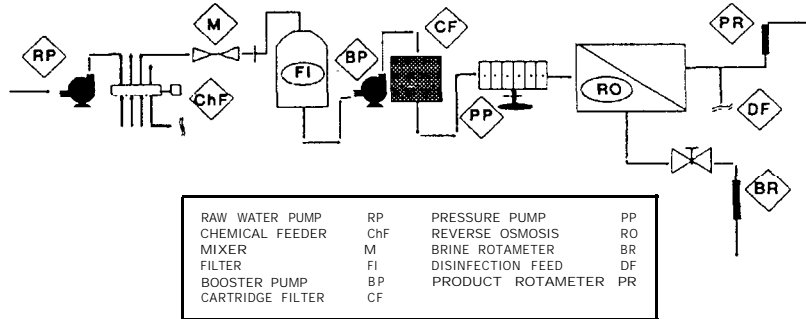


Figure 9-1.

600 GALLON PER HOUR ROWPU

BASIC FLOW SHEET



600 Gal/h ROWPU (isometric layout view)

Figure 9-2.

diseases experienced within the unit, and the integrity of the unit water system must be considered.

a. Chlorination. Chlorination is the most common method of disinfecting potable water. Sufficient chlorine is added to the water to achieve the desired free available chlorine (FAC) residual after a 30 minute contact time.

(1) Chlorine is available in several forms:

(a) Calcium hypochlorite, 65-70% (HTH). This is the preferred agent because it comes in granular form, has a long shelf-life and is readily available from

the Navy stock system. It comes in convenient units including 100 lb drums, 3.75 lb containers, 6 oz bottles or 1 gm ampules.

(b) Sodium hypochlorite (5%) or (10%). This is a liquid solution (household bleach) and may be used in lieu of HTH. However, it is less convenient to handle, takes larger quantities to achieve the same concentration of FAC, and has a much shorter shelflife than HTH.

(c) Chlorine gas (in compressed gas cylinders). This is the most common form used by municipal

600 Gal/H ROWPU
GAUGE READINGS, NORMAL AND TROUBLE POINTS

INDICATOR GAUGE	NORMAL READING	TROUBLE POINT READING
1. Cartridge Filter	1 to 20 psid	Over 20 psid
2. Multimedia Filter	0 to 10 psid	5 psid over first reading, or over 10 psid
3. Raw Water Flow	27 to 33 gpm	Drop to 25 gpm or less
4. Brine Flow	16 to 24 gpm	Below 15 gpm
5. Product Water Flow a. Salt Water b. Brackish water c. Fresh Water	6 to 12 gpm Up to 13.5 gpm Up to 13.5 gpm	Above 12.0 gpm Above 13.5 gpm Above 13.5 gpm
6. R. O. Pressure psi a. Salt Water b. Brackish Water c. Fresh Water	800 psi or less 500 psi or less 500 psi or less	Above 900 psi Above 600 psi Above 600 psi
7. R. O. Vessels	50 to 100 psid	Above 100 psid
8. TDS of Product Water	Below 1500 ppm	Above 1500 ppm

Table 9-2.

Chlorine Dosage Calculator

The figures on the following charts give the "dosage rate" for chlorination. The quality of water, e.g. the organic and inorganic materials present, will affect final chlorine residual. The amount of chlorine required to react with and be absorbed by these materials is called the "chlorine demand". The chlorine absorbed or neutralized has no disinfectant value, so it is necessary to add enough chlorine (adequate dosage rate) to satisfy the "chlorine demand" and still provide FAC. The FAC is the active disinfecting agent and is the chlorine reading determined with the calorimetric test kit.

For 10% Liquid Sodium Hypochlorite						
Quantity (Gal)	PPM: 1	5	25	50	100	200
50,000	2 Qt.	10 Qt.	50 Qt.	25 Gal.	50 Gal.	100 Gal.
25,000	1 Qt.	5 Qt.	25 Qt.	50 Qt.	25 Gal.	50 Gal.
10,000	13 oz.	2 Qt.	10 Qt.	5 Gal.	10 Gal.	20 Gal.
5,000	7 Oz.	1 Qt.	5 Qt.	10 Qt.	5 Gal.	10 Gal.
2,000	3 Oz.	13 Oz.	2 Qt.	1 Gal.	2 Gal.	4 Gal.
1,000	1.5 Oz.	7 Oz.	1 Qt.	2 Qt.	1 Gal.	2 Gal.
500	1 Oz.	4 Oz.	1 Pt.	1 Qt.	2 Qt.	1 Gal.
200	2 TSP.	2 Oz.	7 Oz.	13 Oz.	26 Oz.	55 Oz.
100	1 Tsp.	1 Oz.	4 Oz.	7 Oz.	13 Oz.	26 Oz.
50		.5 Oz.	2 Oz.	4 Oz.	7 Oz.	13 Oz.
25		2 TSP.	1 Oz.	2 Oz.	4 Oz.	7 Oz.
10		1 Tsp.			2 Oz.	3 Oz.
5					1 Oz.	2 Oz.

For 5% Liquid Sodium Hypochlorite						
Quantity (Gal)	PPM: 1	5	25	50	100	200
50,000	1 Gal.	5 Gal.	25 Gal.	50 Gal.	100 Gal.	200 Gal.
25,000	2 Qt.	10 Qt.	50 Qt.	25 Gal.	50 Gal.	100 Gal.
10,000	26 Oz.	1 Gal.	5 Gal.	10 Gal.	20 Gal.	40 Gal.
5,000	13 Oz.	2 Qt.	10 Qt.	5 Gal.	10 Gal.	20 Gal.
2,000	6 Oz.	26 Oz.	1 Gal.	2 Gal.	4 Gal.	6 Gal.
1,000	3 Oz.	13 oz.	2 Qt.	1 Gal.	2 Gal.	4 Gal.
500	2 Oz.	7 oz.	1 Qt.	2 Qt.	1 Gal.	2 Gal.
200	1 Tbsp.	3 Oz.	13 Oz.	26 Oz.	52 Oz.	103 Oz.
100	2 TSP.	2 Oz.	7 Oz.	13 Oz.	26 Oz.	52 Oz.
50	1 TSP.	1 Oz.	4 Oz.	7 Oz.	13 Oz.	26 Oz.
25		1 Tbsp.	2 Oz.	4 Oz.	7 Oz.	13 Oz.
10			1 Oz.	3 TSP.	3 Oz.	6 Oz.
5			1 TSP.	5 TSP.	2 Oz.	3 Oz.

For 65 to 70% Granular Calcium Hypochlorite						
Quantity (Gal)	PPM: 1	5	25	50	100	200
50,000	10 Oz.	3 lb.	15 lb.	30 lb.	59 lb.	119 lb.
25,000	5 Oz.	24 Oz.	7.5 lb.	15 lb.	29 lb.	59.5 lb.
10,000	2 Oz.	10 Oz.	3 lb.	6 lb.	12 lb.	23 lb.
5,000	1 Oz.	5 Oz.	1.5 lb.	3 lb.	6 lb.	11 lb.
2,000		2 Oz.	10 Oz.	19 Oz.	2 lb.	4 lb.
1,000		1 Oz.	5 Oz.	10 Oz.	20 Oz.	2 lb.
500			3 Oz.	5 Oz.	10 Oz.	19 Oz.
200			1 Oz.	2 Oz.	4 Oz.	8 Oz.
100				1 Oz.	2 Oz.	4 Oz.
50					1 Oz.	2 Oz.
25						1 Oz.

Table 9-3.

water treatment plants. However, chlorine gas is not normally considered appropriate for field use.

(2) Procedures for Chlorinating With HTH

(a) First make a small amount of HTH concentrate by dissolving a measured amount of calcium hypochlorite granules (sufficient to produce the desired residual for the total volume of water to be disinfected) in a clean container (canteen cup, bucket, etc.) of water. Stir the mixture thoroughly. *Note that not all granules will*

dissolve. Allow undissolved granules to settle to the bottom of the container. Only the clear liquid concentrate (supernatant) is added to the water to be disinfected. Refer to table 9-3 for the correct amount of HTH to add.

(b) Next, pour the supernatant into the water to be disinfected. Provide sufficient agitation to promote thorough mixing. This is best accomplished by adding the supernatant to the water container (oyster bag, trailer, tanker, etc.) when it is partially filled, then

proceed to fill the container to the desired level with additional water.

(c) The final step is to take a measurement of the resulting FAC 30 minutes after adding the chlorine. The reading should be at or above the required dosage. If it is not, add additional chlorine and recheck the level after another 30 minutes. Repeat the procedure until the desired level is obtained.

(3) Required Chlorine Residuals:

Water Source	Required Chlorine Residual
1. Public water supply systems of questionable quality	5.0 parts per million (ppm) FAC after a 30 minute contact time and maintain at a minimum of 2.0 ppm FAC throughout distribution system.
2. Engineering water points	5.0 ppm FAC at the standpipe or fill-hose.
3. Water tankers, trailers, bladders and cans	Maintain between 5.0 ppm and 2.0 ppm FAC when filled at an approved engineering water point. Maintain at 5.0 ppm FAC when used as a "source" for a distribution (piping) system.
4. Distribution (piping) system	Maintain 5.0 ppm FAC at the source and 2.0 ppm FAC at the spigot.
5. Lyster bags and canteens	Maintain at 2.0 ppm FAC when filling from an approved water source. Chlorinate to 5.0 ppm FAC initially and maintain at 2.0 ppm FAC when filling from an unapproved or raw water source.

b. Superchlorination. This process is used to disinfect water containers and distribution systems initially (before they are used) or when they have become contaminated. Superchlorination is accomplished by chlorinating the water in a container or distribution system to at least 100 ppm FAC and holding it in the container for 4 hours. During that time the FAC must not drop below 50 ppm. Otherwise, the process must be repeated. The words "Poison Do Not Drink" must be displayed clearly on all sides of the container or at all water outlets during the process. The procedures are:

(1) Make up a supernatant of HTH as discussed previously. Use sufficient HTH to chlorinate the total volume of the water container or distribution system to at least 100 ppm (a higher concentration may be desirable, depending on the extent of the contamination in the container, to ensure the residual does not drop below 50 ppm after the 4 hour contact time). Refer to Table 9-3 for the amount of calcium hypochlorite granules or sodium hypochlorite bleach to use for the volume of the container or water pipes to be disinfected. Figure 9-3 provides a formula for estimating volume of water in a pipe for use in a distribution system.

(2) Add the supernatant to the partially filled container or distribution system and add additional water to fill the container or pipes.

(3) Determine the resulting FAC using a DPD kit. The water sample must be diluted 1:10 with distilled water to be within the range the DPD kit is

Formula for obtaining volume in different sized pipe

- V = Gallons of fluid in a pipe
- D = Diameter of pipe in inches
- L = Length of pipe in feet
- $V = D^2 \times .041 \times L$

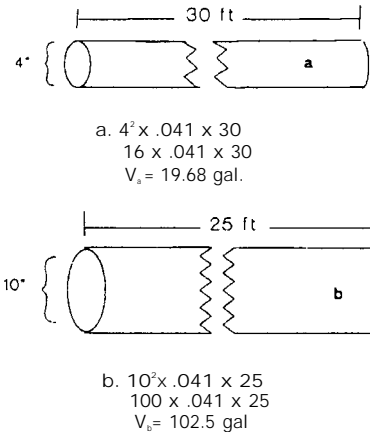


Figure 9-3.

designed to measure. Otherwise, the color quickly subsides or does not appear.

(4) Measure the FAC residual again after a 4 hour contact time. The FAC must be at least 50 ppm at this time. If the FAC is below 50 ppm the superchlorination procedure must be repeated.

(5) After superchlorination has been completed, drain the container or pipes, rinse them thoroughly and fill them with potable water from an approved source. In the event of scarce water supplies it maybe essential to use the superchlorinated water for drinking. If needed, the superchlorinated water may be dechlorinated with sodium thiosulfate or sodium bisulfite. However, large quantities of these agents may be required and the water must be dechlorinated as appropriate to protect the water from contamination.

c. Water Purification Tablets. Water purification tablets (NSN 6850-00-985-7166) are intended for disinfecting water contained in small containers such as canteens or water jugs. These tablets are usually composed of iodine and are available through the standard stock system in bottles of 50 tablets. These tablets are subject to deterioration in storage. Therefore, they must be inspected for signs of physical change before they are used. Otherwise, they may not disinfect the water! Iodine tablets which are completely yellow or brown or those which stick together or crumble easily are no longer effective and must be discarded or surveyed. Iodine tablets in good condition should be steel-gray in appearance. The procedures for disinfecting small quantities of water with these tablets are given below:

(1) Canteens

(a) Fill the canteen with the cleanest, clearest water available.

(b) Add two (2) iodine tablets to each canteen full of any type of water. Double these amounts for 2 quart canteens. Tincture of iodine 2% may be used in place of the tablets. Put 5 drops per 1 quart canteen of clean water or 10 drops if the water is cloudy.

(c) Place the cap on the canteen loosely. Wait 5 minutes, then shake the canteen vigorously, allowing leakage to rinse the threads around the neck of the canteen.

(d) Tighten the cap and wait an additional 30 minutes before using the water for any purpose.

(2) Five Gallon Cans

(a) Fill a 5 gallon container with the cleanest, clearest water available.

(b) Dissolve 40 iodine tablets in a canteen cup full of water to disinfect any type of water. Add this solution to the 5 gallon container of water and agitate the solution.

(c) Place the cap on the container loosely. Wait 5 minutes, then agitate the container vigorously, allowing leakage to rinse the threads around the neck of the can.

(d) Tighten the cap and wait an additional 30 minutes before using the water for any purpose.

d. Boiling. Boiling is a simple, effective method of disinfecting nonpotable water. Use the cleanest water available and bring it to a rolling boil for 2 minutes; then let it cool. This method is only practical for small containers of water such as canteens and it has several disadvantages:

(1) Fuel is required.

(2) It is time consuming. It takes a long time for the water to boil and then to cool.

(3) There is no residual substance in the water to guard against contamination.

9-12. Water Containers. The water standards discussed below apply to canteens, water jugs, lyster bags, bladders, trailers, tankers, water mains, hoses, piping systems and other vessels used to hold or convey potable water:

1. All containers used for the treatment, storage or distribution of water must be clean and clearly labeled "Potable Water."

2. Interior surfaces must be constructed of smooth, nontoxic, noncorrosive materials and free from rust and chips. They must have tight fitting caps or lids which close securely. The gaskets must be easily cleanable.

3. Potable water containers must not be used for any other purpose and must be inspected, cleaned, and disinfected whenever necessary but not less than monthly.

9-13. Disinfection of Water Containers and Systems.

1. Mechanical cleaning and chemical disinfection must be accomplished when one or more of the following conditions exists:

a. Prior to placing a new container or system into service.

b. Prior to using containers or systems that have an accumulation of rust, scale, or sludge.

c. When there is evidence of contamination (hu-

man, animal, or chemical).

d. In extreme water emergencies, fuel oil containers can be converted for potable water use. In this event, special attention must be given in removing all fuel oil residues from these containers before disinfection and use. Containers whose contact surfaces are not readily accessible for inspection and cleaning (e.g., 5 gallon gas cans) must never be used for the storage of potable water. Also fuel oil hoses must never be used for potable water because of possible chemical reactions between the fuel and the rubber compounds within the hose.

e. Whenever system components have been dismantled or replaced for the purpose of repair or alteration.

2. Mechanical Cleaning Procedures

a. Drain the container or system.

b. Scrub the interior surfaces with a soft brush and a detergent solution taking care not to damage the interior lining. Be sure to scrub all gaskets, lids, and spigot openings.

c. High pressure water or steam should be used, if available, to rinse the container.

d. Open all valves, lids, taps, or spigots and allow the detergent solution to drain out through the system.

e. Rinse all surfaces thoroughly with potable water. Several rinsings may be necessary.

f. Superchlorinate the container or system as described in Article 9-11.3.b.

9-14. Water Quantity Requirements. Ensuring that personnel consume sufficient quantities of water is extremely important. This keeps them in good physical and mental condition to complete their mission. The daily water requirements for personnel in the field varies with a number of factors including the season of the year, geographical area, and the tactical situation. Dehydration can occur quickly in both extremely hot or cold climates if personnel don't drink plenty of water. Personnel in extreme environments must drink water even if they don't "feel thirsty." The minimum water consumption requirements under arid conditions to prevent dehydration is provided in Table 9-4. Slightly less water is required in temperate zones. A method for computing water requirements is provided in Table 9-5. A rule of thumb for the minimum amount of water required for advanced base medical facilities is 65 gallons per medical treatment bed per day.

9-15. Testing Requirements.

1. FAC Testing

a. Determine the FAC residual of all water supplies at least daily. Tests should be performed on all engineering water points, tankers, trailers, bladders, lyster bags, and on representative samples from 5 gallon cans and distribution system spigots. In the latter instance, the sampling points must be varied from day to day and be representative of the entire lot of cans or the distribution system.

b. Record the results in the Medical Department Water Log and investigate the cause of any low readings. Report all significant findings to the unit engineer. Prompt action must be taken by the unit engineer to

DAILY WATER REQUIREMENTS
Multi-Service Water Consumption
for Arid Environment^a

1. USAGE FACTORS	GAL/MAN/DAY	
	Marines	Navy
Drinking ^b	5.2	5.2
Hygiene ^b (Brushing teeth, shaving)	2.7	2.7
Centralized showers ^b	1.3	1.3
Food Preparation ^c	3.0	3.0
Vehicles	0.3	0.3
Medical ^b :		
Heat treatment (ice water)	1.0	1.0
Hospitals	65 gal/bed/day)	
Graves registration (50 gal/KIA) ^c	0.2	0.2
Laundry (6 lb/man/wk)	2.0	2.0
Construction ^d	1.5	1.5
Aircraft	0.7	5.2
Total Use	17.9	22.4
Waste/evaporation (10% of total)	1.8	2.2
Total	19.7	24.6

Notes:

- a. For light work and normal salt intake.
 - b. Must be potable. All other water quality must be consistent with intended use.
 - c. Army accomplishes graves registration for all services within the theater of operations. (KIA = killed in action)
 - d. Dust control must be accomplished by means other than water.
2. Recommended Joint Planning Factor: 20 gal/man/day (Includes waste/evaporation factor but excludes requirements for decontamination, POWs, refugees, and civilians).
3. Decontamination requirements: Cannot be reduced to gal/man/day factor. The following can be used for planning purposes:
- a. Combat troop-13 gal per decontamination application. (This need not be potable water.)
 - b. Major end items—200 gal per decontamination application. In addition, the following should be considered:
 - (1) Factors apply each time a person or piece of equipment requires decontamination due to the presence of persistent chemical agent.
 - (2) The factors assume that the contaminated units will apply sound decontamination principles.
 - (3) All personnel and equipment in a given unit are assumed to require decontamination if any one person or piece of equipment becomes contaminated.
 - (4) For many pieces of equipment, specific decontamination procedures and times have not been established, especially for aircraft, generators, communications gear, and crew-served weapons.

Table 9-4.

eliminate all sources of contamination or other factors contributing to the FAC dissipation and to restore the FAC to the appropriate levels addressed in Article 9-11.3.a.(3).

2. Bacteriological Testing

a. Field water supplies must be tested bacteriologically at least weekly following the procedures provided in Chapter 6 of this manual. Analysis must be accomplished on all engineering water points, tankers, trailers, bladders and lyster bags and representative samples of 5 gallon cans and distribution system spigots. Sample

points must be varied to represent the entire lot of cans or the distribution system.

b. Record the results in the Medical Department Water Log.

c. Notify the unit commander of all positive results which indicated possible contamination and recommend that the container(s) or sampling point(s) in question be secured until disinfection and retesting can be performed.

d. Investigate to determine the source(s) of contamination and retest. The positive sampling point(s) container (s) or spigot (s) must remain secured until

SAMPLE METHODOLOGY FOR COMPUTING UNIT/FORCE WATER REQUIREMENT

1. Company (160 men)

$$\begin{aligned} \text{Drink + P. Hyg + Food + Veh} &= \text{Unit Factor} && (5.2 + 2.7 + 3.0 + 0.3 = 11.2 \text{ G/M/D}) \\ \text{Unit Factor} \times \text{Unit Str.} &= \text{Co. Consumption} && (11.2 \times 160 = 1792 \text{ gal/day}) \\ \text{Consumption} + 10\% \text{ Waste} &= \text{Co. Requirement} && (1792 + 179 = \underline{1971} \text{ gal/day}) \end{aligned}$$

2. Battalion (750 men)

$$\begin{aligned} \text{Unit Factor} + \text{Heat Treat} &= \text{Bn Factor} && (11.2 + 1.0 = 12.2) \\ \text{Bn Factor} \times \text{Bn Str} &= \text{Consumption} && (12.2 \times 750 = 9150) \\ \text{Consumption} + 10\% \text{ Waste} &= \text{Hn Requirement} && (9150 + 915 = \underline{10,065} \text{ gal/day}) \end{aligned}$$

3. Brigade (3500 men)

$$\begin{aligned} \text{Bn Factor} + \text{Cent. Hyg} &= \text{Bde Factor} && (12.2 + 1.3 = 13.5) \\ \text{Bde Factor} \times \text{Bde Str} &= \text{Bde Consumption} && (13.5 \times 3500 = 47,250) \\ \text{Consumption} + 10\% \text{ Waste} &= \text{Bde Requirement} && (47,250 + 4725 = \underline{51,975}) \end{aligned}$$

4. Division (16,000 men)

$$\begin{aligned} \text{Bde Factor} + \text{Hosp} + \text{Ldry} + \text{Grav} + \text{Constr} &= \text{Div Factor} && (13.5 + 1.0 + 2.0 + 0.2 + 1.5 = 18.2) \\ \text{Div Factor} \times \text{Div Str} &= \text{Div Consumption} && (18.2 \times 16,000 = 291,200) \\ \text{Consumption} + 10\% \text{ Waste} &= \text{Div Requirement} && (291,200 + 29,120 = \underline{320,320}) \end{aligned}$$

5. Corps/Force (_____ men)

$$\begin{aligned} \text{Navy Service Factor} \times \text{Non self-sustaining Str} &= \text{Req} && (24.4 \times \underline{\hspace{1cm}} = \underline{(N)}) \\ \text{USMC Service Factor} \times \text{Non self-sustaining Str} &= \text{Req} && (19.5 \times \underline{\hspace{1cm}} = \underline{(MC)}) \\ \text{Army Service Factor (incl. waste)} \times \text{Army Str} &= \text{Req} && (17.2 \times \underline{\hspace{1cm}} = \underline{(A)}) \\ \text{USAF Service Factor} \times \text{Non self-sustaining Str} &= \text{Req} && (21.5 \times \underline{\hspace{1cm}} = \underline{(AF)}) \end{aligned}$$

N + MC + A + AF = Total Requirement for Force Support

Note: 1. Non self-sustaining strength = Number of personnel to support

2. Service Factor is outlined in Table 9-4

Table 9-5.

negative follow-up samples are obtained. Retesting requires 300 milliliters of water be tested for each 100 ml original positive sample. Follow-up testing is accomplished as follows.

(1) In a distribution system, take a 100 ml follow-up sample from the original positive spigot, take one from within 5 outlets upstream of the original positive sample and one from within 5 outlets downstream. If the original positive sample was at the end of the distribution line, two samples will be collected downstream (within 5 outlets) from the original positive

sampling site.

(2) Distribution systems with a single outlet, tankers, trailers, bladders, Lyster bags and 5 gallon cans will have three 100 ml samples taken from the original positive sampling site. When testing the three 100 ml samples from a single testing site, using the membrane filter technique, it is optional to filter each 100 ml through a single filter or the three 100 ml samples (300 ml) may be filtered through a single filter.

e. The water is considered safe to use when the set of follow-up samples are total coliform negative.

SAMPLE METHODOLOGY FOR COMPUTING UNIT/FORCE WATER REQUIREMENT

1. Company (160 men)

Drink + P. Hyg + Food + Veh = Unit Factor	(5.2 + 2.7 + 3.0 + 0.3 = 11.2 G/M/D)
Unit Factor x Unit Str. = Co. Consumption	(11.2 x 160 = 1792 gal/day)
Consumption + 10% Waste = Co. Requirement	(1792 + 179 = 1971 gal/day)

2. Battalion (750 men)

Unit Factor + Heat Treat = Bn Factor	(11.2 + 1.0 = 12.2)
Bn Factor x Bn Str = Consumption	(12.2 x 750 = 9150)
Consumption + 10% Waste = Hn Requirement	(9150 + 915 = 10,065 gal/day)

3. Brigade (3500 men)

Bn Factor + Cent. Hyg = Bde Factor	(12.2 + 1.3 = 13.5)
Bde Factor x Bde Str = Bde Consumption	(13.5 x 3500 = 47,250)
Consumption + 10% Waste = Bde Requirement	(47,250 + 4725 = 51,975)

4. Division (16,000 men)

Bde Factor + Hosp + Ldry + Grav + Constr = Div Factor	(13.5 + 1.0 + 2.0 + 0.2 + 1.5 = 18.2)
Div Factor x Div Str = Div Consumption	(18.2 x 16,000 = 291,200)
Consumption + 10% Waste = Div Requirement	(291,200 + 29,120 = 320,320)

5. Corps/Force (men)

Navy Service Factor x Non self-sustaining Str = Reqt	(24.4 x = (N))
USMC Service Factor x Non self-sustaining Str = Reqt	(19.5 x = (MC))
Army Service Factor (incl. waste) x Army Str = Reqt	(17.2 x = (A))
USAF Service Factor x Non self-sustaining Str = Reqt	(21.5 x = (AF))

N + MC + A + AF = Total Requirement for Force Support

- Note: 1. Non self-sustaining strength = Number of personnel to support
 2. Service Factor is outlined in Table 9-4

Table 9-5.

negative follow-up samples are obtained. Retesting requires 300 milliliters of water be tested for each 100 ml original positive sample. Follow-up testing is accomplished as follows.

(1) In a distribution system, take a 100 ml follow-up sample from the original positive spigot, take one from within 5 outlets upstream of the original positive sample and one from within 5 outlets downstream. If the original positive sample was at the end of the distribution line, two samples will be collected downstream (within 5 outlets) from the original positive

sampling site.

(2) Distribution systems with a single outlet, tankers, trailers, bladders, Lyster bags and 5 gallon cans will have three 100 ml samples taken from the original positive sampling site. When testing the three 100 ml samples from a single testing site, using the membrane filter technique, it is optional to filter each 100 ml through a single filter or the three 100 ml samples (300 ml) may be filtered through a single filter.

e. The water is considered safe to use when the set of follow-up samples are total coliform negative.

Section III. FOOD SERVICE IN THE FIELD

Importance of Sanitary Practices in the Handling of Food	Article 9-16
Transportation of Food	9-17
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Galley Waste Disposal	9-21
Meal, Ready to Eat (MRE)	9-22
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9-16. Importance of Sanitary Practices in the Handling of Food.

1. The conditions under which food is transported, stored, prepared, and served can have a direct bearing

on the success or failure of a military mission. Consumption of food contaminated with disease causing microorganisms can result in outbreaks of foodborne illness and compromise the combat readiness of the unit. All personnel who handle food must maintain the highest stan-

dards of personal hygiene and sanitary practices.

2. In the field, all the factors which normally contribute to foodborne illness outbreaks, such as improper storage and holding temperatures, inadequate protection of food from contamination, and poor food handler personal hygiene, are exacerbated. Supervisory responsibilities and individual attention to sound sanitary practices become increasingly important. Whenever possible, food service sanitation regulations set forth in Chapter 1 of this manual will be followed.

9-17. Transportation of Food.

1. Vehicles used for transporting food must be clean and completely enclosed, if possible. Clean tarpaulins, boxes, bags, etc., may be used to protect food from contamination by dust, dirt, and the elements.

2. Vehicles used for transporting garbage, trash, chemicals, petroleum products, or similar materials will not be used for transporting food unless they have been properly cleaned and sanitized.

3. If bulk quantities of perishable foods are to be transported over considerable distances, refrigerated containers must be used.

4. Perishable food products must be stocked at a level commensurate with the capacity of the food service storage facilities of the unit.

9-18. Storage.

1. All food items are to be inspected by the food service officer (FSO), or his designated representative, at the time of receipt. These inspections are usually limited to identity, count, and condition. If the fitness of any item appears questionable or the food item has been purchased on the local market or under contracts which require inspection at destination, the FSO must request an inspection of the item from the MDR. Accepted food items will be stored immediately. Unaccepted items will be disposed of in accordance with Chapter 1 of this manual. Otherwise, any food determined unfit for human consumption by the MDR will be surveyed as garbage.

2. Field refrigerators and freezers are available for use but internal space is limited. Temperature controls may not always be accurate and exposure to the elements puts a tremendous strain on the working parts. Creating a shade and dust barrier can improve these conditions tremendously. Careful monitoring of internal temperatures and maintenance of temperature logs are mandatory. One internal and one external thermometer is required on all bulk storage refrigerators/freezers. An external, high temperature alarm system is strongly recommended. Temperature readings must be taken and logged at least once per meal period (at least 3 times each day). Resupply of spoiled rations may take several days; therefore, reading and logging of cold storage temperatures every three hours is recommended. Care must be given to menu planning to help ease refrigerated space requirements.

3. Refrigerated space should be emptied and thoroughly cleaned at least once per week. These spaces

must be defrosted whenever the frost accumulation on the cooling coils exceeds $\frac{1}{4}$ of an inch thick.

4. Perishable foods must be refrigerated or frozen at temperatures noted in Chapter 1 of this manual. As a general rule, field reefers will be maintained at or below 40 degrees Fahrenheit (F). Freezers will be maintained at or below 0 degrees F.

5. Semi-perishable foods such as potatoes, onions, lettuce, etc., must be stored in a dry place on dunnage/pallets to allow for air circulation and to protect them from decay, spoilage, and vermin infestation. Screened food boxes may be used to keep such items as bread for short periods of time. These screened boxes can be suspended to permit free circulation of air.

6. Nonperishable/canned foods, such as canned vegetables, dried beans, flour, sugar, etc., must be palletized to allow for air circulation and minimize harborage for vermin. These items also need protection from the elements. Improper storage will result in the loss/destruction of the product. The contents of any can showing signs of deterioration will be disposed of as garbage.

7. All storage spaces should be inspected regularly for evidence of vermin infestation.

9-19. Preparation and Serving.

1. As in garrison, messmen working in a field galley must receive food handlers' physicals as specified in Chapter 1 of this manual. Due to the many problems associated with field exercises and special problems with sanitation, screening of food handlers is very important. Freedom from disease, acne, cuts/scratches, and a high level of personal hygiene is essential. Food service physicals will be given prior to deployment. This will also afford an opportunity to establish contact with and ensure proper training of mess supervisory personnel. Handwashing stations for mess men and cooks must be readily available with soap and water, figures 9-4 and 9-5.

2. Foods will be handled in accordance with Chapter 1 and the following:

a. Potentially hazardous foods should be avoided in a field situation. The lack of clean preparation areas, inadequate spaces for refrigeration, unreliable electrical supplies, and the potential for contamination dramatically increases the potential for a foodborne illness outbreak. Improperly handled potentially hazardous food items must be discarded as garbage.

b. Chopping and grinding of meat in the field is prohibited. When meats need to be pre-sliced, they will be carefully protected and refrigerated or cooked immediately.

c. Frozen foods should be thawed under refrigeration. Foods may be thawed at room temperature when no refrigeration space is available. The following conditions must be met when thawing at room temperature:

(1) The product must be cooked as soon as possible once thawed.

(2) The room temperature must not exceed 80° degrees Fahrenheit (26.7° C).

(3) Meat, poultry and fish must remain in their original sealed wrappers or containers.

HAND WASHING DEVICE NO. 10 CAN

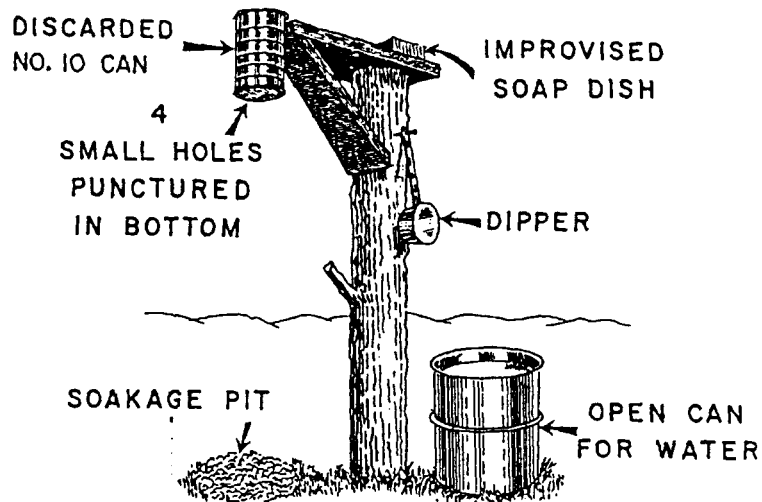


Figure 9-4.

A hand washing facility which is suitable for installation near latrines and messes is easily improvised using a perforated number 10 can sprinkler, small can dipper and open oil drum as a clear water reservoir. The soap dish may be fabricated using a small can which has been split and sharp edges turned down.

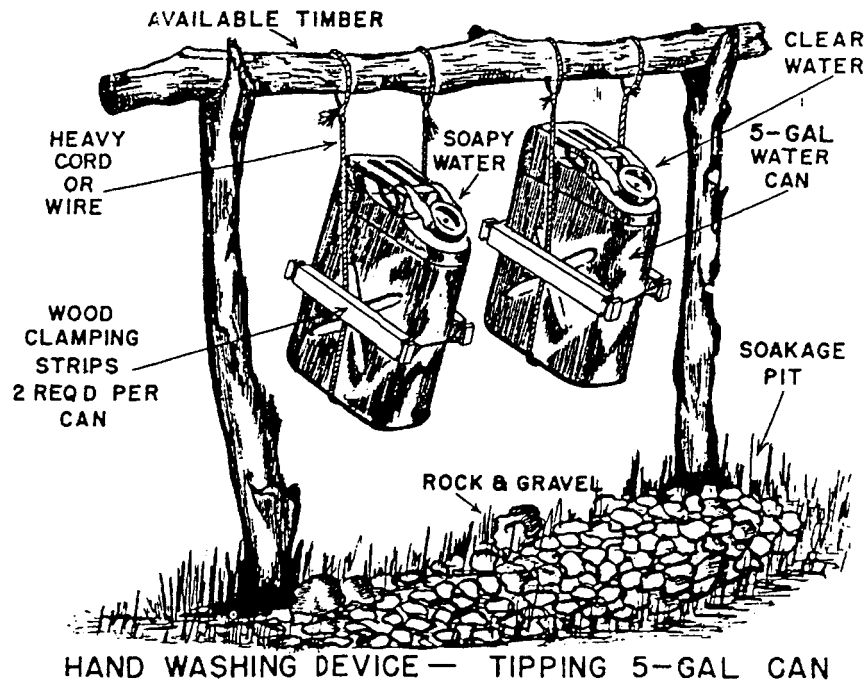


Figure 9-5.

A hand washing facility which is suitable for installation near latrines or messes is easily improvised using 5-gallon water cans. The cap of the cans may be perforated with $\frac{1}{4}$ inch holes to conserve washing water.

(4) Proper precautions are taken to ensure potentially hazardous foods are not allowed to remain at room temperature once thawed.

(5) The Medical department representative is notified.

(6) Thawed foods must never be refrozen.

d. Serving lines in field messes usually are unable to maintain proper holding temperatures and refrigerated space is at a premium. Therefore, due to the increased potential for food contamination in the field mess, the saving of leftovers is strictly prohibited. All leftovers must be disposed of as garbage.

e. Ice machines at field messes are to be scrupulously maintained. These units must not be operated as self service types of equipment. Use an ice scoop made of impervious material. Store the scoop in a metal bracket inside the ice storage bin. Mount the bracket at a level at which the scoop will not be covered with ice when the bin is full. The scoops are to be properly washed and sanitized at least daily. The use of ice chests by individuals or groups will be discouraged. Bacteriological testing requirements are discussed in Chapters 1 and 6 of this manual.

f. Sandwiches should be prepared as close as possible to serving time. Condiments such as mayonnaise, relish, etc., will be provided in individual packets only and applied by the patron. Salad type fillings, such as egg, tuna and poultry, are prohibited.

g. Care must be exercised with fruits and vegetables obtained from the local economy, particularly in areas where "night soil" is used as a fertilizer. These products must be soaked in a 100 ppm FAC solution for 15 minutes or a 50 ppm FAC solution for 30 minutes and thoroughly rinsed with potable water before serving.

h. Self-service areas are authorized for prepackaged items such as individual cartons of milk, salt, pepper, syrup, catsup, mustard, and mayonnaise. Individual cartons of milk must be displayed in drainable trays containing ice. Ensure the top portion of the carton is not submerged in the ice.

i. All food, except self-service items, must be served by a physically qualified and properly trained cook or messman.

j. When items requiring refrigeration are placed on the serving line, they must be placed on the line in small quantities and replenished as needed.

k. Foods requiring hydration, such as powdered eggs, must be handled as fresh food items once they are hydrated.

3. The "Four Hour Time Rule" must be strictly enforced in the field. Potentially hazardous foods, which have been held at temperatures between 40 degrees F. and 140 degrees F. for more than four hours cumulative time must be disposed of as garbage. Remember to keep hot foods hot (140 degrees F. or above) and cold foods cold, 40 degrees F. or below.

9-20. Mess Facilities and Equipment.

1. Advance base/field messes range from primitive (i.e., where personnel sit on the ground to eat after receiving their rations, cooking accomplished in a tent) to a semipermanent structure with plumbed in water,

concrete decks and portable galley equipment. Some of these field messes have stainless steel surfaces for food preparation, whereas only wooden surfaces may be available in others. Regardless of the type of structure, cleanliness will be the key to the prevention of foodborne illness outbreaks. The following provides general guidance and should be used in conjunction with chapter 1 of this manual:

a. Vat cans, ovens, stoves, grills, and other food preparation and serving equipment must be thoroughly cleaned and sanitized after each meal period.

b. All needed repairs must be made as soon as practicable.

c. All food contact surfaces must be cleaned and sanitized as described in Chapter 1 of this manual.

d. All food service equipment is to be installed up off the ground and protected from contamination by dust and vermin.

e. Wooden surfaces should be covered with clean, heavy wrapping paper or waxed paper. Discard the paper after each meal period. If paper is not available, surfaces must be wiped down and scrubbed with an approved sanitizing solution and air dried after each meal period.

f. When pesticides are used, the directions on the label are to be strictly adhered to. Use caution when applying pesticides in the food service areas. All food and food contact surfaces are to be properly protected during spraying and dusting operations. Pesticides are not to be stored in a food service area at any time. Pesticides are to be applied only by certified personnel. Chapter 8 of this manual gives detailed information on pesticide application and pest control programs.

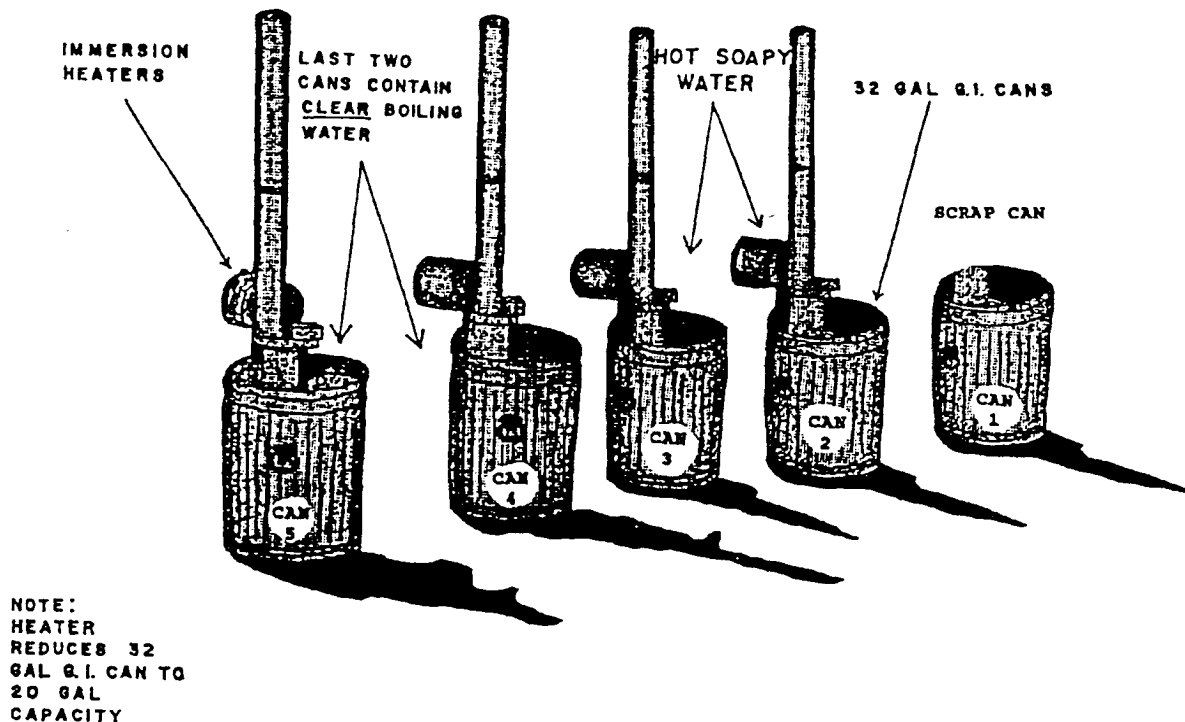
g. The use of disposable eating utensils is encouraged. The benefits of reduced disease risk, and water/fuel savings outweigh the solid waste disposal disadvantage.

2. Insulated food containers (vat cans) are used to transport, store, and serve hot or cold foods. Each container has three aluminum inserts and a tight fitting cover. Inserts must always be used and are to be filled to capacity (5 1/3 liters/5 2/3 quarts). Inserts of hot food and inserts of cold food must be placed in separate containers.

a. Preparation, filling, pre-heating and pre-chilling of the container must be accomplished prior to placing inserts with food into the container. This is accomplished by filling the container with 2 quarts of boiling water, ice water, or crushed ice, covering the container, and letting it stand for 30 minutes before use. After filling, each container must be labeled across the top of the container lid with the item, date and time of preparation, and number of servings. Foods held for over four hours must be discarded as garbage.

b. Cleaning of vat cans is critical and should be performed before and after every use. Vat cans should not be immersed in water. Inserts and rubber gaskets must be removed and washed with soap and water then rinsed in boiling water. After gaskets have been washed and rinsed, they should be placed flat side down on the container to dry to prevent warping.

3. A field dishwashing unit can be set up by using five (5) metal GI cans (approximately 32 gallon size) and



5 CAN DISHWASHING BATTERY

Figure 9-6.

immersion heaters. A long handled brush is to be attached to wash cans number two and three. To avoid burns, hooks made from coat hangers can be used for clipping metal trays in the fourth and fifth cans.

a. The dishwashing battery, as illustrated in figure 9-6, is set up in the following manner:

- (1) First GI can is for collecting garbage.
- (2) Second GI can is for prewash and will contain a hot detergent solution and a brush.
- (3) Third GI can is for washing and will contain a hot detergent solution and a brush.
- (4) Fourth GI can is for rinsing and will contain clean hot water held at a rolling boil.
- (5) Fifth can is for the final sanitizing rinse and will contain clean hot water held at a rolling boil.
- (6) Mess gear will be air dried only. No dish cloths are permitted.
- (7) The water in the cans must be changed as often as necessary to ensure proper cleaning.
- (8) Each can must be permanently marked as to its use (e.g., garbage, prewash). These cans must never be used for any other purpose.
- (9) A similar unit can be set up for pots and pans using one can for wash, one can for rinse and one can for sanitizing rinse. Dip and drain racks or a suitable alternative will have to be devised to prevent hands from contacting boiling water.

b. The field dishwashing area must be away from the food preparation and serving area so that carbon monoxide, smoke, and soot do not blow back into the

food service areas. Immersion heaters also present an explosion hazard.

3. In emergency situations where hot water is not available, messing utensils can be sanitized by immersion in a 50 ppm FAC solution for 60 seconds.

4. The entire food service area will have proper drainage to eliminate or prevent standing water.

9-21. Galley Waste Disposal.

1. Soakage pits.

a. Soakage pits must be constructed to dispose of waste water from the food service area. Special attention is to be given to the separation of grease and scrap food particles from the waste water. Grease must be contained and not allowed to enter drainage ditches, evaporating beds, leaching fields, or soakage pits as grease will clog the soil, preventing the absorption of the water. It will also attract vermin, provide a breeding site for flies, and give off offensive odors. Diagrams of soakage pits and trenches and grease traps are found in article 9-27 of this chapter.

b. Determine the required soakage pit size (volume) by considering these factors: duration of the operation, number of personnel involved, amount of drainage generated per day, expected period of use, and absorbent quality of the soil substrate.

2. Collect and properly dispose of solid wastes such as garbage, metal cans, plastic, and cardboard. Methods of

disposal consist of compacting, burial or burning and in many cases local contractor recycling. In peacetime, local civilian health authorities must be consulted prior to selecting a disposal method. The method to be employed may vary from area to area depending on environmental and tactical situations. Solid wastes are not to be buried or burned in close proximity to the galley or messing areas.

3. The proper disposal of liquid and solid wastes will greatly enhance pest control operations in any given area. Further waste disposal guidance is contained in section IV of this chapter.

9-22. Meal, Ready to Eat (MRE).

1. The MRE was designed as the replacement item for the more familiar Combat Rations or C Rations. They are lighter, less bulky, and easier for personnel to transport. There are several different menus available.

2. The MRE presently has a shelf life of 48 months. Routine inspection schedules must be established to ensure adequate stock rotation and suitability for use of the product. There are no special storage requirements established for the MRE's. However, they must be stored off the deck and not stacked more than three pallets high without the use of storage aids. Inspect the MRE's by taking a random sample of the oldest stock. Use a square (approximately 36" x 36") of smooth white paper for a surface on which to inspect case contents. Remove sleeve from the MRE case. Open the case and invert it, dumping the MRE's onto the paper. Rap case sharply to knock out any insects or debris onto paper. Collect insect specimens for identification. Inspect MRE menu bags individually. Check menu bag for punctures caused by spoons packed within each bag. Check for miscellaneous penetrations caused by knives, staples, etc. Inspect the folds and seams of the bag for insect debris and penetration. Most insect penetrations will be found along folds and seams. Note: The menu bag is the outer bag containing a list of the components within the MRE.

3. MREs are subject to infestation by boring/chewing insects such as *Rhyzopertha dominica* (lesser grain

borer), *Trogoderma variabile* (warehouse beetle), *Lasioderma serricorne* (cigarette beetle), *Tribolium castaneum* (red flour beetle), and *Tribolium confusum* (confused flour beetle). This infestation would most likely occur in MRE cases that are stored for long periods of time and/or those located in the least lighted area of the storerooms or warehouses. Once the integrity of the outer or menu bag has been breached, any small insect can invade the bag. Components are rarely penetrated, however, the insects may explore a poor seal in a component package. Most susceptible components are peanut butter and cocoa beverage powder.

4. The practice of heating entrees in a container of hot water and then using the water for hydration of food or drink is to be discouraged. This is due to the possibility of laminates leaching into the water.

9-23. T-Rations.

1. Tray packs are the main component of T-Rations. They are semi-perishable food items which provide nutritionally adequate hot meals while reducing the manpower, fuel and water requirements for feeding. The tray packs are hermetically-sealed half-size steam table containers in which up to 36 servings of food, depending on product, have been thermally processed and can be transported and stored without refrigeration. Contents can be easily heated in and served directly from the tray packs.

2. The tray pack serves as a storage, heating, and serving vessel. They are heated by immersion in boiling water from 15 to 45 minutes. During heating, some swelling of cans is expected. Overheating (especially vegetable products) causes excessive swelling. If tray packs become extremely cold or frozen from arctic conditions, heating time will have to be adjusted. Frozen tray packs may show degradation of texture when prepared.

3. After initial heating, *unopened* tray packs may be retained for re-use under the following conditions:

- a. They must be marked with the time and date of initial heating.
- b. They must be used at the *next* meal period or discarded.

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Section IV. WASTE DISPOSAL METHODS IN THE FIELD

	Article
Medical Importance of Waste Disposal	9-24
Types of Waste	9-25
Responsibilities	9-26
Disposal of Human Waste	9-27
Disposal of Liquid Waste	9-28
Garbage Disposal	9-29
Rubbish Disposal	9-30

9-24. Medical Importance of Waste Disposal. In the field large amounts of all types of wastes are generated each day. If the wastes are not disposed of properly, the camp will quickly become an ideal breeding area for flies, rats, and other vermin. Diseases such as dysentery, typhoid, cholera, and plague could compro-

mise the integrity of the unit. Zoonotic diseases, such as rabies, could occur from exposure to infected animals as they scavenge for food.

9-25. Types of Waste. The term wastes include all types of refuse resulting from the living activities of

humans or animals. The following types of wastes will be discussed in this section:

1. Human Wastes (feces and urine)
2. Liquid Wastes (bathing and liquid kitchen wastes)
3. Garbage (peelings, slicings and other semisolid or solid organic material resulting from food service operations)
4. Rubbish (boxes, cans, paper, and plastics)

9-26. Responsibilities.

1. Unit commanders, through the engineering section, are responsible for the disposal of wastes generated within their areas. When waste disposal facilities are not provided, the commander must arrange for their construction, operation and closure.

2. Medical department personnel should provide technical assistance in the fabrication, location, and maintenance of field waste disposal facilities. PREVMED personnel must inspect the facilities prior to their initial use to ensure proper construction and location and then on a daily basis to ensure the facilities are being run in a sanitary manner.

9-27. Disposal of Human Waste.

1. The devices for disposing of human wastes in the

field vary with the tactical situation, soil conditions, water table, weather conditions, availability of materials, and local environmental regulations.

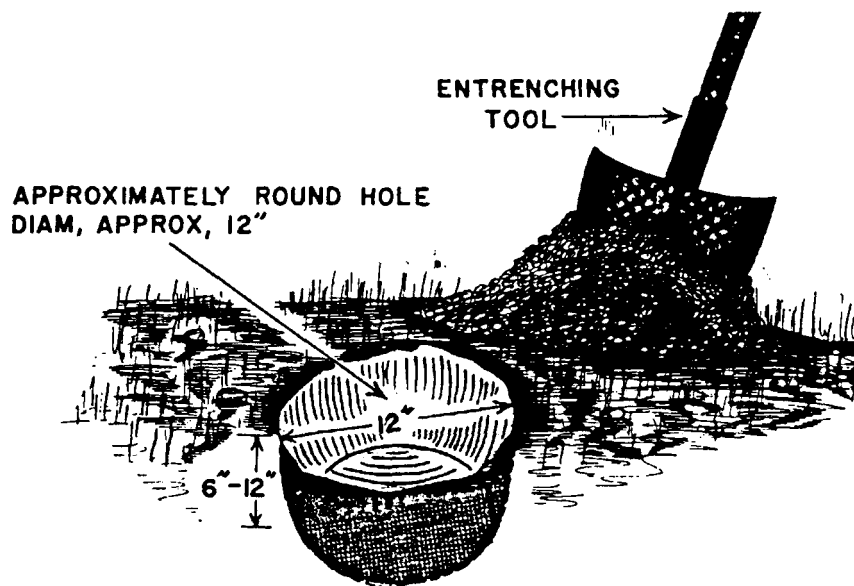
a. When troops are on the march, each person uses a "cat hole" device during short halts. It is dug 8 to 12 inches in diameter and 6 to 12 inches deep and is covered and packed down after use, figure 9-7.

b. In temporary bivouacs (1 to 3 days), the straddle trench, figure 9-8, is used unless more permanent facilities are provided.

c. In permanent camps, one or more of the devices in paragraph 4, below, are constructed. Straddle trenches are used while more permanent facilities are being built. In training situations, portable chemical toilets may be required by local public health law.

2. In determining the type of latrine to be constructed, consideration must be given to the length of stay, the water table, and soil conditions. For example, if the water table is high, then the depth of a deep pit latrine may cause contamination of underground water supplies. A burn out latrine would be more appropriate in this situation. During peacetime, contact the local public health department prior to use to ensure burning is lawful.

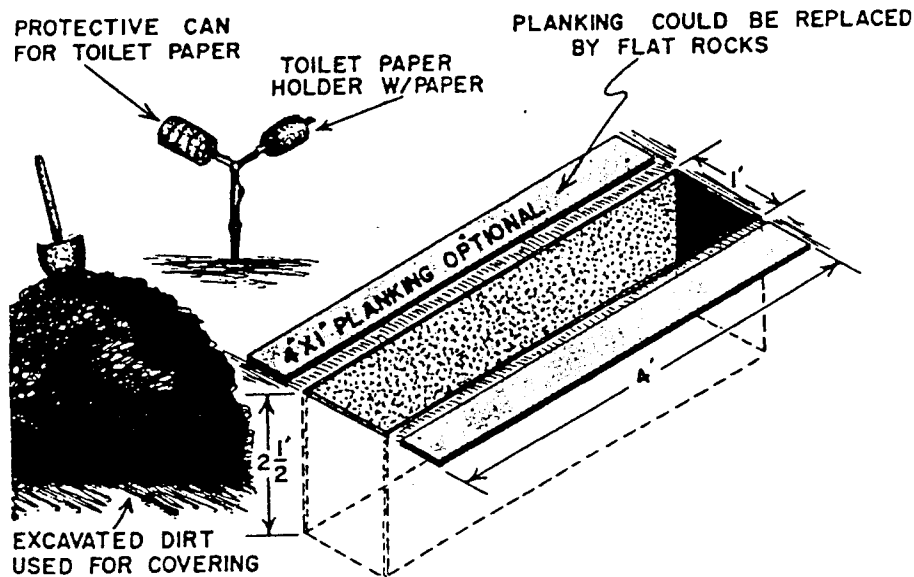
3. In determining the location for latrines, give consideration to protecting food and water supplies from contamination as well as providing convenient access-



CAT HOLE

Figure 9-7.

The cat hole is used for the disposal of individual human excreta in situations where other latrines are not available such as when on the march and at short halts. The hole has a diameter of 8 to 12 inches and a depth of 6 to 12 inches. The feces are deposited and immediately covered with tightly compacted earth which was originally removed from the hole.



STRADDLE TRENCH

Figure 9-8.

Trenches are built 1 foot wide, 2½ feet deep, and 4 feet long. Boards may be placed along both sides of the trench to provide footing. Rolls of toilet paper, set on posts, are kept dry covering with cans, as illustrated. Unless there is natural concealment, a wood or canvas screen will be constructed to provide privacy and a wind break. Earth, removed in digging the trench, is piled at one end for prompt covering.

bility. Select a location which is at least 100 feet from the nearest natural water source, at least 100 yards from food service areas, and 50 feet from berthing areas. Common sense implores that the selected site be reasonably near the user.

4. Design and Construction of Human Waste Disposal Devices

a. **Straddle Trench Latrine.** This temporary latrine is made by digging a trench 1 foot wide, 2½ feet deep and 4 feet long. It will serve 25 people and accommodate two people at one time. Additional trenches will be at least two feet apart. There are no seats in this type of latrine, but boards may be placed along both sides of the trench to provide better footing. The removed earth is placed at the end of the trench and each person promptly covers their excreta and toilet paper using their own entrenching tool. The trench will be closed when filled to within one foot from the top of the trench. To close, spray the excreta with an approved insecticide, fill the trench with several layers of dirt compacting each layer, and mound the dirt at least one foot above ground level. Tactical situation permitting, post a sign indicating the type of latrine and the date closed, figure 9-8.

b. **Deep Pit Latrine.** This temporary latrine is made by constructing a latrine box over a pit. The standard latrine box has four holes (seats), is 8 feet long and 2½ feet wide at the base, and is mounted on two 6-inch planks. One, 4 seat, deep pit latrine is required for every 50 people. Seats will be covered with fly-proof, self-closing lids. Cracks in the wood will be fly-proofed by nailing strips of wood or metal over the openings,

sandbagging, or by using oil soaked burlap. A metal deflector will be secured to the inside surface of the front panel of the box to prevent urine from soaking into the wood. Skin contact surfaces will be sanded smooth. The pit is dug 2 feet wide and 7½ feet long and up to a maximum of 6 feet deep. (Alternately, a 5 foot square, 4 seat latrine can be placed over a 4 foot square pit up to 6 feet deep). As a guide, allow 1 foot of depth for each week of planned usage and one foot for dirt cover. Close as noted in 4.a. above, figure 9-9. The deeper the pit, the greater the chances of it caving in!

c. **Burn-Barrel Latrine.** The burn-barrel (burn out) latrine has been used extensively over the past several years in major operations. It is desirable where the soil conditions are hard, rocky or frozen making digging difficult and where water tables are high. A screen (#18 mesh) enclosed building can be constructed of plywood, and suitable framing lumber. This structure usually contains 2 to 4 toilet seats built over 55 gallon drums that are cut in half. A burn barrel is placed under each seat. Note correct placement of barrels in Figure 9-10. All barrels will be "primed" with 3 inches of diesel fuel prior to placing them into service. This allows the fecal matter to become oil soaked enhancing complete thermal destruction of fecal matter during the daily (or more often if needed) burn out process. The oil also serves as an insect repellent and obnoxious odor deterrent. (Caution!! Ensure that "NO SMOKING" is conspicuously posted inside and outside of the structure)

When a barrel is 1/2 to 2/3 full it must be removed from the structure and burned out. Encourage personnel

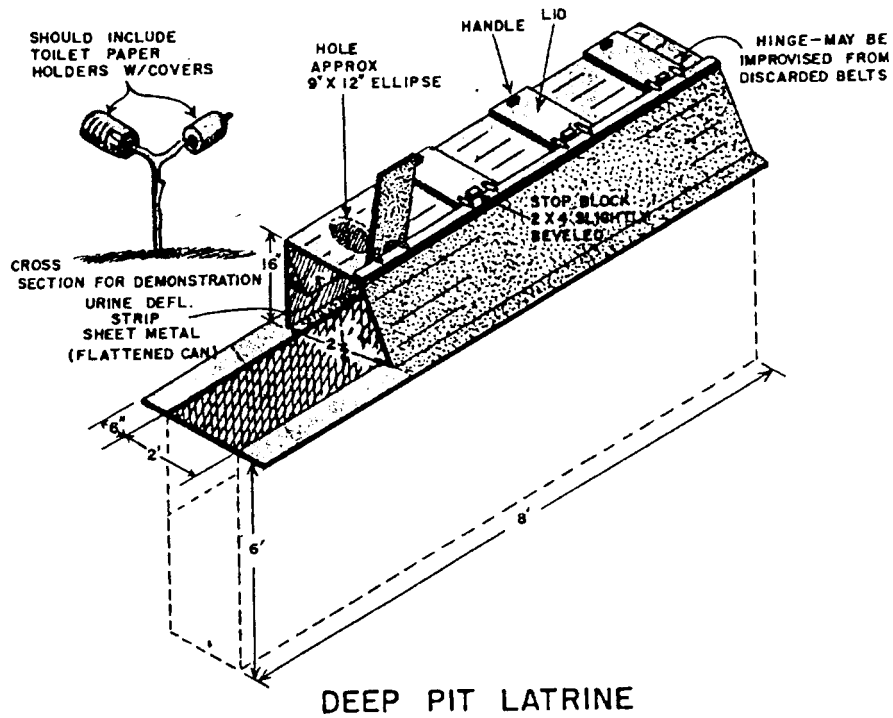


Figure 9-9.

A pit, 7½ feet long and 2 feet wide, is dug to conform to the standard size latrine box which is 8 feet long and 2½ feet wide. The depth of the pit will depend on the length of stay. The illustration shows stop blocks, to ensure self-closing lids, a metal urine deflector strip, and a method of keeping the toilet paper dry. It is best to provide a separate urinal at each male deep pit latrine.

TYPICAL BURN BARREL LATRINE

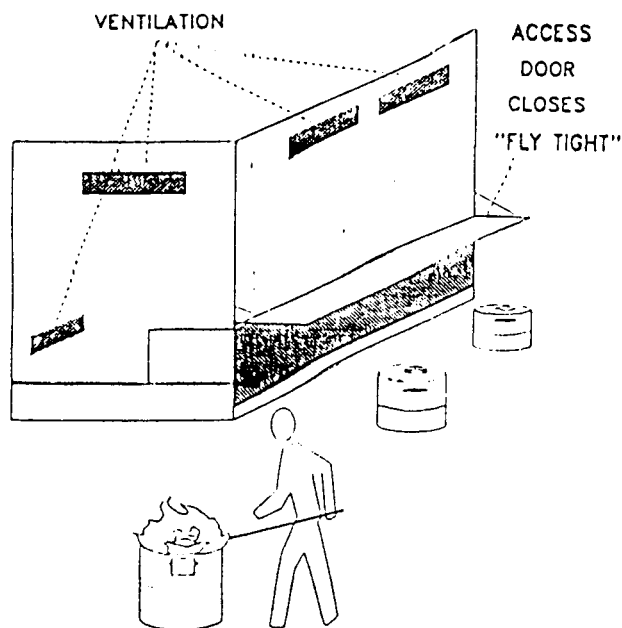
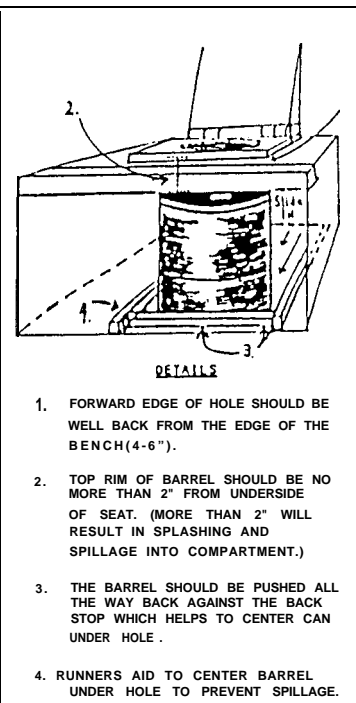


Figure 9-10.



to use urine soakage pits or other methods of urine disposal instead of burn barrel latrines since additional fuel will be required to promote complete burning. Mix 4 parts diesel fuel to one part gasoline (mogas) until the contents of the barrel is sufficiently covered. Ignite the barrel with a long stick or pole used to stir the mixture. Sticks or poles that are less than 4 feet in length must be replaced. Burning must be continued until the contents of the barrels are reduced to a fine ash, which may take more than one attempt. Burial of ashes to a depth of 12 inches is acceptable. Scattering the ashes over ground surfaces is not recommended.

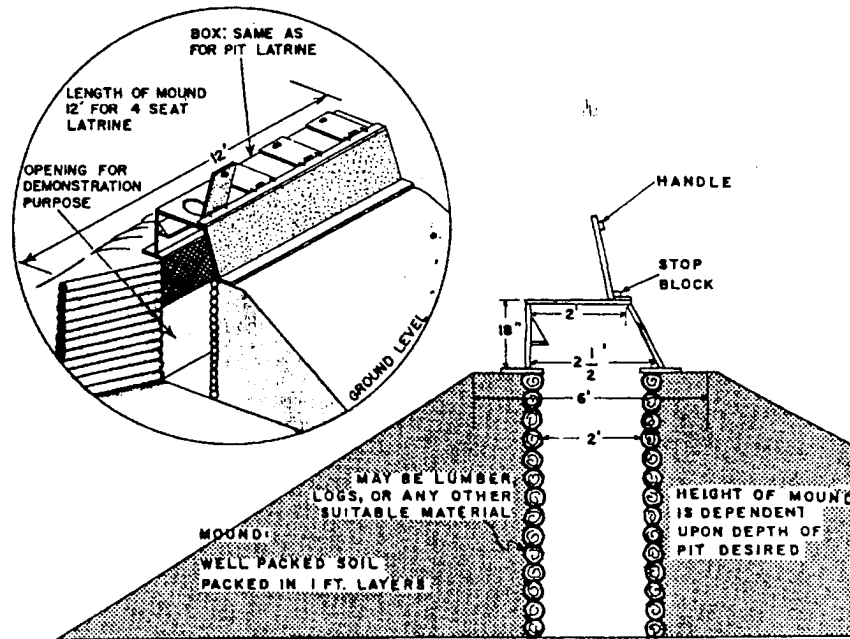
d. Mound Latrines. These temporary latrines are indicated when higher ground water levels or rock formations prevent the digging of a deep pit. By mounding the earth, it is possible to then dig a deep pit and still not intrude into the groundwater or rock. The top of the mound is at least 6 feet wide and 12 feet long so that a standard 4 seat latrine box can be placed on top of it. The mound is formed in approximately 1 foot layers with the surface of each layer compacted prior to adding the next layer. When the mound has reached the desired height, a deep pit is dug into it. The side walls are reinforced with timbers or scrap wood, figure 9-11.

e. Bored Hole Latrines. These temporary latrines require specialized drilling equipment and are, therefore, seldom used. An 18 inch diameter hole is bored to a depth of 15 to 20 feet. The hole is covered with a one seat latrine box and fly-proofed. Bored hole latrines are

constructed on the basis of 8 per 100 people, figure 9-12.

f. Urine soakage pit. This temporary latrine is most effectively used in sandy soils. It is dug 4 feet square by 4 feet deep. The pit is filled to within 6 inches of ground level with any of the following materials; large rocks, flattened tin cans, broken bottles, rubble, bricks or other suitable contact material. Ventilation shafts will be inserted into the pit to within 6 inches of the bottom. The shafts will extend 6 to 12 inches above ground level. This allows air to circulate through the-pit and lessens odors. Six urine tubes, made of 1 inch by 36 inch pipe, are then inserted into the pit. The tubes are inserted, at a slight angle, about 8 inches below ground level, which leaves about 26 inches above ground level. A screened funnel, made of moisture proof material, is placed in the top of the tube. Oil soaked burlap is then spread over the pit and covered with 6 inches of compacted earth. One pipe will accommodate 20 men, figure 9-13.

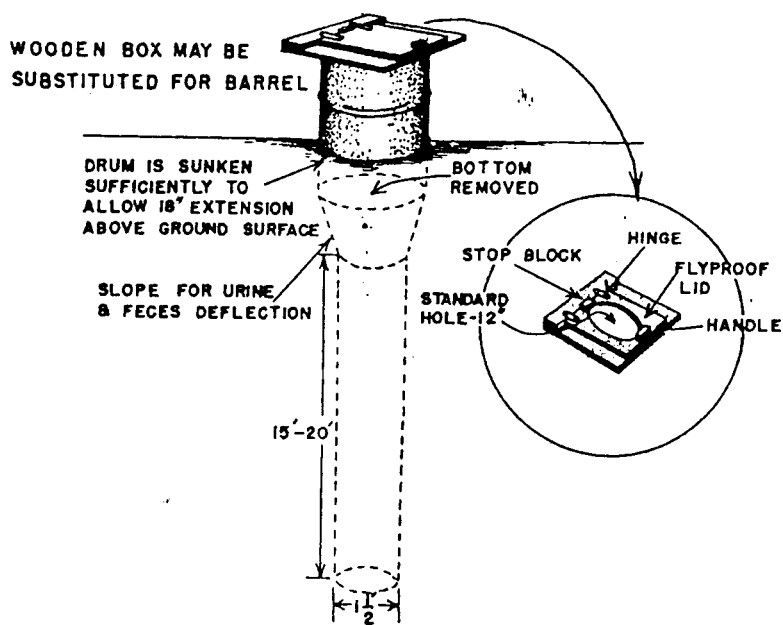
g. Urine Troughs. This type of latrine is made when construction materials are readily available. A 10 foot long, "V" or "U" shaped trough is made of sheet metal or wood. Wooden troughs are lined with moisture proof materials. A splashboard is inserted in the middle of the trough. A drain trough or pipe is attached to one end to drain urine into a soakage pit. One urine trough is designed to serve 100 men, figure 9-14. Construct it so the side with the drain trough or pipe is slightly lower than the other to ensure proper drainage.



MOUND LATRINE

Figure 9-11.

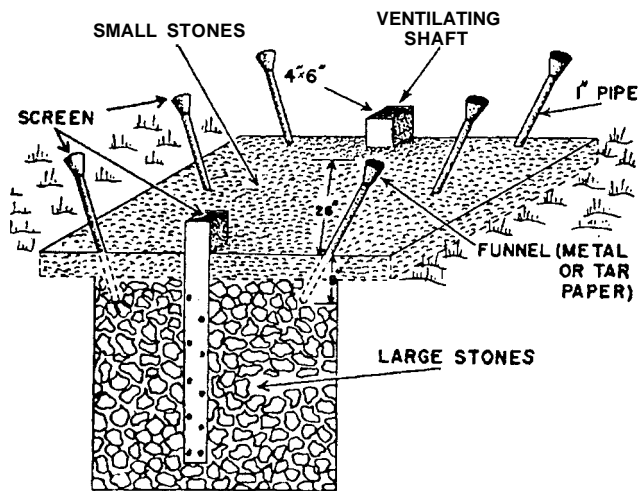
This latrine may be used where ground characteristics (high water table, frozen or rocky ground) are such that a deep pit latrine cannot be constructed. After a crib of timbers or wood planking is built, earth is compacted around the "pit" to form a mound.



BORED HOLE LATRINE

Figure 9-12.

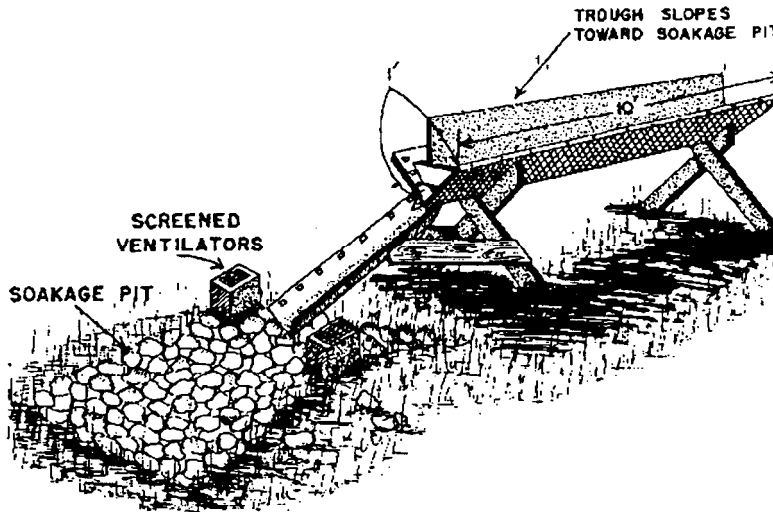
This latrine may be used for small units in isolated areas if facilities are available for boring the deep hole. Because mechanical equipment is required for its construction, it is not too often utilized.



URINE SOAKAGE PIT

Figure 9-13.

This reproduction shows salvaged pipe and improvised funnels and depicts a soakage pit with a cross section view showing construction. This pit is filled with rocks, flattened cans, broken bottles, bricks and other material. For clarity of illustration, the 6 inches of earth covering the oil-soaked burlap have not been shown. Note the same ventilating shafts as shown on the illustration of the soakage pit. (The shafts, with the openings screened, extend from 6 to 12 inches above the surface of the pit to within 6 inches of the bottom of the pit.) The surfaces of the shafts that extend below the level of the ground are perforated with one inch holes.



TROUGH URINAL

Figure 9-14.

This figure illustrates a trough urinal with splashboard and soakage pit. This urinal is made of wood and tar paper, or may be improvised of tin, galvanized iron, or any other suitable material.

h. Urinoils. These permanent type latrines are very sanitary and less odorous than other urine disposal methods. The urinoil is a screened 55 gallon drum designed to receive and trap urine and to dispose of it into the soakage pit. Urine entering through the screen is deposited on a surface of waste oil and then sinks to the bottom. As urine is added, the liquid level rises in a 3 inch diameter pipe until it overflows into a 1½ inch diameter pipe which drains into the soakage pit. The oil acts as an effective barrier against odors and flies. A covered windbreak must be constructed around the urinoil to protect it from flooding with rain water. Fresh sand or dirt must be spread around the barrel periodically. One urinoil serves 100 men, figure 9-15.

i. Chemical toilets. This type of latrine is usually obtained as a contracted service. Close scrutiny of the contractor's pumping and cleaning services is mandatory for maintaining sanitary facilities. PREVMED

Chemical Toilet Requirements

# of Personnel	# of Chemical Toilets
1 to 15	1
16 to 35	2
36 to 55	3
56 to 80	4
61 to 110	5
111 to 150	6
Over 150	Add 1 toilet for each additional 40 persons.

Note: When females are not involved in the exercise, urinals may be substituted for some of the seat type latrines. The number of seats, in such cases, will not be reduced to less than 2/3 of the number specified in this chapter.

Table 9-6.

personnel will maintain a current telephone number for the contract service. When used, chemical toilets will be ordered at the ratio displayed in Table 9-6.

5. Maintenance of Latrines

a. After latrines have been constructed, they should be enclosed in shelters to facilitate insect control, routine cleaning, privacy, and protection from flooding with rain water.

b. To prevent surface runoff from flooding the latrines, dig drainage ditches around them.

c. Provide sufficient amounts of toilet paper daily. Protect the paper from moisture, i.e. cover rolls with inverted tin cans.

d. Install a simple, easily operated, hand washing device outside each latrine, and keep these devices filled with hand soap and potable water.

e. Sweep and scrub all surfaces of each latrine daily. Disinfect the seats with a mild chlorine solution.

f. Provide a convenient trash receptacle inside latrine enclosures and empty daily.

g. Provide and maintain butt kits outside each latrine and empty daily.

h. Construct urine tube screens in the shape of a cone. Install with the apex of the cone pointing up.

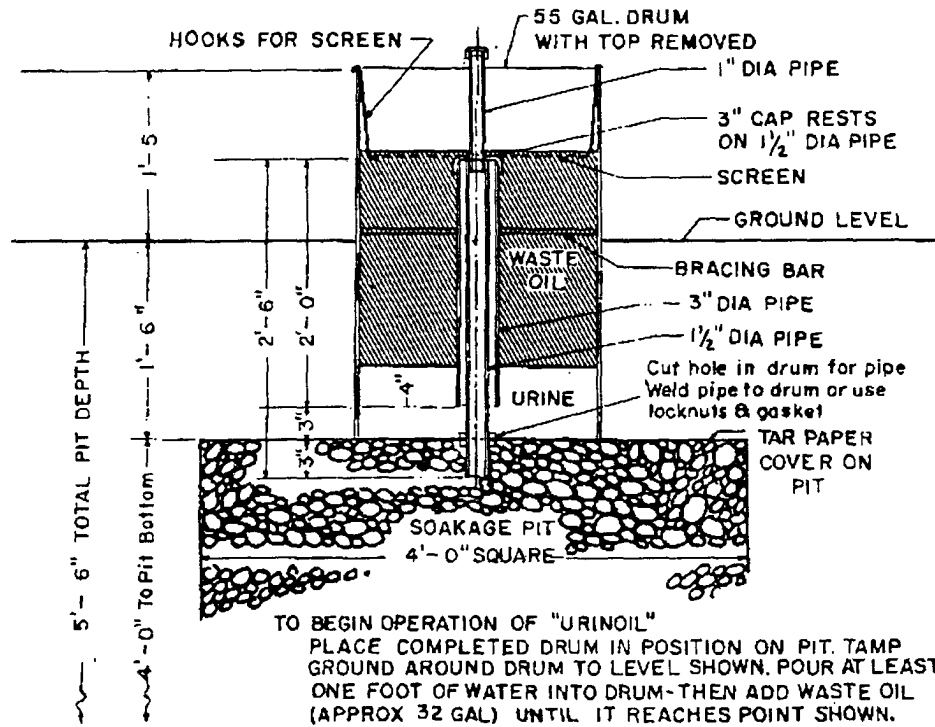
i. Keep doors and seat lids closed when not in use.

j. Mark or number each latrine to facilitate the cleaning and inspection schedules.

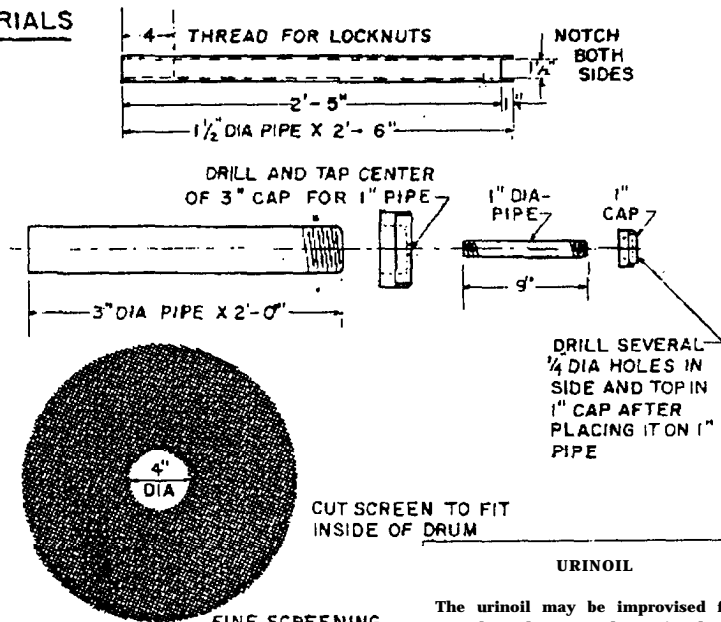
k. When a latrine pit becomes filled with wastes to within 1 foot of ground level, or if it is to be abandoned. Close the latrine as follows:

(1) Using an approved, residual insecticide, spray the pit contents, the side walls and the ground surface for about 2 feet extending out from the mouth of the pit.

(2) Fill the pit to ground level with successive



MATERIALS



URINOIL

The urinoil may be improvised from a 55-gallon drum as shown in the drawing. The urinoil should be placed on a soakage pit when possible, or installed with a French drain.

Figure 9-15. Urinoil

layers of earth, packing each layer down before adding the next one. Then mound the pit over with at least one foot of compacted dirt, and spray again with insecticide.

(3) When the tactical situation permits, mark the closed latrine by placing a rectangular sign on top of the mound stating, "LATRINE CLOSED (date)."

9-28. Disposal of Liquid Waste.

1. In the field, bathing and liquid field mess wastes are disposed of in the soil by means of either a soakage pit or soakage trench. In order for the soil to absorb liquid field mess wastes the grease, scrap food, and other suspended solids must first be removed. Grease traps are designed for this purpose and must be constructed between the field mess and each pit, trench, or evaporation bed. In places where heavy clay prevents the use of soakage pits or trenches and the climate is sufficiently hot and dry, evaporation beds are used. In either case, inspections should ensure standing water does not lead to the breeding of disease vectors.

2. Design and Construction of Liquid Waste Disposal

Devices:

a. Soakage pits, for field messes, are constructed like urine soakage pits (without urine tubes), that is, 4 feet square, 4 feet deep and filled with a suitable contact medium. One soakage pit will service a field mess serving 200 people or less. If the mess is to remain operational for 2 weeks or more, two pits will be constructed and used on alternating days. Each washing or drinking device will have a soakage pit under it. Pits are also recommended under water trailers. These pits may vary in size depending on the size and water volume of the device, figure 9-16. Soakage pits will eventually become clogged. When this happens, simply close the pit and dig a new one. A soakage pit is closed in the same manner as a urine soakage pit and marked, "SOAKAGE PIT CLOSED (date)."

b. Soakage trenches are used when the ground-water level or a rock formation prevents the use of a soakage pit. A soakage trench consists of a central pit which is 2 feet square and 1 foot deep. A trench is dug outward from each side of the pit. The trench is at least 6 feet long, 1 foot wide and 1 foot deep at the end nearest

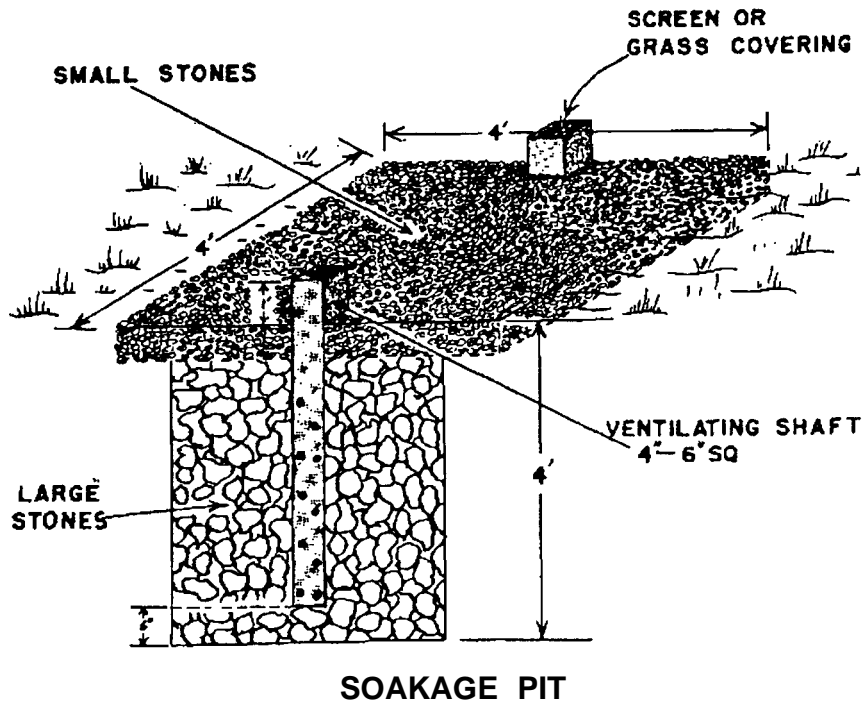
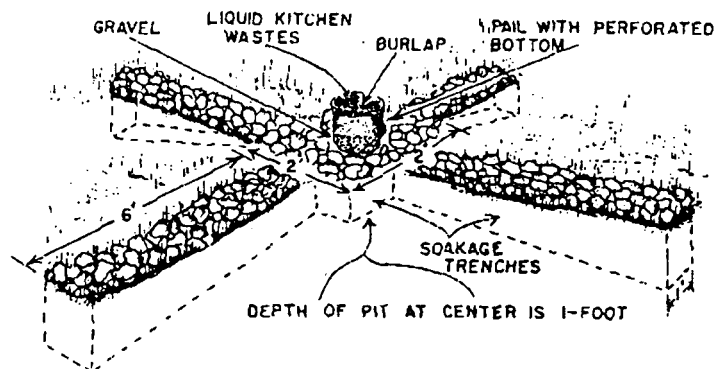


Figure 9-16.

The soakage pit is used to dispose of all types of liquid wastes where the soil is capable of absorbing moisture. The pit is dug 4 feet square and 4 feet deep. The hole is filled with any of the following materials: rocks, flattened tin cans, rubble, bricks, broken bottles, or any other suitable contact material. The liquid waste is held in void spaces until it seeps into the ground. A layer of small gravel or crushed stones may be placed on the surface of the stone.

Ventilating shafts made of scrap materials 4 to 6 inches square may be used but are not essential to satisfactory operation of a soakage pit. When the shafts are used to introduce air into the pit, they extend 6 to 12 inches above the surface and to within 6 inches of the bottom of the pit. Numerous holes are interspersed in the sides of the underground sections. The top of these shafts are covered by screen, straw, or grass.



PAIL GREASE TRAP

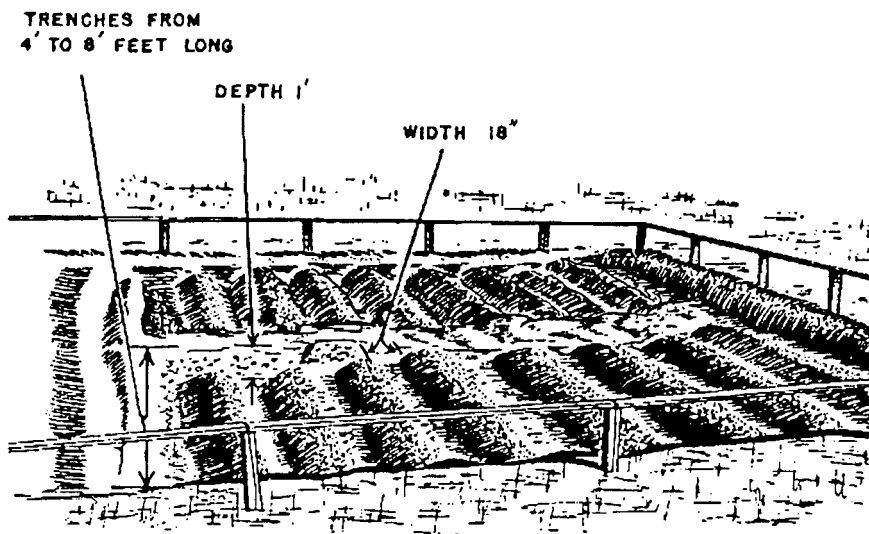
Figure 9-17.

This grease trap utilizes crossed soakage trenches and a pail. For normal operation, two such devices will be constructed and used on alternate days.

the pit with a gradual downward slope to 1½ feet deep at the end farthest away from the pit. The bottom of the structure is filled with a suitable contact medium such as small rocks. Trenches are closed in the same manner as soakage pits. Figure 9-17 shows a soakage trench with a pail type grease trap.

c. Evaporation beds are constructed to allow 3 square feet of evaporation area per person, per day, for field mess wastes and 2 square feet per person, per day,

for bathing wastes. Each bed is constructed in the same manner and spaced so that wastes can be easily distributed to any one of them. An 8 foot by 10 foot rectangle is marked off. The top soil is scraped and used to form a dike around the perimeter of the bed. The bed is then spaded to a depth of 10 to 15 inches and raked into a series of ridges and depressions with the ridges about 6 inches higher than the depressions. In operation, one bed is flooded with liquid wastes to the top of the ridges. This



EVAPORATION BED

Figure 9-18.

This sanitary device is used to dispose of liquid kitchen wastes in locations where soakage pits and grease traps are impractical. Evaporation beds are recommended for periods of short duration in hot, dry climates where soakage pits cannot be dug or where the soil is too hard (frozen or rocky) to absorb moisture.

is equivalent to an average depth of 3 inches over the bed. The liquid wastes are then allowed to evaporate and percolate. After 3 or 4 days, the bed is usually dry enough to permit respading and reforming. Other beds are flooded on successive days and the same sequence of events is followed, figure 9-18.

d. Grease traps must be constructed between the field mess and each soakage pit, trench or evaporation bed.

(1) Filter grease trap. A 55 gallon drum, with the top removed and the bottom perforated is used. It is filled two thirds full with three layers of material. Crushed rock or large gravel is placed on the bottom, progressively smaller gravel in the middle, and a 6 inch layer of sand, ash, charcoal or straw is placed on top. The top of the drum is covered with burlap to strain out the larger pieces of debris. The burlap is removed daily, burned or buried, and replaced with a clean piece. The internal filtering material is removed, buried, and replaced at least once a week. The barrel will be installed in the center of a soakage pit or trench about 2 inches below ground level, figure 9-19.

(2) Baffle grease trap. The baffle grease trap is the most effective device for removing grease. It consists of a watertight container divided into three equal sized chambers by hanging baffles. The lower edge of the first baffle hangs to within 1 inch of the bottom of the container. The second baffle hangs to a point half the depth of the box. The outlet pipe (2" diameter) is inserted 6 to 8 inches below the upper edge of the last (exit) chamber and extends outward to the center of and 1 foot below the surface of a soakage pit or trench. The outlet pipe may also terminate in an evaporation bed.

The liquid waste is strained before it flows into the entrance chamber of the trap. Before the trap is put into service, it is filled with cool water. The cool water causes the grease to solidify and rise to the surface where the baffle prevents it from reaching the outlet and flowing into the soakage area. The trapped grease is skimmed from the first (entrance) and second chamber at least daily and buried. The trap must be emptied and scrubbed with hot, soapy water as often as necessary to keep it operating efficiently, figure 9-20.

9-29. Garbage Disposal.

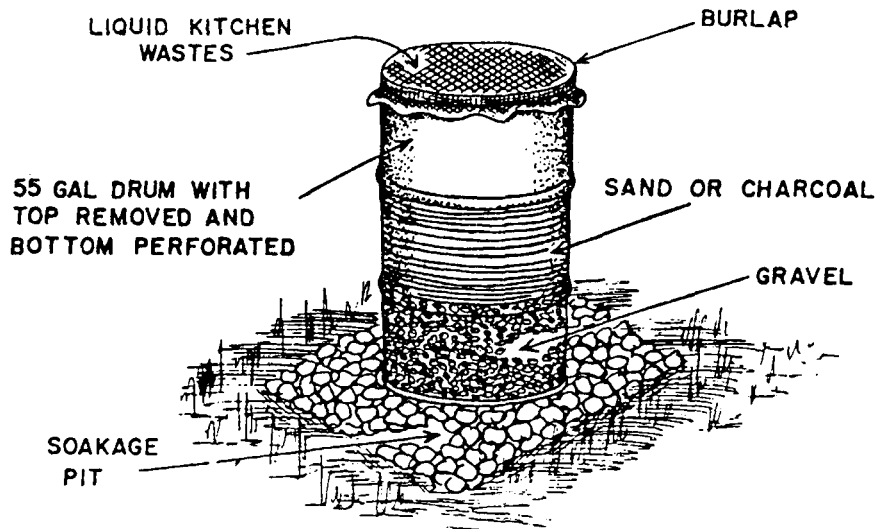
1. Garbage is the solid or semisolid wet wastes resulting from the preparation, cooking and serving of food.

2. Garbage is disposed of by burial or incineration. In either case, the tactical situation must be considered before proceeding.

a. Burial. When troops are on the march or in camps for less than one week, garbage is disposed of by burial in pits or trenches. Burial must be at least 100 feet away from any natural water source and from the field mess (further if insects, vermin or odor become a problem).

(1) Pits. Pits are preferred for overnight halts. They consist of a 4 foot square pit that is 4 feet deep and will service 100 people for one day. When the pit is filled with garbage to within 1 foot from the top, it is covered with compacted dirt and mounded with an additional 1 foot of dirt.

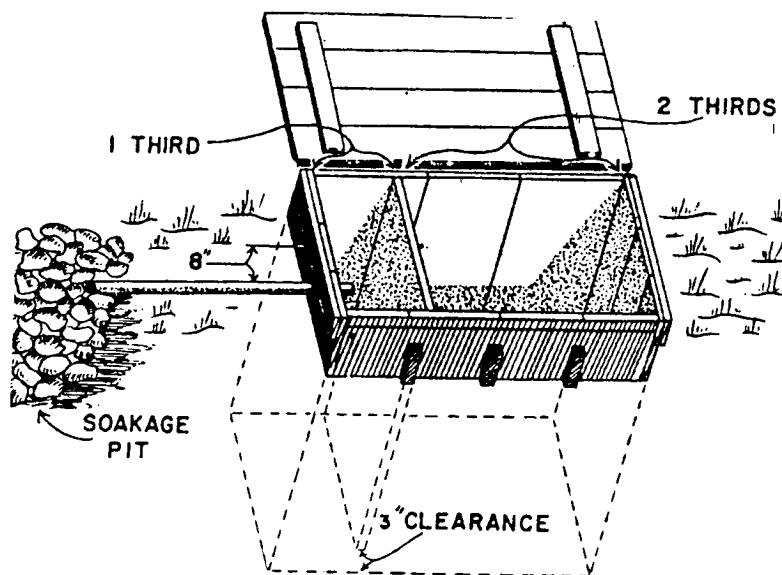
(2) Continuous trench. A continuous trench is used for stays of 2 days or more. The trench is dug 2 feet wide, 4 feet deep and long enough to accommodate the



FILTER GREASE TRAP

Figure 9-19.

This grease trap may be used in place of the baffle type. It will effectively remove grease from liquid kitchen waste, although the top layer of sand will require frequent replacement.



BAFFLE GREASE TRAP

Figure 9-20.

In this illustration the box-type baffle grease trap is shown. A baffle may be used in a box, drum, or barrel in the construction of a grease trap. Salvage boxes or barrels may be reinforced and/or treated to serve this purpose. One baffle extends half the depth of the box and the other baffle extends within one inch of the bottom of the box. The water is poured into the box on the side nearest the half baffle and the grease remains on the surface of the first two sections of the trap. The pressure of the fluid forces the grease free water under the last baffle board and out the pipe into the soakage pit.

next day's garbage. When the first section is full, it is covered and mounded, then another section is dug to accommodate the next day's garbage. The process can be repeated indefinitely.

b. Incineration. Incineration is the garbage disposal method often used in camps that will be used for 1 week or more. Wet materials will not burn easily and tend to disrupt the incinerator air draft. Therefore, it is necessary to separate the liquid from the solids. Separation is done by straining the garbage through a coarse strainer such as an old bucket or 55 gallon drum with holes punched in the bottom. The liquid is run through a grease trap and into a soakage pit. The solids are incinerated. Incinerators must be located at least 50 yards from the camp area and away from flammables.

(1) Inclined plane incinerators will handle the garbage of an entire battalion. Their effectiveness in combustion and the fact that they are somewhat protected from wind and rain makes them excellent improvised devices. A sheet metal plane is inserted through three telescoped 55 gallon drums from which the ends have been removed. The drums are laid on an incline. The metal plane is extended about 2 feet beyond the upper end of the inclined drums and serves as a loading or stoking platform. A grate is placed at the lower end of the inclined drum/plane mechanism. A wood or oil fed fire is provided under the grate. After the incinerator becomes hot, drained garbage is placed on the stoking

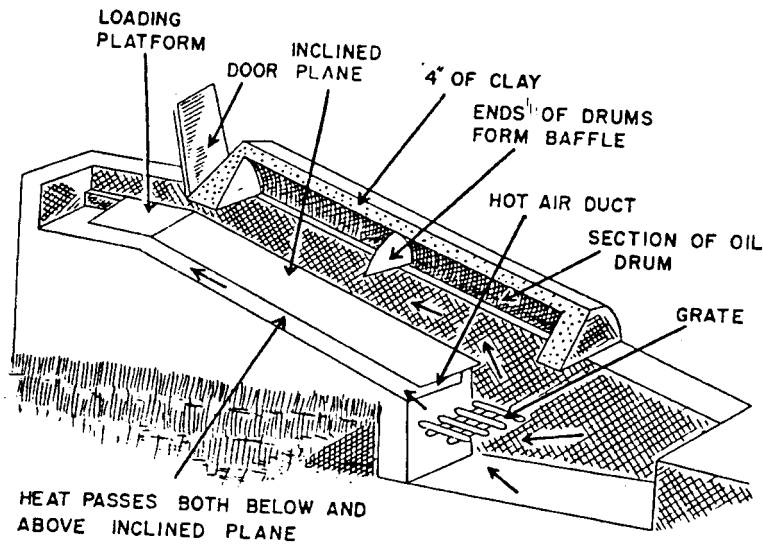
platform. As the garbage dries, it is pushed down the plane in small amounts and is burned on the grate, figure 9-21.

(2) Barrel incinerators. A barrel incinerator is made from a 55 gallon drum by cutting out both ends, punching many holes near the bottom, and inserting metal rods or small pipes through the barrel, several inches above the holes. The metal rods serve as a grate; the punched holes allow for air draft. The barrel is supported several inches above the ground on stones, bricks, or dirt filled cans so that a fire can be built under it. Drained garbage is added in small amounts and burned, figure 9-22.

9-30. Rubbish Disposal.

1. Rubbish is dry, disposable waste resulting from almost all of man's activities.

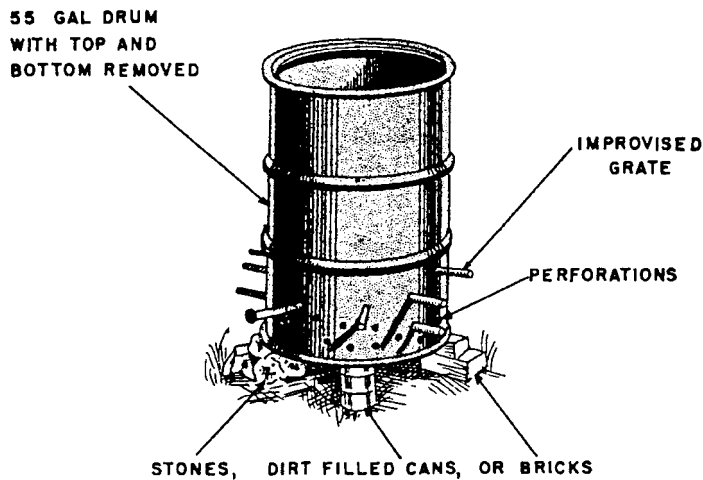
2. Rubbish which for tactical reasons cannot be hauled to a proper disposal site is either buried or incinerated depending on the field situation. For short stays, rubbish is buried in pits with the garbage taking care to flatten cans and break down boxes. In camps where the length of stay is expected to be over one week, the rubbish is incinerated, and the ash and noncombustibles are buried with the garbage. Barrel incinerators are commonly used for rubbish incineration.



INCLINED PLANE INCINERATOR

Figure 9-21.

This incinerator can be very useful in temporary camps. Garbage is placed on the loading platform and fed continuously down the inclined plane towards the grate. This device is particularly useful for burning wet garbage in places where it cannot be buried.



BARREL INCINERATOR

Figure 9-22.

This incinerator is easily improvised and will effectively consume small amounts of garbage and combustible refuse. A grate is made of scrap pipe inserted in the holes as shown. An alternate method is to create a grate by simply punching holes in the bottom of the barrel. Instead of trenches to supply draft, the barrel could be elevated on supports of bricks or stones.

Section V. PREVENTION OF HEAT INJURIES

	Article
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Physiological Factors.....	9-33
Types of Heat Injuries.....	9-34
Prevention.....	9-35
Wet Bulb, Globe Temperature (WBGT) Index.....	9-36

9-31. General. Heat injuries are a major threat to field operations, and will be discussed briefly in the following section. The internal temperature of the human body is regulated within a vary narrow range. High internal temperatures produce stress on the body which, if not effectively counterbalanced, may result in heat injury or death (See figure 9-23). Environmental as well as physiological factors influence the body's thermal equilibrium mechanism. A detailed discussion of heat stress, its identification, treatment and prevention is contained in Chapter 3 of this manual.

9-32. Environmental Factors.

1. Ambient air temperature dictates the direction of heat flow from (or to) the body. When air temperatures are below normal body temperature, heat loss to the surrounding environment is rapid. When air temperatures are high the body can only dissipate heat by sweating where the heat is carried away by sweat evaporation at the skin surface.

2. Wind velocity. Body heat is carried away by air currents. The higher the velocity of these currents, the faster the heat loss. The rate of heat loss diminishes as air temperatures increase. When the body stops sweating (as in heat stroke), the condition reverses itself and the body absorbs heat rapidly. High wind velocity can also produce windburn which will influence thermal regulation.

3. Humidity. Ambient air, at any given temperature, can only absorb so much moisture. When the moisture content (humidity) of the air is high, sweat evaporates slowly and the rate of heat loss is diminished. When humidity is low, sweat evaporates quickly and the rate of heat loss is rapid.

4. Radiant heat is the heat produced by the reflective energy of the sun or equipment in close proximity to a human body. The radiated heat is absorbed into the surrounding air or directly into the body. In either case, the body's ability to cool itself is hampered.

9-33. Physiological Factors. Predisposing factors which may adversely effect heat injury prevention are:

1. Illness. Personnel suffering from or recovering from an acute or chronic disease.
2. Previous history. Personnel who have a history of heat illness (exhaustion, stroke or cramps).
3. Skin trauma. Personnel suffering from sunburn, heat rash or other dermatologic malady. The body's heat regulatory mechanism is hampered at the skin surface.
4. Dehydration. Individual's fluid output is greater than fluid intake. Causes include vomiting, diarrhea and insufficient water intake.
5. Fatigue. Physical and mental weariness can cause a lack of concern and result in a failure to take proper precautions against heat injuries.
6. Obesity. Body fat will interfere with the heat regulatory mechanism, cause the individual to expend more energy to accomplish a given amount of work and could be an indicator of poor physical conditioning.
7. Poor physical conditioning.
8. Alcohol and drug use. Alcohol and certain medications, including immunizing agents, decongestants and allergy remedies interfere with the body's heat regulatory mechanism. Alcohol should not be consumed for 24 hours prior to heat stress.
9. Sickle cell trait. Sickling of blood cells impairs circulation and increases risk of injury. Persons with sickle cell trait should be advised of their risks and preventive methods.

9-34. Types of Heat Injuries. The type and number of heat injuries anticipated changes with environmental and physical factors. The spectrum of heat illnesses ranges from mild to severe as body temperature increases as seen in figure 9-23 below. Table 9-7 summarizes prevention, symptoms and treatment methods for each type of heat injury.

1. Heat cramps. These are painful and severe cramps of the voluntary muscles, primarily in the extremities

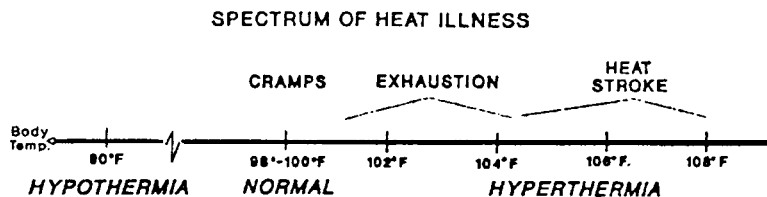


Figure 9-23.

HEAT ILLNESS SUMMARY

HEAT ILLNESS	PREVENTION	SYMPTOMS	TREATMENT
CRAMPS	Training-Education Pre-Exercise Hydration Conditioning-Salt Foods	Muscle Contraction in Legs and Arms	Stop Exercise- Hydration-Extension
EXHAUSTION	Training-Education	N&V-Vertigo-Syncope- Dyspnea Body Temp < 104°F	Loosen Clothing-Monitor Temp. Rectally-Water Spray-Fan-Shade- Replace Fluids-Transport
HEAT STROKE	Training-Education Physical Conditioning	Confusion-Disorientation- Drowsiness-Irrational Behavior, Body Temp > 104° F	Emergency Cooling- Water Spray-Fan-Shade- Water-IV Fluid Replacement Transport
HEAT SYNCOPE	Training-Education Physical Conditioning	Fainting or loss of consciousness while standing in the heat	Emergency Cooling Water Spray-Fan-Shade- Water-IV Fluid Replacement-Transport

Table 9-7.

and abdominal wall. Heat cramps result primarily from the excess loss of salt through sweating. The body temperature remains normal "unless accompanied by heat exhaustion. Treatment includes cooling and fluid/electrolyte replacement.

2. Heat Syncope. Heat syncope occurs when there is excessive pooling of the blood in the extremities, consequently the brain does not receive enough blood. There is peripheral vasodilation to dissipate the heat and if personnel have been standing still they are likely to faint. This is most likely to occur when standing after a march or exercise. Heat syncope may be avoided by not requiring personnel to stand still in the heat, particularly after exercise.

3. Heat exhaustion. Heat exhaustion results from peripheral vascular collapse due to excessive water and salt depletion. Symptoms include profuse sweating, headache, weakness, pallor, nausea, vomiting, mild dyspnea, and palpitations. The casualty may become faint and lose consciousness. The blood pressure may be low, the body temperature may be elevated or normal and the pupils may be dilated. Treatment includes cooling and fluid replacement, taking care that the victim does not go into hypothermia. Heat exhaustion should not be treated with aspirin, or other antipyretics.

4. Heatstroke. **HEATSTROKE IS A MEDICAL EMERGENCY!** It is the result of the collapse of the thermal regulatory mechanism. Early symptoms may include dizziness, weakness, nausea, headache, confusion, disorientation, drowsiness and irrational behavior. The skin may be hot and dry or there may be profuse sweating. The casualty may progress through the symp-

toms of heat cramps and heat exhaustion with the onset of heatstroke occurring with dramatic suddenness. There may be collapse and loss of consciousness; profound coma and convulsions may occur. Body temperatures rise to the critical levels above 104° F, and may reach 108° F. Treatment must be administered within minutes or irreversible damage or death will occur. Treatment includes **IMMEDIATE** cooling and evacuation to a medical treatment facility. Remove or loosen the casualty's clothing, move to a shaded area, spray or splash with water, rub with ice, (if available); fan to aid the cooling process, take whatever action is necessary to lower the body temperature and do it quickly. Take care that the victim does not go into hypothermia. If a thermometer is available core temperature as measured rectally should be taken as early as possible and monitored continuously. Taking the temperature orally is inadequate. Intravenous normal saline should be given as soon as possible and continued to guard against possible myoglobin-induced renal failure. Heat stroke should not be treated with aspirin or other antipyretics.

9-35. Prevention. The successful prevention of heat injuries depends largely on education of personnel, especially supervisory personnel. Equally important is the development of procedures to alert individuals to the existence of dangerous heat stress levels. The application of measures to reduce both the severity and duration of exposure and adoption of techniques to increase the resistance of exposed persons are:

1. Acclimatization. A period of three weeks is optimal

for acclimatization, with progressive degrees of heat exposure and physical exertion. Note that acclimatization at one level of heat stress does not guarantee any level of acclimatization at higher levels of heat stress.

2. Water Intake

a. Adequate water intake is the single most important factor in avoidance of heat injury. The human body is highly dependent on water to cool itself in a hot environment. An individual subjected to high heat stress may lose in excess of one quart of water per hour by sweating. This loss must be replaced or rapid rise in body temperature and heart rate may occur. This also decreases the ability and motivation to work, and deterioration in morale may occur. These are good indicators of impending heat injury.

b. Personnel exposed to heat must consume water frequently, preferably at 10 to 20 minute intervals. Water should be consumed before, during, and after exercise. The theory that personnel can discipline themselves to do without water is inaccurate and the practice can be deadly.

c. Thirst is not a reliable indicator of the body's need for water. Personnel with ample water supplies will frequently dehydrate by one or two quarts unless drinking water is encouraged or required. Personnel must be trained to drink liberal quantities of water even though they do not feel thirsty. Mandatory water consumption monitored by unit leaders and assigned medical personnel (water discipline) will be required during periods of extreme heat stress exposure. Individuals should be instructed to note the color of their urine. The color should be straw to clear. Dark colored, concentrated urine suggests dehydration.

d. When the WBGT index is above 80 degrees F, water requirements can range from 8 to 10 quarts per person per day, doing light work (i.e., desk work), to 13 to 19 quarts per person per day doing heavy work (i.e., forced march). When water is in short supply, water savings can be made only by reducing physical activity, or limiting it to the cooler hours of the day. Any attempt at water economy by restricting water intake must be paid for in reduced work capability, reduced efficiency and the increased risk of heat injury.

e. The optimum temperature for drinking water is between 50 and 60 degrees F.

3. Salt Intake. In addition to water, salt (sodium chloride) is lost in sweat. An adequate diet is essential to health and normally contains an adequate amount of salt intake when personnel simply salt their food to taste. Salt supplements are not necessary. Unsupervised, routine consumption of salt tablets is contraindicated.

4. Clothing

a. Except when exposed to the direct rays of the sun, an individual in a hot environment is better off wearing the least allowable amount of clothing. Clothing reduces the exposure of the skin to sunlight, but will decrease the movement of air over the surface of the skin.

b. Clothing should be loose fitting, especially at the neck, arms, waist and lower legs, to permit circulation of air, the exception being that trousers must be tucked inside the boots and blouses inside the trousers when operating in an area of tick and mite infestation.

c. Field uniforms must not be starched. The starch blocks the fabric pores and restricts air circulation.

d. The practice of wearing workout clothing specifically designed to restrict sweat evaporation (portable saunas) is not authorized in a hot field environment. The practice is extremely dangerous and has no place in a physical conditioning program.

5. Work Schedules. Work schedules must be tailored to the situation. When temperatures are high, work must be curtailed or even suspended under severe conditions. The temperature at which work schedule modification will take place depends on humidity, radiant heat, wind velocity, character of the work, degree of acclimatization, and other factors. Work can be scheduled during the cooler hours of the day, such as morning and evening, and still meet the workload requirement.

6. In Garrison Area Prevention. The effects of thermal stress can be lessened within an area while in garrison by employing a few shading techniques to provide protection from the radiant sun rays. Camouflaged netting can reduce temperatures inside tents and other facilities exposed to the direct rays of the sun. This is especially important in common use areas such as dining tents, recreation areas, and berthing. Hydration of troops should be promoted by providing protected sources of cool drinking water in numerous locations throughout the camp.

7. Careful monitoring of the WBGT index is essential to the prevention of heat injury (see article 9-36).

9-36. Wet Bulb, Globe Temperature (WBGT) Index.

1. The WBGT Index is the most effective means of assessing the effect of heat stress on the human body. Heat casualties can be expected at WBGT readings of 75 degrees F. and above unless preventive measures are instituted. Heavy work can cause heat injury at lower temperatures especially if body armor or protective clothing is worn.

2. While in garrison, area commanders and commanding officers are responsible for procuring and maintaining WBGT equipment and conducting readings for their area. While deployed to AOs in the field, medical personnel are relied upon to have, operate, and maintain WBGT equipment and post flag conditions. The WBGT kits are found in Appendix C. Procedures, recording, and posting requirements are listed in Appendix C. Careful monitoring and adherence of procedures and equipment maintenance is necessary to ensure valid assessment of WBGT conditions. Ensure readings are:

a. Taken in an unshaded area most likely to reflect conditions experienced by troops.

b. Taken with clean equipment, clean water etc.

c. Taken with appropriate materials, i.e. a clean 100% cotton wick which extends into the water and above the thermometer reservoir.

d. Recorded consistently in a heat stress log.

3. The WBGT Index is a single number derived mathematically from three distinct temperature measurements: wet bulb temperatures, dry bulb temperatures, and globe temperatures. Color coded flags are flown in strategic locations so that all personnel will be aware of the current heat stress index and make appropriate work

schedule adjustments.

a. When the WBGT Index is <80, extremely intense physical exertion may precipitate heat exhaustion or heat stroke, therefore, caution must be taken. A white flag is flown at this condition level.

b. When the WBGT index is between 80 and 84.9, discretion is required in planning heavy exercise for unacclimatized personnel. This is a marginal heat stress limit for all personnel. A green flag is flown at this condition level.

c. When the WBGT index is between 85 and 87.9, strenuous exercise and activity must be curtailed for new and unacclimatized personnel during the first 3 weeks of heat exposure. Outdoor classes in the sun must

be avoided when the WBGT Index exceeds 85. A yellow (amber) flag is flown at this condition level.

d. When the WBGT index is between 88 and 89.9, strenuous exercise must be curtailed for all personnel with less than 12 weeks training in hot weather. A red flag is flown at this condition level.

e. When the WBGT index is 90 or above, physical training and strenuous exercise must be suspended for all personnel. (excludes operational commitment not for training purposes). A black flag is flown at this level.

f. Wearing body armor or NBC protective uniforms adds approximately 10 points to the measured WBGT. Limits of exposure should be adjusted accordingly.

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f. Wearing body armor or NBC protective uniforms adds approximately 10 points to the measured WBGT. Limits of exposure should be adjusted accordingly.

Section VI. PREVENTION OF COLD INJURIES

	Article
General.....	9-37
Environmental Factors.....	9-38
Physiological Factors.....	9-39
Types of Cold Injuries.....	9-40
Prevention.....	9-41

9-37. General.

1. Cold injury is defined as tissue damage produced by exposure to cold. The type of injury depends on the degree of cold, the duration of exposure, and environmental and physiological factors.

2. Cold injury can occur at nonfreezing and freezing temperatures although their pathology will be very similar.

a. Non-freezing, wet cold injuries are associated with prolonged exposure to cold water, dampness or high humidity. Keeping clothing and exposed extremities dry is the primary preventive measure against this type of injury.

b. Freezing, dry cold injuries are associated with extended exposure to subfreezing temperatures, usually 14 degrees F. or lower when the humidity is low. Whole body insulation is the primary preventive measure against this type of injury.

9-38. Environmental Factors.

1. Ambient air temperatures. The rate of body heat loss is inversely proportional to the temperature of the surrounding air. As temperatures decrease, heat loss increases. Air temperatures do not have to be below the freezing point of water to cause cold injuries. Prolonged exposure to temperatures as high as the 50 degree F. range can cause injury depending on other environmental factors and the degree of personal protection.

2. Humidity. Cold injury is due, in part, to the effect of low temperatures on moisture in or on the body. The higher the moisture content, especially on the skin surface, the more rapid the heat loss. As humidity rises, the temperature at which cold injury can occur also rises. High humidity can also induce sweating which

will further reduce body heat.

3. Wind velocity. Heat loss is further influenced by wind velocity when humidity is high. Consult Table 9-8 for wind chill equivalent temperatures.

4. Field situation. Personnel in the field do not always have control over their situations or circumstances. Combat can induce prolonged periods of immobilization. Reduced blood circulation and the inability to generate internal body heat will result. Forces on the move, rapid marching, running or riding in open vehicles will greatly increase the effects of wind velocity.

9-39. Physiological Factors.

1. Age. Within the usual age range of sailors and Marines, age is not significant as a factor of susceptibility to cold injury.

2. Rank. Cold injuries are more likely to occur in "front line" troops and predominately those below the rank of E4. The decreased incidence of cold injury among higher ranks is a reflection of a combination of factors such as experience, receptivity to training, and significantly less exposure.

3. Previous cold injury. A previous episode of cold injury increases the individual's risk of subsequent cold injury. However, the individual with a previous cold injury is more sensitive to cold and is more likely to take protective actions.

4. Fatigue. Mental weariness may cause apathy leading to neglect of acts vital to survival.

5. Other injuries. Injuries resulting in significant blood loss, shock, or inactivity reduce effective blood flow to extremities and predispose to cold injuries.

6. Psychological factors. Cold injury is more common in passive individuals who tend to display little muscular activity and are prone to pay less attention to personal protective measures.

Estimated wind speed (in mph)	Actual Thermometer Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	EQUIVALENT TEMPERATURE (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-124
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-21	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER (for properly clothed person) Maximum danger of false sense of security.			INCREASING DANGER Danger from freezing of exposed flesh.				GREAT DANGER				
Trenchfoot and immersion foot may occur at any point on this chart.												

Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature

Table 9-8. Wind Chill Chart

7. Geographic Origins. Personnel from warmer climates appear to be predisposed to cold injury. However, proper acclimatization will help compensate for this predisposition.

8. Nutrition. Poor nutrition predisposes a person to cold injury. The standard military ration will provide adequate nutrition for appropriately clothed and protected personnel during most cold weather operations.

9. Activity. Too much or too little activity will contribute to cold injury. Over activity, with deep, heavy breathing, generates a large amount of body heat loss. The resulting perspiration, which becomes trapped in the clothing, markedly reduces the insulating quality of the clothing. Conversely, immobility causes decreased body heat production which results in cooling, especially of the extremities.

10. Drugs and medications. Personnel taking prescription medication must be aware that some drugs have an adverse effect on blood circulation or sweating.

a. Alcohol can impair judgment and will cause dilation of peripheral blood vessels which results in increased heat loss to the environment.

b. The nicotine in tobacco causes the peripheral blood vessels to constrict thereby decreasing blood flow to the extremities.

9-40. Types of Cold Injuries.

1. Immersion syndrome is a serious condition which may occur in as little as 24 hours in environments where the water temperature is below 50 degrees. When water temperatures exceed 50 degrees, injuries occur with exposure from 48 to 72 hours. This syndrome is not limited to the feet. Any skin area, usually an extremity,

that is subjected to damp exposure may be affected. Pale, wrinkled skin is a symptom that indicates the need for complete drying out before underlying tissues begin to break down. Once damage to underlying tissues begins, immobilization may occur and recovery is prolonged, with some cases requiring one month or more depending on the extent of damage. Severe cases have required amputation.

2. Frostbite occurs from exposure to ambient or wind-chill temperature below freezing. The time of exposure varies from instantaneous to several hours depending on the temperature, wind velocity, humidity, and protective measures taken. The first symptoms of frostbite are usually a sharp, pricking sensation which reveals a yellow/white, numb area of hardened skin. The most frequently affected parts of the body are the cheeks, nose, ears, chin, forehead, fingers and toes. Permanent tissue damage may result and excision or amputation of the affected area may be required.

3. Hypothermia is the general cooling of the body's core temperature. It usually results when a person, who is not adequately clothed, is exposed to a cold, windy and possibly even wet environment for an extended period of time. Under extreme conditions, hypothermia may result in as little as 5 minutes, particularly if submerged in very cold water.

4. Carbon monoxide poisoning indirectly results from the exposure to cold weather. As fuels are burned to provide warmth, carbon monoxide is given off. The colorless, odorless gas can cause asphyxiation in poorly ventilated spaces. Personnel must be aware of and constantly reminded of the need for adequate ventilation of enclosed spaces where fuel heaters are being used.

5. Snow burn/snow blindness. Normally, much of the

solar radiation which reaches the earth is absorbed into the ground and the surrounding environment. In the snow, however, the majority of the sun's rays are reflected off the facets of ice crystals and are absorbed by the skin or pass into the eye.

9-41. Prevention.

1. Protective clothing. Wear or carry adequate amounts of the proper types of clothing for the weather to be encountered. Clothing must be worn in layers so excess layers can be removed before sweating causes the material to lose its insulating properties. Outer layers should be wind resistant. Loose clothing allows for efficient blood circulation and creates air pockets which provide insulation. The clothing must be clean and dry. The rain suit must be large enough to fit over the cold weather clothing. All exposed skin areas need protection from the cold and wind. The face is especially vulnerable to cold injury and as much as 75% of body heat loss is through the head. Heat injuries may occur in cold weather operations, so wearing the clothing as stated above can prevent such an occurrence.

2. Care of the feet. The feet must be given special attention. Cold weather, insulated, rubber boots (black or white) will be issued to troops during cold weather operations. Frequent changes of socks is important with these boots because of increased sweating, retention of sweat and a lowered resistance to fungal infections. Sweat in these boots can lead to softening of the soles of the feet which can result in skin loss, infection and hospitalization (see immersion syndrome). Cold injuries can still occur in these boots if the feet are not exercised. In any boot, the feet are more prone to sweating than other parts of the body. Moisture in the socks will reduce their insulating quality making frequent sock changes a must. Wet socks can be dried by placing them unfolded inside the shirt. Extra socks must be carried at all times and dirty socks washed whenever possible. Sweating of the feet may be controlled by the use of antiperspirants containing aluminum chlorhydrate. Feet should be massaged daily, toenails trimmed (not too short), and blisters cleaned and protected.

3. Protection of the hands. Mittens are more protective than gloves and individuals should keep a dry pair for use whenever possible. Gloves present more surface area for heat loss and are therefore less efficient than

mittens in keeping hands and fingers warm. When wet, leather gloves must be dried slowly to prevent shrinking and hardening of the leather. The wool liners must be dried slowly to prevent shrinking.

4. Personal hygiene. Proper personal hygiene must be maintained in cold weather operations. Personnel involved in field operations may neglect basic hygiene and become susceptible to skin disease because of the lack of hot water and convenient washing facilities.

5. Exercise. Avoid immobilization. Exercise of large muscle groups will generate internal body heat. Wiggling the fingers and toes will increase circulation and keep them warm. Massage the ears and nose periodically for the same reason. When exercise is not possible, frequent changes of position will encourage circulation.

6. Sunglasses/Sunscreen. When working in snow conditions, use of sunscreen and sunglasses is strongly recommended. Sunglasses must be worn during daylight hours regardless of whether the sun is shining brightly or not. A bright, cloudy day is deceptive and can be as dangerous to the eyes and skin as a day of brilliant sunshine. The glasses will also protect against blowing snow. The risk of snow blindness and sunburn is increased at high altitudes because the clear air allows more of the burning rays of sunlight to penetrate the atmosphere.

7. Diet. Increased caloric intake, especially in the form of carbohydrates, is important for the production of internal body heat. Proper diet includes hydration. Adequate water intake is as important in cold environments as in hot. Personnel, bundled up in layers of protective clothing, may not be aware of the amount of sweat they are losing. Water discipline must be enforced in cold environments.

8. The Buddy System. Personnel must be trained to recognize signs of cold injuries on other individuals. When blanching of the skin is noted, immediate action will usually prevent the development of cold injury. Holding (not rubbing) a warm hand on the blanched area until it returns to a normal color is an effective treatment for a cold ear, nose or cheek. Fingers can be warmed against the bare abdomen, chest or armpit. If the casualty complains of an abrupt loss of cold sensation or extreme discomfort in the affected body part, immediate action must be taken as these are classic early warning signs of frostbite.

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Section VII. DISEASE CONTROL

	Article
General	9-42
Diseases of Military Importance	9-43
Communicable Disease Reporting	9-44

9-42. General.

1. Communicable diseases are those diseases that are transmitted from a carrier to a susceptible host. They may be transmitted directly from an infected person or

animal or indirectly through the agency of an intermediate host, vector or inanimate object. The illness produces results from infectious agents invading the host and multiplying or from the release of their toxins.

2. Disease control, as it pertains to the field or combat

situation, cannot be overemphasized. Prevention is the key to a successful disease control program and may mean the difference between success or failure of the mission. Disease occurrence requires a "chain of transmission" consisting of four links: a reservoir, a means of transmission, a portal of entry, and a susceptible host. To prevent or control communicable diseases it is necessary to "break" one or more of the links in the chain.

3. As discussed in Section 1, the medical department must ensure the 100% medical deployability of the unit. This can only be achieved through constant maintenance and updating of medical readiness programs such as immunizations, tuberculosis control, hearing conservation, physical exams, G6PD screening, etc. With all personnel in 100% compliance, these programs will not have to be brought up to date a few days prior to a deployment. The time prior to deployment is needed to obtain and review medical intelligence for the AO and prepare for and initiate any special preventive medicine programs indicated by the medical intelligence.

9-43. Diseases of Military Importance.

1. Intestinal diseases are caused by the ingestion of infectious microorganisms or their waste products. They are often transmitted by food or water which has become contaminated with bacteria, viruses or intestinal parasites. These infectious agents are introduced as a result of a breakdown in personal hygiene, sanitation, food preparation or water treatment. Food or water becomes contaminated by direct contact with the infectious agent or by contact with a mechanical vector such as flies, rodents, etc.

a. Some intestinal diseases of particular importance to the military in field environments are typhoid and paratyphoid fevers, amebic dysentery (amebiasis), bacillary dysentery (Shigellosis), cholera, hepatitis, leptospirosis, food infection and food intoxication. Symptoms typically associated with these diseases include abdominal cramps, diarrhea, fever, nausea, dehydration, jaundice, vomiting and weakness. (Consult Chapter I of this manual for detailed information on the control of food borne illness.)

b. Control is relatively easy in that the infectious agents are ingested. Therefore, proper handling, storage, inspection and preparation of food, (Section III of this chapter and Chapter I of this manual), and adequate treatment of potable water supplies, (Section II of this chapter and Chapters 5 and 6 of this manual), will effectively eliminate intestinal diseases in a field unit. Troop education is strongly emphasized.

2. Diseases of the respiratory tract are caused by direct inhalation of infectious microorganisms which are carried on airborne droplets or dust particles. These bacteria and viruses may also be indirectly transmitted through ingestion by the use of common cups, food utensils, cigarettes, etc.

a. Some diseases which can be spread in this manner are influenza, common colds, diphtheria, rubella, rubeola, pneumonia, scarlet fever, strep throat and tuberculosis. Symptoms range from mild fevers to permanent incapacitation.

b. Control involves:

(1) Isolation of known or suspected cases, where practical. Avoidance of overcrowding and close physical contact is ideal but will be dictated by the tactical situation.

(2) Frequent ventilation of living spaces.

(3) Providing medical surveillance, education and patient/contact interviewing.

(4) Providing prophylactic immunization/treatment of susceptible personnel.

(5) Use of personal protection devices such as dust masks/scarves to reduce exposure to noxious or infectious dusts, spores etc.

3. Vector-borne diseases

a. Arthropods transmit many communicable diseases. Two classes of arthropods involved are insects (fleas, flies, lice, mosquitoes, etc.) and arachnids, (ticks, mites, spiders, etc). Diseases transmitted by these vectors may include malaria, yellow fever, sandfly fever, typhus, plague, spotted fever, dengue and hemorrhagic fevers. Troop morale and major operations will be adversely affected, and relapse and extended recovery time can be anticipated with these diseases.

b. Transmission occurs in two ways. Mechanical transmission is the carrying of disease agents on or in the body of the vector with deposition on food, water, open sores or soil which is inhaled as dust. Biological transmission occurs when a vector ingests the disease agent by feeding on an infected person or animal. At this point, the infectious agent can remain the same, multiply, and transform within the body of the vector. The disease is transmitted to a susceptible host when the vector bites, defecates or regurgitates on the host with subsequent introduction of infectious agents into the blood or other tissues.

c. Control involves:

(1) Surveillance for vector identity, prevalence and breeding sites.

(2) Chemical applications targeted to one of the stages in the life cycle of the infected vector. Consult Chapter 8 of this manual for detailed instructions on chemical control of vectors.

(3) Physically controlling the vector by eliminating breeding sights and harborages; properly using netting, screens, protective clothing, etc.; the liberal use of approved repellents.

(4) Obtaining and using prophylactic medications such as doxycycline or chloroquine and primaquine for malaria prevention, or vaccination for Japanese encephalitis virus.

4. Parasitic Diseases

a. There are a variety of parasitic diseases in which man plays a part in the life cycle, or in which man accidentally becomes infected with a disease agent by unintentionally interrupting the life cycle of a parasite.

b. Some parasitic diseases are the result of poor sanitation, inadequate clothing, or improper cooking methods. All food, particularly food taken from the native countryside, should be thoroughly cooked or disinfected. Fresh fruits and vegetables should be washed carefully and chemically disinfected, as "Night Soil" (human feces) is commonly used as a fertilizer in many underdeveloped nations. All troops should be discouraged from going barefoot and from drinking, bathing and

swimming in rivers and streams. It is also commonplace in many areas of the world to defecate or urinate in irrigation ditches which are also used by the local populace as a source of cooking and washing water. Emphasis should be placed on careful disposal of human wastes.

5. Zoonotic Diseases are those transmitted under natural conditions from vertebrate animals (hosts) to man either directly (rabies) or indirectly by vector borne means (plague). The best prevention for this broad group of diseases is avoidance of animals that are acting unnaturally, dead animals and animal nests and burrows. Medical intelligence is essential in identifying enzootic or epizootic diseases in the area of operation (AO).

6. Sexually Transmitted Diseases (STD) are passed from one person to another by intimate sexual contact. The types of STD most frequently encountered in field environments are gonorrhea, non gonococcal urethritis, chancroid, syphilis, lymphogranuloma venereum, herpes and venereal or genital warts (condylomata acuminata). In recent years, gonorrhea has developed a resistance to penicillin therapy (i.e., penicillinase producing *Neisseria gonorrhoea*, PPNG). This is particularly true in the Far East and Indian ocean areas. Refer to current instructions and literature for appropriate therapy. Vigorous educational efforts must be made prior to and during a deployment in order to effectively reduce STD morbidity. Lectures/training should emphasize abstinence and the correct use of condoms. In planning for deployments in countries where prostitution is legal or widespread, the local availability of condoms should be considered.

7. *Other Diseases of Military Importance*

a. *Pediculosis* is an infestation of lice on various parts of the body, depending on the species of the louse. The adult lice and eggs (nits) generally stay in the hairy parts of the body or in the clothing worn close to the body, particularly in the seams. Lice are spread from person to person by direct contact or by indirect contact such as sharing of clothing, head gear or sleeping bags.

b. *Scabies* is an infectious disease of the skin caused by a mite. Penetration of the skin is visible as

papules, vesicles, or tiny linear burrows containing the mites and their eggs. Mite lesions are prominent in the webbing between the fingers, anterior surfaces of wrists and elbows, anterior axillary folds, belt line, thighs and exterior genitalia in men. Nipples, abdomen and lower portion of the buttocks are frequently affected in women. The transmission of mites is by direct, skin-to-skin contact, frequently during sexual contact and to a limited extent, from undergarments or soiled bed clothes freshly contaminated by an infected person.

8. *Venomous Animals*. There are numerous species of venomous animals throughout the world. Prior to deployment, a thorough review of available medical intelligence is necessary. Once dangerous and venomous species are identified, troop education will help reduce morbidity and mortality from these sources. In some cases, anti-venoms are available, and should be included in medical supplies if practical. If the anti-venoms are too expensive or fragile to take on the deployment, identification of their nearest location must be made prior to deployment.

9-44. Communicable Disease Reporting.

1. Regulations pertaining to communicable disease reporting are contained in NAVMEDCOMINST 6220.2 series, Disease Alert Reports. These reports are required for specified diseases or increased sick call morbidity that may affect operational readiness, be a hazard to the community, be spread through transfer of personnel, require diagnostic, epidemiologic, or other medical assistance or be of such political or journalistic significance that inquiry may be made to the Bureau of Medicine and Surgery or higher authority.

2. Disease Alert Reports are to be initiated by the medical unit that initially suspects or diagnoses disease occurrence as noted above, usually the Battalion or Regimental Aid Station. Further guidance may be obtained from organic Preventive Medicine Services, the area Naval Hospital Preventive Medicine Department, or the cognizant Navy Environmental and Preventive Medicine Unit.

APPENDIX A

SOURCES OF MEDICAL INTELLIGENCE FOR THE NAVY AND MARINE CORPS

- A-1. Officer in Charge
Navy Environmental and Preventive
Medicine Unit No. 2
Naval Station, Norfolk, VA 23511-6288
AV 564-7671
COM (804) 444-7671
FAX (804) 444-1191
- A-2. Officer in Charge
Navy Environmental and Preventive
Medicine Unit No. 5
Box 143
Naval Station, San Diego, CA 92136-5143
AV 526-7070
COM (619) 556-7070
FAX (619) 556-7071
- A-3. Officer in Charge
Navy Environmental and Preventive
Medicine Unit No. 6
Box 112
Pearl Harbor, HI 96860-5040
AV 471-9505
COM (808) 471-9505
FAX (808) 474-9361
- A-4. Officer in Charge
Navy Environmental and Preventive
Medicine Unit No. 7 (Naples, IT)
FPO New York, 09521-4200
AV 18-625-1110 ext. 4468/4469
COM 9-011-39-81-724-4468/4469
FAX 39-81-762-4045
- A-5. Officer in Charge
Navy Disease Vector Ecology
and Control Center
Naval Air Station
Jacksonville, FL 32212-0043
AV 942-2424
COM (904) 772-2424
FAX (904) 779-0107
- A-6. Officer in Charge
Navy Disease Vector Ecology
and Control Center
Naval Air Station, Bldg. 130
Alameda, CA 94501-5039
AV 993-2806
COM (510) 263-2806
FAX (510) 263-2799
- A-7. Commanding Officer
Naval Medical Research Unit No. 2 (Manila, RP)
APO San Francisco, CA 96528-5000
COM 632-732-3778
FAX 632-732-3107
- A-8. Commanding Officer
Naval Medical Research Unit No. 3 (Cairo, Egypt)
FPO New York 09527-1600
COM 39-81-202-350-6854
FAX 011-202-282-2039
- A-9. Officer in Charge
U.S. Naval Medical Research
Institute Detachment (Lima, Peru)
APO Miami 34031-0008
COM 39-51-14-529-662
- A-10. Officer in Charge
U.S. Naval Medical Research
Institute No. 2 Detachment
APO San Francisco 96356-5000
COM 622-141-4507
- A-n. Armed Forces Medical Intelligence Center
Fort Detrick
Frederick, MD 21701-5004
AV 343-7511
COM (301) 663-7511
FAX (301) 663-2409
- A-12. Local Naval Hospital/Naval Medical Clinic
Preventive Medicine Services. Note: All medical
intelligence data, no matter what form, must be
shared with the G-2/4, S-2/4 and other cognizant
staff offices.

APPENDIX B

REFERENCE

B-1. Navy Instructions

1. OPNAVINST 5090.1 Series, Environmental and Natural Resources Protection
2. NAVSUPINST 5100.24 Series, Calcium Hypochlorite
3. NAVMEDCOM 6240.1 Series, Standards for Potable Water
4. NAVMEDCOMINST 6220.2 Series, Disease Alert Report
5. BUMEDINST 6222.10 Series, Sexually Transmitted Disease (STD) Clinical Management Guidelines
6. SECNAVINST 6222.1 Series, Policy on Venereal Disease Control
7. NAVMEDCOMINST 6230.1 Series, Viral Hepatitis Prevention
8. NAVMEDCOMINST 6230.2 Series, Malaria Prevention and Control
9. NAVMEDCOMINST 6230.3 Series, Medical Services Immunizations and Chemoprophylaxis

B-2. Marine Corps Orders

1. Marine Corps Order 6200.1 Series, Heat Casualties
2. Marine Corps Order P-10110.14 Series, Food Ser-

- vice and Subsistence Management Manual
3. FMFM 4-5, Medical and Dental Support

B-3. Navy Publications

1. NAVMED P-5038, Control of Communicable Diseases in Man
2. NAVMED P-5010, Chapters 1-8
3. NAVMED P-5052-5, Technical Information Manual for Medical Corps Officers, Chapter 5, Prevention and Control of Heat Injury
4. NAVMED P-5041, Treatment of Chemical Agents Casualties and Conventional Military Chemical Injuries

B-4. Army Publications

1. TB MED 576, Sanitary Control and Surveillance of Water Supplies at Fixed Installations
2. TB MED 577, Sanitary Control and Surveillance of Field Water Supplies
3. FM 21-10, Field Hygiene and Sanitation
4. FM 10-23, Basic Doctrine for Army Field Feeding
5. FM 90-3, Desert Operations
6. FM 8-250, Preventive Medicine Specialist

APPENDIX C

WET-BULB GLOBE TEMPERATURE INDEX (WBGTI) SYSTEMS

C-1. *Installation.* This appendix describes the materials required to assemble a WBGT station. Certain items, such as clamps, stoppers, and flasks, have not been addressed but are required to assemble this station. Refer to Marine Corps Order 6200.1 series, Subj: Heat Casualties, Appendix A. Included in this appendix also are two heat stress instruments that are currently available in the stock system.

C-2. *Use.* A copy of instructions for the appropriate instrument must be prominently displayed at each WBGT station.

C-3. *Instrument Procurement.* Most instruments have been provided on a one-time basis. Additional instruments may be obtained locally so long as specifications are the same. Sources of the three sets are provided as follows:

a. *Shelter Instrument Thermoscreen.* This item is listed in section L of the Naval Aviation Supply table 00-34-QL-22 under Meteorological Equipment for Aerological Units. The stock number is 5410-00-267-8898, ML-41 (medium standard cotton region-type).

b. *Globes.* These are copper hemispheres, 6 inches in diameter and obtained in pairs. The manufacturer is Arthur Harris and Company, 210-218 North Aberdeen Street, Chicago, Illinois 60607.

c. *Mercury Thermometers.* These instruments are ordinary thermometers of about 30 cm overall length. The range of thermometer is from 30° to 150° F in one increment. The manufacturer is Nurnberg Thermometer Company, Inc. 127 Merrick Road, Rockville Center, New York 11570.

C-4. *Distribution* Those commands in receipt of instruments will install and maintain instrument sites, as required, and provide the readings to subordinate commands for use in the regulation of training when temperatures exceed 80° F.

C-5. *The WBGTI.* This index is a single number derived mathematically from three distinct temperature measurements: wet bulb temperatures, dry bulb temperatures, and globe temperatures. Training programs in warm weather should be planned provisionally on the basis of the WBGTI. Readings are to be taken every hour on the hour from 0800-1700 (local time) or until training is completed. Readings of all thermometers must be taken and recorded at the same time.

a. INSTRUMENTS

(1) *The Wet Bulb Thermometer*

(a) The natural Wet-bulb thermometer is an ordinary mercury thermometer, 30° to 150° F, with a wet wick around the bulb and exposed in an unshaded position to natural air movement and to solar radiation. The natural wet-bulb is cooled by natural convection but at the same time is warmed by solar radiation; and therefore, for the same air movement, its reading will be higher than a shaded wet-bulb.

(b) The natural wet-bulb thermometer is

suspended from a horizontal arm support by the same upright used to mount the globe thermometer.

(2) *The Dry Bulb Thermometer* This is an ordinary thermometer which measures air temperature and is the only instrument kept inside the thermoscreen shelter.

(3) *The Globe Thermometer*

(a) The Globe thermometer consists of a 6-inch sphere of copper painted matte black on the outside. In to the neck of the globe is inserted an ordinary mercury thermometer, 12 inches long and graduated from 30° to 150° F. The thermometer is held in place with a tight-fitting, one-hole rubber stopper; the bulb of the thermometer being centered at the midpoint of the globe.

(b) The Globe thermometer should be mounted from a 6-foot vertical support with a horizontal arm about 36 inches long. The globe is suspended by a sturdy braided flexible wire from the outboard end of the horizontal arm. The center of the globe should be 48 inches from the ground. The arm must point south to avoid a shadow of the upright from falling on the globe.

(c) The purpose of the globe thermometer is to combine the thermal effects of the radiation from the sun and hot surfaces in the environment into a single reading. This reading, when related to humidity, will provide a means of estimating total heat stress in the environment.

(d) To perform reliably, the globe must be situated in a widely open area where it will not be shielded in any way from the sun and wind. The ground below should be either grass or gravel. Asphalt surfaces are not desirable.

(e) The globe requires no attention except that the surface should be kept free of dust and streaks and must be repainted each year. After rain, the thermometer should be removed and the globe turned upside down to empty any water that may have leaked in.

(4) *Results.* It can readily be seen that the three instruments described above take into account all four variables of the normal environment; temperature, humidity, radiation, and air circulation.

b. *Formula* The WBGTI is calculated as follows:

Dry-Bulb Temperature	x 0.1
Wet-Bulb Temperature	x 0.7
Globe Temperature	x 0.2
Total	WBGTI

C-6. *Wet Bulb Globe Temperature Kit-NSN 6665-00-159-2218.* The WBGT Kit is enclosed in an aluminum case that contains three different thermometers. The threaded hole in the bottom of the case is used to attach the case to a standard lightweight photographers tripod that is not supplied with this kit. Place the kit with the thermometers toward the sun, with the "black globe" thermometer closest to the sun.

a. A stationary wet bulb thermometer exposed to the sun and prevailing wind.

b. A similarly exposed "black globe" thermometer with a black sheath over the bulb. The sheath and bulb

are inside a transparent perforated plastic shield.

c. A dry bulb thermometer with its bulb shielded from the direct rays of the sun by a shield painted white.

d. The WBGTI is determined by utilizing the attached slide rule and readings from the three different thermometers.

C-7. Wet-Bulb Globe Temperature (WBGT) Meter, NSN 7G 6685-01-055-5298

a. This instrument is also known as the Heat Stress Meter. It is a compact electronic instrument that independently measures the dry-bulb, wet-bulb, and globe temperatures. The instrument displays each of these values as well as computes and displays the

WBGTI.

b. It is lightweight, self-contained, and equipped with a rechargeable power supply.

c. A ventilating fan is included in the shielded dry and wet-bulb sensor assembly to obtain aspirated wet-bulb temperatures.

d. The entire unit can be adapted for remote monitoring and reading.

C-8. WBGTI Log Sheet. The provided WBGTI Log Sheet may be locally reproduced, and maintained at each instrument site or a log book may be utilized with the same information. All the readings from each instrument site must be maintained for 1 year.

WBGTI LOG SHEET

Date

Time (Local)	Instrument Inside Shelter	<u>A</u> Enter Dry-Bulb Reading x 0.1 =	Instrument Outside Shelter Globe Thermometer Reading	<u>B</u> Enter Globe Thermometer Reading x 0.2 =	Instrument Outside Shelter Natural Wet-Bulb Thermometer Reading	<u>C</u> Enter Natural Wet-Bulb Thermometer Reading x 0.7 =	Columns A + B + C = WBGTI	Enter Flag Color
0800								
0900								
1000								
1100								
1200								
1300								
1400								
1500								
1600								
1700								

Note: This log sheet may be locally reproduced, maintained at the instrument site, and disposed of after 1 year.

FLAG COLORS AND CORRESPONDING TEMPERATURES

White Flag	Green Flag	Yellow Flag	Red Flag	Black Flag
<80° F	80 to 84.9°F	85 to 87.9° F	88 to 89.9° F	>90° F