Field Manual
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DEPARTMENT OF THE ARMY
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UNIT FIELD SANITATION TEAM

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PREFACE

Purpose and Scope

To fulfill the requirements in AR 40-5, this manual provides a training program for personnel appointed as members of the field sanitation team of each company, battery, or similar unit. It contains a master schedule, a text which may serve as reference material for the instructor, and lesson plans with supporting illustrations. The lesson plans should be modified in order to place more emphasis upon special problems for your particular geographical area of operations. The demonstrations and practical exercises, which are described with the subject matter to which they pertain, maybe grouped into more comprehensive field exercises. Metric measurements used throughout this publication are approximate equivalents of the customary units of measure and are provided for the convenience of the instructor.

Gender Statement

When used in this publication, “he,” “him,” “his,” “men,” and “soldier” represent both masculine and feminine gender unless otherwise stated.

User Comments

Users of this manual are encouraged to submit recommended changes and comments to improve the publication. Comments should be keyed to the page, paragraph, and line of text in which the change is recommended. Reasons will be provided for each comment to ensure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications) and forwarded direct to: Commandant, Academy of Health Sciences, US Army, ATTN: HSHA-TLD, Fort Sam Houston, Texas 78234-8100.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Objective of Field Sanitation Team Training

The objective of this instructional program is to train the field sanitation team to ensure that small units have preventive medicine resources to reduce disease and nonbattle injury (DNBI) as outlined in this manual, AR 40-5 (Preventive Medicine), and FM 21-10 (Field Hygiene and Sanitation).

1-2. Responsibilities

The commander is responsible for appointing and training the field sanitation team (AR 40-5). The Army Medical Department is responsible for providing the necessary technical guidance.

1-3. General Guides

a. Role of Field Sanitation Team. The role of the field sanitation team is to aid the unit commander in protecting the health of the command; this is accomplished by advising and assisting him in the many duties essential to reducing DNBI. By means of performing, instructing, supervising, assisting, inspecting, and reporting, the field sanitation team ensures that appropriate field sanitation facilities are established and maintained; that effective sanitary and control measures are applied; and that effective Preventive Medicine Measures (PMM) are practiced.

b. Selection of Team Members.

(1) The selection of team members should be made from personnel whose normal field duties allow them to devote sufficient time to field sanitation activities. Personnel whose MOS and training require full time operation under field conditions, such as kitchen personnel, motor pool personnel, and clerks, should not be appointed members of the field sanitation team.

(2) The field sanitation team must consist of at least two soldiers, one of whom must be a noncommissioned officer when organic medical personnel are not available. However, aidmen/combat medics will constitute the field sanitation team in units having organic medical personnel.

(3) In order that the unit may benefit fully from the training given the field sanitation team members, considerations in their selection should be given to the individuals initiative, aptitude, and to individuals who have at least 6 months service remaining with their unit. Only highly motivated soldiers should be selected for this critical duty, when organic medical personnel are not available.

c. Training of Team Members.

(1) The training should be conducted under field conditions and with the frequency necessary for the team to maintain proficiency.

(2) Principles and techniques of effective military instruction, including examinations, are defined and discussed in FM 25-1, FM 25-2, FM 25-3, FM 25-4, and FM 25-100.

d. Application of This Manual. The master schedule and lesson plans presented in this manual should be considered as guides to instruction; actual content of material to be presented during training classes is flexible and may be tailored to the type and situation of units for which the training is to be conducted.

Section II. MASTER SCHEDULE (20 Hours)

Period	Subject	Hours and type of Instruction	Scope of instruction	References
1	Introduction, medical threat and preventive medicine measures	1-Lecture and conference	The importance of the field sanitation team. The medical threat, PMM, and the individual in the field environment.	AR 40-5; FM 21-10; and chap 2, this manual.
2	Personal hygiene and preventive medicine measures	1-Lecture and conference	The role of the field sanitation team in relation to the unit commander and soldiers. Personal hygiene and PMM not discussed under other subjects.	AR 40-5; FM 21-10; and chap 2, this manual.
3	Water supply	2-Lecture and practical exercises	Importance of water in the practice of sanitation, including water as a vehicle in transmission of disease. Quantity of water needed for soldiers. Production of potable water. Chlorine residual determination.	AR 40-5; FM 21-10; chap 2, this manual and CTA 8-100.
4	Food service sanitation	1-Lecture and demonstration	Importance of sanitary practices in food handling. Transportation and storage of food. Personal hygiene of food handlers. Cleaning and sanitizing utensils. Physical facilities. Preparing and serving food. Inspection of food service facilities.	AR 40-5, FM 10-23; FM 21-10, TB MED 530; and chap 2, this manual.

MASTER SCHEDULE (CONTINUED)

Period	Subject	Hours and type of Instruction	Scope of instruction	References
5	Waste disposal in the field	2-Demonstration, conference, and practical exercise	Importance of proper waste disposal in prevention of diseases and nuisances. Construction of facilities for proper waste disposal in the field. Special problems in disposal. Maintenance and closing of waste disposal facilities.	AR 40-5; FM 21-10; and chap 2, this manual.
6	Arthropods and disease	1-Lecture	Direct and indirect ways arthropods affect the health of man.	AR 40-5; FM 21-10; TM 5-632; and chap 2, this manual.
7	Control of arthropods through field sanitation and individual PMM	2-Lecture and demonstration	Environmental control of arthropods through field sanitation. Individual PMM.	AR 40-5; FM 21-10; TM 5-632; and chap 2, this manual.
8	Control of arthropods with pesticides	2-Lecture, demonstration and practical exercise	Chemical control, including pesticides and equipment	AR 40-5; FM 21-10; TM 5-632; SB 3-40; CTA 50-990; and chap 2, this manual.
9	Rodent control	2-Lecture, demonstration and practical exercise	Habits of rodents. Relation of rodents to human disease. Environmental, mechanical, and chemical control measures	AR 40-5; FM 21-10; TM 5-632; and chap 2, this manual.
10	Heat injuries	1-Lecture	Recognize the types of heat injuries, factors influencing injuries and PMM	AR 40-5; TB MED 507; and chap 2, this manual.
11	Cold injuries	1-Lecture, demonstration and practical exercise	Recognize the types of cold injuries, factors influencing injuries and PMM	AR 40-5; TB MED 81; and chap 2, this manual.
12	Chemical hazards (NonNBC)	1-Lecture	Recognize the toxic chemical threat, plan for toxic chemicals, identify sources, develop protective actions and enforce PMM.	AR 40-5; FM 8-250; TB MED 503; and chap 2, this manual.

MASTER SCHEDULE (CONTINUED)

Period	Subject	Hours and type of Instruction	Scope of instruction	References
13	Noise hazards	1-Lecture	Recognize the types of noise, the effects of noise on soldiers and unit mission, and PMM.	TB MED 501; and chap 2, this manual.
14	Examination	2-Examination and discussion	A comprehensive test which serves as a valid, reliable, and discriminating instrument for evaluating the effectiveness of instruction and individual student learning. A discussion following the test to enhance student learning.	FM 25-1; FM 25-2; FM 25-3; FM 25-4; and FM 25-100

CHAPTER 2

INSTRUCTOR'S REFERENCE MATERIAL

Section I. INTRODUCTION: RELATIONSHIP BETWEEN THE INCIDENCE OF DISEASE AND THE ENVIRONMENT

2-1. Importance of the Field Sanitation Team

a. The field sanitation team (FST) is responsible for those preventive medicine measures (PMM) that affect units as a whole or are beyond the resources of the individual soldier (AR 40-5). This is a most important responsibility because unit effectiveness is greatly dependent upon the health of its soldiers. Military units are unable to carry out their missions when the soldiers are weakened by disease. The success or failure of an army, the outcome of a war, and the fate of a nation may, therefore, rest upon how well diseases and nonbattle injuries (DNBI) are prevented through effective PMM in the units. For example, historical records of armies in the field are replete with accounts of failures for which disease was a major contributing factor. This was true of Napoleon in his retreat from Moscow in 1812. Confronted with cold weather and louse-borne typhus, his elite army was almost completely decimated. However, Napoleon's loss is understandable in view of his lack of knowledge concerning the medical threat. Yet, modern armies have also experienced great losses from DNBI. Arthropod-borne diseases alone were responsible for the loss of 16,576,100 man–days among United States Armed Forces during World War II. The entire Asiatic-Pacific campaign in World War II was seriously threatened by the debilitating effects of malaria. In one instance during the campaign for the Solomon Islands, casualties from malaria were eight times those caused by the enemy.

b. The forerunner of the present field sanitation team was established during World War II. When it became apparent that the control of malaria and other arthropod-borne diseases was beyond the capability of existing engineer and medical units, commanders of company-size units were required to appoint malaria control details. In 1956 the operation of these details was broadened to include the control of all animal pests. In 1958, health problems encountered in the field by the American Task Force in Lebanon focused attention on the need for a team with broader training. Subsequently, the vector control detail became the field sanitation team with its training expanded to include not only the control of potential animal vectors but also field water supply, food service sanitation, waste disposal, and personal hygiene. The field sanitation team, therefore, plays a major role in reducing DNBI. When the unit commander encounters problems beyond the capabilities of the field sanitation team, he requests assistance from supporting preventive medicine elements.

2-2. The Medical Threat

a. The impact of casualties caused by DNBI upon military campaigns has been a prominent and a continuous feature of military operations. From the beginning of recorded history up to the present time, armies have had immense problems with heat, cold, and communicable diseases. In all US conflicts, three times as many soldiers have been lost to DNBI as to enemy action. The ultimate objective of a military force, success in battle, demands that troops be maintained in a constant state of good health.

b. There are four major components of the medical threat to field forces—

- Heat is the most lethal category of all. Those of us born and raised in temperate climates have a hard time relating to heat and its awesome impact. During the 1967 Arab-

Israeli conflict, the Israelis enveloped the Egyptians, severing their lines of support, the Egyptians suffered 20,000 deaths due to heat while the Israelis had no deaths and only 128 cases of heat injury. The Israelis demonstrated that health hazards, such as heat, can be as effective as tactical weapons in securing success on the battlefield. In the US Sinai Peacekeeping Force, 1982, thirty-five members of an airborne company were incapacitated by the desert heat. These soldiers were so badly dehydrated that they required intravenous fluids to recover. Commanders can minimize the effects of heat by: ensuring soldiers drink adequate amounts of water, based on the heat category, since thirst is a poor indicator of a body's need for water; ensuring they consume three meals a day to replace lost electrolytes; and when the tactical situation permits, following correct work/rest cycles.

● Cold can also be very incapacitating on the battlefield. In World War II, during the winter of 44-45 in the European theater, over 54,000 US soldiers were admitted to hospitals with cold injuries. Over 90,000 US soldiers were admitted with cold injuries throughout the war. In the twenty-four days the British were in combat on the Falkland Islands, they sustained 777 total casualties, 109 (or 14%) were cold injuries. When the British had the Argentineans surrounded at Port Stanley, they could have waited until the Argentineans exhausted their food and water. But they were forced by the adverse environment to attack, thus sustaining additional combat casualties. Commanders can reduce the risk of cold injuries by incorporating weather data into operations planning, enforcing the proper wearing of the uniform, particularly frequently changing wet or damp socks; and when the tactical situation permits, providing warming areas.

● There are many species of arthropods that transmit diseases which seriously affect military operations. Napoleon's Le Grand Armee numbered over 600,000 when it crossed the Russian border in June of 1812. Although he succeeded in taking Moscow, his troops were decimated by guerrillas, disease, and cold injury, forcing his retreat. Only 100,000 men returned to France. There were 70,000 combat losses versus 430,000 DNBI losses. It is estimated that over 100,000 of Napoleon's soldiers were lost to louse-borne typhus. And recently, nearly fifty percent of the US units in Grenada were deployed to that tropical environment without insect repellent, and at least one unit was using ineffective Cuban repellent. Commanders must ensure: soldiers consume malaria pills, when necessary; insect repellent is used liberally; and when the tactical situation permits, bednets are used.

● Diarrheal disease can be contracted from contaminated water or food, but in either case it can have catastrophic impact on a fighting force; Rommel's situation in North Africa is a superb example. Not one of Rommel's original highly successful generals was available to help him when he needed them most—at El Alamein, they had all, over time, been medically evacuated for illness. Rommel himself was not present when the battle began, he was in Germany recovering from hepatitis. His Chief of Staff and his Intelligence Officer were evacuated just prior to the battle and his Operations Officer was evacuated during the battle, all three for amoebic dysentery. In Operation Bright Star, 1980, the US commander rewarded his troops for a job well done by allowing them to go into town the evening prior to redeployment. Thirty percent of his command contracted shigellosis and were simultaneously vomiting and defecating in the aircraft on the flight back to the states. Commanders must ensure that: soldiers only consume food and water from approved sources; waste disposal and handwashing devices are constructed; and unit dining facilities are operated under sanitary conditions. The above examples are just as relevant today as in the past. These commander's responsibilities are not all-inclusive, but outline a few measures that only the commander can

enforce. Emphasis is usually placed only on those things the commander himself checks; therefore, it is important for him to appoint and train a functional field sanitation team because the ultimate responsibility for ensuring the health of soldiers rests with the commander. Commanders must gain a new awareness of the importance of preventive medicine. The direct relationship between soldier health and success in battle must be emphasized throughout the chain of command. In the Soviet commander's decision-making process, his correlation of forces assesses a degradation of our fighting force over time due to factors such as disease and nonbattle injury. If commanders ignore the medical threat facing us, our degradation can be greater over a shorter period of time. However, with sound PMM we can maintain our fighting strength, and exploit that strength when the enemy expects weakness.

c. In the field our soldiers have increased vulnerability to disease and nonbattle injury because of—

- The harshness of the environment, and the tactical situation often requiring us to go into places good sense tells us to avoid. The environment may be mosquito-infested jungles; sandfly-infested villages; hot, dusty deserts; or cold windy plains. Our soldiers and their leaders must be prepared to live and fight in such places.

- The disruption of the body's natural defenses. The human body has an excellent capacity to protect itself against disease and climatic injury. But the efficiency of these mechanisms is dependent upon our overall well being. By deploying soldiers halfway around the world, we disrupt their circadian rhythms. Adding heat or cold, feeding meals at irregular hours, and depriving soldiers of sleep, soon result in individuals who are more susceptible to illness and combat stress.

- Breakdowns in basic sanitation. Potable water and proper waste disposal are examples of things taken for granted in garrison. But even using the latrine or changing your socks becomes a challenge when you are living in a muddy foxhole.

2-3. The Individual in a Field Environment

a. Ordinarily, the US Soldier has a high standard of personal hygiene when in an environment with convenient facilities. In the field, however, where proper sanitation requires coping with the elements of nature, a problem arises; the soldier is suddenly faced with inconveniences.

b. In garrison, an individual follows a rather routine course after arising in the morning. Routine acts of personal hygiene are performed in a conveniently located latrine that is warm and has hot and cold water. However, upon arising in the field, one may feel too cold to change into clean underwear. Even in the summer, a cold-water shower is uncomfortable. Usually, the toilet in the field is not as pleasant as the one in garrison. An ordinarily well groomed individual may become dirty and unkempt. Filth and disease go hand in hand. Dirty, sweaty socks may cause the feet to be more susceptible to disease. Dirty clothing worn for a prolonged period of time and unwashed hair are open invitations to lice. The problems entailed in reducing DNBI, therefore, pertain not only to the existing elements of nature but also to the reactions of soldiers brought into the environment. Inadequate individual PMM in the field is one of the most difficult problems to overcome, because it requires a sense of responsibility on the part of each individual to try to maintain his health regardless of difficulties encountered.

2-4. Duties of the Field Sanitation Team

The FST duties may be categorized both as basic sanitation and as arthropod and rodent control. They entail the following:

a. Basic Sanitation and Protection.

(1) Supervise the disinfection of water in the unit area. Instruct soldiers as necessary in individual water purification methods (Section II).

(2) Advise the unit food service personnel in the prevention and elimination of deficiencies in food service sanitation. Instruct the soldiers as necessary in methods of washing individual eating utensils (Section III).

(3) Supervise the construction of garbage and soakage pits and assist the unit commander in inspections for proper disposal of garbage (Section IV).

(4) Supervise the construction of field latrines and urinals and assist the unit commander in the inspection for proper sanitation (Section IV).

NOTE

A unit detail is responsible for the actual construction of field waste disposal facilities.

(5) Assist the unit commander in the guidance and inspection of personnel and facilities to ensure a high level of personal hygiene (paragraph 2-5 *a).*

(6) Provide guidance as needed in the use of protective measures to prevent heat and cold injuries (paragraph 2-5 *b).*

(7) Report inadequacies to the unit commander.

b. Arthropod and Rodent Control.

(1) Ensure the practice of proper waste disposal which is essential for arthropod and rodent control (Section IV).

(2) Explain to soldiers the ways in which arthropods may affect their health (Section V) and instruct them in the use of individual protective measures against arthropods (Section VI).

(3) Supervise the application of or apply pesticides as required for arthropod control (Section VI).

(4) Inspect to ensure the elimination of food and shelter (harborage) for rodents (Section VII).

(5) Supervise the use of traps and authorized rodenticides as required in the control of rodents (Section VII).

(6) Report inadequacies to the unit commander.

2-5. Personal Preventive Medicine Measures

Various aspects of personal PMM are discussed in relation to water supply (Section II), food service sanitation (Section III), waste disposal (Section IV), arthropod control (Section VI), and rodent control (Section VII). Those aspects which are not discussed elsewhere are as follows:

a. Personal Hygiene.

(1) The FST can promote personal hygiene of soldiers by arranging for facilities such as handwashing and showering devices, hot water for shaving, and a heated place to dress. Handwashing devices are provided outside latrine enclosures and in the food service area. They may also be set up at other points in the bivouac area. They are constructed so that they operate easily and are kept filled with water at all times. All washing and showering devices must have a soakage pit underneath them to prevent water from collecting and forming pools.

(2) The team members provide soldiers guidance or instruction as needed in regard to the hazards involved when personal hygiene is neglected (paragraph 2-3). They assist the unit commander in inspecting soldiers and their billets to ensure adequate personal hygiene, including body, hair, and teeth; airing sleeping bags; wearing clean clothes; and disposing of refuse. Moreover, enforcement of sanitary control measures pertaining to all camp facilities encourages soldiers to have more pride in their personal hygiene.

b. Preventive Medicine Measures. The FST provides guidance as needed in the use of PMM to prevent cold injuries. Hypothermia or frostbite may be prevented by wearing several layers of warm, loosely fitting clothing; by protecting the face from the wind; and by exercising the face, fingers, and toes to keep them warm. Trench foot, which results from standing in cold water or slush when the temperature is between 32^0 and 50^0F (0^0 and 10^0C) may be prevented by the use of protective footgear and dry socks. Snow blindness, which occurs when the sun shines brightly on unbroken ice or snow, can be prevented by wearing sunglasses or an improvised device made of cardboard or cloth and by blackening the areas around the eyes.

Section II. WATER SUPPLY

2-6. Importance of Water in the Practice of Sanitation

a. General. Water is essential to the army in the field. Safe water ranks in importance with ammunition and food as a unit of supply in combat and often has an important bearing on the success or failure of a mission. When in the field, soldiers must be supplied with sufficient water to drink and to maintain personal hygiene. The water for these purposes must be safe for human consumption and should be reasonably free of objectionable tastes, odors, turbidity, and color.

b. Water as a Vehicle in Disease Transmission. A primary source of illness to the soldier is waterborne disease organisms. Common waterborne diseases of man are hepatitis, typhoid and paratyphoid fever, bacillary and amoebic dysentery, cholera, common diarrhea, leptospirosis, and schistosomiasis (snail fever). No direct method has been developed for detecting the minimum infectious quantities of these organisms in water; therefore, it is necessary to resort to an indicator test to determine the bacteriological acceptability of water. The water is tested for the presence of coliform bacteria. Coliform bacteria are found in great numbers in the excreta (feces) of humans, warm-blooded animals, and in soil. Also many of the diseases mentioned above are spread through feces. Although the presence of coliform bacteria in water may not prove fecal contamination it is an indication that pathogenic (disease-carrying) organisms may be present. This test is the best indicator that contamination exists, therefore, we must assume that pathogens are present. Many military units in the field do not have the capability for determining the presence of coliform bacteria in water, hence all water must be thoroughly treated and disinfected before use.

c. Quantity of Water Required for Soldiers. The quantity of water required for soldiers varies with the season of the year, the geographical area, and the tactical situation. For instance in a cold climate, only one-half gallon (2 liters) of water per soldier per day may be required for drinking purposes even though they are engaged in active physical activity. On the other hand, 3 or 4 gallons (12-16 liters) per man per day may be required in a hot climate when they are engaged in only sedentary duty. Additional amounts of water are required for personal hygiene and cooking. A guide for planning to meet the water requirements in an arid zone is 3-6 gallons (11-23 liters) per individual per day unless improvised showering facilities are made available. In this case the requirement should be increased to 15 gallons (57 liters) or more. (For additional information on water requirements see FM 10-52.)

2-7. Responsibilities for the Production of Potable Water in the Field

a. Army Medical Department. The bacteriological examination of water, as well as the chlorine residual and pH tests under some circumstances, is done by the Army Medical Department as part of its responsibility for military water supply. The Army Medical Department establishes standards for water quality; inspects water points or sources; advises the proper authorities as to methods of purification which may be used to produce safe water; and after appropriate laboratory or field examination, approves water for consumption.

b. Corps of Engineers. The Corps of Engineers selects sources of water, and establishes water points. The selection of water points may be based on examination of data provided by the Army Medical Department as well as the reconnaissance performed by engineers.

c. Quartermaster Corps. The Quartermaster Corps (QM) sets Up and operates bulk water treatment equipment. They procure, treat and distribute the treated water. Sometimes, the QM units transport water to centralized distribution points (dry points) for convenient pick up by military units. However, the usual practice is to provide standpipes adjacent to the water point for filling unit water trailers or containers.

d. Unit Commander. Water supply and treatment in the unit are responsibilities of the unit commander. The commander makes certain that the unit has an adequate supply of safe drinking water; enforces the rules of water discipline; and ensures that each individual

thoroughly understands the danger of drinking unsafe water. The rules of water discipline are to: drink approved water only; prevent water waste; and protect water sources by good sanitary practices. It should be emphasized that water discipline does not imply teaching soldiers to do without water. It means using water intelligently and not wasting it.

2-8. Sources of Water

The six sources of water which may be used are surface, ground, rain, ice, snow, and sea water. Surface water includes streams, ponds, rivers, and lakes. Ground water includes wells and springs. Rain water is obtained by collecting it from the roofs of buildings or from other catchment surfaces. Water from ice or snow is obtained by melting the ice or snow. Water obtained from oceans or salty seas cannot be used for human consumption until it has been distilled or demineralized to remove the salt. Water taken from any of these sources must be treated before use, as all sources of water in the field are considered contaminated. In selecting a water source, the following factors are considered:

- The military situation.
- The quantity of water needed.
- The accessibility of the source.
- The general quality of the source.
- The type of purification equipment available for use.

a. Surface Water. Surface water is generally the most accessible, and is commonly selected for use in the field. It is usually more contaminated and polluted than other water sources; but in the field the quantity requirements are given priority over quality requirements.

b. Ground Water. When a surface source is not readily available, the engineers may select ground water for use. Even though ground water is usually less contaminated than surface water, from the bacteriological standpoint, and requires less treatment, it is extremely difficult to determine the quantity available. It is also difficult, costly, and time-consuming to drive or drill wells. Because of these disadvantages, the use of ground water in the field is limited unless existing native wells are available.

c. Other Sources. Rain, melted snow or ice, and sea water are used in special instances where neither surface nor ground water is available.

2-9. Water Treatment

a. General. The objective of water treatment is to produce potable water. Treatment processes used in the field are the same as those commonly used in civilian water treatment. These include, but are not limited to, coagulation and sedimentation to remove turbidity, filtration to remove the remaining turbidity and a large portion of the pathogenic organisms, and disinfection to kill the pathogenic organisms which were not removed by sedimentation and filtration. Water coagulation, sedimentation, and filtration are not discussed here, as these are specialized operations performed by the Quartermaster Corps.

b. Disinfectant. Chlorine is the chemical agent commonly used for disinfecting water. Calcium hypochlorite, which releases 70 percent of its weight as chlorine, is the compound normally used for field water disinfection. It is added to the water in the amount necessary to destroy the organisms (chlorine demand) with some remaining to serve as a continuing disinfectant (chlorine residual). Sudden disappearance of all chlorine probably indicates recontamination. A relatively small quantity of chlorine and contact time of at least 30 minutes is required for satisfactory water disinfection. Experience has proven that in most cases the major portion of the chlorine demand is satisfied within 10 minutes after chlorine dosage is added. If the required chlorine residual is present after this period, an additional contact period of 20 minutes is mandatory before the water can be consumed. Under ordinary field conditions the chlorine residual required is 5 parts per million/milligrams per liter (ppm/mgl) after a 30-minute total contact period. In areas of the world where amoebic, bacterial, or viral dysentery or infectious hepatitis are problems, chlorination (disinfection) requirements as recommended by the surgeon will be established by a command directive.

c. Method of Disinfecting Water.

(1) Use of water purification (Lyster) bag and calcium hypochlorite.

(a) This is the most satisfactory and convenient method for disinfecting water for a small unit in the field. The 36-gallon Lyster bag is issued to units on the basis of 1 per 100 persons. The calcium hypochlorite is issued in ampules for handling convenience. Each ampule contains 0.5 gram of calcium hypochlorite and gives a dosage of approximately 2 ppm/mgl when added to the water in the Lyster bag. As many ampules as necessary are used to provide the required 5 ppm/mgl chlorine residual after a 10-minute contact period. After the desired chlorine residual is obtained, the water is allowed to stand for an additional 20 minutes before use. When a residual above 5 ppm/mgl is desired, the 5 ppm/mgl chlorine residual after a 10-minute contact is first obtained, then the number of ampules of calcium hypochlorite required to create the desired residual are added. The number required is based on the fact that after the initial chlorine demand is satisfied, 1 additional ampule will raise the residual approximately 2 ppm/mgl in 36 gallons of water. After additional chlorine has been added, a 30-minute contact period must be allowed before the water is consumed.

(b) The Lyster bag must be cleaned before it is used and hung by supporting ropes before it is filled with water. The bag is cleaned with a solution made with one ampule of calcium hypochlorite dissolved in one gallon (3.8 liters) of water. The cleaned bag is filled only to within 4 inches (10 cm) from the top. If possible, the water is settled and clear (perhaps even strained through a cloth) before it is poured into the Lyster bag. Before the calcium hypochlorite is added, it is first dissolved in a canteen cup with a small amount of water taken from the Lyster bag. As this mixture is poured into the Lyster bag, the water is stirred with a clean stick. Then the faucets are flushed with a small quantity of water. After 10 minutes the faucets are flushed again, and the chlorine residual is determined (see paragraph *d* below). The sample must not be collected in the same cup or container used to dissolve the hypochlorite.

(2) Use of the 400-gallon (1514-liter) water trailer (Water Buffalo) and Calcium Hypochlorite.

(a) When the water trailer arrives in the unit area from the refill point, always check the chlorine residual. This accomplishes two things-first it verifies that the driver went

to an approved water point; and second, it verifies that the water point is maintaining the correct chlorine residual in the water. The chlorine residual should be at the level established for the area of operation. If the residual meets the required standard the water is safe to drink; if not, the water must be dechlorinated to the required level. After dechlorination the water must be checked periodically to maintain the minimum required level. Heat and sunlight will cause chlorine to evaporate/dissipate more rapidly; therefore, periodic dechlorination may be required.

(b) To dechlorinate a full water trailer, mix 3 MRE spoonsful of calcium hypochlorite from the 6 ounce bottle, or 22 ampules of calcium hypochlorite, with one-half canteen cup of water. Thoroughly mix the slurry and then add it to the water in the trailer. Use a clean stick or other clean device to mix the chlorine slurry in the water. Flush the four water taps for several seconds. Wait 10 minutes, then flush the taps again and check the chlorine residual; if the residual is at least 5 ppm/mgl or greater wait an additional 20 minutes before releasing the water for consumption. If the residual is below 5 ppm/mgl, additional chlorine must be added to the water. Mix a slurry as before; however, the amount of chlorine required may be less than 3 MRE spoonsful, estimate the amount needed. After adding the new batch, the 10 minute waiting time, flushing, and testing procedures as above must be repeated. Once the required residual has been met, a final waiting period of 20 minutes is required.

(3) Use of individual canteens and iodine tablets or ampules of calcium hypocldorite. This method is used when soldiers are on the march or on patrol and the only source is raw/unapproved water.

(a) One iodine purification tablet is added to a canteen (1 qt/960 ml) of water. It releases 8 ppm/mgl of iodine as a disinfecting agent. This amount is normally more than adequate for normal water. In case of turbid (colored) water or cold water (below 40^{0}F), two tablets are used to ensure adequate disinfection. Place the tablet(s) into the canteen and after 5 minutes shake the canteen, loosen the canteen cap and allow the iodine-treated water to seep around the neck of the canteen to kill any organisms harbored there. A minimum contact time of 30 minutes is required for water disinfection using the iodine purification tablets. At the present time there is no method which can be used in the field to determine the iodine residual.

(b) When calcium hypochlorite is used instead of the iodine tablet, a solution is first prepared by dissolving the contents of one calcium hypochlorite ampule in one-half canteen cup of water. Use one-half plastic canteen capful or one NBC capful of this concentrate in each canteen of water. After 5 minutes, the chlorine-treated water is allowed to seep around the neck of the canteen to kill any organisms harbored there. A total of 30-minutes contact time is required before drinking the water, Sometimes the addition of small amounts of chlorine to water causes disagreeable odors or taste to develop. If this occurs, one or more additional canteen caps of the prepared solution will usually correct the condition.

(4) The procedure for treating other containers of water with calcium hypochlorite are the same as for the lyster bag except that the amount of chlorine must be adjusted. See FM 21-10 for additional information.

(5) Boiling of water. This method is used when disinfecting compounds are not available. It is not the best method, since there is no residual protection against recontamination. Boiling water at a rolling boil for 5 to 10 minutes kills most organisms that

are known to cause intestinal diseases. In an emergency, even boiling water for 15 seconds will help. Care must be taken to use clean containers for boiling the water. After boiling, the water must be stored in a clean, closed container to prevent recontamination.

d. Determination of Chlorine Residual.

(1) The level of chlorine residual in treated water is determined by use of a comparator. A comparator consists of three plastic tubes and three vials of orthotoludine tablets which are contained in the chlorination kit with the calcium hypochlorite ampules. Each plastic tube has a band of a different shade of yellow around it; the lower edge of this band is just above the halfway point of the tube. The lightest shade of yellow indicates 1 ppm/mgl; the medium shade, 5 ppm/mgl, and the darkest shade, 10 ppm/mgl. These figures are printed on the tubes. Place one test tablet in the tube cap and crush it by using the tablet bottle. Add the crushed tablet to the vial and then add water to be tested to a point just below the bottom of the yellow band; close the tube and shake. Hold the tube in the palm of your hand and keep it warm to aid in color development. If the 5 ppm/mgl tube is used, for example, and the test tablet reacting with the chlorine produces a color exactly the same as or slightly darker than the yellow band, the chlorine residual is at least 5 ppm/mgl. If the color is lighter than the band, the chlorine residual is less than 5 ppm/mgl. In this case, additional calcium hypochlorite is added to the water; then the water is retested after another 10-minute period.

(2) A new chlorine residual determination kit has been procured and placed in the updated field chlorination kits. The new kit consists of a color comparator with color comparisons for measuring 1, 1.5, 2, 3, 5, and 10 mgl chlorine residual. The procedure for testing chlorinated water with this kit is as follows:

- Treat the water with desired amount of chlorine. Wait 10 minutes.

- Fill the comparator with treated water to a level above the uppermost black border.

- Open one DPD tablet package and drop the tablet into the comparator. Wait 2 minutes, place your thumb over the opening and invert the comparator 3 times (this is a must for correct reading).

- If the color of the water in the left window marked 1, is the same or darker than the right window marked 1 then the water is acceptable if a 1 mgl residual is desired. If the color of the water is lighter than the window marked 1, repeat chlorination, wait 10 minutes and retest the water.

- If higher residuals are required, compare the color of the water in the left window with the color of the right window of the required level. If the colors match or the left window is darker then the required level has been met.

- Wait an additional 20 minutes before drinking the water.

CAUTION

- When testing water with the DPD test kit carefully observe the color changes of the water. When the chlorine residual is above 10 mg/1 the water color will change through the test kit levels, then turn clear.
- Failure to carefully observe color changes may lead to excessive chlorination of the water supply.

Section III. FOOD SERVICE SANITATION

2-10. Importance of Sanitary Practices in Food Handling

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. Food contaminated with disease-causing microorganisms through improper or unsanitary practices can result in outbreaks of foodborne disease. All persons who handle food must maintain the highest sanitation standards.

2-11. Factors That Most Often Cause Foodborne Disease Outbreaks

Although the FST does not have to memorize every sanitary standard and regulation; they must use common sense; and must be aware of factors that contribute to foodborne disease outbreaks. The only way to control these factors is through proper supervisory actions. The five factors that most often cause foodborne disease outbreaks are failure to—

- Refrigerate potentially hazardous cold foods and maintain a product temperature of 45°F or below.
- Maintain potentially hazardous hot foods at a product temperature of 140°F or above.
- Protect foods from cross-contamination.
- Use proper transportation and storage practices.
- Protect food from contamination.

2-12. Transportation of Food

Vehicles used for transporting food must be clean and completely enclosed, if possible. Vehicles used for transporting garbage, trash, petroleum products, or similar materials, must not be used for transporting food unless the vehicles have been properly cleaned and sanitized. If bulk quantities of meat and dairy products are to be transported over a considerable

distance, refrigerated containers should be used. Every unit should have clean tarpaulins, boxes, or bags to protect food from contamination. Perishable foods are stocked only at a level commensurate with the capacity of the food storage facilities of the unit.

2-13. Storage of Food

Immediately upon receipt, the food must be inspected by unit food service personnel. Any food suspected of being unfit for human consumption is referred to the supporting veterinary unit or to the surgeon for disposition instructions.

a. Food Requiring Refrigeration. Food products requiring refrigeration should be stored at a temperature of 45°F (7°C) or below. Some units have a refrigerator and a generator as part of their equipment. Each unit with food preparation capabilities, however, is issued an ice chest with a 200-pound (90-kg) capacity. Every effort must be made to keep the temperature of food in the ice chest below 50°F (10°C).

b. Potentially Hazardous Foods.

(1) Food items that can support the rapid growth of foodborne disease microorganisms are called *potentially hazardous foods* (PHF). Foods high in protein, high in moisture, and with a pH of 4.5 or higher are potentially hazardous. Given the right temperature for a long enough period of time, disease-causing microorganisms can grow rapidly in foods such as—

- Chopped ham.
- Ground meat.
- Potato salad.
- Egg salad.
- Fish.
- Poultry.

(2) Safe product temperatures.

(a) Decisions for the type of rations issued are usually beyond the control of the unit. It is of utmost importance that all product temperatures be monitored. PHF must be stored immediately in the best refrigeration available to maintain a safe product temperature.

(b) When serving hot or cold meals in the field, maintaining safe product temperatures 45°F (7°C) and below or 140°F (60°C) and above can seem like an impossible job. By correctly using equipment that is available and using good supervisory techniques, the job can be done. Failure to maintain a safe product temperature is the leading cause of foodborne disease outbreaks. In addition to disease prevention, temperature control retards food spoilage and loss of culinary quality. When food temperature is not controlled, spoilage

will occur sooner. It should be noted that foods containing enough microorganisms or toxins to cause foodborne disease may not have any changes in odor, taste, or appearance.

(c) Safe temperatures are 45°F or below and 140°F or above. Any temperature between 46°F and 139°F is in the DANGER ZONE. Food products may have to be in the danger zone during some periods of preparation. For example, when food is being mixed with other ingredients, chopped, or formed, it is in the danger zone. At each stage of preparing and serving, the product may be exposed to unsafe temperatures and the chance of becoming contaminated. The goal in temperature control is to minimize the time PHFs are in the danger zone. Three hours cumulative time is the maximum such food can be in the danger zone and not be a health hazard. After 3 hours in the danger zone, enough bacteria may have grown in the food to cause foodborne disease outbreaks. This time accumulates—that is, each separate period of time that the food is in the danger zone adds to the 3-hour limit.

(d) Transporting potentially hazardous foods from a base camp to troops at other locations requires the use of insulated food containers. Correct use of the insulated food container will help maintain safe product temperatures.

(e) For hot foods, preheat the insulated container by using boiling water. Preheating the container helps maintain safe hot-food temperatures. When correctly preheated, foods should remain at safe temperatures for 3 to 4 hours. Take the following steps for preheating:

1. Remove the inserts.

2. Pour 2 quarts/liters of boiling water into the container.

3. Close and let the container stand for at least 30 minutes.

4. Pour out enough water to provide room for the inserts.

5. Place the hot food (at least 140°F) into the inserts and then place the inserts in the container.

6. Close and fasten the container lid.

(f) For foods that must remain cold, put 2 quarts/liters of crushed ice into the container to prechill it. When correctly prechilled, cold foods should remain at safe temperatures for 3 to 4 hours. Take the following steps for prechilling

1. Remove the inserts.

2. Put crushed ice or 2 quarts/liters of iced water into the container.

3. Close and let the container stand for 30 minutes.

4. Dump out enough ice to provide room for the inserts

5. Place the cold food (below 45^{0}F) into the inserts and then place the inserts in the container.

6. Close and fasten the container lid.

c. Semiperishable Food. Vegetables such as potatoes and onions are stored in a dry place on dunnage so air can circulate around them, thus retarding decay and spoilage. Screened food boxes may be used to keep such items as bread for a short period of time. These screened boxes are suspended to permit free circulation of air and to protect the food from insects and rodents. The food is covered before it is placed in the boxes to protect it from dust. Items such as flour, sugar, and rice are stored in their original containers and placed in metal containers with tightly fitted lids and protected from excessive heat and moisture. Improper storage can result in loss from rodent or insect infestation or from deterioration because of excessive heat or moisture.

d. Acid Food. Acid food or beverages such as potato salad, citrus fruit drink or other acidified drinks must never be stored or served in galvanized containers because they are capable of dissolving the zinc which can cause heavy-metal poisoning.

2-14. Personal Hygiene of Food Handlers

a. Food handlers can be a primary source of disease and contamination. Measures to reduce this hazard include daily inspections by supervisors; instructions on maintenance of personal hygiene; provisions for adequate toilet and handwashing facilities; and provisions for clean uniforms. Medical examination of foodhandlers is only conducted if deemed necessary by the medical authority. Consider the nature of disease prevalence among the local population before using indigenous personnel in overseas food service facilities. Persons who appear ill or have been absent from work because of a communicable disease, including diarrheal illness, must be referred to the medical treatment facility for determination of fitness for duty before resuming work. Changes to this policy may be directed by the command surgeon based on local conditions.

b. The food service supervisor or other supervisory personnel of the food-handling activity inspects all food service personnel daily at the beginning of their duty shift and observes them throughout the work period for signs of illness. Anyone showing evidence of illness, skin disease, infected cuts or boils is not permitted to handle food unless cleared by a medical officer. Hand washing after visiting a latrine must become an unfailing habit.

2-15. Cleaning and Sanitizing Utensils

a. Cooking Utensils. Cooking utensils are washed, rinsed, sanitized, and properly stored after each use. In the field, they are scraped free of food particles, washed in hot 120^{0}F to 150^{0}F soapy water, rinsed in one container of boiling water, sanitized in another container of boiling water, and allowed to air dry. They are then stored in a clean covered place that is protected from dust and vermin. Several types of water heaters are discussed in FM 8-34, FM 10-23 and FM 21-10. The type most widely used is the immersion heater, M-1937, which displaces approximately 12 gallons (45 liters) of water. It is standard equipment for TOE units.

b. Mess Kit Laundry.

(1) The mess kit laundry consists of four 32-gallon (121-liter) containers which are sufficient to service 80 soldiers per meal. The following is the setup and operation of a mess kit laundry:

(a) First can (waste can) for food scraps.

(b) Second can (wash can—hot soapy water) using a long-handled brush, wash the utensils and mess kit in hot (120°F to 150°F) hand dishwashing compound solution.

(c) Third can (rinse can—clear boiling water). Rinse the utensils and mess kit in the boiling water, dip them a few times to get the suds off, then shake off excess water.

(d) Fourth can (sanitizing can–clear boiling water). Dip items in the boiling water for at least 10 seconds; this will sanitize the items. Shake off excess water and let the items air dry.

(2) When it is impossible to heat the water, a chlorine solution is used in the fourth container. Utensils are washed in the soapy water; rinsed in the third can of clear water; then are immersed in the fourth container of sanitizing solution for at least 30 seconds. This method is usually sufficient for a dining facility serving approximately 100 soldiers. When a chemical sanitizer must be used, the following steps should be followed:

- If possible, use Disinfectant, Food Service, as specified on the label.

- In an emergency, use 3 MRE spoonsful of calcium hypochlorite powder/granule for every 10 gallons of water (250 ppm/mgl chlorine solution).

OR

- Use 1 canteen cup of 5 percent liquid chlorine bleach in 32 gallons of water (250 ppm/mgl chlorine solution).

NOTE

If mess kits become soiled or contaminated between meals, they should be rewashed, as described in (1) above, prior to use.

2-16. Physical Facilities

The physical facilities where food is stored, prepared, and served must be free of rats, mice, flies, roaches, ants, and other vermin. Screening and ratproofing methods are used to the greatest extent possible. Repairs are made as soon as the need is indicated. Food and utensils are stored in

protected places. Proper waste disposal and control methods (Sections IV, VI, and VII) are used to eliminate arthropod and rodent feeding and breeding places. When pesticides are used, the directions on the container must be followed exactly! Extreme care is taken when using pesticides in the presence of food. All food and food contact surfaces must be protected during the application of pesticides. Pesticides must never be stored in any food storage area.

2-17. Preparing and Serving Food

a. The food service functions are coordinated to eliminate any unnecessary lapses of time between preparing and serving food. Every effort is made in handling food items to keep them from becoming contaminated, since most foods provide microorganisms with the ideal environment to multiply and in some instances to produce enough toxins to cause illness. Potentially hazardous foods furnish a very good media for the growth of microorganisms; therefore meats, milk, and eggs are especially hazardous. Salads, chopped meats, and sandwich fillings require considerable handling during preparation, thus increasing the possibility for contamination. Such items are, therefore, prepared immediately before serving or promptly refrigerated after preparation. When neither procedure is feasible, as in the case of box lunches, PHF are avoided. Proper storage of leftover food presents a serious problem, meals must be planned to reduce the amount of leftovers. Items held at unsafe temperatures will not be retained as leftovers for reuse. Prepared refrigerated items which have not been placed on the serving line may be retained, but no more than 24 hours. Never save foods such as opened T-Rations, creamed beef, casseroles, or gravies.

b. Fresh fruits and vegetables grown in areas where human excreta is used as fertilizer, or where gastrointestinal or parasitic diseases are prevalent, must not be consumed raw except with the approval of the medical authority. When authorized for consumption, fruits, vegetables, including leafy vegetables, may be served raw if thoroughly washed in clean potable water, then disinfected by using Disinfectant, Food Service, according to the packet label instructions. Where Disinfectant, Food Service, is not available, emergency disinfection of fruits and vegetables may be accomplished by thoroughly washing them, then soaking them for 30 minutes in a 200-ppm/mgl chlorine solution or by immersing them in potable water at 160^{0}F for 1 minute. Prepare the. solution by mixing one tablespoon of household liquid bleach (sodium hypochlorite–5%) with 1 gallon of potable water. Fresh fruits and vegetables from other areas must be thoroughly washed and rinsed with potable water before serving. Certain fruits and berries such as strawberries cannot be properly washed or readily disinfected; therefore, they should not be served or eaten raw outside the United States.

2-18. Inspection of Food Service Facilities

Food service facility inspections are made for the purpose of identifying basic defects which could cause or spread communicable diseases, recommending corrective measures, and providing information and instructions which help food service personnel understand effective sanitation practices and their importance. The most serious defects include items such as those discussed in paragraph 2-11. The field sanitation team can be of great assistance to unit food service personnel in the prevention of such defects.

Section IV. WASTE DISPOSAL

2-19. Importance of Proper Waste Disposal in Disease Prevention

The proper disposal of all wastes is essential in preventing the spread of diseases. Liquid and solid wastes produced under field conditions may amount to 100 pounds (45 kg) per person per day, especially when shower facilities are available. A camp or bivouac area without proper waste disposal methods soon becomes an ideal breeding area for flies, rats, and other vermin and may result in diseases such as dysentery (amoebic and bacillary), typhoid, paratyphoid, and cholera among soldiers.

2-20. Responsibilities for Waste Disposal

a. The unit commander is responsible for proper waste disposal in his unit area. If facilities are not provided, as is often the case when the unit is in the field, the unit commander must arrange for their construction and operation.

b. The Army Medical Department is responsible for inspecting waste facilities and methods of operation. It recommends changes which aid in protecting the health and welfare of soldiers.

2-21. Waste Disposal Methods

There are several disposal methods for the different kinds of wastes, which include human and animal waste, garbage, kitchen and bath liquid waste, and rubbish. The methods selected for use will depend upon the location of the unit and the military situation. Generally, wastes are buried if the environment, especially soil conditions, and local regulations permit.

2-22. Human Waste Disposal

a. General. Human waste disposal becomes a problem for both the individual and the unit in the field. During short halts when troops are on a march, each soldier uses a "cat-hole" latrine. It is dug approximately 1 foot (30 cm) deep and is completely covered and packed down after use. In temporary bivouac (1 to 3 days) the straddle trench latrine is used unless more permanent facilities are provided for the unit. When setting up a temporary camp, a deep pit latrine and urine soakage pits are usually constructed. Alternate devices, which may be used to dispose of human waste in the field, are the mound, bored-hole, pail, burnout or chemical latrines (FM 21-10). As a guideline, four percent of the male population within the command should be provided with latrines. Urine disposal facilities should be collocated with the latrine to prevent soiling of toilet seats. Six percent of the female population within the command should be provided with latrines.

(1) Latrines are so constructed to prevent the contamination of food and water. They are located at least 100 yards (90 meters) downwind (prevailing wind) from the unit food service facility and at least 100 feet (30 meters) from any unit ground water source. For further protection, latrines are not dug to the ground water level or in places where pit contents may drain into the

water source. Usually they are built at least 30 yards (30 m) from the border of the unit area but within reasonable distance for easy access. A drainage ditch is dug around the edges of the latrine enclosure to keep out rain water and other surface water. A handwashing device is installed outside each latrine enclosure; these devices should be easy to operate and be kept filled with water. Each individual must wash his hands after he uses the latrine.

(2) When a latrine is filled to within 1 foot (30 cm) of the ground surface or when it is to be abandoned, it is closed in the following manner. The pit is filled to the ground surface in 3 inch (8 cm) layers, each layer being compacted. This is to prevent fly pupae from hatching and gaining access to the open air. Dirt is then compacted over the pit to form a mound at least 1 foot (30 cm) high. A sign is posted with the date and the words "closed latrine," if the tactical situation permits.

b. Straddle Trench Latrine. A trench is dug 1 foot (30 cm) wide, 2½ feet (75 cm) deep, and 4 feet (120 cm) long. Two feet (60 cm) of length are allowed per person. These trenches, which are constructed parallel to one another, are spaced at least 2 feet (60 cm) apart. Since there are no seats on this type of latrine, boards may be placed along both sides of the trench to provide sure footing. As the earth is removed, it is piled at one end of the trench, and a shovel or paddle is provided so that each soldier can promptly cover his excreta. Toilet paper is placed on suitable holders and protected from bad weather by a tin can or other covering. The straddle trench latrine is closed, using the same method described in *a(2)* above.

c. Deep Pit Latrine. The deep pit is used with the standard latrine box which is issued to or built by the unit. The two-seat box is 4 feet (120 cm) long 2 ½ feet (75 cm) wide at the base, and 18 inches (45 cm) high. A four-seat box 8 feet (240 cm) long 2½ feet (75 cm) wide at the base; and 18 inches (45 cm) high may be built by the unit using scrap lumber or other material.

(1) The pit is dug 2 feet (60 cm) wide and either 3½ or 7½ feet (105 or 225 cm) long, depending upon the size of the latrine box. This allows 3 inches (8 cm) of earth on each side of the pit to support the latrine box. The depth of the pit depends on the estimated length of time the latrine will be used. As a guide, a depth of 1 foot (30 cm) is allowed for each week of estimated use, plus 1 foot (30 cm) of depth for dirt cover. Generally, it is not desirable to dig the pit more than 6 feet (2 m) deep because of the danger of the walls caving in. Rocks or high ground water levels may also limit the depth of the pit. In some soils supports of planking or other material may be necessary to prevent the walls from caving in.

(2) To prevent fly breeding and to reduce odors, the latrine box must be kept clean, the lids closed, and all cracks sealed. If a fly problem exists, they may be controlled by the application of a residual pesticide, Control effects should be based upon fly surveys and pesticides applied in accordance with label directions. Pit contents should not be sprayed routinely since flies can develop resistance to pesticides used over and over. The latrine boxes and seats are scrubbed daily with soap and water. Using lime in the pit or burning out the pit contents is not effective for fly or odor control; these methods are not, therefore, recommended. The deep pit latrine is closed as described in *a(2)* above.

d. Burn-Out Latrine. The burn-out latrine may be provided when the soil is hard, rocky, or frozen making it difficult to dig a deep pit latrine. It is particularly suitable in areas

with high water tables, because digging a deep pit is impossible. The burn-out latrine is not used when regulations prohibit open fires or air pollution. Personnel should urinate in a urine disposal facility rather than the burn-out latrine, as more fuel is required to burn out the liquid.

(1) To construct a burn-out latrine, an oil drum is cut in half, and handles are welded to the sides of the half drum for easy carrying. A wooden seat with a flyproof, self-closing lid is placed on top of the drum.

(2) The latrine is burned out daily by adding sufficient fuel to incinerate the fecal matter. Highly volatile fuel such as JP4 should not be used because of its explosive nature. A mixture of 1 quart (1 liter) of gasoline to 4 quarts (4 liters) of diesel oil is effective, but must also be used with caution. It is convenient to have two sets of drums, one set for use while the other set is being burned clean. If the contents are not rendered dry and odorless by one burning, they should be burned again. Any remaining ash should be buried.

e. Mound Latrine.

(1) This latrine may be used when a high ground water level or a rock formation near the ground surface prevents digging a deep pit. A dirt mound makes it possible to build a deep pit and still not extend it into the ground water or rock.

(2) A mound of earth with a top at least 6 feet (2 m) wide and 12 feet (4 m) long is formed so that a four-seat latrine box may be placed on top of it. It is made high enough to meet the pit's requirement for depth, allowing 1 foot (30 cm) from the base of the pit to the level of the ground water or rock level. The mound is formed in approximately 1 foot (30 cm) layers. The surface of each layer is compacted before adding the next layer. When the desired height is reached, the pit is then dug in the mound. Wood or other bracing may be needed to prevent the pit walls from caving in. An alternate method is to construct a latrine pit on top of the ground, using lumber, logs, corrugated sheet metal, or whatever other material is available, and to pile dirt around it and up to the brim, thus creating the mound around the latrine pit. The exact size of the mound base depends upon the type of soil; it should be made large to avoid a steep slope. It may be necessary to provide steps up the slope. The mound latrine is closed as described in *a(2)* above.

f. Pail Latrine. A pail latrine may be built when conditions (populated areas, rocky soil, marshes) are such that a latrine of other types cannot be constructed. A four seat latrine box *(c* above) may be converted for use as a pail latrine by placing a hinged door on the rear of the box, adding a floor, and placing a pail under each seat. If the box is located in a building, it should, if possible, be fitted into an opening made in the outer wall so that the rear door of the box can be opened from outside the building. The seats and rear door should be self-closing, and the entire box should be made flyproof. The floor of the box should be made of an impervious material (concrete, if possible) and should slope enough toward the rear to facilitate rapid water drainage used in cleaning the box. A urinal may also be installed in the latrine enclosure with a drainpipe leading to a pail outside. This pail should also be enclosed in a flyproof box. The waste in pails may be disposed of by burning *(d(2)* above) or by hauling to a suitable area and burying. Emptying and hauling containers of waste must be closely supervised to prevent careless spillage. The use of plastic bag liners for pails reduces the risk of accidental spillage. The filled bags are tied at the top; they then are disposed of by burning or burial.

g. Chemical Latrines.

(1) Chemical latrines (toilets) are used in the field when federal, state, or local laws prohibit the use of other field latrines. These toilets are self-contained in that they have a holding tank with chemical additives to aid in decomposition of the waste and for odor control. The number of such facilities required is established by the surgeon or other medical authority in the area of operation.

(2) The facility must be cleaned daily and the contents pumped out for disposal in a conventional sanitary waste water system. The frequency of emptying is determined by the demand for use of the device.

h. Urine Disposal Facilities. Urine disposal facilities should be provided for the males in the command. Urine should be drained from the urinals either into a soakage pit, into a standard deep pit latrine if the urinals are constructed in conjunction with the latrine, or into the chemical latrine. The urine may be drained into a pit latrine through a pipe, hose, or trough. If a soakage pit is used, it should be dug 4 feet (1.2 m) square and 4 feet (1.2 m) deep and filled with rocks, flattened tin cans, bricks, broken bottles, or similar nonporous rubble.

(1) Urinal pipes, should beat least 1 inch (2.5 cm) in diameter and approximately 36 inches (1 m) long, and placed at each corner of the soakage pit and, if needed, on the sides halfway between the corners. The pipes are inserted at least 8 inches (20 cm) below the surface of the pit with the remaining 28 inches (80 cm) slanted outward above the surface. A funnel of tar paper, sheet metal, or similar material is placed in the top of each pipe and covered with a screen.

(2) A urinal trough, about 10 feet (3.3 m) long, is provided when material for its construction is more readily available than pipes. The trough is made of sheet metal or wood with either V- or U-shaped ends. If the trough is made of wood, it is lined with tar paper or metal. The legs supporting the trough are cut slightly shorter on one end where a pipe carries the urine into the soakage pit or latrine pit.

(3) A urinal trough about 12 inches long is attached to the inside wall of the chemical latrine. A pipe is connected to the trough to drain urine into the latrine holding tank.

(4) In areas where the ground water level is more than 3 feet below the surface, the urinoil is an acceptable substitute for other types of urine disposal facilities. The urinoil is a 55-gallon drum designed to receive and trap urine and to dispose of it into a soakage pit. Urine voided through the screen onto the surface of the oil immediately sinks through the oil to the bottom of the drum. As urine is added, the level rises within the 3-inch diameter pipe and overflows into the 1½-inch diameter pipe through the notches cut in the top of this pipe. The oil acts as an effective seal against odors and against fly entrance. The screen on top of the oil is lifted by supporting hooks and cleaned of debris as necessary.

(5) For the urine soakage pit to function properly, soldiers must not urinate on the surface of the pit, The funnels or trough must be cleaned daily with soap and water and the funnels replaced as necessary. Oil and grease must never be poured into the pit, as they will clog it. When a urine soakage pit is to be abandoned or it becomes clogged, it is sprayed with a residual insecticide and mounded over with a 2-foot (60-cm) covering of compacted earth.

2-23. Garbage Disposal

Garbage is disposed of by burial or incineration. Tactical requirements must be considered in either case. The excavated soil must be concealed; also smoke and flame may not be tolerated in a tactical situation. In a training situation environmental protection may rule out burning or burying; therefore, garbage will have to be collected and hauled away.

a. Burial. Garbage must not be buried within 100 feet (30 m) of any natural source of water, such as a stream or well, used for cooking or drinking. The garbage burial area should be a reasonable distance from the kitchen to minimize problems with flies, odor, and appearance.

(1) On the march, in bivouac, or in camps of less than 1 week duration, the kitchen wastes are disposed of by burial in pits or trenches. Pits are preferred for overnight halts. They are usually dug 4 feet (1.2 m) square and 4 feet (1.2 m) deep. The pit is filled to not more than 1 foot (30 cm) from the top; then it is covered, compacted, and mounded with 1 foot (30 cm) of earth.

(2) The continuous trench is more adapted to stays of 2 days or more. This method is started by digging a trench about 2 feet (60 cm) wide, 4 feet (1.2 m) deep, and long enough to accommodate the garbage. As in the pit method the trench is filled to not more than 1 foot (30 cm) from the top. The trench is extended as required, and the excavated dirt is used to cover and mound the first deposit. This procedure is repeated daily or as often as garbage is dumped. It is a very efficient field expedient for disposing of garbage.

b. Incineration. In temporary camps of 1 week or more, the garbage is often burned in open incinerators. Excellent types of open incinerators may be constructed from materials which are readily available in any camp area. Since incinerators will not handle wet garbage, it is necessary to separate the solid from the liquid portions of the garbage. This is done by straining the garbage with a coarse strainer such as an old bucket, salvaged can, or oil drum with holes punched in the bottom. The solids remaining in the strainer are incinerated, and the liquids are poured through a grease trap (paragraph *2-25a(3))* into a soakage pit. Since field incinerators create an odor nuisance, they should be located at least 50 yards (50 m) downwind from the camp.

(1) *Cross trench and stack incinerator.* The cross trench and stack incinerator will effectively take care of the waste produced by a company-size unit. This is an excellent dry trash incinerator, but wet material tends to disrupt proper draft and does not burn easily. Two trenches, each 10 feet (3 m) long, are constructed so that they cross at right angles. The trenches slope from the surface of the ground at the ends to a depth of 18 inches (45 cm) at the intersection. A grate is made from pieces of scrap iron laid over the intersection of the trenches. A stack is made from an oil drum with both ends cut out or with one end cut out and the other end liberally punched with holes to admit draft air. A fire is built on top of the grates; and the waste is added, one shovel full at a time, on top of the fire.

(2) *Inclined plane incinerator.* The inclined plane incinerator will dispose of the garbage of an entire battalion, evacuation hospital, or other unit of similar size. Its effectiveness in combustion and the fact that it is not affected by rain or wind make it an excellent improvised device. Time and skill, however, are required in building it. A sheet metal

plane is inserted through telescoped oil drums from which the ends have been removed. A loading or stoking platform is built; then one end of the plane-drum device is fastened to it, thus creating an inclined plane. A grate is positioned at the lower end of the plane, and a wood or fuel oil fire is built 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 incline in small amounts to burn. Final combustion takes place on the grate.

2-24. Liquid Waste Disposal

a. Liquid Kitchen Wastes. Liquid kitchen wastes accumulate at the rate of 1 to 5 gallons (4 to 19 liters) per man per day.

(1) *Soakage pits.* The liquid kitchen wastes are disposed of in the soil by means of soakage pits at or near the place where they are produced. A soakage pit for the disposal of kitchen wastes is constructed in the same manner as the soakage pit for urine disposal (paragraph *2-22h)* except that it is equipped with a grease trap ((3) below). Two pits are needed for a company, so that each one can have a rest period every other day. In porous soil a soakage pit 4 feet (1.2 m) square and 4 feet (1.2 m) deep will take care of 200 gallons (760 liters) of liquid per day. In camps of long duration each soakage pit should be given a rest period of 1 week every month. Even though precautionary measures are taken, a pit may become clogged with organic material.

(2) *Soakage trenches.* If the ground water table is high or a rock stratum is encountered near the surface, soakage trenches may be substituted for soakage pits. These trenches are extended outward from each corner of a central pit dug 2 feet (60 cm) square and 1 foot (30 cm) deep. The trenches are dug 1 foot (30 cm) wide and 6 or more feet (2 m) long. The depth is increased from 1 foot (30 cm) at the end joining the pit to 18 inches (45 cm) at the outer end. The pit and the trenches are filled with rock, flattened cans, broken bottles, or other coarse contact material. Two such units should be built for every 200 persons fed, and each unit should be used on alternate days. A grease trap ((3) below) is employed with this device.

(3) *Grease traps.* The grease trap is a necessary addition to the kitchen soakage pit and trenches ((1) and (2) above). All kitchen liquids are passed through a grease trap to remove food particles and as much grease as possible; otherwise the soakage pits become clogged and useless. There are two types of grease traps: the filter and the baffle.

(a) Filter grease trap. An oil drum with the top removed and the bottom perforated is filled two-thirds full with crushed rock or large gravel at the bottom, followed by gravel which has been graded to smaller sizes and then a 6-inch (15-cm) layer of sand, ashes, charcoal, or straw. The top of the drum is covered with burlap or other fabric to strain out the larger pieces of debris. The burlap or other fabric is removed daily, burned or buried, and replaced with a clean piece. The 6-inch layer of filtering material is removed at intervals of once or twice weekly and buried. The barrel is usually placed in the center of the soakage pit with the bottom of the barrel about 2 inches (5 cm) below the pit surface.

(b) Baffle grease trap. The baffle grease trap is the most effective way of removing grease. It is a watertight container divided into entrance and exit chambers by a baffle, the entrance chamber having about twice the capacity of the exit one. The lower edge of the baffle hangs within 1 inch (2.5 cm) of the bottom. The outlet, a 2-inch (5-cm) pipe, is placed

from 3 to 6 inches (7.5 to 15 cm) below the upper edge of the exit chamber. The baffle grease trap is usually placed on the ground at the side of the soakage pit with the outlet pipe extending 1 foot (30 cm) beneath the surface at the center of the pit. The liquid waste is strained of solids and debris before it goes into the entrance chamber of the trap. The strainer is filled two-thirds full with loose straw, hay, or grass. Before the grease trap is used, the chambers are filled with cool water. When the warm liquid strikes the cool water in the entrance chamber, the grease rises to the surface and is prevented by the baffle from reaching the outlet to the soakage pit. If the water is warm, proper separation of the grease will not occur. This is often the case in hot climates. The grease retained in the entrance chamber is skimmed from the surface of the water daily or more frequently as required and buried. The trap should be emptied and thoroughly scrubbed with hot, soapy water as often as necessary. The efficiency of this grease trap can be increased by constructing it with multiple baffles. Also, a series of baffle grease traps may be used.

(4) *Evaporation beds.* In a hot, dry climate where heavy clay soil prevents the use of standard soakage pits, evaporation beds may be required. These beds actually involve the processes of evaporation, percolation, and oxidation. Sufficient beds, 8 by 10 feet (240 by 300 cm), are constructed to allow 3 square feet (2787 cm^2) per person per day for kitchen waste and 2 square feet (1858 cm^2) per person per day for bath waste. The beds are spaced so that the wastes can be distributed to any one of the beds. The beds are constructed by scraping off the top soil and constructing small dikes around the 8 by 10 foot (240 by 300 cm) spaces. These spaces are then spaded to a depth of 10 to 15 inches (25 to 38 cm), and the surfaces are raked into a series of ridges and depressions with the ridges approximately 6 inches (15 cm) above the depressions. These rows may be formed either lengthwise or crosswise as deemed desirable for best distribution of water. In operation, one bed is flooded during one day with liquid waste to the top of the ridges which is equivalent to an average depth over the bed of 3 inches (7.5 cm); the liquid waste is allowed to evaporate and percolate. After about 4 days this bed is usually sufficiently dry for respading and reforming. The other beds are flooded on successive days, and the same sequence of events is followed. Careful attention must be given to proper rotation, maintenance, and dosage. It is also essential that the kitchen waste be run through an efficient grease trap before it is allowed to enter the evaporation beds. If these beds are used properly, they create no insect hazard and only a slight odor.

b. Bath and Wash Water. This water is disposed of in the same manner as liquid kitchen waste *(a* above).

2-25. Rubbish Disposal

Combustible rubbish is burned when the tactical situation permits. Other rubbish is either buried or hauled to a suitable disposal site, depending on the tactical situations.

Section V. ARTHROPODS AND DISEASES

2-26. General

a. Historically, arthropod-borne diseases have caused more casualties than combat injuries. One arthropod-borne disease casualty in a unit could be only the tip of the iceberg in

terms of the potential loss of soldiers to the mission. The chain of infection for arthropod-borne diseases involves a pathogenic organism in an infected person or animal (the reservoir), an arthropod vector, and a susceptible person. The significance of vector efficiency in disease transmission from reservoir to soldiers or from soldier-to-soldier is related to many factors. Some of the biotic factors are species related such as reproductive capacity, physiology, morphology, and genetics. Abiotic factors are physical and related to environmental conditions, such as temperature, moisture, rainfall, pH, weather, geographical and topographical location, photoperiod, and wind. Soldiers in a field environment must break the chain of infection for arthropod-borne disease or arthropod injury by preventing access of arthropod pests to themselves.

b. Arthropods are members of the phylum Arthropoda, which makes up over 75 percent of all animals. There are approximately 750,000 species of Arthropoda. Less than 1 percent of these species have a tremendous impact on mankind. This impact is injury to man and other animals; damage to crops; infestation of stored products; and destruction of wooden structures. Still many species are beneficial as pollinators, predators of pests, scavengers of waste, manufacturers of food, and a part of the natural balance of nature. However, the economic damage and medical disorders caused by a few arthropods make some pest management practices necessary to control the problem pests. Protection of the soldier and his resources from injurious arthropods and arthropod-borne diseases is essential to mission accomplishment. Methods of arthropod control are discussed in Section VI.

2-27. Direct Arthropod Affects on Human Health

In addition to disease transmission, arthropods can cause direct injuries to man. Bites, stings, and allergic reactions are three major categories of injuries caused by arthropods. Arthropods also affect man by annoying and disturbing him. The sound of a single mosquito buzzing around your head while your are trying to sleep is annoying. Standing guard with gnats buzzing around your face can be disturbing. Also, finding cockroaches or other insects or parts of insects in your food is disturbing. The problems of arthropod injury and the exaggerated fear of arthropods can even result in psychotic problems.

a. Biting Arthropods. Biting by arthropods is the act of feeding, probing, or defending. Most penetrations of human skin are made by mouth parts that are developed for ingesting blood, tissue and tissue fluids of animals or plants. These bites usually result in the arthropod injecting salivary fluids or regurgitating its digestive tract products into the man or animal. Some biting arthropods can also produce skin injuries. Each individual's reaction to arthropod bites can be very different. Biting arthropods are grouped according to the duration of host contact as transient (short-term) or prolonged (long-term).

(1) *Transient host contact.* Most arthropods that bite man have only transient host contact. Blood sucking arthropods are frequently winged or highly mobile. This accounts for their ability to quickly attack and escape capture or detection. Some arthropods hide in structures close to the host and only feed when the host is nearby. Others that bite man may not have intended to attack, but did so in defense or by mistake. Arthropods can bite man in several stages of their development, that is adult, larvae, or nymph stages. The mouth parts are generally classified into chewing or sucking. Chewing mouth parts are generally not used for skin penetration. Usually, injuries of this type are not reported, but secondary infections

may occur due to bacterial contamination. Sucking mouth parts are structured for skin penetration,

(a) Blood sucking (Hematophagous) Arthropods. Blood, normally from warm-blooded animals (including man), is used both for life-support and growth and/or egg development. The mouth parts of sucking arthropods vary greatly in structure from arthropod-to-arthropod. For example, adults of the order Diptera (two-winged insects) have the most diverse mouth parts. Only the females of the mosquitoes, black flies, biting midges, horseflies, and snipe flies are bloodsuckers; while both males and females of tsetse flies, biting horse flies, and stable flies are bloodsuckers. The mouth parts are different within each of these families of Diptera, but the goal of a blood meal is the same. Other examples of hematophagous arthropods which are transient in terms of exposure time are fleas, true bugs (cone-nose bugs and bedbugs), and soft ticks.

(b) Nonhematophagous (nonblood sucking) Arthropods. Some plant-feeding arthropods and some arthropod predators have piercing-sucking mouth parts which are quite capable of penetrating the human skin. Bites from these arthropods can be as painful, if not more so than those of bloodsuckers. Bites from these arthropods are usually an act of defense.

(2) *Long-term host contact.* Some biting arthropods require a considerable time on the host to complete a normal life cycle. Since a continuous food supply is available on one host, the search for another host is reduced. Most of these arthropods are categorized as parasites. They are classified as either ectoparasites or endoparasites. Ectoparasites (those living outside the host body) may be flat (fleas) or thin (lice) which allows them to travel easily through a hairy environment. Their feet (tarsi) are specialized for holding on to hair. The mouth parts of ticks and mites are designed to anchor their bodies to the host. Endoparasites (those living inside the host body) are usually soft-bodied (fly larvae, mites) without legs or with very short legs; their body usually has specially arranged spines or hairs.

b. Stinging (envenomizing) Arthropods. Some arthropods affect man by injecting venom (insect toxins) through stingers, fangs, modified front legs, or spines. An arthropod's injection of poison is in defense or to kill prey. Usually, man is envenomized by arthropods in defense of themselves and their nest or eggs.

(1) *Anteriorly stationed venoms.* Spiders and centipedes are arthropods in the category that use mouth parts and modified front legs, respectively, for envenomization. Most spiders use venom to at tack prey. Man is not part of a spider's diet. The fangs of many spiders cannot penetrate the human skin. However, one should not cause the spider to attack to find out if its fangs are long enough. Some species have venom that is more poisonous than other venomous animals, including snakes. Fortunately spiders are not aggressive, but they will defend themselves and their eggs and/or nest. Antivenoms have been developed for the venom from some species of spiders, but they may not be immediately available for use. Some of the more toxic spiders are night hunters, and by day they hide in clothing and boots that were left on the floor or in tents on the ground. Less common are the bites of centipedes which are also night hunters. In the tropics some species of centipedes reach 25 centimeters in length; a bite by such a large specimen could be serious.

(2) *Posteriorly stationed venoms.* The number of soldiers seeking medical assistance because of arthropod bites is far fewer than those seeking aid because of bee, wasp,

hornet, or ant stings. Stings from the posterior ends of these arthropods are frequently the result of defensive action of the arthropod. A single sting to an allergic person can be fatal. Even to a person who is not strongly allergic, medical complications due to swelling can occur with stings to the face, neck or throat. Usually stings are reported as occurring during daylight hours. However, night maneuvers can result in individuals running into paper wasp nests and being stung by wasps trying to protect their nests; or an individual may stand in an ant hill and receive numerous stings from the ants trying to protect their nest. Therefore, individuals who are highly sensitive or have severe reactions to stings should carry an emergency first aid kit for stings as prescribed by a physician. Obviously high risk persons should use extreme caution in tropical areas. Another venomous arthropod with a potent sting is the scorpion. Scorpions are active at night. During the day scorpions are usually well-hidden from the light; they hide under rocks or in piles of debris outside and in clothing, cabinets, boxes and footwear indoors. Stings often are the result of individuals walking barefoot or in stocking feet, or because they use their hand to move the object where the scorpion is hiding. Also stings occur when individuals put on clothing or footgear without first shaking the item to make sure that it is free of unwanted arthropods. Some scorpion venoms are painful while others are not. The absence of initial pain is not always an indication of no problem. The lack of or the nonavailability of antivenom and the possible medical problems associated with the use of antivenoms, even if it were on hand, are additional reasons for avoiding scorpion stings.

c. Allergy. Allergic reactions are caused by both the bites and stings of arthropods. Additionally, arthropod parts (live or dead) and their body fluids can cause allergic reactions. Allergic reactions are extremely variable in different people ranging from very mild to severe reactions. Highly sensitive persons should be prepared to deal with their problems in case they are bitten, stung, or exposed to other arthropod allergens.

2-28. Arthropod-borne Diseases

Diseases transmitted to man by arthropods are of primary concern to both the diseased individuals and to the commander who loses these individuals. The effect of these diseases on man can range from a very mild illness to death. For examples of arthropod-borne diseases and their vectors see Table 2-1. The disease organisms or parasites of humans are carried from diseased humans or animals (reservoirs) by arthropods (vectors) to other humans or animals (hosts). By employing individual preventive medicine measures, soldiers can stop arthropod-borne diseases from being a factor in their lives and in their units mission accomplishment.

Table 2-1. Arthropod-borne Diseases and Their Vectors

DISEASE	VECTOR
Malaria	Mosquito
Chagas' disease	Kissing bug (Reduviids)
Leishmaniasis	Sandfly (Phlebotomine)
Yellow fever	Mosquito
Dengue fever	Mosquito
Encephalitis	Mosquito
Sandfly fever or Phlebotomus fever	Sandfly (Phlebotomine)
Typhus fever (epidemic)	Body louse
Typhus fever (murine)	Flea
Scrub typhus	Larval mite (chigger)
Bubonic plague	Flea
Dysentery	Filth flies (particularly the house fly)
Typhoid fever	Flies and cockroaches (by food contamination)
Spotted fever	Tick
Filariasis (elephantiasis)	Mosquito
Onchocerciasis	Black fly

Section VI. ARTHROPOD CONTROL

2-29. General

Bivouac sites are selected according to well-defined military and sanitary rules. The ideal location for a bivouac site is on high, well-drained ground at least 1 mile (1.6 km) from breeding sites of flies and mosquitoes and 1 mile (1.6 km) from native habitations. It is not always possible, however, to bivouac in the ideal location. Therefore, a unit commander may be faced with unusual arthropod control problems in the vicinity of his camp site. An effective program for arthropod-borne disease prevention should consist primarily of sanitation measures, but may include the use of individual preventive medicine measures as well as the application of pesticides. Essential to the operation of an effective control program is an understanding of the life cycles of medically important arthropods and a knowledge of where they can be found in nature. For examples of life cycles of arthropods see Table 2-2.

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Table 2-2. Life Cycles of Arthropods

MEDICALLY IMPORTANT ARTHROPODS	APPROXIMATE DURATION OF LIFE CYCLES AT 72 °F (22 °C)		WHERE FOUND
Flies (Example: housefly)	egg larva pupa adult	10 hours 5 days 5 days 30 days	Animal or human waste, garbage, grass, decomposing animals, and mud contaminated with organic material.
Mosquitoes (Example: yellow fever mosquito)	egg larva pupa adult	4 days 10 days 2 days 14 days	Standing water which may be found in ponds, tin cans, old tires, and tree holes.
Fleas (Example: oriental rat flea)	egg larva pupa adult	7 days 15 days 8 days 365 days	Nests or beds of animals.
Lice (Example: human body louse)	egg nymph adult	7 days 16 days 30 days	Hair and clothing of humans.
Cockroaches (Example: German cockroach)	egg nymph adult	30 days 60 days 200 days	Cracks and crevices which provide warmth, moisture, and food such as around water, garbage, and food facilities.
Ticks and mites	Life cycle completed	6 weeks to 2 years	Tall grass, underbrush, animal watering places, and shady rest areas of animals.

2-30. Individual Preventive Medicine Measures

Individual PMMs are those which must be used by each soldier. Often they are the only preventive measures available for soldiers in the field. Had the regiment which lost 403 men to scrub typhus in Dutch New Guinea during World War II used individual PMM, its history would have been different. Individual PMM are categorized as those to be applied when the soldier is at work and those to be applied when he is at rest.

a. Individual PMM for the Soldier at Work.

(1) *Clothing.* The combat uniform worn looselv with the pants tucked into the boots without blousing rubbers, and with the sleeves down and buttoned increases protection for the soldier. Wearing the uniform in this way makes it more difficult for mites and ticks to get under the clothing. A mosquito can bite through the clothing only when it is worn tightly against the skin.

(2) *Clothing Repellent Application.* Some repellent formulations are designed so that clothing or blankets can be dipped into a solution of the repellent. These formulations are able to withstand repeated launderings or wettings without losing their repellent properties. The principal requirement for a clothing treatment chemical for military use is the protection of soldiers against mosquitoes, chiggers, ticks, and land leeches in many areas of the world. Detailed directions for use of these materials vary with the specific item and with the type of clothing being treated. Instructions issued by the local surgeon should be followed.

(3) *Personal use or skin repellent application.* Repellents for personal use are applied directly to the skin. Usually, a few drops rubbed between the hands, and spread evenly over the face, neck, hands, and other exposed skin areas offer protection for several hours, depending upon the pest species concerned. A few additional drops may be spread on the clothing at the shoulders and other areas where the cloth fits tightly against the body. Be careful to keep the chemicals out of the eyes. The chemical is lost from the skin by washing, abrasion, absorption, and evaporation and must be reapplied as required. The effectiveness of the material is lost more rapidly in hot, humid climates where profuse sweating occurs. Repellents which are recommended for application on the skin may also be applied by hand or by sprayer to the outside of the clothing if desired; however, several special items have been developed for impregnating clothing to either repel or kill mites, insects, or other pests. The repellent for personal use is DEET (75 percent N, N-diethyl-m-toluamide), which provides protection against mosquitoes, other biting Diptera and fleas. It is relatively effective against ticks and chiggers.

b. Preventive Medicine Measures for the Soldier at Rest.

(1) *Screened billets.* Screened billets are a desirable protective measure, but it is not always possible to provide them in the field.

(2) *Bed net.* The bed net is a necessity even though the billets are screened. This device is composed of two T-bars and a net. One T-bar is attached to each end of the bed and the net is suspended from, not draped over, the T-bars and tucked under the mattress securely except for an entrance port. The net is then inspected for holes and repaired as needed. After crawling through the entrance port, the occupant tucks the remainder of the edge of the net under the mattress. Care must be taken not to come in contact with the net, as insects can bite through it. Nets must be inspected daily for tears and holes; any damage must be repaired before use.

(3) *Aerosol insecticide.* Use of the aerosol insecticide is the last line of defense. Before getting under a bed net, the occupant sprays the insecticide inside the net according to label instructions.

2-31. Chemical Control (Pesticides)

Pesticides are valuable aids in the control of arthropods. They are used to augment, not replace, field sanitation and individual PMM.

a. Properties. Pesticides are chemical substances which are poisonous to all animals but less poisonous to man and domestic animals than to arthropods. In sufficient quantity, they will kill any animal. Sound judgment must, therefore, be exercised in the use of these

chemicals. Not only are the chemicals poisonous but the agent, such as a solvent, mixed with the chemicals may make them more hazardous. For example, kerosene or fuel oil which is used as a solvent for most modern pesticides makes them more hazardous for humans. The human skin repels water but absorbs oil; therefore, the pesticide is absorbed with the oil. Refer to the pesticide label for specific protective clothing recommendations and safety precautions.

b. Precautions. Some liquid pesticides issued to field sanitation teams are flammable; they must not be used around or stored near an open flame.

c. Arthropod Resistance. Some arthropods, particularly those that reproduce rapidly, often become resistant to the pesticide which is being used. When this is suspected, preventive medicine personnel should be notified.

d. Disposal. All pesticides, pesticide containers, and pesticide related wastes will be disposed of in accordance with DOD Directives or as directed by preventive medicine personnel.

2-32. Equipment Used in Pesticide Applications

Two items of equipment are authorized for use by the field sanitation team in applying pesticides (AR 40-5). These items are the hand duster and the hand pressure sprayer.

a. Hand Duster. The hand duster is used with 1 percent lindane dust for delousing purposes.

b. Hand Pressure Sprayer. The hand pressure sprayer (2 gallon capacity) is used for most chemical control operations. Various makes of this sprayer are available. The instructional manual furnished with each sprayer must be retained and followed in regard to its operation and maintenance.

(1) *Sprayer preparation for use.*

(a) Fill the sprayer with the insecticide and water mixture, but do not exceed 2 gallons (7.5 liters) and screw the filler cap hand-tight. This permits air space for building up air pressure.

(b) Insert the appropriate nozzle for the desired application.

(c) Unlock the pump by turning the handle 90 degrees to the left.

(d) Pressurize the tank to approximately 40 to 60 pounds per square inch (275-415 kPa). If the sprayer does not have a pressure gage, approximately 30 to 35 pump strokes will usually be sufficient. An equally, if not more reliable method, is to pump the sprayer until it becomes too hard to pump.

(e) To increase pump efficiency and ease of operation, put a few drops of lubricating oil on the pump rod at the beginning of each day's operation. No other lubrication is required.

(2) *Sprayer operation.* Operation of the sprayer consists primarily of manipulating the wand of the sprayer to produce an even spray. When a team member is able to cover all of a designated surface with pesticide without its running off the surface, he has mastered the spraying technique. This technique is mastered by means of observation and practice. All pesticide in the sprayer should be used up on the job. Never pour excess pesticide on the ground or down the drain.

(3) *Sprayer maintenance.* Proper maintenance of the sprayer is essential to effective control operations.

(a) Cleaning the sprayer. A most important aspect of maintenance is keeping the sprayer clean.

1. After each use, flush and rinse the sprayer with kerosene or fuel oil and wipe off the exterior of the sprayer to prevent the pesticide from crystallizing. The crystals will corrode metal, jam the valves, deteriorate the gaskets, and cause the nozzles to malfunction.

2. Clean the tank and strainers thoroughly any time that the sprayer fails to function properly. Remove the in-line strainer and nozzle strainer; then clean and rinse them thoroughly with kerosene or fuel oil.

(b) Replacing worn parts.

1. To replace the piston-cup, first remove the pump assembly by pulling the pump handle until the piston rod comes out of the cylinder; then remove the piston-cup screw and retainer and replace the cup with a new one. Place the piston rod into the cylinder, taking care not to damage the piston cup. Replace pump assembly and tighten securely.

2. To replace the pump cylinder valve, first remove the pump assembly. Remove the valve if worn and replace with a new one. The valve is a push-on, pull-off type construction. Check for sand, soil, or other material under the valve and clean if needed. Replace the pump assembly and pump it to check for pressure leaks and buildup. If leaks are found, remove assembly and repair as needed.

3. To repair the hose, first remove the hose by loosening the hose clamp. Cut off the broken portion from the hose. Put the end of the hose through the hose clamp and on the hose adapter; then screw the hose clamp securely into position. A new hose cut to proper length can be installed by removing both hose clamps and following the procedure outlined above.

Section VII. THE BIOLOGY AND CONTROL OF RODENTS

2-33. General

Throughout history rodents have played an important and often decisive role in man's development. Plague, a disease transmitted from rodents to man by fleas, caused the death of

approximately one-fourth of the European population in the Middle Ages. In more recent times it is estimated that, in the United States alone, damage to crops caused by rodents amounts to millions of dollars each year.

a. Rodents consist of a large group of mammals classified in the order *Rodentia.* This order encompasses a wide variety of animals including squirrels, chipmunks, and prairie dogs as well as rats and mice. The rodents are commonly identified by the presence of two sets of chisel-like incisor teeth and the absence of canine teeth. This arrangement of teeth facilitates the rodent's eating habits. Rodents are almost exclusively herbivorous or seed eaters. The exceptions to this are domestic rats and house mice, which eat almost any type of available food.

b. During recent times three rodent species have associated themselves with man for their primary requirements of food and shelter. These are the Norway rat, the roof rat, and the house mouse. A pictorial key for field identification of these three domestic rodents is provided in Figure 2-1.

2-34. Norway Rat

a. The Norway rat, *Rattus norvegicus,* has been incriminated in the transmission of a number of diseases to man. Among these are plague, typhus, leptospirosis, rat bite fever, Rocky Mountain spotted fever, tick-borne relapsing fever, and scrub typhus. They may also be involved in the transmission of various kinds of food poisoning through contamination with urine or feces.

b. In nature, the life span of the Norway rat is approximately 1 year; however, it may live up to 4 years in a laboratory. At 3 to 5 months of age the rat becomes sexually mature. The gestation period is about 22 days. As a result, about seven litters can be produced yearly. Normally, a litter will consist of from eight to 12 young, thus giving a single female a potential of 84 young per year. Fortunately, only about 20 young are actually weaned each year. Due to its close contact with man, the Norway rat has developed an affinity for man's food; therefore, it prefers meat, fish, and garbage. This species normally eats from three-fourths to 1 ounce of food a day and requires about one-half to 1 ounce of water. In his search for food, the Norway rat will travel 100 to 150 feet from his harborage. Because he is heavier and less agile than other domestic rodents, the Norway rat is usually found on ground levels. Normally they burrow into the ground for harborage.

c. The physical characteristics of the Norway Rat include the—

- Tail is shorter than the head and body;
- Body is thick with a blunt nose;
- Adult rat weighs approximately 16 ounces; and
- Eyes and ears are small.

2-35. Roof Rat

a. The roof rat, *Rattus rattus, is* involved in the transmission of the same diseases as is the Norway rat. The Norway rat is generally found in temperate regions, whereas the roof

rat is normally restricted to tropical and subtropical locations. In nature, the life span of the roof rat is about 1 year. At about 3-5 months of age the female becomes sexually mature. It is capable of producing six litters of six to eight young annually; however, only about 20 of these are actually weaned. Although the roof rat will eat various types of human food, it prefers vegetables, fruits, or grain. The food and water requirements of this rodent are similar to those of the Norway rat. As opposed to the Norway rat, the roof rat does not burrow in the ground but is found in attics, between walls of buildings, and may also nest in trees.

b. The physical characteristics of roof rats include the—

- Tail is longer than the head and body;
- Body is slender;
- Adult weighs 8 to 12 ounces; and
- Eyes and ears are large.

2-36. House Mouse

a. The house mouse, *Mus musculus,* adapts itself to a variety of living conditions and is found throughout the world in close association with man. Although it prefers houses and out buildings, it has been known to nest in holes gnawed in frozen beef carcasses in storage lockers. The house mouse has a life span of about 1 year and is sexually mature at about 6 weeks. The gestation of this species is only 19 days. Up to eight litters may be produced each year, with six to eight young per litter. Only about 35 are actually weaned. The house mouse will eat any food available; however, it tends to prefer grain or grain products. It requires about one-tenth of an ounce of food and about one-twentieth of an ounce of water each day.

b. The physical characteristics of the house mouse include the—

- Body is small;
- Tail is as long as the body and head; and
- Adult weighs ½ to ¾ ounce.

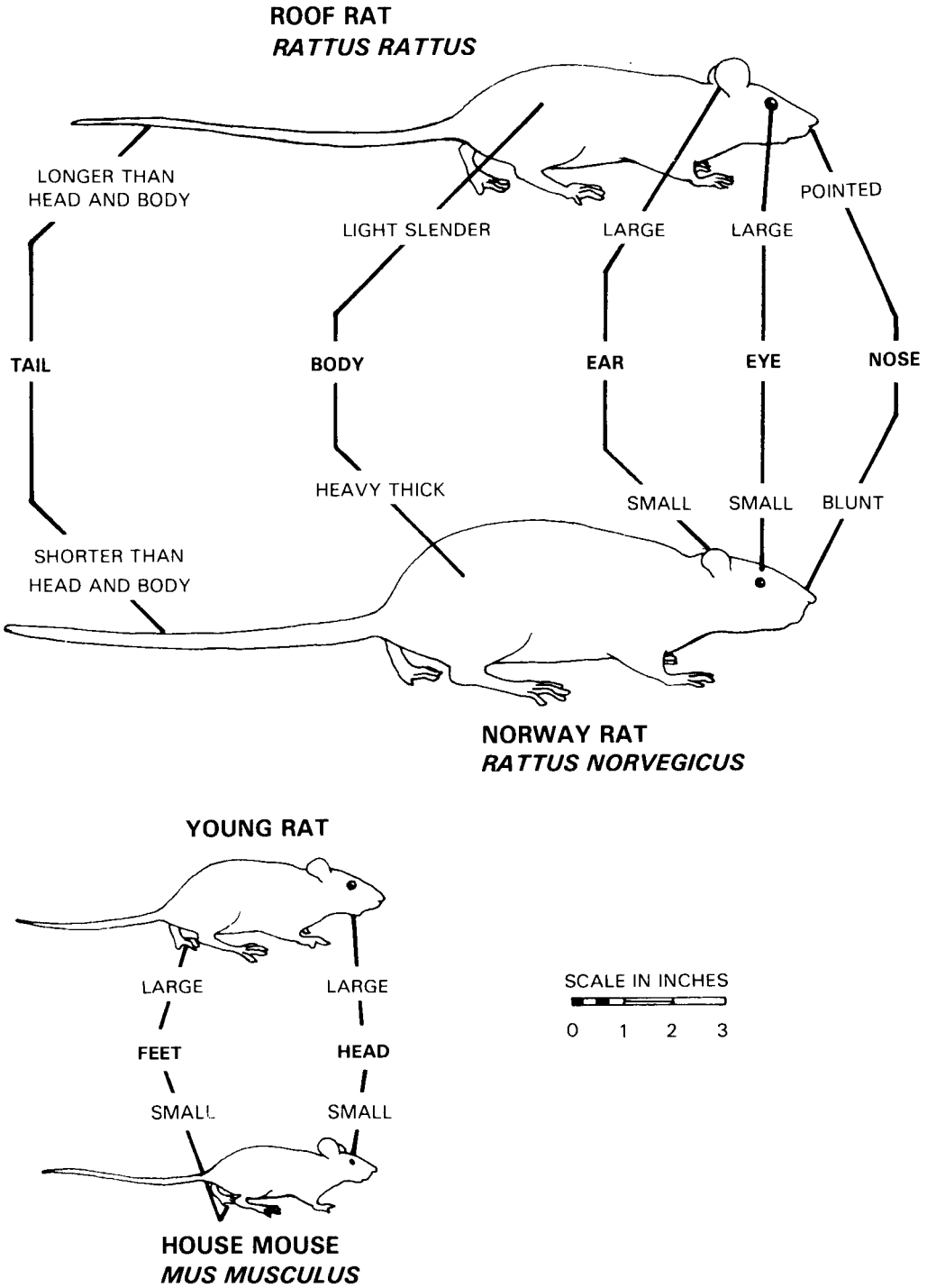

Figure 2-1. Pictorial key of domestic rodents.

2-37. Rodents and Human Disease

Rats are especially harmful to man and domestic animals as carriers of disease. The more important diseases are discussed below.

a. Plague. Plague is caused by the bacillus *Yersinia pestis.* It is primarily a rodent disease transmitted by fleas. Man acquires the disease through contact with infected fleas or animal tissue. The disease is found in many parts of the world including the western United States.

b. Murine Typhus. Murine typhus is a rickettsial infection *(Rickettsia mooseri)* transmitted by infected flea feces. Itching from flea bites causes the victim to scratch, thereby rubbing flea feces into the skin.

c. Leptospirosis. Rat-borne leptospirosis is caused by a spirochete, *Leptospira icterohaemorrhagiae,* which lives in the rat's kidneys and is shed in the urine. Man contracts the disease by swimming in contaminated water; by contacting moist infected soil; by touching rat smears which contain infected urine; or by coming in contact with infected animal tissues.

d. Salmonellosis. Rats and mice are most commonly infected with *Salmonella typhimurium* and *Salmonella enterocolitis.* These diseases are spread to man through the infected feces and urine of rats and mice. Infection most commonly occurs as the result of contaminated food or food preparation on contaminated surfaces. Mice are probably more important than rats in the transmission of these diseases.

e. Rickettsialpox. Rickettsialpox is a mild infection caused by *Rickettsia akari* which is transmitted from mice to man by the bite of the house-mouse mite, *Liponyssoides sanguineus.*

2-38. Control Measures

a. Rodent Surveys. Rodents can be a problem in any structure that soldiers inhabit, especially where there is food, water, and shelter (harborage) present. An active rodent survey program should be conducted to look for signs of rodent infestations. These signs include sightings of live or dead rodents, droppings, smudge marks, tracks, gnawings, burrows/holes, nests, sounds, and odors. The earlier an infestation is detected, the easier it is to eliminate.

b. Eliminate Food.

(1) Deny access to garbage by using cans with tight-fitting lids, secured to prevent dislodging by animals. Dispose of garbage regularly, and clean garbage cans regularly.

(2) Store foodstuffs in rodent-proof containers and require unit personnel to store personal food in tightly covered metal containers such as cake tins.

(3) Clean up all spilled foods.

c. Eliminate Water.

(1) Repair leaking water trailers.

(2) Drain low spots where runoff forms puddles.

(3) Eliminate water holding items such as old tires, cans and other refuse.

d. Eliminate harborage. Rodents rely on concealment for protection while traveling, feeding, and resting. They avoid well-lighted and open spaces as much as possible.

(1) Clean up debris, rubble, building materials and trash.

(2) Thin or remove dense vegetation; keep fencelines clear of thick growing vines and shrubs.

(3) Minimize weeds, shrubs, and grass adjacent to buildings and tentage.

(4) Trim tree limbs that overhang roofs,

(5) Keep areas free of clutter and debris.

(6) Stack stored materials away from walls.

(7) Deny access to potential nesting materials such as paper, cloth, and straw.

e. Trap rodents.

(1) Snap traps can be used to kill rodents in situations where poison baits cannot be used (such as around food), and where rodent infestations are not excessive. Effective trapping depends on putting the traps where rodents will contact them. The best locations are against walls, behind or under objects, and other places where rodents may hide.

(2) Meat baits such as hot dogs or bacon are effective for Norway rats, while nuts and dried fruits may be best for roof rats. Peanut butter, plain or mixed with grain (rolled oats), works well for house mice. Testing a variety of baits can aid in determining bait preference and increasing trap success.

(3) A large number of traps, placed in or near rodent runways, for a short period are more effective than a few traps over a longer time. Bait must be securely fastened to the trap trigger mechanism. Traps must be checked and reset daily.

f. Chemical rodent control. Chemical control is another method that can be used to control rodent infestations. The field sanitation teams will not use chemicals in food areas for rodent control. This work must be performed by personnel with specialized training. Also, chemicals will not be stored near food. Instances have occurred where rodent control baits (rodenticides) were mistaken for food and were consumed by humans. The type of rodenticides available for use by field sanitation teams are the multiple dose anticoagulants. These

compounds are considered the safest rodenticides for general use. The action of multiple dose rodenticides is cumulative; rodents must feed on the anticoagulant treated bait for several days with not more than 48 hours between feedings. Adequate supplies of toxic bait must be kept available until control is achieved. Notify Preventive Medicine personnel if rodents are not accepting the bait.

g. Rodent bait stations. Proper placement of bait is very important. Place baits in rodent travel ways or near their burrows and harborage; the best of these locations is in the rodents normal line of travel. Baits should be placed in containers. Such containers should be placed next to walls or in places where the rodents will intercept them. Some bait boxes may be large enough so that both water and dry baits can be placed inside. They may be constructed of wood, plastic, or metal. The containers should be made tamper proof to prevent people and other animals from tipping them over or spilling the baits. If properly placed, bait containers provide a secure place for rodents to feed.

h. Disposal of dead rodents. All traps and bait stations must be checked early each morning for dead rodents. The following self-protective measures are essential in disposing of the dead rodents:

(1) Spread insect repellent on your hands, sleeves, and the front of your clothing to repel any parasites which may attempt to leave the rodent as they are removed from the traps or stations. Do not assume that all parasites have already left the rodents.

(2) Using long-handled tongs or a shovel, pick up the rodents and place them in a plastic bag or a metal container which has a tightly fitted lid.

(3) Burn or bury the dead rodents, depending upon the local situation.

Section VIII. HEAT INJURIES

2-39. General

a. The human body temperature is regulated within extremely narrow limits, even though there may be marked variations in the environmental temperature. Exposure to high environmental temperature produces stress on the body which may lead to a heat injury. The conditions which influence the heat equilibrium of the body and its adjustments are the air temperature; the temperature of surrounding objects; the sun's radiant heat; the vapor pressure of the water in the air (relative humidity); the air movement; and the amount and type of clothing worn. Another important factor which influences the heat equilibrium is the metabolic heat produced by the body as a result of physical activity.

b. The environment also plays a part in body heat loss.

(1) The rate and direction of heat flow from (or to) the body depends on the *temperature* of the environment. When the environmental temperature is much below body temperature the rate of heat loss is large. This rate falls as the environmental temperature

reaches body temperature and stops when these temperatures are equal. As the environmental temperature rises above body temperature, the only way for the body to lose heat is by sweating.

(2) The *wind* is another important environmental factor in heat regulation. As the wind rate increases, the warm air cooled by the body through conduction is blown away and replaced by additional warm air that increases body heat. If the air is warmer than the skin, it may still help cool the body by evaporating sweat. Of course, with a high wind rate, the skin may be injured by mechanical forces (windburn) which will decrease body heat loss.

(3) Air *humidity* is yet another important heat loss factor. The air, at any given temperature, can hold only a certain amount of water vapor. As the environmental humidity (the measurement of how much water vapor there is in the air) rises, smaller amounts of sweat can evaporate, and heat loss by evaporation slows. This is the main difference between the heat of the desert (low humidity) and the jungle (high humidity). Because of the limitation of evaporation, heat injuries occur at lower environmental temperatures in the jungle or in any area where the humidity is high. For sweating to be effective, it must evaporate from the skin surface. Sweat that drips or is wiped off does not aid in body heat loss.

(4) Radiant energy is also an important environmental factor. If objects, such as tanks, surrounding a human body are hotter than the body, they will radiate heat to the body. In warm weather, and especially outdoors in the sun, the radiant heat load is high, and the body cannot lose heat by radiation. Shade and light colored clothing block absorption of the radiant energy of the sun by the body.

2-40. Types of Heat Injury

Three distinct clinical syndromes of heat injury may occur, depending on the manner of breakdown in the individual's heat adjustment. These syndromes are heat cramps, heat exhaustion, and heatstroke. The three conditions produce distinctive signs and symptoms which should be recognized at once not only by the medical officer, but also by the line officer and other personnel if the casualty is to receive proper care and attention. All military personnel must be familiar with the preventive measures for these conditions.

a. Heat Cramps. Painful cramps of the voluntary muscles may occur following exposure to heat. Heat cramps result primarily from excessive loss of salt from the body. The muscles of the extremities and of the abdominal wall are usually involved and the cramps may be of great severity. Heat cramps can occur alone or in the presence of heat exhaustion. Body temperature is normal unless heat cramps are accompanied by heat exhaustion.

b. Heat Exhaustion. Heat exhaustion occurs as the result of peripheral vascular collapse due to excessive salt depletion and dehydration. This syndrome is characterized by profuse sweating, headache, tingling sensations in the extremities, pallor, dyspnea, palpitations associated with gastrointestinal symptoms of anorexia, and occasionally, nausea and vomiting. Neuro-muscular disturbances with trembling, weakness, and incoordination coupled with cerebral signs ranging from slight clouding of the sensorium to momentary loss of consciousness complete the classical picture. The skin is cool and moist. The pulse rate is rapid (120 to 200 beats per minute), and the blood pressure may be low. The oral temperature

may be subnormal (as in cases where hyperventilation is present) or slightly elevated, but the rectal temperature is usually elevated.

c. Heatstroke. **HEATSTROKE IS A MEDICAL EMERGENCY,**with a high death rate. Whereas heat exhaustion may be regarded as the end result of overactive heat-balance mechanisms that are still functioning, heatstroke results when thermo-regulatory mechanisms are not functional, and the main avenue of heat loss (cooling by evaporation of sweat) is blocked. There may be early signs, such as headache, dizziness, delirium, weakness, nausea, vomiting, and excessive warmth, however sweating may or may not be absent. Although the casualty may first progress through the symptoms of heat cramps or heat exhaustion, the onset of heatstroke may occur with dramatic suddenness with collapse and loss of consciousness. Profound coma is usually present and convulsions may occur. In the early stage, the casualty's skin is usually hot, red, and dry. The presence of sweating does not exclude this diagnosis. The best sign of this injury is a high body temperature, in excess of 106 ºF (41 °C). A rectal temperature exceeding 108 °F *(42 °C) is* not uncommon and indicates a poor prognosis. The casualty's condition deteriorates rapidly, therefore treatment must begin immediately. One attack of heatstroke predisposes to a second attack, and care should be taken by the individual to avoid a second exposure to the precipitating condition. An alternative view is that the individual is a member of a susceptible population and remains susceptible.

2-41. Predisposing Factors Leading to Heat Injury

a. Several human factors come into play which increase the heat load on the body and make the likelihood of injury more prevalent. Individuals who are unacclimatized are much more likely to be injured. Recruits are particularly vulnerable to heat injury. The individual who has been living in a cool climate does not handle heat stress well. In fact a person who is acclimatized to heat and who moves to a cool area for 1 month loses most of his acclimatization to heat.

b. Overweight and fatigue impair the body's heat losing mechanisms. It takes work on the part of the body to lose heat, and an already tired body cannot perform this function well.

c. Heavy meals and hot foods put unnecessary stress on the body. Hot meals add heat which must be eliminated. Heavy meals direct blood flow to the digestive tract.

d. Use of alcoholic beverages, especially amounts resulting in hangovers, will decrease the ability of the body to deal effectively with heat stress.

e. Fever increases the amount of heat to be dissipated by the body. Fever is usually the result of disease processes, but can also be induced by man. Many of the immunizations which are administered produce fevers.

f. Drugs which inhibit sweating such as atropine, antihistamines, some tranquilizers, cold medicines, and some antidiarrheal medications markedly impair heat loss when temperatures are high.

g. Tight clothing is detrimental to heat loss from the body. Clothing should be loose so as not to restrict circulation or impede movement of air over the skin.

2-42. Prevention of Heat Injuries

Successful prevention of adverse effects of heat depends largely on education of personnel, including personnel exposed to heat, especially those charged with the supervision of such personnel. Specifically, prevention of heat injury involves 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. Resistance is increased by gradual acclimatization of individuals to hot environments, or at least graduated introduction of the required work level in a hot environment; by replenishing water and salt losses from the body as they occur; and by the maintenance of the optimum physical condition of personnel. Heat stress is decreased by reducing the workload and by introducing any measure which will protect the individual from the hot environment.

a. Water.

(1) The human body is highly dependent on water to cool itself in a hot environment. By sweating, an individual may lose water in excess of 1 quart per hour. These losses must be replaced, or rapid decrease in the ability to work; a rise in body temperature and heart rate; deterioration of morale; and heat injury will occur. Water loss should be replaced by frequent intake of small amounts of water throughout the work period. Personnel must be encouraged to drink water and be given time to do so, since normal thirst does not serve as a true indication of the body's need for water. Table 2-3 may be used as a guide to estimate the drinking water requirements for personnel exposed to heat. This table should be used for planning and procurement purposes only, and should not be used as a yardstick for water intake of any individual.

(2) During periods of moderate activity, with moderate conditions prevailing, water requirements will be 1 pint or more per hour per man. This is best taken at 20- to 30-minute intervals. As activities or conditions become more severe the intake increases accordingly. When water is in short supply, significant water economy may be achieved by limiting physical activity to the early morning, late evening, and night hours when the heat load is less and sweating is reduced. The optimum drinking water temperature is between 50 °F and 60 °F.

(3) The belief that men can be taught (toughened up) to adjust to decreased water intake is incorrect. Man cannot live or work in heat without sufficient water.

b. Salt.

(1) In addition to water, sodium chloride is lost in the sweat. The military diet usually provides adequate salt.

(2) A convenient method of providing adequate salt intake is to encourage the use of salt added to food at mealtime. This, along with salt in cooking and in bread, will meet most requirements. Excess intake of salt should be avoided; it may cause increased thirst and intestinal disturbances.

CAUTION

Due to the high salt concentration in field rations, caution must be taken to maintain a high water intake.

Table 2-3. Heat Injury Prevention

*CRITERIA		CONTROLS		
Heat Condition/ Category	WBGT Index °F	Water Intake Quart/Hour	Physical Activity for Soldiers **Acclimatized Work/Rest	Unacclimatized Soldiers and Trainees
1	78-81.9	At least ½	Continuous	
2	82-84.9	At least ½	50/10 minutes	Use discretion in planning heavy exercises.
3	85-87.9	At least 1	45/15 minutes	Suspend strenuous exercise during first three weeks of training. Training activities may be continued on a reduced scale after the second week of training. Avoid activity in direct sun.
4	88-89.9	At least 1½	30/30 minutes	Curtail strenuous exercise for all personnel with less than 12 weeks of hot weather training.
5	90 and up	More than 2	20/40 minutes	Physical training and strenuous exercise is suspended. Essential operational commitments not for training, where risk of heat casualties may be warranted, is excluded from suspension. Enforce water intake to minimize expected heat injuries.

* MOPP gear or body armor adds 10 °F to the WBGT index.
**An acclimatized soldier is one who has worked in the given heat condition for 10 to 14 days.
NOTE: ''Rest'' means minimal physical activity. Rest should be accomplished in the shade if possible. Any activity requiring only minimal physical activity can be performed during''rest'' periods. EXAMPLES: Training by lecture or demonstration, minor maintenance procedures on vehicles or weapons, personal hygiene activities, such as skin and foot care.

c. Acclimatization.

(1) Training programs for personnel who are climatically and/or physically unseasoned to heat should be limited in intensity and time. A period of approximately 2 weeks should be allowed for acclimatization with progressive degrees of heat exposure and physical exertion. If personnel are required to perform heavy physical work before being acclimatized; the work is poorly performed; development of the capacity to effective work is retarded; and the risk of heat injury and disability is high. A period of acclimatization (10 to 14 days) is necessary regardless of the individual's physical condition, although the better the physical condition, the quicker acclimatization is completed.

(2) Acclimatization to heat begins with the first exposure, and is usually well developed by the end of the first week. Individuals who are unusually susceptible to heat will require additional time for acclimatization. Full acclimatization (the ability to perform a maximum amount of strenuous work in the heat) is attained most quickly by gradually increasing work in the heat. Resting for 3 or 4 days in the heat, with activity limited to that required for existence, results in only partial acclimatization. Physical work in the heat must be accomplished for development of full acclimatization to that work level in a given hot environment. A day or two of intervening cool weather will not interfere significantly with acclimatization to a hot environment.

(3) A schedule should be established which provides for alternating work and rest periods. Although advantage should be taken of the cooler hours in accomplishing a portion of the work, the schedule should include gradually increasing exposure during the hotter parts of the day rather than complete exclusion of work at that time. Table 2-3 provides work/rest cycles. These cycles may be modified to be consistent with local conditions. The work period should be divided so that a man works and rests in alternating periods. When necessary to accomplish a given task two details can be arranged to work in sequence. The schedule is based on work equal to that of marching with a 20-pound pack at the rate of 2.5 miles per hour. Lighter work maybe carried out for longer periods of time, and heavier work for shorter periods. During the midday period personnel should rest and keep in the shade as much as possible. Peak wet bulb globe temperature (WBGT) conditions usually occur between 1200 and 1600 hours. Local and regional variations may warrant modifications of the above schedule. Acclimatization schedules for unseasoned individuals should be scaled down to their tolerance.

(4) Adequate water must be provided at all times. Personnel cannot learn to do without water.

(5) Once acclimatized, the soldier will retain his adaption for 1 week after leaving the hot environment, but if not exposed to work in high temperatures, the acclimatization will then decrease at a variable rate, the major portion being lost within 1 month.

(6) Acclimatization to a hot, dry (desert) environment markedly increases the ability to work in a hot, moist (jungle) environment; however, for proper acclimatization to the latter, residence in such an area with regulated physical activity is required. Whereas carefully and fully developed acclimatization increases resistance, it does not provide complete protection against ill effects of heat, especially moist heat.

(7) Under conditions of heat stress, meals should be cool rather than hot. The heaviest meal should be served in the evening rather than at noon. An hour of rest following the noon meal is beneficial.

d. Physical Condition. The general physical condition of the individual has a significant bearing on the reaction to heat stress. Individual susceptibility y to heat may be enhanced by a large number and variety of conditions. Among these are infections, fevers, immunization reactions, heat rash, sunburn, fatigue, overweight, and previous case of heatstroke. The risk of heat injury is much higher in overweight unfit persons than in those of normal weight. Special care should be exercised when such persons are exposed to high temperatures. An individual once affected should therefore be exposed to heat stress with caution. Predisposition is not developed in the case of heat exhaustion and heat cramps.

e. Work Schedules. Work schedules must be tailored to fit the climate, the physical condition of personnel, and the military situation. Close supervision by medical personnel and commanders is essential in achieving maximum work output with minimum hazard. Several principles must be considered:

(1) The amount of heat produced by the body increases directly with increasing work; therefore, reduction of workload markedly decreases the total heat stress.

(2) Workloads and/or duration of physical exertion should be less during the first days of exposure to heat and should be gradually increased to allow for acclimatization.

(3) Decisions to modify work schedules must be governed by the local situation, heavy work should be scheduled for the cooler hours of the day such as early morning or late evening.

(4) Alternate work and rest periods may prove desirable. Under moderately hot conditions, 5-minute rest periods in the shade alternating with 25 minutes of work in the sun may be desirable. Under severe conditions the duration of rest periods should be increased.

(5) Exposure to high temperature at night as well as in the daytime will decrease the amount of work that can be performed effectively.

(6) Workloads must be reduced at high temperatures when dehydration resulting from excess sweating and lack of water replacement occurs. When water is in short supply, working in the early morning and late evenings will allow for the accomplishment of much more work for the expenditure of a given amount of water than working during the hottest hours of the day.

(7) Work in the direct sun should be avoided as much as possible on hot days.

(8) Unnecessary standing at attention in the heat should be avoided because continued standing places an added burden on the body's circulatory system.

(9) When the temperature is very high, physical work should be curtailed or, under extremely severe conditions, even suspended. The temperature at which work should be curtailed or suspended depends on the humidity, heat radiation, air movement, character of the work, degree of acclimatization of personnel, and other factors. Heat casualties may be expected at wet bulb globe temperature indices of 75°F and above unless preventive measures are instituted. Overexertion can cause heat injury at even lower temperatures, especially if body armor or vapor impermeable protective clothing is worn.

f. Protection from the Environment. Except when exposed to the sun's rays, an individual in a hot environment is better-off wearing the least allowable amount of clothing. Clothing reduces the exposure of the body surface to solar radiation, but at the same time decreases the movement of air over the skin. To take full advantage of its benefits and minimize its disadvantages, clothing should be loose fitting especially at the neck, wrists, waist, and lower legs to allow air circulation. Protection from the environment also includes such simple but frequently overlooked things as marching troops over grass rather than concrete and operating in the shade, if available.

g. Education. Prevention of heat casualties depends largely on the education of personnel exposed and especially upon supervision by informed leaders. Every individual exposed to high temperatures should be informed of the potentially serious results of heat injury, the general nature of these conditions, and how they can be prevented. Supervisors must be able to identify environmental conditions under which adverse heat effects are likely to occur. They should recognize the earliest signs of heat injury and take action to prevent the development of cases. All personnel should be able to apply effective first aid. Mental confusion and overactivity usually precede collapse from heatstroke. Supervisors must be alert to detect this condition, enforce rest, and obtain medical assistance promptly. Medical personnel should assist commanders in the development of local programs for heat injury prevention.

h. The WBGT Index. The Wet Bulb Globe Temperature Index serves as a guideline for making recommendations to the commander when hot weather conditions are hazardous for the soldiers. With this information, decisions can be made regarding soldier activity in hot weather. The WBGT Index can be obtained from preventive medicine or the military meteorological service.

2-43. Use of the WBGT Index in the Control of Physical Activity

It should be emphasized that the measurements must be taken in a location which is the same as, or closely approximates, the environment to which personnel are exposed.

a. When the WBGT Index reaches *82* °F, discretion should be used in planning heavy exercise for unseasoned personnel.

b. When the WBGT reaches *85* ºF, strenuous exercises such as marching at standard cadence should be suspended for unseasoned personnel during their first 2 weeks of training. At this temperature training activities may be continued on a reduced scale after the second week of training.

c. Outdoor classes in the sun should be avoided when the WBGT exceeds *85* °F.

d. When the WBGT reaches *88* ºF, strenuous exercise should be curtailed for all recruits and other trainees with less than 12 weeks training in hot weather. Hardened personnel, after having been acclimatized each season, can carry on limited activity at WBGT of *88* ºF to *90* ºF for periods not exceeding six hours a day.

e. When the WBGT index is *90* ºF and above, physical training and strenuous exercise should be suspended *for all personnel* (excluding essential operational commitments not for training purposes, where the risk of heat casualties may be warranted).

f. Wearing body armor or mission oriented protective posture (MOPP) in effect adds 10 ºF to the measured WBGT. Limits should be adjusted appropriately.

Section IX. COLD INJURIES

2-44. General

a. Cold injury is defined as tissue injury produced by exposure to cold. The type of injury produced depends upon the degree of cold to which the body is exposed, the duration of the exposure, and the environmental factors responsible for injuring the body.

b. Cold injury can occur at nonfreezing and at freezing temperatures. Pathologically, all cold injuries are similar. Nonfreezing cold injury is associated with exposure to water and cold. Chilblain, immersion foot, and trench foot are the three common terms applied to nonfreezing cold injury, and a description of each appears below. However, these three terms apply to the same basic injury. The other injury, frostbite, is an injury caused by freezing cold. Hypothermia is a condition caused by cold and body heat loss.

(1) Chilblain results from intermittent exposure to temperatures above freezing, in high humidity.

(2) Immersion foot results from prolonged exposure, usually in excess of 12 hours, in water at temperatures usually below 50 ºF. It is not limited to the feet, but may involve other areas of the body following immersion. Exposure for several days in water at 70 ºF in tropical latitudes has produced severe injury.

(3) Trench foot results from prolonged exposure to cold–and usually wetness–at temperatures from just above freezing to 50 ºF. It is often associated with immobilization and dependency of the lower extremities. The average duration of exposure resulting in trench foot is 3 days.

(4) Frostbite is produced by exposure at temperatures of freezing or below. Depending upon the air temperature, the time of exposure varies from a few minutes to several hours. High altitude frostbite results from exposure at high altitude to temperatures varying from -20 ºF to -80 ºF. At these very low temperatures, severe injury may be instantaneous, especially to exposed parts such as fingers, ears, and the nose.

(5) General hypothermia is an acute problem resulting from prolonged cold exposure and body heat loss. If an individual becomes fatigued during physical activity, he will be more prone to heat loss, and as exhaustion approaches, sudden blood vessel dilation occurs with resultant rapid loss of body heat.

2-45. Predisposing Factors

Cold injury, as it involves a military population, behaves in general according to accepted epidemiologic principles. A specific agent is present and a variety of environmental and host factors influence the incidence, prevalence, type, and severity of the injury. Three main factors are involved in cold injury:

a. Agent Factors. Cold is the specific agent in cold injury and is the immediate cause of tissue damage without respect to the influence of modifying factors. If the effect of cold is considered in terms of body heat loss, the effect of moisture as a conductor of heat is readily apparent, also the ways in which various host and environmental factors modify the extent and severity of cold injury become clear. Therefore, the effect of cold cannot be evaluated in direct relation to air temperature alone.

b. Environmental Factors.

(1) Weather is a predominant factor in cold injury. Temperature, humidity, precipitation, and wind modify the rate of body heat loss. Low temperatures and low relative humidity favor development of frostbite. Higher temperatures (just above freezing to 50 ºF) together with moisture are usually associated with trench foot. Wind velocity accelerates body heat loss under conditions of both coldness and wetness. The effect of low temperatures is intensified as air movement passing the body increases. This can be the result of wind against the body or the effect of a body moving rapidly through the air, such as in running, skiing, or riding in an open vehicle. The effects of wind speed on chilling the body are illustrated in Table 2-4.

(2) The incidence of cold injury varies greatly according to the type of combat action. Units in reserve or in rest areas have relatively few cases of cold injury. On holding missions or on static defense, exposure is greater, and a moderate increase in incidence is expected. On active defense or offense, marked increases in cold injuries usually occur. Immobility under fire, prolonged exposure, lack of an opportunity to rewarm and change clothing or carry out personal hygienic measures, fatigue, and a lack of nutrition may be involved.

(3) Adequate clothing properly worn is essential to survival. Clothing for cold weather combat has been designed to be worn as an assembly for protecting the head, torso, and extremities. Failure to wear the total assembly, and inadequate supplies of properly sized clothing are important factors leading to cold injury. The assembly depends upon the layering principle to conserve body heat. Accordingly, loose layers of clothing with air space between and under an outer wind- and water-resistant garment provide maximum protection. It is flexible; because outer layers may be removed for comfort and efficiency to permit escape of perspiration in higher air temperatures or during strenuous physical exertion. Clothing wet by perspiration loses much of its insulating value. Therefore, care must be taken to prevent perspiration from accumulating in the clothing. In all forms of cold injury, preventing body heat loss by proper protection of the body is as important as wearing efficient head, hand, or footgear. All articles of clothing must be loose enough to avoid constriction.

c. Host Factors.

(1) *Age.* Within the usual age range of combat personnel, age is not significant.

(2) *Rank.* Trench foot and frostbite injuries are higher in frontline riflemen, and predominantly in those of the lower ranks because they have greater exposure. The decreased incidence of cold injury among higher ranks is because of a combination of factors, such as experience, leadership, receptivity to training, and significantly less exposure.

(3) *Previous cold injury.* A previous episode of trench foot, frostbite, or immersion foot greatly increases the individual's risk of another cold injury to the same area.

(4) *Fatigue.* Fatigue contributes to cold injury because as personnel become exhausted they fail to carry out simple preventive measures. This occurs more frequently in personnel who have been in combat for 30 days or more without rest. Mental weariness may cause apathy leading to the neglect of needs vital to survival. Frequent rotation of troops from the front lines for even short periods lessens the effects of fatigue.

(5) *Discipline, training and experience.*Individual and unit discipline, training, and experience are closely related as they influence the incidence of cold injury. Well-trained and well-disciplined men profit from combat experience in the cold. They are better able to care for themselves through personal hygiene, care of the feet, change of clothing, exercise of the extremities in pinned-down positions, and similar simple but effective measures. Preventive measures necessary for survival in the cold must be continuously stressed to the troops, enabling them to cope with these problems.

(6) *Psychosocial factors.* Cold injury tends to occur in passive, negativistic, or hypochondriacal individuals, who display little muscular activity and who are prone to pay less attention to carrying extra footwear; changing socks when needed; and reducing smoking under combat conditions where cold injury is a threat.

(7) *Race.* In terms of numbers at risk, and independent of geographic origin, Blacks appear to be considerably more vulnerable to frostbite than are Caucasians.

(8) *Geographic origin*. The geographic origin of the individual seems to be a significant factor among Caucasians in the incidence of cold injury. Origin from warmer climates of the United States (including Puerto Rico) (in states where the mean minimum January temperature is above 20 ºF) predisposes cold injury,

(9) *Nutrition.* Poor nutrition contributes to susceptibility to cold injury. Adequately clothed and protected personnel living and working in cold climates do not require an increase in caloric intake above that normally provided in the military ration. Individuals who do not eat regularly, or do not eat complete, balanced meals are more susceptible to injury.

(10) *Activity*. Too much or too little activity can contribute to cold injury. Overactivity with rapid and deep breathing can cause large amounts of body heat loss. Perspiration trapped in clothing markedly reduces the insulating quality of the clothing. On the other hand, immobility causes decreased heat production with the danger of resultant cooling, especially of extremities.

(11) *Drugs and medications.* Personnel should be made aware of the effects of smoking in decreasing peripheral circulation and of alcohol ingestion in dilating peripheral vessels. Persons on peripheral vasodilator medications may be at added risk of cold injury due to reduced circulation. Both tobacco and alcohol should be avoided when the danger of cold injury exists.

Table 2-4. Windchill chart

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill 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	-121
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	-20	-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 in less than one hour with dry skin. Maximum danger of false sense of security.

INCREASING DANGER Danger from freezing of exposed flesh within one minute.

GREAT DANGER Flesh may freeze within 30 seconds.

NOTE: 1. Trench foot and immersion foot may occur at any point on this chart.
2. F = 9/5 C +32.

2-46. Prevention of Cold Injuries

a. General. Cold injuries are preventable except in unusual situations. Successful prevention requires vigorous command leadership; prior planning in such activities as cold-weather training; and the provision of cold-weather clothing and equipment. Specific preventive measures are directed toward conserving body heat and avoiding unnecessary exposure of personnel to cold, moisture, and activities or factors favoring cold injury.

b. Meteorological Data. All commanders must be familiar with the use of meteorological data such as humidity, temperature, wind, and ground surface conditions which influence the risk of cold injury. The windchill chart (Table 2-4) can help you and your commander judge the severity of the environment. Some weather conditions require shortening the exposure time of individuals engaged in patrols, guards, or motor movements in unheated vehicles despite the adequacy of their clothing and equipment. These can frequently be anticipated by using meteorological data and existing weather conditions to predict the hazard for the next 12-hour period.

c. Cold Injury Control Officer. Each platoon or comparable-sized unit should have a cold injury control officer or NCO (frequently the FST member), who is selected on the basis of

leadership, interest, and ability to supervise others in simple but constant preventive activities. He should frequently check clothing supplies; inspect personnel daily for personal hygiene and care of their feet as well as early signs and symptoms of cold injury; ensure that socks are changed at appropriate intervals and that all reasonable efforts are made to keep them clean and dry; encourage efforts to exercise even if only their extremities; and ensure that constriction of extremities by clothing, equipment, and footgear is avoided.

d. The Buddy System. Personnel should be taught to observe their buddy for evidence of cold injury. If blanching of the skin is noted, immediate care will usually prevent the development of cold injury. Holding (not rubbing) a warm hand on the blanched area until it returns to normal color will rewarm a buddy's ear, nose, or cheek. Fingers can be warmed against the skin of the abdomen or in the armpit. Toes can be rewarmed by holding them against a buddy's bare chest or abdomen, care being taken to provide protection from the wind. A symptom of incipient frostbite on fingers and toes is the sudden and complete cessation of the sensation of cold or discomfort in the part. This is often followed by a pleasant feeling of warmth. If these danger signals are instantly heeded, cold injury can be prevented.

e. Personal Measures.

(1) Wear or carry adequate clothing for the weather to be encountered. Remove excess layers of clothing before perspiration starts so that clothing does not become wet. Avoid getting clothing or footgear wet, since moisture causes loss of insulating quality.

(2) Wear clothing and footgear in loose layers to permit layers of air to provide good insulation and to permit good circulation of blood to all parts of the body. Tailored, tight-fitting uniforms are dangerous in cold climates.

(3) Keep hands well-protected; mittens are more protective than gloves. Avoid lengthy exposure of bare hands and wrists that will cause stiffening and reduce circulation, since it takes a long time to recondition the hands to normal use. Do not touch metal, snow, or other objects with bare hands.

(4) Avoid immobilization in the cold. If the situation permits, walk about and exercise periodically to generate and maintain body heat. If unable to walk about, shift positions frequently, especially move the toes, feet, legs, fingers, and arms. Sit or stand on insulating material such as wood, cardboard, or other poor cold conductors rather than on cold or wet ground or snow.

(5) Remove excess clothing when near a fire or in a warm enclosure; otherwise, the body adjusts to the warm temperature and excess clothing. Upon returning to the cold air, the body will adjust more slowly to the cold and excessive amounts of body heat will be lost. The result will be the loss of more heat than the body gained during warming, with an increased susceptibility to cold injury.

f. Clothing.

(1) A standard number of layers of clothing cannot be prescribed for universal wear during winter months. Flexibility must be provided for local conditions. Some basic principles

are important, including ventilating the body during physical activity, the cleanliness and repair of clothing to prevent loss of insulation, and avoidance of constriction produced by snug-fitting socks, boots, underwear, sweaters, jackets, and trousers.

(2) Ground forces personnel in cold areas should be equipped with insulated rubber combat boots. Frequent changes of socks is important with these boots because of increased sweating, retention of sweat, and a lowered resistance to fungal infections. Although sweating in these boots does not contribute to the loss of insulation, it does lead to softening the soles of the feet by the retained sweat. Trauma to macerated tissues, produced by walking, results in a loss of skin from the soles of the feet which may require hospitalization. Cold injuries to the feet have been reported when wearing the insulated boot. These injuries usually result from inactivity and dependency of the feet, which can occur with prolonged sitting or standing without foot or leg movement. Periodic exercise, plus good foot hygiene and dry socks, will help prevent such injuries. The insulated boot should be inspected periodically for punctures. A hole in the boot renders it ineffective and may cause cold injuries.

(3) In all types of footgear, feet perspire more and are less ventilated than other parts of the body, so that moisture accumulates in socks, decreasing their insulating quality. Because of this and the fact that the feet are susceptible to cold injury and less frequently observed than the remainder of the body, special foot and sock care is essential. Extra socks should be carried by all personnel. Socks damp from perspiration will dry if carried unfolded inside the shirt; they should be changed daily and washed whenever the opportunity permits. Socks and other clothing charged with dirt, grease, or mineral salts from perspiration will conduct heat more rapidly, thus affording less protection against the cold.

g. Unusually Susceptible Groups. Individuals with host factors listed in paragraph 2-45 require greater protection and supervision of preventive measures in order to prevent cold injury.

Section X. CHEMICAL HAZARDS (NONNBC)

2-47. General

Occupational hazards may be classified as chemical, physical, or biological. Chemicals are found in many areas where toxic materials are produced, used, and stored, or may appear as by-products or impurities in otherwise safe substances. These chemicals may produce injury or death in all situations including combat. The loss of key personnel during combat may have a serious impact upon a unit's ability to accomplish its mission. This nonbattle injury and death is preventable.

2-48. Toxic Chemical Routes of Entry

Toxic chemicals can enter the body by various routes. The body's response to any toxic chemical may vary markedly depending on the specific route of entry.

a. Inhalation. Inhalation is the most important route of entry. Some toxic chemicals may produce acute effects that are quickly recognized by the exposed person. Other chemicals may cause chronic effects that take many years to develop, such as asbestosis from asbestos exposure.

b. Absorption. The most common occupational disease seen is dermatitis. Contact dermatitis may be caused by irritation or allergic sensitization. Systemic poisoning can also result from skin absorption.

c. Ingestion. Ingestion occurs as a result of eating or smoking with contaminated hands, utensils, or in contaminated areas.

d. Injection. Accidental injection may occur from the use of high pressure air or from liquid lines rupturing, or from puncture wounds caused by contaminated objects.

2-49. Toxic Chemical Classifications

Toxic chemicals are classified according to their physical state or chemical characteristics. Classification is important in determining the route of exposure.

a. Gas. A state of matter in which material has a very low density and viscosity; can expand and contract greatly in response to changes in temperature and pressure; is easily diffused into other gasses; is readily and uniformly distributed throughout any container. A gas can be changed to a liquid or solid state only by the combined effect of increased pressure and decreased temperature.

b. Liquid. A state of matter in which the substance is a free flowing formless fluid. A liquid takes many forms depending on environmental conditions.

(1) *Vapor.* The gaseous form of substances which are normally in a solid or liquid state at normal room temperature and pressure.

(2) Mist. Suspended liquid droplets generated by condensation from the gaseous to the liquid state or by a liquid breaking up into a dispersed state by splashing, foaming or atomizing.

c. Solids.

(1) *Fume.* Airborne dispersion consisting of minute solid particles arising from heating a solid such as lead. This physical change is often accompanied by a chemical reaction, such as oxidation. Fumes flocculate and sometimes coalesce.

(2) *Dust.* Solid particles generated by handling, crushing, grinding, impacting, detonating and decrepitating materials. Dust does not tend to flocculate, except under electrostatic forces. These particles do not tend to diffuse in the air, but settle under the influence of gravity.

2-50. Chemical Actions and Effects

a. A detailed discussion of all biological actions of all the chemicals that you may encounter is impossible. Instead chemicals will be discussed according to their general biological actions.

(1) *Irritants.* These materials cause inflammation of mucous membranes with which they come in contact. Many irritants are strong acids or alkalis that are corrosive to nonliving things; however, they cause inflammation to living tissue. Examples are sulfur dioxide, acetic acid, formaldehyde, formic acid, sulfuric acid, iodine, ozone, and oxides of nitrogen.

(2) *Asphyxiants.* Asphyxiants are materials that deprive the respiratory tissues of oxygen; they do not damage the lungs. Simple asphyxiants are gases, which when present in sufficient quantities, exclude an adequate oxygen supply. Examples are nitrogen, nitrous oxide, carbon dioxide, hydrogen, helium, methane, and ethane. Chemical asphyxiants are materials which have the ability to render the body incapable of using an adequate oxygen supply. Two classic examples are carbon monoxide and cyanide.

(3) *Anesthetics.* The main toxic action of these materials is their depressant effect upon the central nervous system, particularly the brain. The degree of anesthetic effect depends upon the effective concentration in the brain as well as upon the specific makeup of the contaminant.

(4) *Systemic poisons.* These materials cause damage to internal organs such as the liver, kidney, central nervous system, or the cardiovascular system. Carbon tetrachloride produces necrosis of the liver.

(5) *Carcinogens.* These materials have demonstrated they cause cancer or are suspected of causing cancer based upon animal studies.

CAUTION

The Ml 7 series protective mask will not protect you from nonNBC chemical hazards.

2-51. Carbon Monoxide

a Sources of Exposure. Carbon monoxide is produced whenever fossil fuels are burned in the presence of insufficient oxygen to transform all the carbon to carbon dioxide. Carbon monoxide is produced in the incomplete combustion of coal, gasoline, natural gas, and other carbon-containing substances. It is produced in the explosion of dynamite and nitroglycerine and in the operation of blast furnaces and internally lubricated compressors. Automobile exhaust contains 5 to 10 percent or more carbon monoxide. Carbon monoxide occurs in small traces in natural gas, but incomplete burning of natural gas can produce greater amounts. Since gasoline, oil, coal, and gas are used in virtually all jobs, the potential for exposure to carbon monoxide is widespread. Carbon monoxide is a deceptive hazard, in that it is odorless, colorless, tasteless, and nonirritating, and its presence may go undetected.

b. Bodily Effects. Carbon monoxide interferes with the supply of oxygen to the tissues of the body. Normally, inhaled oxygen is transferred in the lungs to a chemical known as hemoglobin, which is present in all red blood cells. Hemoglobin then transports oxygen, by way of the bloodstream, to the tissue cells where transfer takes place. The affinity of hemoglobin for carbon monoxide is 250 times greater than it is for oxygen. When carbon monoxide combines with hemoglobin, the transport of oxygen to the tissue cells is blocked. Without oxygen, cells cannot live, and when the concentration of carbon monoxide is great enough, death occurs.

c. Prevention. The most common and most easily recognized potential exposure to carbon monoxide is in the motor pool maintenance shops and in space heaters in quarters and office areas. Whenever vehicle engines are operating, a method of disposing of the carbon monoxide-laden exhaust must be used. This is best accomplished by a combination of natural ventilation and mechanical tailpipe extension systems which carry the exhaust outside the structure. Any space heated by a carbon fuel heater must be ventilated by fresh air; ensure that windows are slightly open.

2-52. Hydrogen Chloride

a. Source of Exposure. Hydrogen chloride is produced as an exhaust from rocket systems, such as a shoulder fired rocket, or from vehicle mounted rocket systems. The development and use of these highly mobile weapon systems has greatly increased the potential for exposure to this hazard.

b. Bodily Effects. Hydrogen chloride is a highly irritating gas that forms with water to produce hydrochloric acid. This acid will irritate the mucous membrane, particularly the eyes, throat, and lungs. It can cause a tissue burn and flu-like lung injury.

c. *Prevention.* The most common exposure to hydrogen chloride occurs during the firing process of these weapon systems. Remaining upwind of the exhaust emission and, when necessary, holding your breath until the gas cloud passes will limit your exposure.

2-53. Bore/Gun Gases

a. Source of Exposure. When conventional weapon systems such as cannons and tanks are fired they produce toxic gases such as lead and carbon monoxide as well as other gases from ammo propellent.

b. Bodily Effects. Effects on the body from this exposure will be much the same as effects produced from exposure to hydrogen chloride and carbon monoxide.

c. Prevention. Exposure will be greatly reduced by using on-board ventilation systems, and keeping the bore evacuator on larger weapon systems well maintained.

2-54. Liquid Chemicals

a. General. The most widespread, and some of the most dangerous, occupational hazards are created by liquid chemicals, such as solvents. These chemicals may present hazards from the use of the liquid itself, as a vapor of the liquid, or as a mist of the liquid. The

vast majority of liquid chemicals found in the industrial workplace are organic compounds; these compounds contain carbon. They are found in plant and animal tissues and in materials, such as petroleum and coal, which result from the breakdown of living substances. Lubricants, solvents, fuels, and many insecticides are but a few of the many hundreds of different compounds in use, and new ones are constantly being produced. These chemicals are used in the course of most industrial-type jobs. Because of their widespread use and their harmful properties, organic compounds present significant military occupational hazards.

b. Source of Exposure. It would be virtually impossible to list all the possible occupations or industrial-type operations in which exposure to liquid chemicals occur, since so many occupations or industrial processes use these chemicals in one way or another. There are many military situations in which individuals are exposed to potentially hazardous organic compounds in liquid form. Many different solvents and fuels are used in military operations. Vehicle and weapons maintenance requires grease, oil, and other lubricants. Field sanitation teams, engineers, and preventive medicine personnel handle insecticide concentrates.

c. Bodily Effects.

(1) *General.* The bodily effects of liquid chemicals vary widely, depending on the chemical involved. The effects on the skin, nervous system, liver, and those leading to cancer are discussed below.

(2) *Skin disease.* In terms of numbers, occupational skin diseases (dermatoses) are by far the most important of the occupational diseases. Although occupational skin conditions may cause considerable loss of time from work, usually they are not severe enough to cause permanent disability.

(a) The healthy skin has certain barriers against injury. The dead surface cells resist most chemicals, while the oily secretions of the skin form a protective covering against some chemicals. Deeper skin cells prevent the loss of water from the skin.

(b) The occurrence of occupational dermatosis depends mainly on the specific chemicals to which the skin is exposed and the length of the exposure. The presence of other skin diseases lowers resistance to exposure. Personal cleanliness is important, since failure to wash the skin or to remove dirty clothing increases the length of exposure. The type of skin is an important factor, too. People with oily skin are more likely to develop infected sweat glands, whereas those with dry skin are more affected by drying agents such as detergents. Male workers have more skin disease than do female workers, possibly because females take better care of their skin. Skin disease is more prevalent in the summer than in the winter due to the fact that less clothing is worn and to the presence of sweat.

(c) Chemicals on the skin may cause either an irritant effect, a sensitizing effect, or both. A chemical which is classified as a skin irritant will cause irritation to any individual's skin, if left in contact with the skin long enough. Most organic compounds are considered skin irritants, although they vary greatly in strength. Chemical agents which do not cause skin disease on first contact but do so after 5 days or more of continuous or repeated contact are called sensitizing chemicals. This is a type of allergy which develops only in a small number of exposed people, depending on the chemical involved and the individual's sensitivity

to that substance. Examples of chemicals capable of sensitizing are the explosives, photographic developers, epoxy mixtures, some insecticides, and some fungicides.

(3) *Nervous system effects.* It is difficult to summarize the toxic effects of organic solvents, since they vary greatly in their effects on human tissue. There is one property, however, which is common to practically all organic solvents. It is their ability to produce a loss or disturbance of sensation and sometimes a loss of consciousness. Sudden large exposures to concentrated vapors of some solvents can lead to instant unconsciousness and even death. With lower levels of exposure, less severe symptoms will be experienced. Headaches, dizziness, nausea, vomiting, and convulsions may occur. Even lower exposures may produce enough drowsiness to create an accident hazard under certain conditions. The insecticides are good examples of these toxic properties; for example, the insecticide malathion, an organic compound, exerts its toxic action on that part of the nervous system which controls breathing, digestion, muscle strength, vision, and sweating. Thus, excessive exposure to these chemicals results in respiratory difficulty, vomiting, muscle weakness, blurry vision, and excessive sweating, which are but a few of the many symptoms. No attempt will be made to describe the toxic effects of each specific chemical in this group.

(4) *Cancer-producing liquid chemicals.* Brief mention should be made of the cancer-producing properties of certain liquid chemicals. As early as 1775, cancer of the scrotum in chimney sweeps was recognized as a hazard of that occupation. Since that time, skin cancer has been found in many other occupations in which exposure to coal tar and pitch exists. Cancer of the urinary bladder has been reported in workers who handle certain organic dyes.

2-55. Prevention and Control

a. General. Measures for the prevention and control of illnesses arising from exposure to liquid chemicals fall into three groups: environmental control, personal control, and medical control. By far the most effective category is environmental control; this type of control involves designing the work area and associated equipment to minimize the exposure of the worker to liquid chemical, its vapors or its mists. Environmental control also includes one of the most basic control measures—substituting a less-toxic substance for the more-toxic substance in use. Personal protective measures are not as effective as environmental measures; they are limited to the use of protective clothing and respirators. Medical control refers to programs encompassing preplacement physical examinations and medical surveillance of workers to detect early signs of occupational disease.

b. Occupation Dermatosis Prevention. The best prevention against occupation dermatosis is to use measures which decrease, as far as possible, contact of soldiers with the dermatitis-causing chemicals. When complete avoidance is impossible, personal protective measures are used. These include protective clothing, protective ointments, and personal cleanliness. Protective clothing should cover every part of the body exposed to the irritating or hazardous chemical. This protective clothing, and in some cases, underclothing, must be changed and laundered daily. Contaminated work clothing should never be worn away from the workplace. Personal cleanliness is the best protective measure against occupational dermatosis. If strong irritant chemicals come into contact with the skin, they should be removed immediately with water. Washing facilities should always be readily available. Soldiers should be encouraged to consult a medical officer at the first sign of dermatosis.

Delay in treatment of these conditions may result in more serious conditions requiring extensive medical treatment and evacuation. The impact of lost manpower, especially in shortage or critical MOSS may be detrimental to the unit's combat mission.

Section XI. NOISE HAZARDS

2-56. General

We are surrounded by sound. Twenty-four hours each day, we live in a world of sound. Even while we are sleeping, the clock ticking or the air conditioner whirring may be part of our environment. In our waking hours, we are immersed in sound: passing automobiles, overhead aircraft, clattering typewriters, weapons firing, equipment operating, people talking, and radios playing. A total lack of sound can in itself be disturbing; too much sound can be literally deafening. Exposure to certain noises can have profound physical and psychological effects on the individual. To protect personnel against these effects, hearing conservation programs are planned and implemented at all Army installations. Management of such programs is an installation responsibility; however, the Army Medical Department is responsible for ensuring that such programs are established and that they are effective. As an FST member, you will play an active role in the hearing conservation program.

a. Noise. Noise is simply defined as unwanted sound, whether it is a pure tone, a complex of tones, or unwanted speech or music, In actual practice, the term is usually applied to sounds which have a complex character acoustically, such as those containing a large number of separate frequency components that extend over a wide range of frequencies and which are not normally generated to convey meaning or information.

b. Steady Noise. Steady noise is noise that does not significantly change in intensity or frequency with time.

c. Impulse or Impact Noise. Noise characterized by a sharp rise in intensity followed by a rapid decline in intensity, such as that produced by gunfire. It cannot be measured accurately with an ordinary sound level meter.

d. Sound Levels. Examples of sound levels for various types of equipment are shown in Table 2-5.

2-57. Factors Determining the Degree of Hazard

There are four properties or characteristics of noise which determine whether a given noise is likely to be hazardous to workers' hearing.

a. Frequency. The frequency of a noise determines its pitch, which is that attribute of an auditory sensation in terms of which sounds may be ordered on a scale extending from low to high. High-frequency (high-pitched) noises are more dangerous to hearing than low-frequency (low-pitched) noises.

b. Intensity. The relative loudness of the noise, expressed in decibels, will play a large part in determining the degree of hazard; the louder the noise, the greater its potential for causing hearing loss.

c. The Nature of the Noise, Noise may be continuous, or intermittent. It may be steady, or made up of a series of impact or impulse noises.

d. The Exposure Duration. The longer the exposure, the greater the damage to the hearing mechanism. Exposure duration is usually expressed in terms of a *time-weighted average,* which takes into account both intensity of noise and duration of the exposure.

Table 2-5. Examples of sound levels

SOURCE	SOUND PRESSURE LEVEL
Rustling leaves	20dB(A)
Whisper	34dB(A)
Window air-conditioner	55dB(A)
Conversation	60dB(A)
Vacuum cleaner (at 10 ft)	65dB(A)
Alarm clock (at 2 ft)	80dB(A)
Printing plant	86dB(A)
Diesel truck (at 25 ft)	92dB(A)
Air compressor	94dB(A)
Cut-off saw	97dB(A)
Lawn mower	98dB(A)
Bench grinder	105dB(A)
Air chisel	106dB(A)
Vacuum pump	108dB(A)
Chain saw	115dB(A)
M14 rifle	160dB peak sound pressure level
Howitzer	185dB peak sound pressure level
UD-1D Iroquois (Rotary Wing)	96–99dB(A)
CH-47C Chinook (Rotary Wing)	110dB(A)
U-6A Beaver (Fixed Wing)	99–102dB(A)
U-21A Ute (Fixed Wing)	80–102dB(A)
Truck, Cargo, 5-ton, 8 x 8, M656, M757, M759	87–101dB(A)
Truck, Fork Lift, 6,000-lb, gasoline	98dB(A)
Truck, Fork Lift, 6,000-lb, Diesel	102dB(A)
Grinder, electric, 10-inch	92dB(A)
Riveter, pneumatic	105–112dB(A)
Saw, Chain, gasoline, 7-hp	125dB(A)
Saw, Table, electric, 10-inch	108dB(A)
Tractor, Full-tracked, D-7E	106dB(A)

SOURCE	PEAK SOUND PRESSURE LEVEL dB
Rifle, 5.56-mm, automatic, M16	154–158
Machine gun, 7.62-mm, M60	149–161
Rifle, recoiless, 106-mm, M40A1	171
Howitzer, light, towed, 105-mm	185–191
TOW (tube launched, optical tracked, wire guided)	166–170

2-58. The Mechanics of Hearing

The human ear (Figure 2-2) is composed of three major sections: the external ear, the middle ear, and the inner ear. Each section has a distinct function in the hearing process.

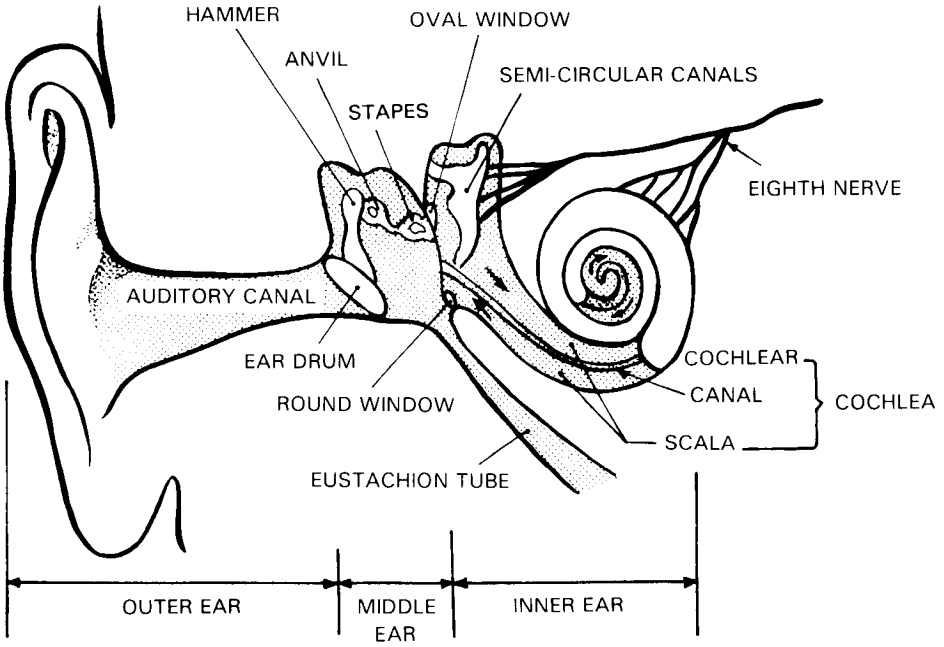

Figure 2-2. Anatomy of the human ear.

a. The external ear captures and funnels the sound waves to the middle ear where they strike the ear drum, (tympanic membrane).

b. The middle ear consists of the ear drum and the space and structures just inside. The space within the middle ear is filled with air. There is a chain of small bones in the middle ear, called the malleus, the incus, and the stapes. One end of this chain rests against the ear drum, while the other end is connected to the inner ear.

c. The inner ear consists of a spiral tube filled with fluid. The spiral tube contains the *organ of Corti,* which consists of many sensory cells with delicate hairs or hair cells projecting into the fluid.

d. As the ear drum vibrates, the chain of bones is set in motion. These motions, in turn, cause the fluid in the inner ear to vibrate. When the fluid vibrates, the hair cells are stimulated, sending impulses to the brain.

2-59. The Effects of Noise on the Ear

a. Exposure to excessive noise for extended periods of time over-activates the hairs *and hair cells* in the inner ear, causing injury or destruction. Such injury to the organ of Corti usually leads to permanent loss of hearing. There is no known treatment for such hearing loss. However, depending upon the duration of the exposure to excessive noise, hearing loss maybe only temporary in nature. This acute partial loss of hearing has the most significant possible impact to the combat mission.

b. Overexposure to high frequency noise causes more significant hearing loss than overexposure to low frequency noise of the same intensity. During initial exposure, most of the hearing impairment is in the frequency range above those important to understanding speech. As a result, early damage is seldom noticed by individuals. Detection of losses in these ranges by the medical officer is important, as these early losses maybe danger *signs* of further extensive hearing loss. Continued exposure will lead to progressively greater damage, including loss of the speech frequencies which, if allowed to reach an advanced stage, will cause a severe handicap.

c. Other physiological effects which are produced by excessive exposure to noise include nausea and headaches. In many cases the reflex responses of the individual are affected.

d. Psychological stress from noise maybe manifested in the form of fatigue, inability to function, annoyance, and distraction.

2-60. Personal Protective Measures

a. Personal protective devices to lessen the risk of hearing loss consist of ear plugs and earmuffs (Tables 2-6, 2-7, 2-8, 2-9, and Figures 2-3, 2-4 and 2-5). Whichever device can be worn comfortably and consistently by the exposed individual is an important element in selecting the device to be worn. In exposures to extremely high, steady-state noise levels (120 dB and above), ear plugs and earmuffs must be worn together. Table 2-10 gives a list of earplugs and earmuffs available through medical and/or regular supply channels.

Table 2-6. General information on using ear plugs

1. A good seal should be accompanied by a vacuum sensation (a back pressure). Also, your voice should sound muffled to you as if talking inside a barrel.
2. Plugs tend to work loose as a result of talking and chewing and must be reseated.
3. Little difficulty is experienced understanding speech when plugs are worn, if the voice is raised slightly above the level of ordinary conversation.
4. Even a small leak defeats the purpose of wearing plugs.
5. Keep plugs clean with soap and water, but ensure plugs are dry when returned to case. When not in use, keep plugs in plastic carrying case provided.
6. Ear plugs are part of your personal issue and are to be retained upon change of station.

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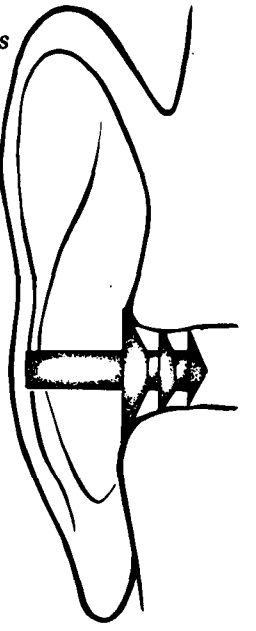
Table 2-7. Insert triple-flange ear plugs



1. Place ear plug stem into stem holder (top of case).
2. Insert smaller flange in ear canal. Push and twist plug firmly into ear canal.
3. If a good seal is not obtained, use smaller or larger size. Triple-flange plugs are available in three sizes—large, regular, and small.

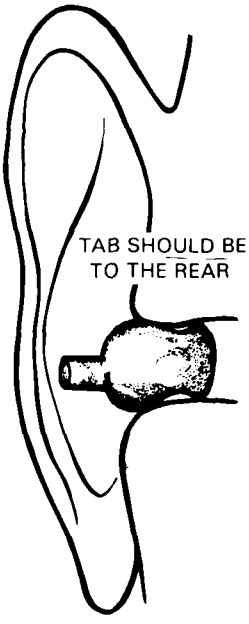
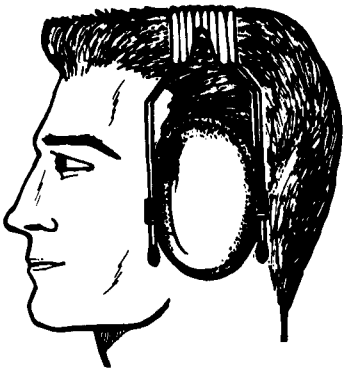


Table 2-8. Inserting single-flange ear plugs

1. Make the ear canal accessible by reaching over head with opposite hand and pulling ear outward.
2. Grasp plug tab between thumb and forefinger and insert plug into ear canal.
3. Push and twist plug toward rear-center of head until seal is made.
4. If a good seal is not obtained, use smaller or larger size. Single-flange plugs are available in five sizes—extra-small, small, medium, large, and extra-large.

Table 2-9. Use of earmuffs



1. Adjust headband to ensure earcup seals are in complete contact with head.
2. Earcup seals must fit well around temples of eyeglasses.
3. When indicated, wear muffs in position specified on earcups.
4. When earmuffs are properly worn, your own voice should sound muffled to you as if talking inside a barrel.
5. Do not bend, alter or modify any part of headband, cups, cup lining or earcup seals.
6. Replace earcup seals that have become hardened, damaged or otherwise unserviceable.
7. Even a small leak eliminates the protection provided by earmuffs.

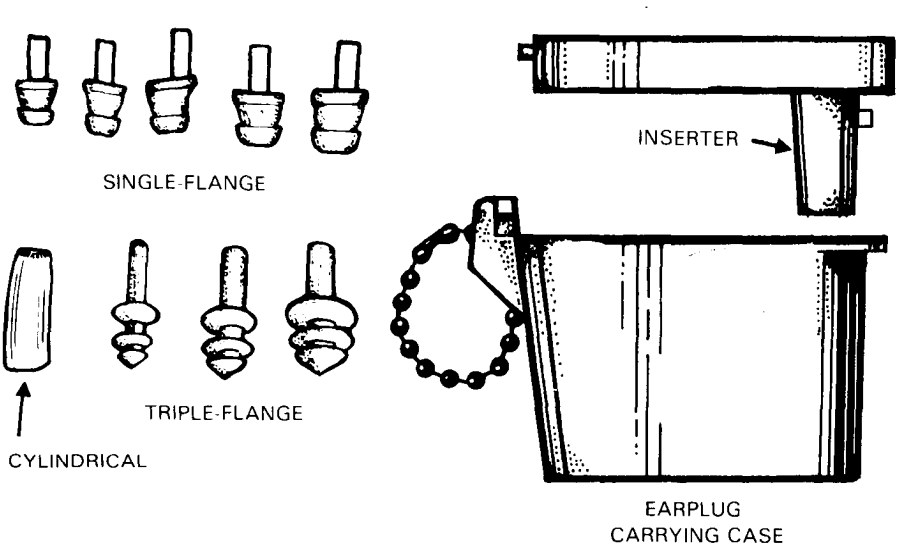


Figure 2-3. Ear plugs and carrying case.

b. Well-designed and properly fitted ear plugs or earmuffs will lessen the noise reaching the inner ear by 15 dB in the lower frequencies and by up to 35 dB in the higher frequencies. Wearing ear plugs and earmuffs together, however, does not provide attenuation (weakening of the sound) equal to the arithmetic sum of the individual attenuation of ear plugs and earmuffs worn separately. The combination of plugs and muffs provides from 35 to 40 dB noise attenuation at most frequencies. Regular use of ear protective devices is mandatory for all individuals exposed to steady-state noise in excess of 85 dB or impulse noise in excess of 140 dB.

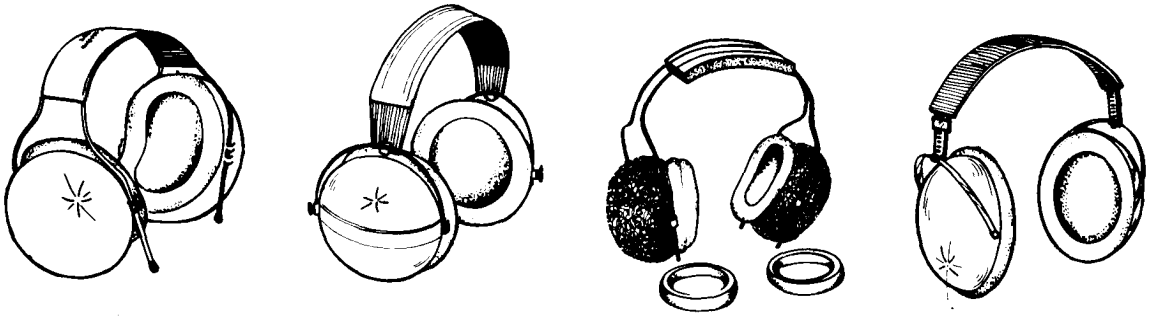


Figure 2-4. Type I earmuffs.

Figure 2-5. Type II earmuffs.

Table 2-10. Hearing Protection Devices

EAR PLUGS AVAILABLE THROUGH MEDICAL SUPPLY CHANNELS:

PLUG, EAR, HEARING PROTECTION, SINGLE-FLANGE, 24s

NSN 6515-00-442-4765 EXTRA-SMALL, WHITE
NSN 6515-00-467-0085, SMALL, GREEN
NSN 6515-00-467-0089, MEDIUM, INTERNATIONAL ORANGE
NSN 6515-00-442-4807, LARGE, BLUE
NSN 6515-00-442-4813, EXTRA-LARGE, RED
NSN 6515-00-181-8058, RUBBER, UNIVERSAL SIZE
NSN 6515-01-100-1674 CASE, EAR PLUG, W/EAR PLUG INSERTER, 20s
(THIS CASE HOLDS ONE PAIR OF TRIPLE-FLANGE EAR PLUGS.)

PLUG, EAR HEARING PROTECTION TRIPLE-FLANGE

NSN 6515-00-442-4818, REGULAR, INTERNATIONAL ORANGE, 24s
NSN 6515-00-467-0092, LARGE, BLUE, 24s
NSN 6515-00-442-4821, SMALL, GREEN, 24s

PLUG, EAR HEARING PROTECTION CYLINDRICAL

NSN 6515-00-721-9092 DISPOSABLE 100s
NSN 65615-00-133-5416 DISPOSABLE 200s
NSN 6515-00-137-6345 UNIVERSAL SIZE 400s
NSN 6515-00-157-1278 W/CORD UNIVERSAL SIZE 200s
NSN 65615-00-135-2612 UNIVERSAL 48s

EAR MUFFS/HELMETS AVAILABLE THROUGH REGULAR SUPPLY CHANNELS:

EARMUFFS, AURAL PROTECTOR, SOUND, TYPE II

NSN 4240-00-022-2946

HELMET, FLYERS, CRASH TYPE (SPH-4)

NSN 8415-00-144-4981 (REGULAR)
NSN 8415-00-144-4985 (EXTRA-LARGE)

HELMET, COMBAT VEHICLE CREWMANS (DH-132)

NSN 8415-00-094-2679 (SMALL)
NSN 8415-00-094-2691 (MEDIUM)
NSN 8415-00-094-2684 (LARGE)

c. Persons with normal hearing will have little difficulty in understanding speech when ear plugs or muffs are worn, if the speakers will raise their voices slightly above the level of ordinary conversation. Actually it is easier for a person to hear and understand auditory signals such as speech in a moderately noisy environment with ear protection than without it, Example, put a fingertip firmly into each ear while carrying on a conversation in a noisy room. You will note that the conversation is more easily understood.

d. Properly fitted earplugs will not damage a normal ear canal if the earplugs are kept reasonably clean. Plugs must be fitted individually for each ear under medical supervision (Figure 2-6). Occasionally, an individual's two ear canals will require ear plugs of different sizes. To prevent leaks, a good seal between the ear canal and the ear plug is very important. A really good seal may cause some initial discomfort to the wearer. When earmuffs are chosen in preference to ear plugs, the headband must be properly adjusted to ensure a snug fit. When eyeglasses are worn at the same time as earmuffs, it is important that the flange of the muff fit well around the temple of the glasses, because even a small "leak" will completely destroy the purpose of the ear protector, yet the wearer will have a false sense of security because of wearing the protector. A related problem with ear plugs is that they tend to work loose as a result of talking and chewing, Therefore, ear plugs must be reseated from time to time during the work day.

e. The only effective ear protector is one that is worn consistently. Hearing damage becomes progressively worse with each additional exposure; personnel must be convinced of the importance of wearing their ear protectors.

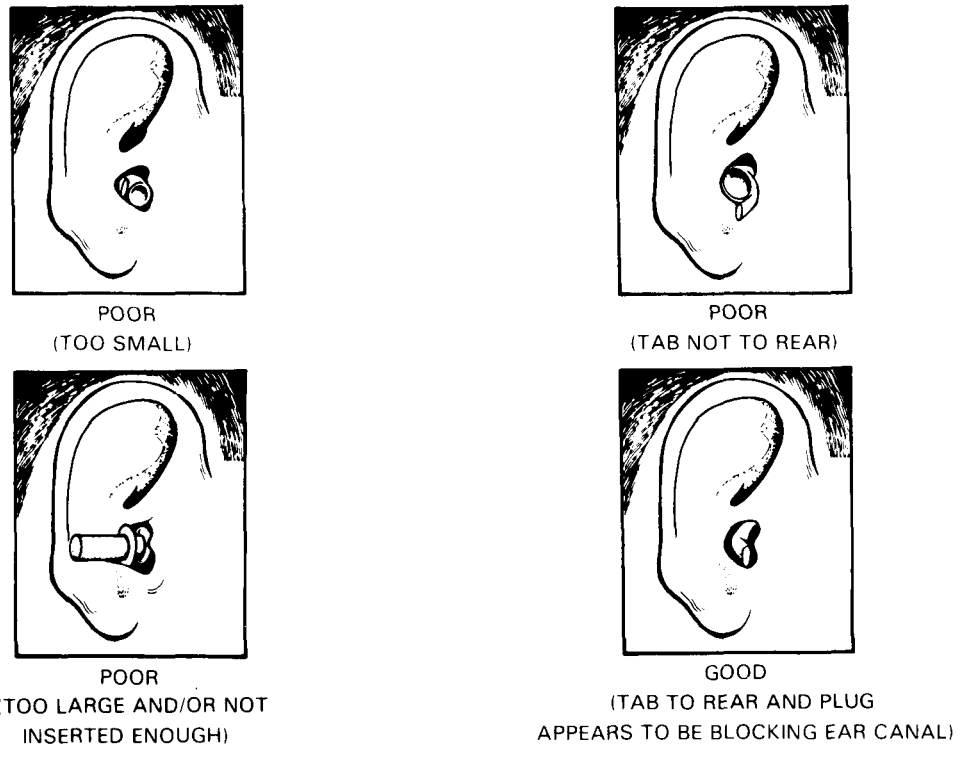


Figure 2-6. Examples of poorly-fitted/poorly-inserted ear plugs and a well-fitted/properly-seated ear plug

APPENDIX A

LESSON PLANS AND SUPPORTING INSTRUCTIONAL MATERIAL

LESSON 1: Introduction to The Medical Threat to Field Forces and Preventive Medicine Measures.
TYPE OF INSTRUCTION: Lecture and conference.
HOURS: One.
TOOLS, EQUIPMENT, AND MATERIALS: None.
PERSONNEL: One instructor.
INSTRUCTIONAL AIDS: Chalkboard with chalk and eraser.
REFERENCES: AR 40-5; FM 21-10; and Section I, Chapter 2, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform; notebook and pencil.
TRANSPORTATION REQUIREMENTS: None.

I. Introduction (25 minutes)

NOTE: Since this is the first session of the course and the students will be coming from several different units, allow time for registration and introductions.

A. Opening Statement. You are here because your unit commander has appointed you as a member of the field sanitation team. This is a most important responsibility. The effectiveness with which you accomplish this responsibility y will have a far-reaching effect upon the health of soldiers and, in turn, upon the success of your unit.

B. Objective. Understand that preventive medicine measures are effective only when you are capable of adapting them to the existing medical threat elements of a particular environment.

II. Explanation (23 minutes)

A. Importance of the Field Sanitation Team.

NOTE: Give examples of diseases in the past and the resulting effects on armies. Use examples applicable to the geographical area where soldiers are receiving this training.

B. Medical Threat.

NOTE: Discuss the medical threat to field forces as affected by the climate and the terrain in various areas of the world.

C. The Individual in the Field Environment.

NOTE: Discuss the reaction of soldiers to problems of sanitation in the field environment.

D. The Role of the Field Sanitation Team.

NOTE: Discuss the general duties which the role entails and the means (performance, instruction, supervision, assistance, inspection, and reporting) by which these duties are accomplished.

1 Basic preventive medicine measures.

(a) Water disinfection.

(b) Food service sanitation.

(c) Waste disposal.

(d) Personal hygiene.

(e) Individual preventive medicine measures.

2 Preventive medicine measures against arthropods and rodents.

(a) Basic sanitation measures.

(b) Individual protective measures.

(c) Mechanical and chemical controls.

III. Summary *(2* minutes)

A. Review of the Main Points.

1 The success or failure of any army, the outcome of a war, and the fate of a nation may rest upon how well diseases are prevented through effective field sanitation and preventive medicine measures.

2 The extent to which diseases are prevented in the unit area depends upon the effectiveness with which you, a member of the field sanitation team, perform your role.

3 Preventive medicine measures must be adapted to the existing medical threat elements of a specific field environment.

B. Closing Statement. During the remaining hours of this course, you will be taught how to accomplish your role as a member of a field sanitation team.

LESSON 2: Personal Hygiene and Preventive Medicine Measures.
TYPE OF INSTRUCTION: Lecture and conference.
HOURS: One.
TOOLS, EQUIPMENT, AND MATERIALS: None.
PERSONNEL: One instructor.
INSTRUCTIONAL AIDS: Cardboard, twine, and scissors; devices for handwashing, showering, and shaving.
REFERENCES: AR 40-5, FM 21-10; and Section I, Chapter 2, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform; notebook and pencil.
TROOPS REQUIREMENTS: None.
TRANSPORTATION REQUIREMENTS: Vehicle with capacity for students and instructor.

I. Introduction (3 minutes)

A. Opening Statement. Inadequate personal hygiene and failure to use individual PMM can result in major health problems for soldiers in the field. Personal hygiene and PMM will be discussed in relation to other subjects of this course, such as water supply, food service sanitation, waste disposal, and arthropod and rodent control.

B. Objectives.

1 Improvise facilities which will encourage soldiers to maintain their health.

2 Provide soldiers guidance or instruction in the proper use of personal PMM, and in the hazards involved when personal PMM is neglected.

II. Explanation and Demonstration (45 minutes)

A. Personal Hygiene. Discuss special ways in which the field sanitation team can assist the unit commander in promoting personal PMM, such as providing hot water for washing and shaving (Figure A-1) and a heated place to dress; inspecting soldiers and sleeping area; and informing soldiers of the hazards of inadequate personal PMM.

B. Personal Hygiene Devices. Take the students to the area where the following personal hygiene devices are set up and explain their construction:

1 Handwashing devices (Figure A-2, and A-3).

2 Showering devices (Figure A-4 and A-5).

NOTE: Water for showering may be heated by any suitable device.

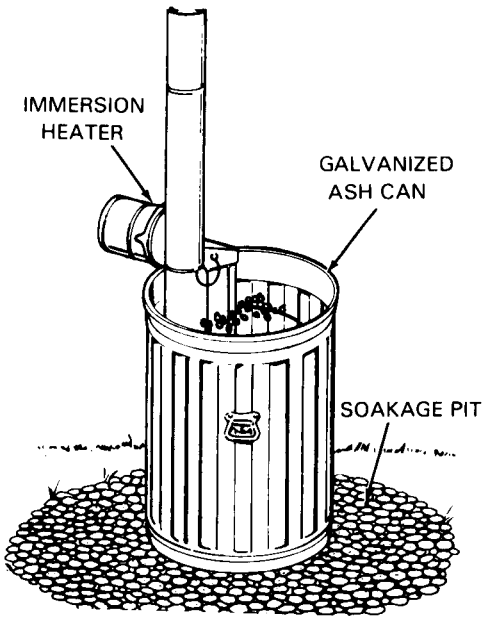


Figure A-1. Clear boiling water for shaving.

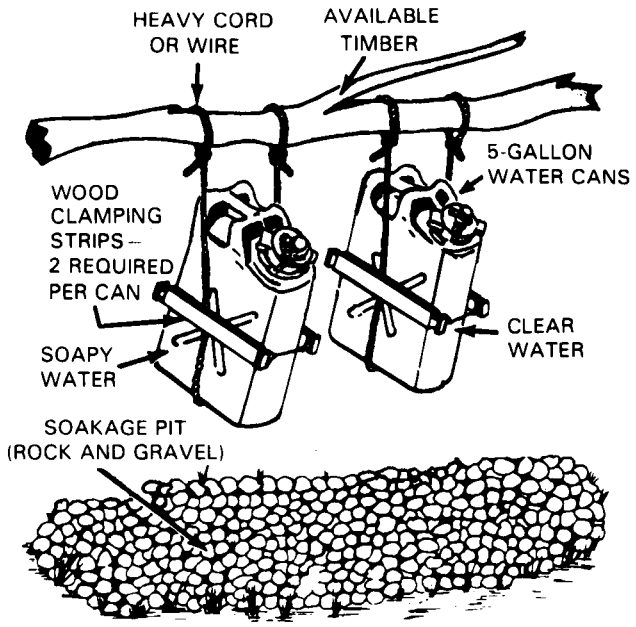


Figure A-2. Handwashing device—tipping 5-gallon cans.

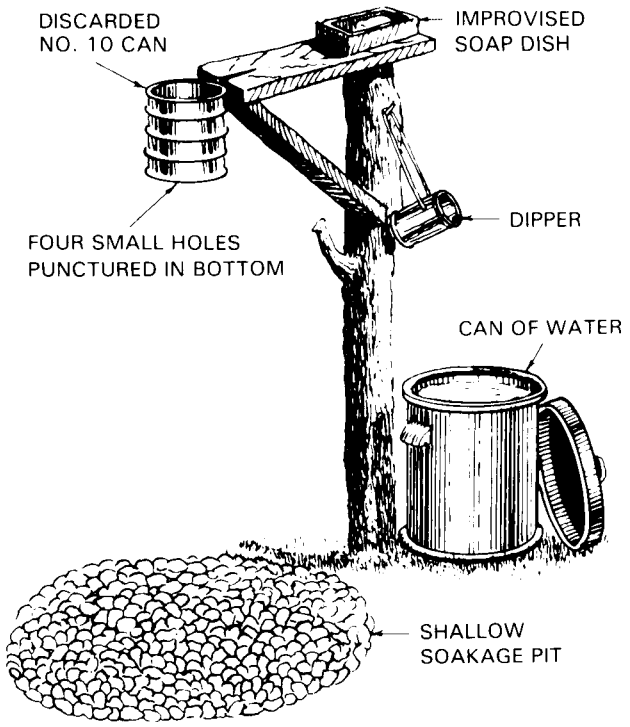


Figure A-3. Handwashing device.

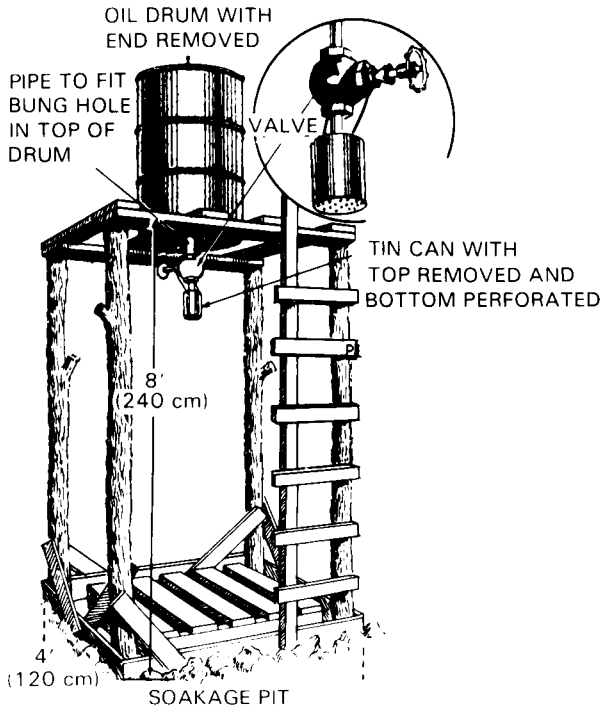


Figure A-4. Shower—solar heated.

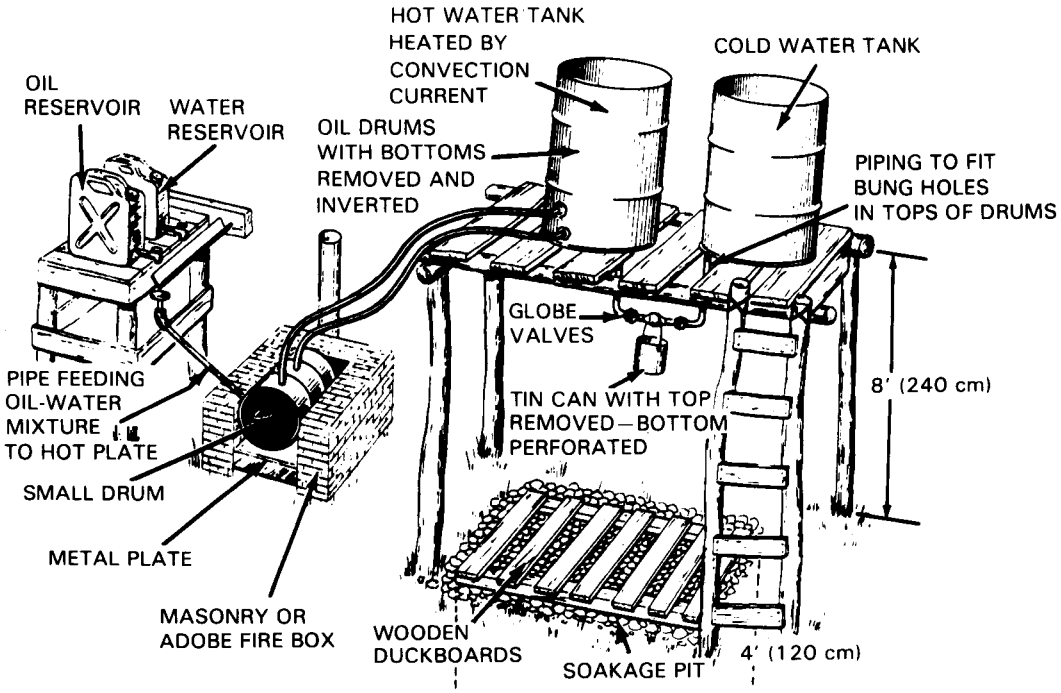


Figure A-5. Shower—oil—water flash burner.

III. Summary (2 minutes)

A. Review of the Main Points.

1 Personal hygiene.

2 Assist unit commander.

3 Devices.

(a) Handwashing.

(b) Shower.

B. Closing Statement. At various times during the remaining hours, you will be taught other personal hygiene and individual PMMs which aid in maintaining the health of the soldiers.

LESSON 3: Water Supply in the Field.
TYPE OF INSTRUCTION: Lecture and practical exercises.
HOURS: Two.
TOOLS, EQUIPMENT, AND MATERIAL: Water (filled water trailer); Lyster bags with tripods and clean sticks (1 for every 10 students); chlorination kit, water purification, (1 kit for 10 to 20 students); bulk calcium hypochlorite; iodine tablets (1 bottle of 50 tablets to 20 students).
PERSONNEL: One instructor.
INSTRUCTIONAL AIDS: A chalkboard with chalk and eraser; canteen with cup; and other instructional aids from the supply of equipment and materials to be provided for students as described above.
REFERENCES: AR 40-5; FM 21-10; Section II, Chapter 2, this manual, CTA 8-100 and CTA 50-970.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform, notebook, pencil, and canteen with cup and MRE spoon.
TROOP REQUIREMENTS: None.
TRANSPORTATION REQUIREMENTS: None.

FIRST PERIOD

I. Introduction (2 minutes)

A. Opening Statement. In combat, safe water ranks in importance with ammunition and food. It often has an important bearing on the success or failure of a mission.

B. Objectives.

1 Disinfect water in a Lyster bag with calcium hypochlorite ampules and obtain the required chlorine residual.

2 Disinfect a canteen with either iodine tablets or calcium hypochlorite ampules.

3 Disinfect a 400-gallon water trailer using calcium hypochlorite.

II. Explanation (48 minutes)

A. Importance of Water in the Practice of Sanitation.

1 Water as a vehicle in the transmission of diseases.

2 Quantity of water needed for soldiers.

B. Production of Potable (Safe) Water in the Field.

1 Responsibilities.

(a) Army Medical Department.

(b) Corps of Engineers.

(c) Quartermaster Corps.

(d) Unit commander.

2 Definitions.

(a) Palatable water.

(b) Potable water.

(c) Water treatment.

(d) Disinfection.

(e) Chlorination.

(f) Chlorine dosage.

(g) Chlorine demand.

(h) Chlorine residual.

(i) Parts per million (ppm).

3 Water sources.

(a) Surface water.

(b) Ground water.

(c) Rain water.

(d) Melted ice.

(e) Melted snow.

(f) Sea water.

4 Water treatment.

(a) Disinfectant.

(b) Method of disinfecting water.

(1) Use of Lyster bag and calcium hypochlorite as disinfectant. Lyster bag setup is illustrated in Figure A-6.

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(2) Use of individual canteens and iodine or calcium hypochlorite as disinfectant.

(3) Boiling of water.

(c) Determination of chlorine residual. Items in chlorination kit are illustrated in Figures A-7 and A-8.

SECOND PERIOD

III. Practical Exercises (40 minutes)

A. Exercise A—Disinfection of Water in the Lyster Bag with Calcium Hypochlorite.

1 Divide the students into groups of five to ten members.

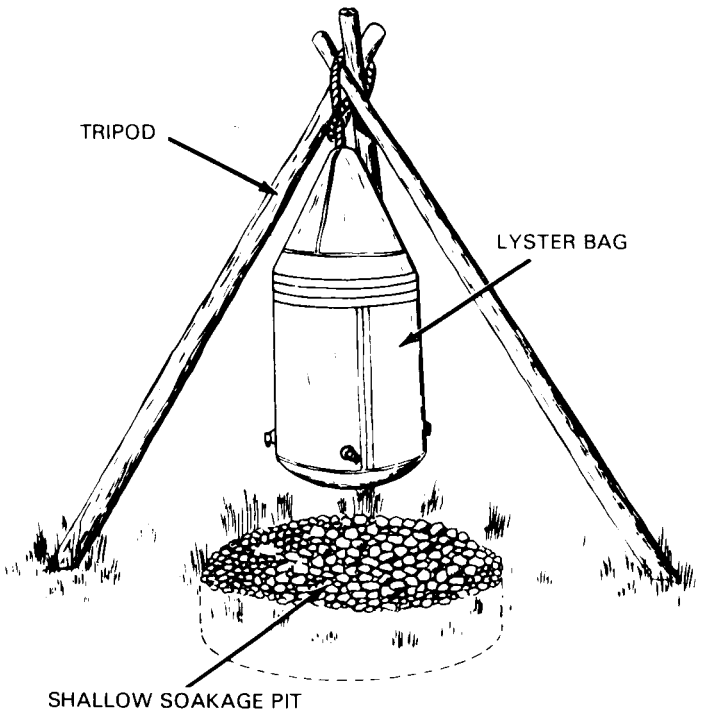


Figure A-6. Lyster bag setup.

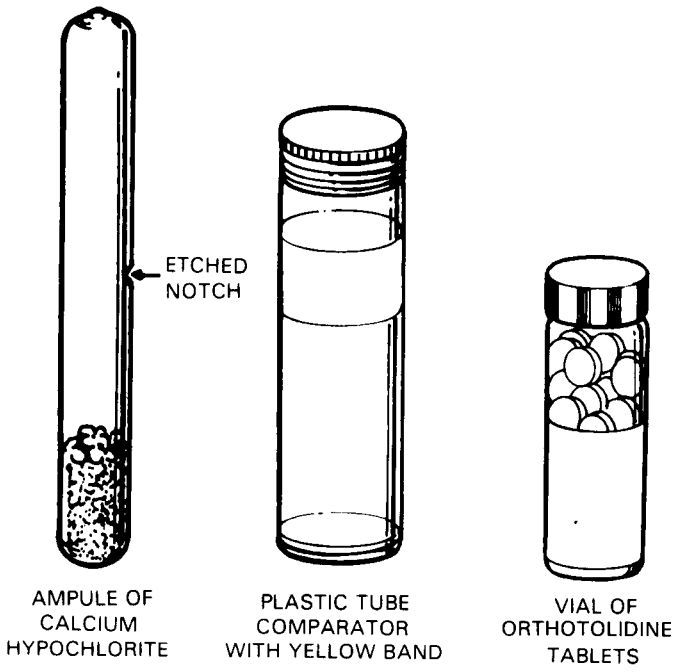


Figure A-7. Items in the chlorination kit.

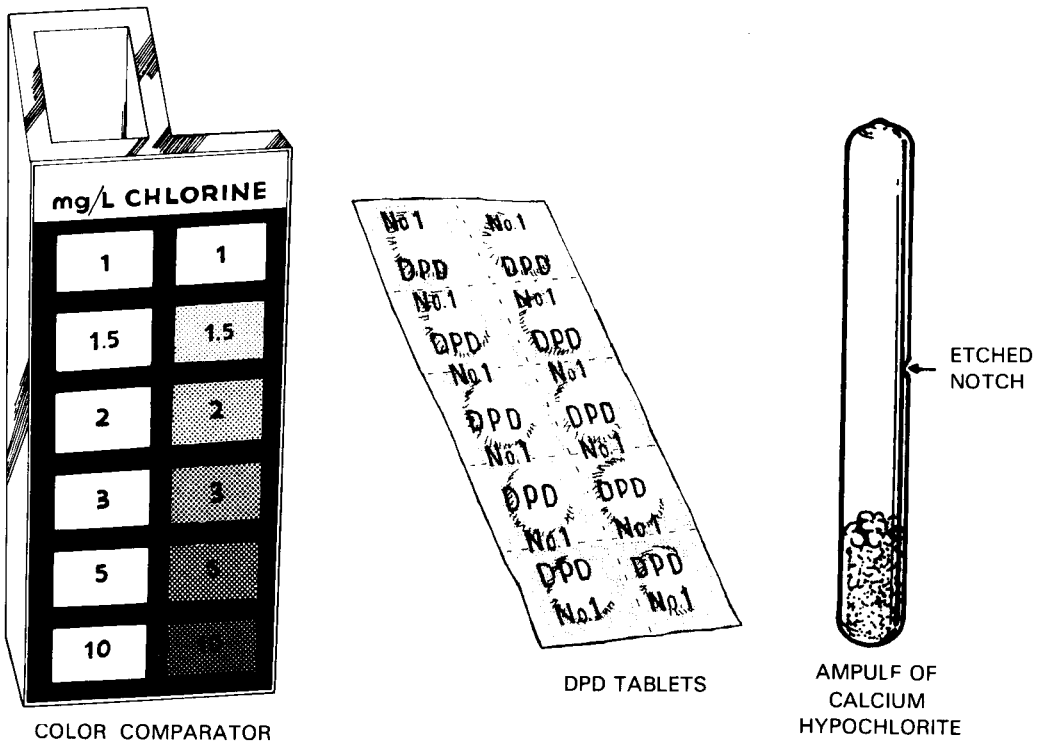


Figure A-8. Items in new chlorination kit.

2 Provide each group with–

(a) Lyster bag mounted on a tripod and filled to 4 inches (10 cm) from the top with untreated water.

(b) Adequate ampules of calcium hypochlorite, chlorine testing tablets, and a tube comparator. Explain that each group may obtain these items from the available chlorination kits as they are needed.

3 Instruct each group to disinfect the water in the Lyster bag and obtain a chlorine residual of 1 ppm. The following procedure should be used:

(a) Break an ampule of calcium hypochlorite into a canteen cup partially filled with water taken from the Lyster bag and mix until the calcium hypochlorite is dissolved as much as possible; not all of it will dissolve.

(b) Pour this mixture into the Lyster bag of water.

(c) Cover the bag and flush the spigots with a small quantity of water.

(d) Wait 10 minutes; then flush the spigots again and fill the 1 ppm comparator tube with water to the bottom of the yellow band.

(e) Determine the chlorine residual of this sample of water. The following procedure should be used.

(1) Take one chlorine testing tablet, crush it in the cap of the testing tube; pour the crushed tablet into the tube; place the cap on the tube and dissolve the tablet quickly by shaking.

(2) Compare the color of the solution with the color of the band on the tube.

(f) If the solution color is not as dark as the band, thus indicating the chlorine residual is not at least 1 ppm, add an additional ampule of calcium hypochlorite to the Lyster bag of water; then wait 10 minutes and check the chlorine residual again. Repeat this process until a chlorine residual of at least 1 ppm is obtained.

4 Instruct the groups–

(a) To move to the Lyster bag to their right and determine the chlorine residual of the water in this bag then to increase the chlorine residual to 5 ppm and use the comparator marked 5 ppm to determine the chlorine residual.

(b) To move to another Lyster bag to their right and determine the chlorine residual of the water in this bag; then to increase the chlorine residual to 10 ppm and use the comparator marked 10 ppm to determine the chlorine residual.

5 Have a member of each group report the findings and any problems encountered; discuss possible solutions to these problems.

6 Ask the following question and emphasize the correct answer:

QUESTION: How long must you wait after the prescribed chlorine residual is measured before drinking the water?

ANSWER: Allow 20 minutes after the prescribed chlorine residual is obtained or a total of 30 minutes after the chlorine has been added.

B. Exercise B–Disinfection of a 400-Gallon Water Trailer (Water Buffalo) with Calcium Hypochlorite.

1 Students should be tested individually.

2 Students should be provided with bulk calcium hypochlorite, chlorine testing tablets, and the plastic color comparator tubes (1.0, 5.0, 10.0 ppm) or DPD tablets and color comparator. They should have their MRE spoon and canteen cup.

3 Have each student test the water to see what the chlorine residual is in the water trailer. Have each student make a recommendation on the water in the trailer (safe to drink or not safe to drink). They should use the following procedure:

(a) Flush all four spigots for several seconds.

(b) Wash out the 1.0 ppm color tube.

(c) Fill the 1.0 ppm color tube to the bottom of the yellow band.

(d) Take one chlorine testing tablet, crush it in the cap of the testing tube; pour the crushed tablet into the tube; place the-cap on the tube and dissolve the tablet quickly by shaking.

(e) Compare the color of the solution to the color of the band on the tube and make your recommendation.

4 Tell the students that the water in the trailer has less than 1.0 ppm chlorine residual. Have each student chlorinate the water trailer to 5.0 ppm chlorine residual. They should use the following procedure:

(a) Place 26 MRE spoonsful of Calcium Hypochlorite into a canteen cup.

(b) Fill the canteen cup one-half to three-fourths full of water and stir the solution to make a slurry solution.

(c) Pour the slurry into the water trailer.

(d) Flush the four spigots for several seconds to aid in mixing.

(e) Wait ten minutes and test the water for 5.0 ppm chlorine using the procedure described in b(3)(a) through (e) above.

(f) If the water has at least 5.0 ppm chlorine, wait 20 additional minutes before drinking.

(g) If water does not have 5.0 ppm chlorine, the student should estimate how much more is needed. Mix that amount, add it to the water and wait 10 minutes. Flush the 4 spigots and test the water again for 5.0 ppm. After reaching 5.0 ppm chlorine wait 20 additional minutes before drinking.

C. Exercise C–Disinfection of Water in the Canteen With Iodine Tablets or With Calcium Hypochlorite.

1 Inform the students that they will use the canteens which they brought to class and that the iodine tablets and calcium hypochlorite ampules are available.

2 Instruct the students to fill their canteens with untreated water and disinfect it with an iodine tablet by using the following procedure:

(a) Add one iodine tablet to the canteen of water (if the water is clear), close the canteen, and agitate it until the tablet is dissolved.

(b) Wait 5 minutes, then loosen the cap and invert the canteen permitting the treated water to seep around the neck of the canteen.

(c) After a total of 30 minutes, have each student drink water from his canteen.

3 Ask the students the following question and emphasize the correct answer:

QUESTION: How long should you wait before drinking the treated water?

ANSWER: Allow a minimum of 30 minutes before drinking the water unless responsible medical authorities have determined that a longer contact time is required.

4 Instruct the students to empty their canteens and refill them with untreated water.

5 With the students observing, prepare a stock solution by dissolving one ampule of calcium hypochlorite in one-half canteen cup of untreated water.

6 Instruct each student to disinfect his canteen of water with this calcium hypochlorite solution by using the following procedure:

(a) Add one-half canteen capful (plastic canteen) of the stock solution to the canteen of water; (Note: If they have the NBC canteen cap use one capful of stock solution) close the canteen and shake it thoroughly.

(b) Wait 10 minutes, loosen the cap and permit the treated water to seep around the neck of the canteen.

(c) Wait an additional 20 minutes (total contact time 30 minutes), have each student drink from his canteen.

7 Ask the students the following question and emphasize the correct answer:

QUESTION: How long should you wait before drinking the treated water?

ANSWER: Allow a total contact time of 30 minutes before drinking.

IV. Summary (10 minutes)

A. Review of Main Points.

1 Water sources and water point.

2 Meaning of potable water, chlorine residual, and ppm.

3 Chlorine residual required under ordinary field conditions.

4 Methods of disinfecting water.

5 Quantity of water needed for soldiers.

6 Rules of water discipline.

B. Closing Statement. Under all situations in the field the soldiers must be supplied with sufficient potable water to drink and to maintain personal hygiene. This requires the coordinated efforts of the Army Medical Department, the Corps of Engineers, the Quartermaster Corps, the unit commander, and the field sanitation team as well as the soldiers.

LESSON 4: Food Service Sanitation in the Field.
TYPE OF INSTRUCTION: Lecture and demonstration.
HOURS: One.
TOOLS, EQUIPMENT, AND MATERIALS: None.
PERSONNEL: One instructor.
INSTRUCTIONAL AIDS: A chalkboard with chalk and eraser; four-can mess kit washing setup (three cans containing water and 3 immersion heaters); field food service area, if available.
REFERENCES: AR 40-5; FM 10-23; FM 21-10; TB MED 530; and Section II, Chapter 2, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform; notebook and pencil.
TROOP REQUIREMENTS: None.
TRANSPORTATION REQUIREMENTS: Vehicle with capacity for students and instructor.

I. Introduction (2 minutes)

A. Opening Statement. The condition under which food is transported, stored, prepared, and served can have a direct bearing upon the successor failure of a mission. Food contaminated through improper or unsanitary practices can result in outbreaks of foodborne disease.

B. Objective. Assist unit food service personnel in identifying basic defects which can cause or spread communicable diseases, to recommend corrective measures, and to provide specialized information and instructions which will help food service personnel and the soldiers understand the importance of effective sanitation practices.

II. Explanation and Demonstration (43 minutes)

A. Importance of Sanitary Practices in Food Handling.

B. Transportation of Food.

C. Storage of Food.

1 Food requiring refrigeration.

2 Potentially hazardous food.

3 Semiperishable food.

4 Acid food.

D. Personal Hygiene of Food Handlers.

E. Washing and Sanitizing of Utensils.

F. Physical Facilities.

G. Preparing and Serving Food.

H. Inspecting Food Service Facilities.

NOTE: Following a brief explanation of the subjects outlined above, take the students to the field food service area. Demonstrate the proper use of insulated food containers (Figure A-9) and the mess kit laundry (Figure A-10). Tour the food service area, pointing out the physical facilities, the methods used in food storage, and the areas in which defects could cause or spread communicable disease. Explain that other aspects of food service sanitation will be discussed during the following periods on the subjects of waste disposal, arthropod control, and rodent control.

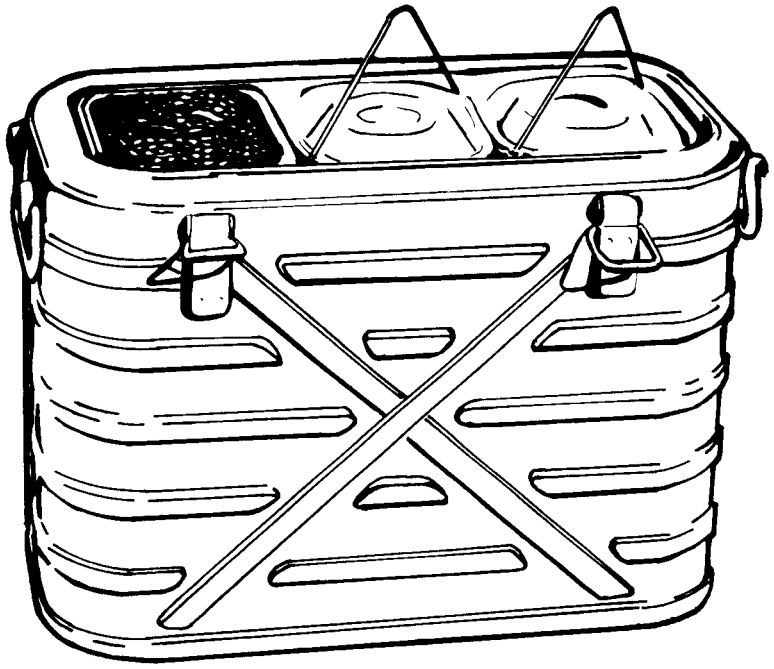


Figure A-9. Insulated food containers.

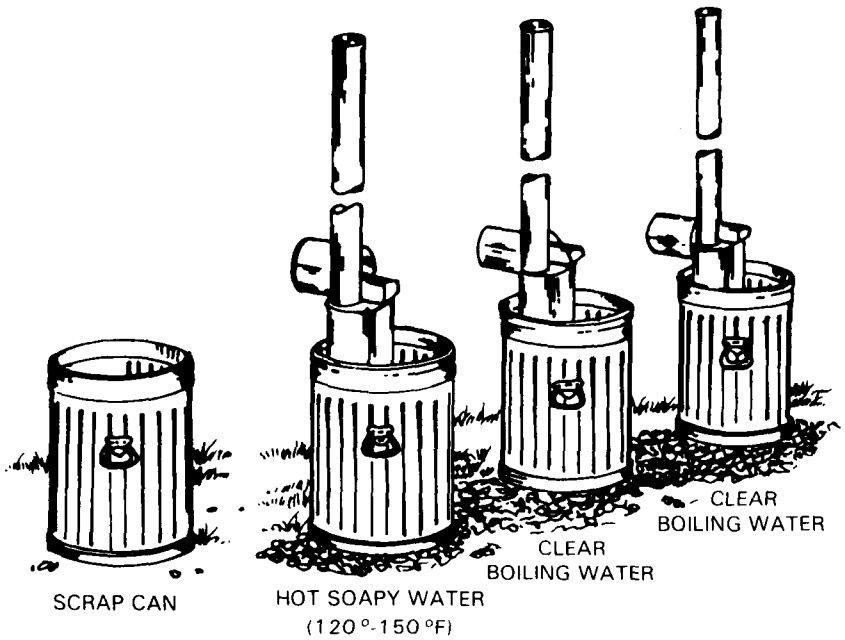


Figure A-10. Mess kit laundry.

III. Summary (5 minutes)

A. Review of Food Service Deficiencies of the Most Serious Nature.

1 Failure to refrigerate potentially hazardous cold foods properly and maintain a product temperature of 45°F (7°C) or below.

2 Failure to maintain potentially hazardous hot foods at a product temperature of 140°F (60°C) or above.

3 Failure to protect foods from cross-contamination.

4 Failure to use proper transportation and storage practices.

5 Cooks who contaminate food through poor sanitation habits.

B. Closing Statement. The field sanitation team can be of great assistance by helping the unit food service personnel identify defects which could cause or spread communicable disease; recommending corrective measures; providing information and instructions which help the food service personnel understand effective sanitation practices and the importance thereof; and promoting the personal hygiene of soldiers.

LESSON 5: Waste Disposal in the Field.
TYPE OF INSTRUCTION: Demonstration, conference and practical exercise.
HOURS: Two.
TOOLS, EQUIPMENT, AND MATERIALS: Problem situations (Appendix C).
PERSONNEL: One instructor, and, if applicable, staff of the sanitary demonstration area.
INSTRUCTIONAL AIDS: Field waste disposal facilities of the unit or facilities of a sanitary demonstration area.
REFERENCES: AR 40-5; FM 21-10; and Section IV, Chapter 2, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform; notebook and pencil.
TROOP REQUIREMENTS: If applicable, regular staff of sanitary demonstration area.
TRANSPORTATION REQUIREMENTS: Vehicle with capacity for students and instructor.

FIRST PERIOD

I. Introduction (2 minutes)

A. Opening Statement. Proper waste disposal is essential in preventing the spread of disease. Solid and liquid wastes produced under field conditions can be as great as 100 pounds (45 kg) per person per day. A camp or bivouac without proper waste disposal methods would soon become an ideal breeding area for flies, rats, and other vermin and could result in filth-borne diseases such as diarrhea, dysentery (amoebic and bacillary), typhoid, paratyphoid, and cholera among the soldiers.

B. Objective. Know the need for specific types of waste disposal facilities in order to arrange for their construction and provide information as needed for proper construction, and to recognize improper operation or lack of maintenance of these facilities and recommend/take appropriate corrective action.

II. Explanation and Demonstration (70 minutes)

NOTE: This instruction is to be given either at a sanitary demonstration area or in the field where waste disposal facilities are available or can be constructed.

A. Disposal of Human Wastes.

1 General requirements for construction of latrines.

2 "Cat-hole" (Figure A-11).

3 Straddle trench with latrine screen (Figure A-12).

4 Deep pit latrine (Figure A-13).

5 Mound latrine (Figure A-14).

6 Bored-hole latrine (Figure A-15).

7 Closed latrines (Figure A-16).

8 Burn-out latrine (A-17).

9 Pail latrine (A-18).

10 Urine disposal facilities.

(a) General requirements for construction and closing of urine disposal facilities.

(b) Urine soakage pit (Figure A-19).

(c) Trough urinal (Figure A-20).

(d) Urinoil urinal (Figure A-21).

B. Disposal of Garbage.

1 Garbage burial pit (Figure A-22).

2 Incineration (Figure A-23).

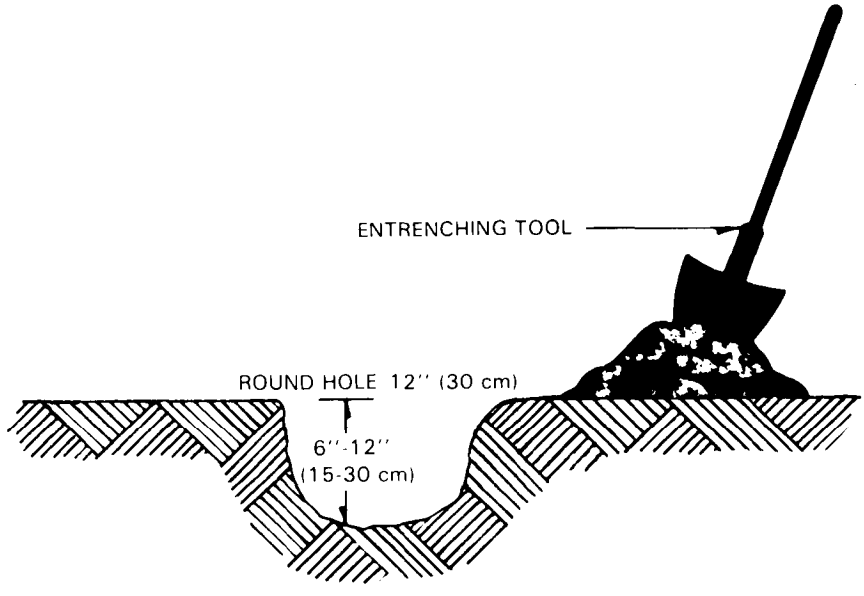


Figure A-11. "Cat-hole" latrine.

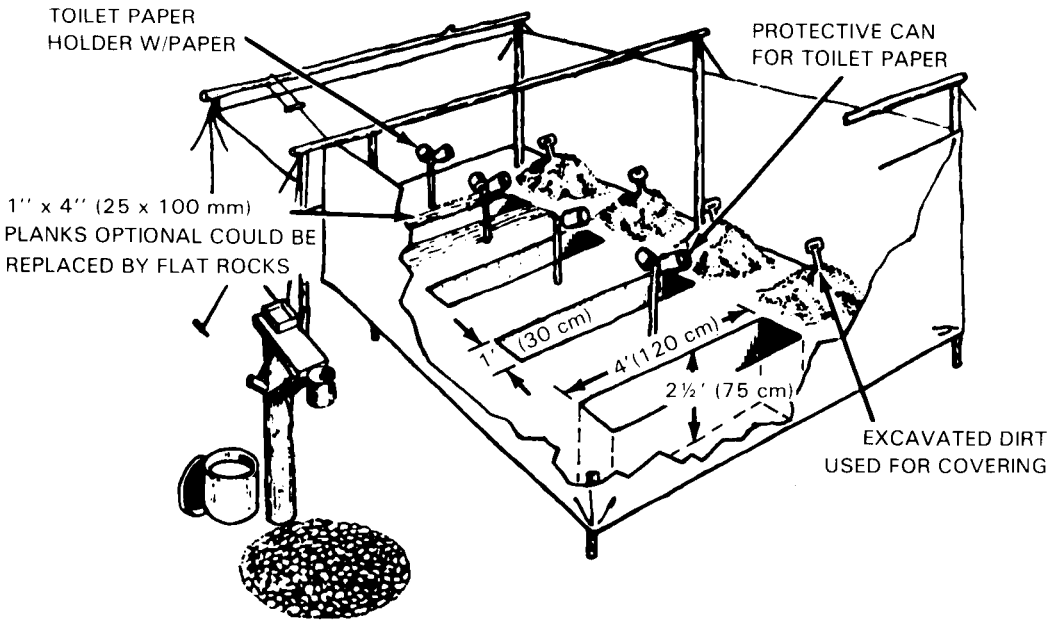


Figure A-12. Straddle trench with latrine screen and hand washing device.

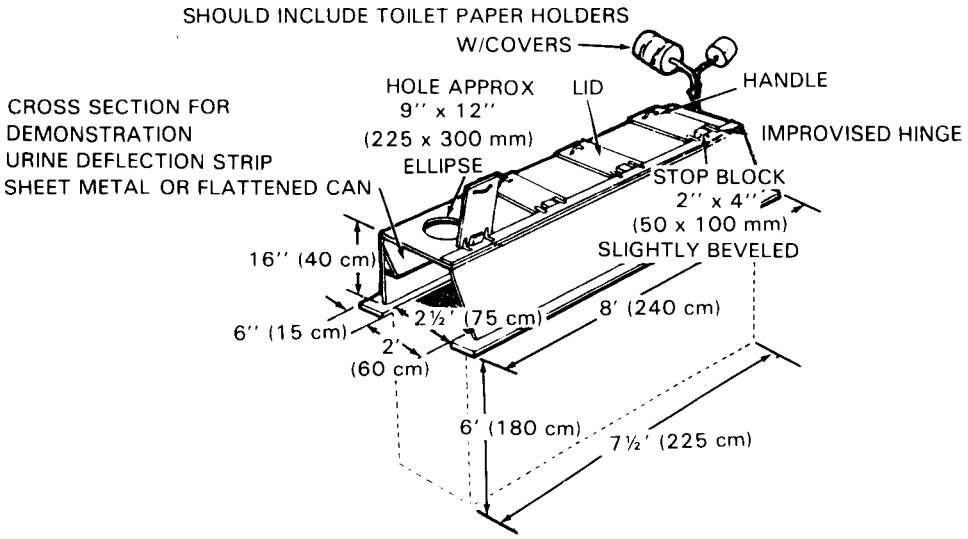


Figure A-13. Deep pit latrine.

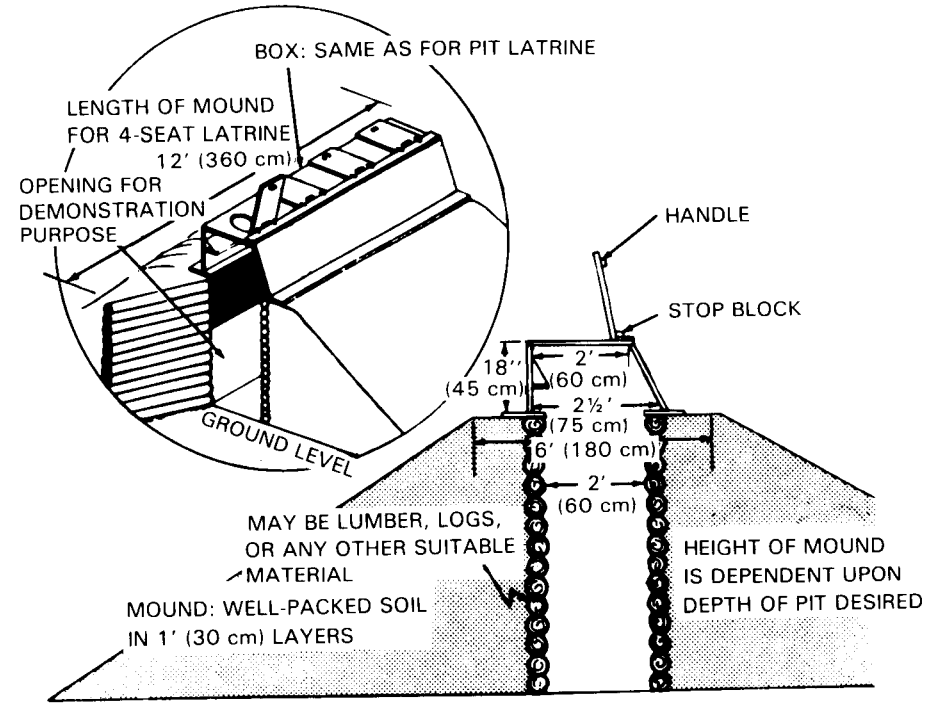


Figure A-14. Mound latrine.

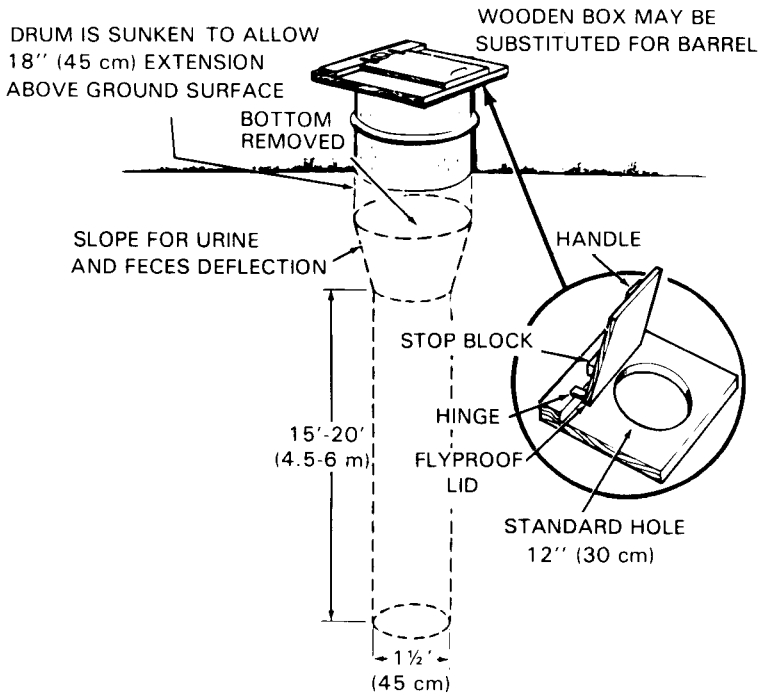
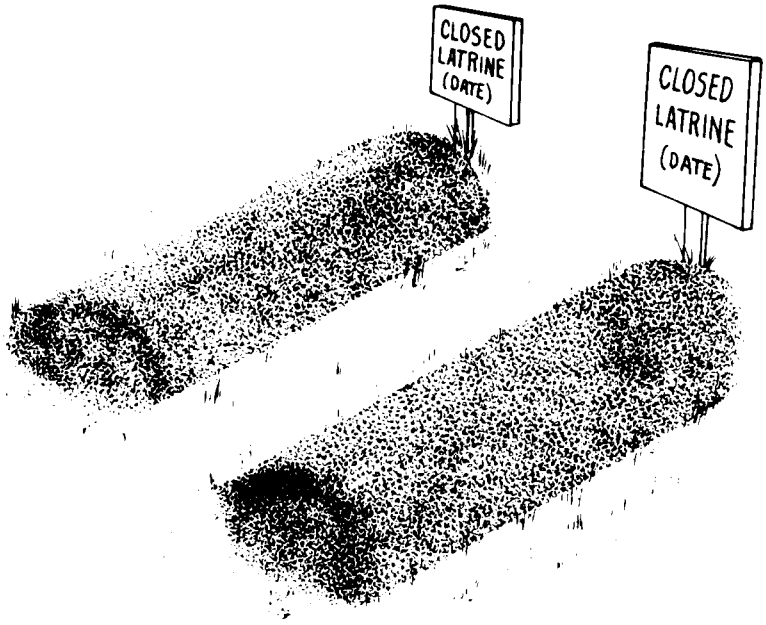


Figure A-15. Bored-hole latrine.



NOTE: MOUNDS SHOULD BE AT LEAST 1' (30 cm) HIGH

Figure A-16. Closed latrines.

Figure A-17. Burn-out latrine.

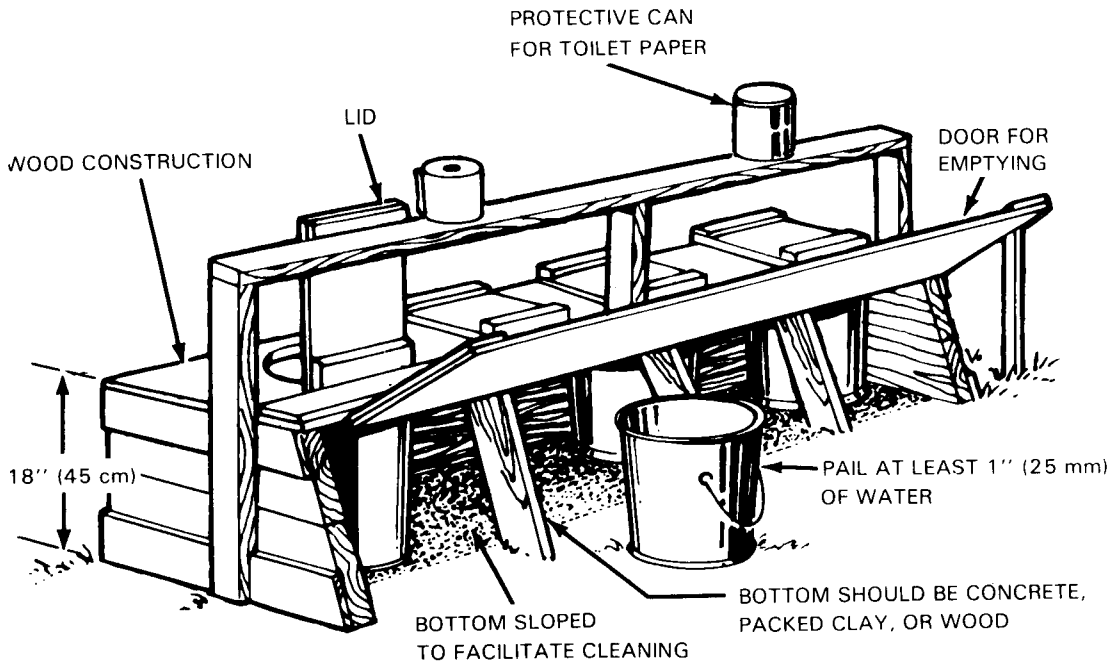


Figure A-18. Pail latrine.

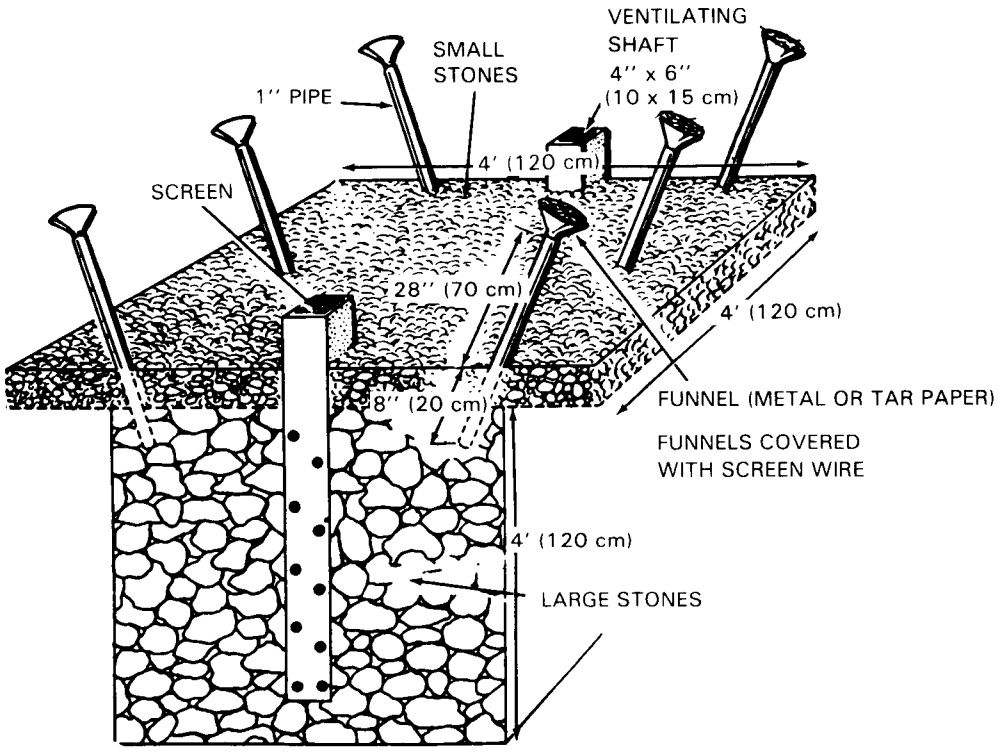


Figure A-19. Urine soakage pit.

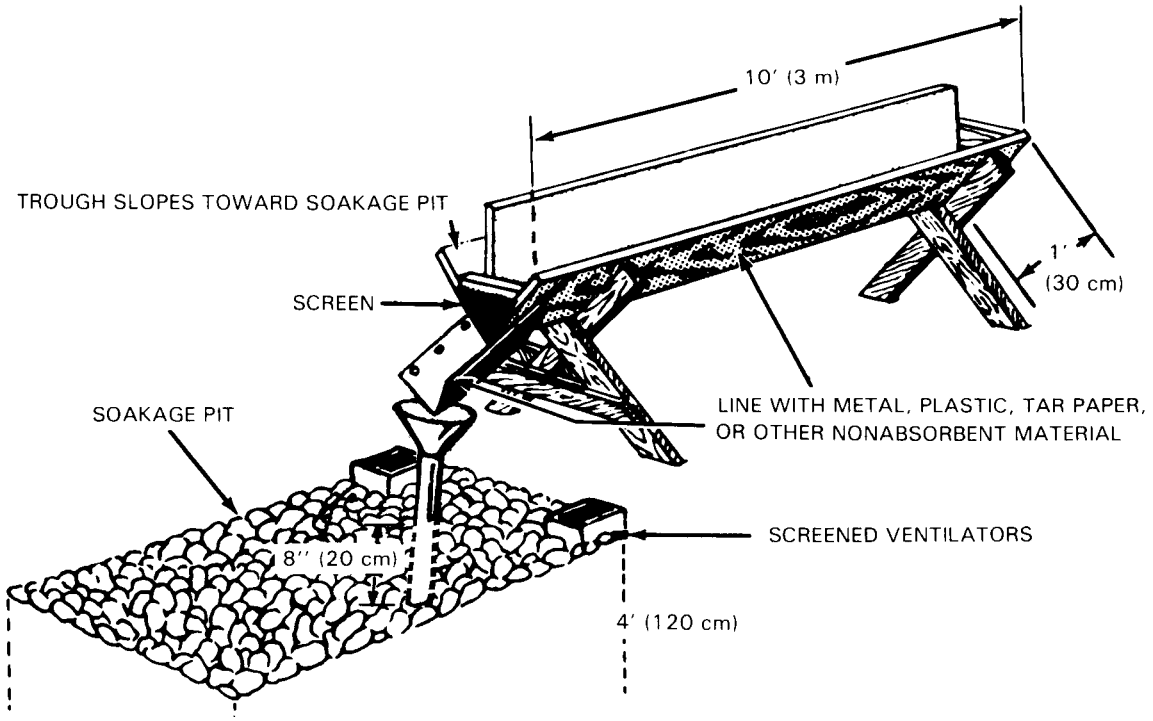


Figure A-20. Trough urinal.

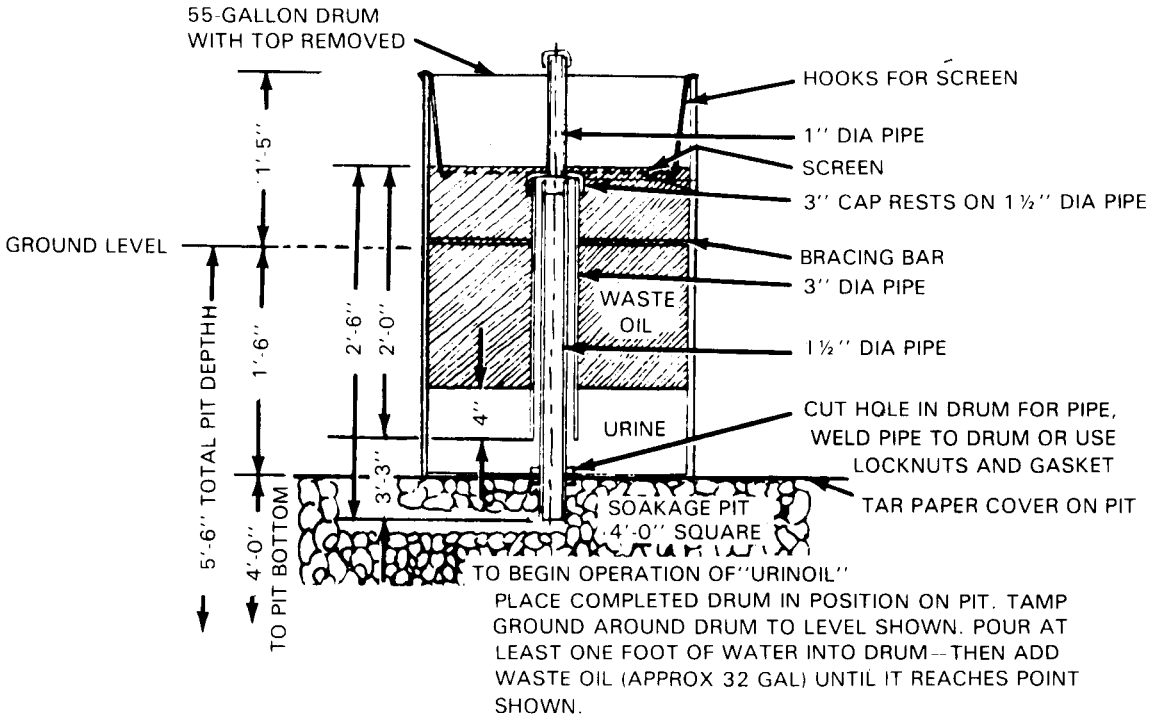


Figure A-21. Urinoil urinal.

SECOND PERIOD

C. Disposal of Liquid Waste. Kitchen, bath, and wash wastes.

1 Soakage pits (Figure A-24).

2 Soakage trenches with pail grease trap (Figure A-25).

3 Grease traps.

(a) Filter grease trap (Figure A-26).

(b) Baffle grease trap (Figure A-27).

4 Evaporation bed (Figure A-28).

D. Disposal of Rubbish (Barrel Incinerator) (Figure A-29).

III. Practical Exercise

A. Hand out problem situations to the students. (Sample problems shown in Appendix c).

B. Allow the students 15 minutes to complete the exercise.

C. Conduct a discussion of the students' answers.

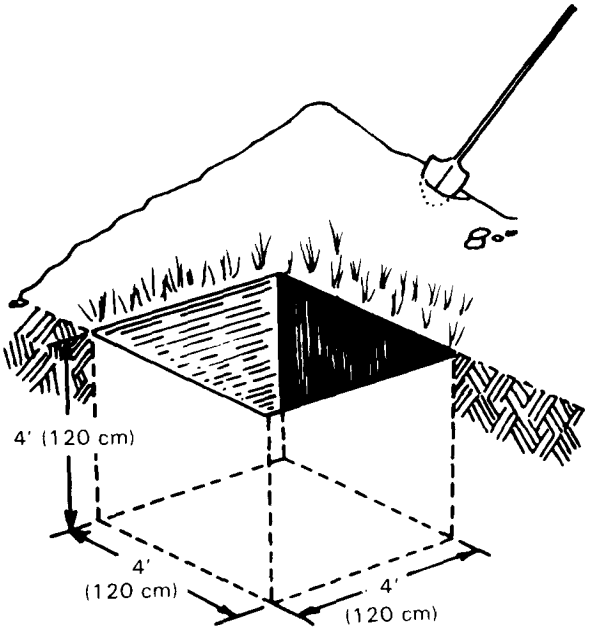


Figure A-22. Garbage burial pit.

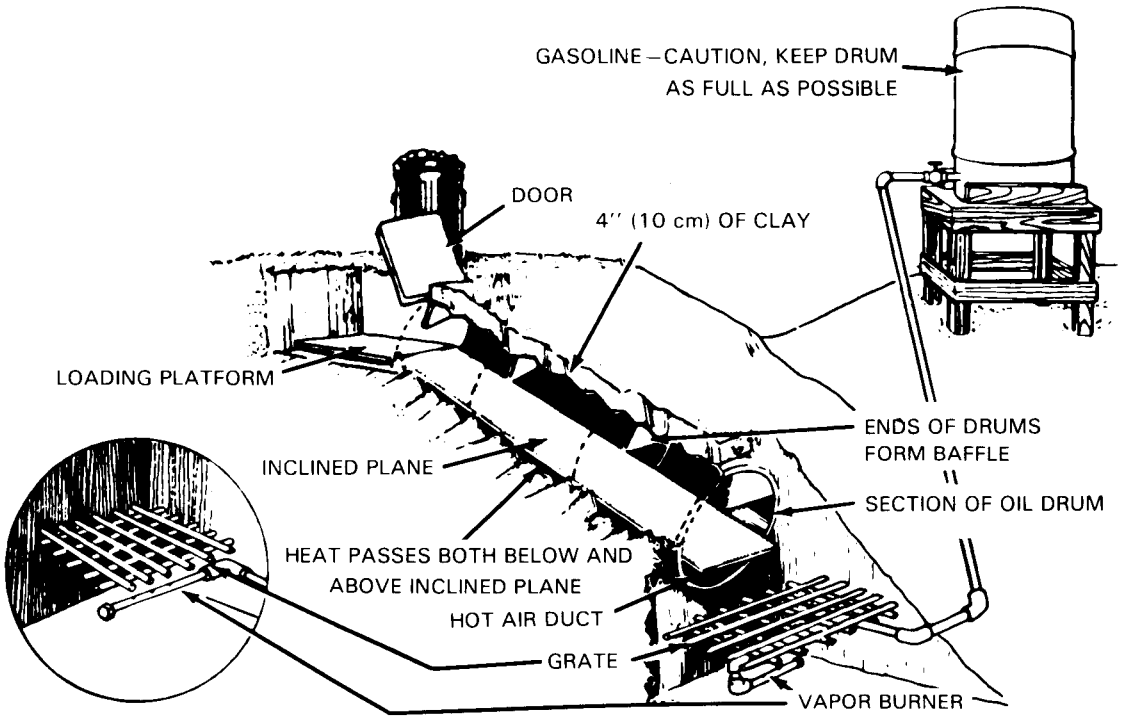


Figure A-23. Inclined-plane incinerator with vapor burner.

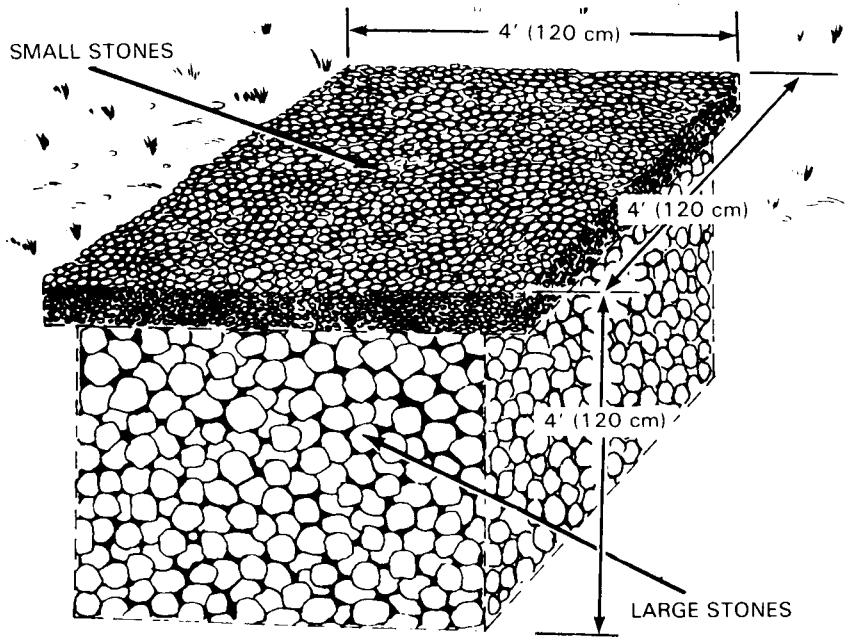


Figure A-24. Soakage pit.

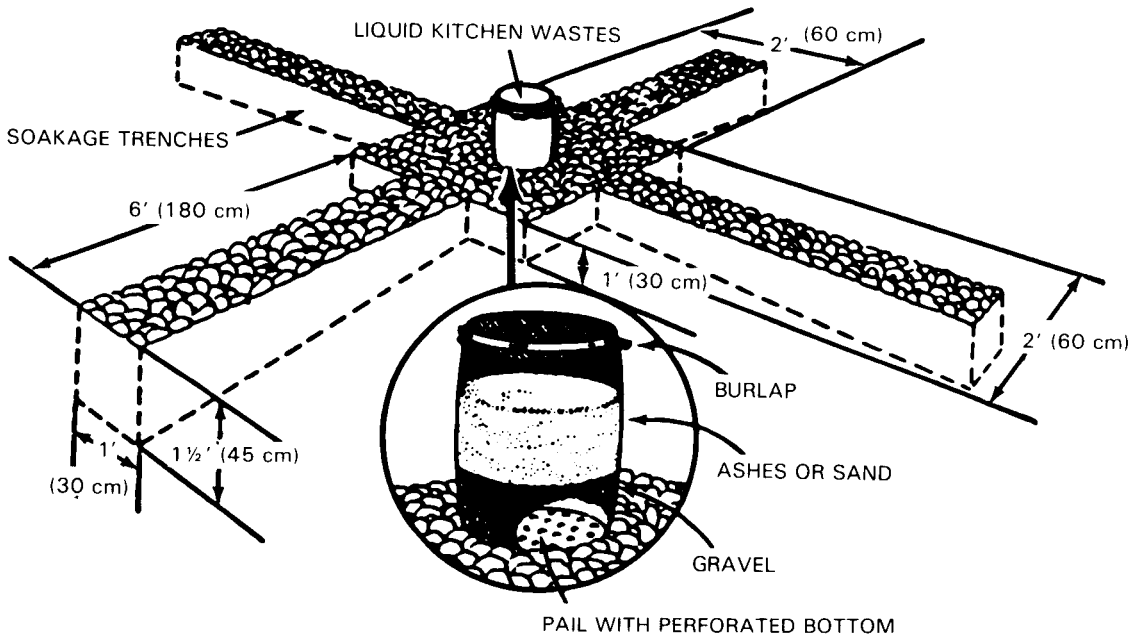


Figure A-25. Soakage trenches with pail grease trap.

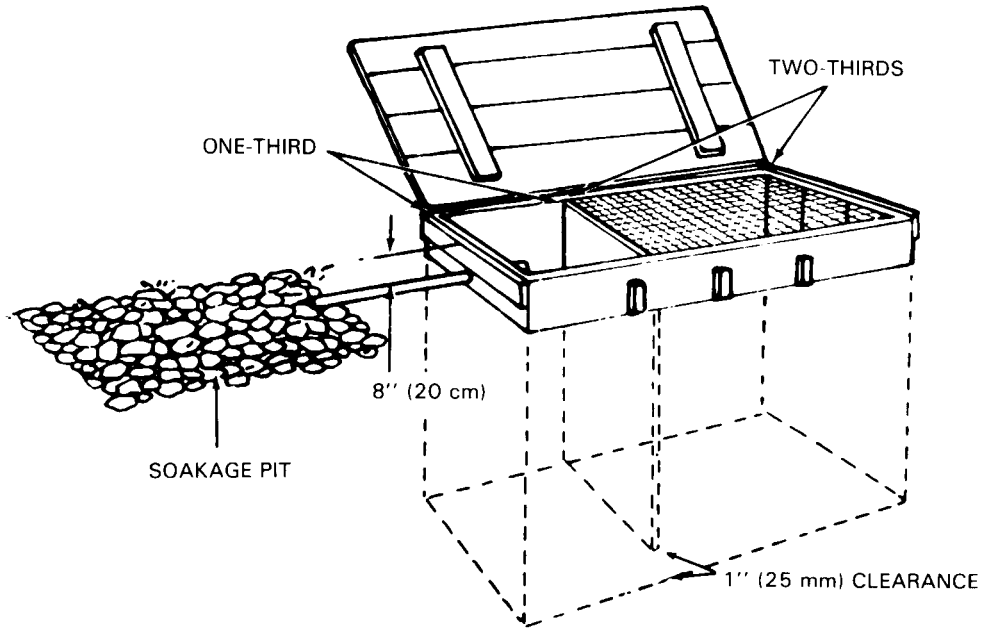


Figure A-26. Filter grease trap.

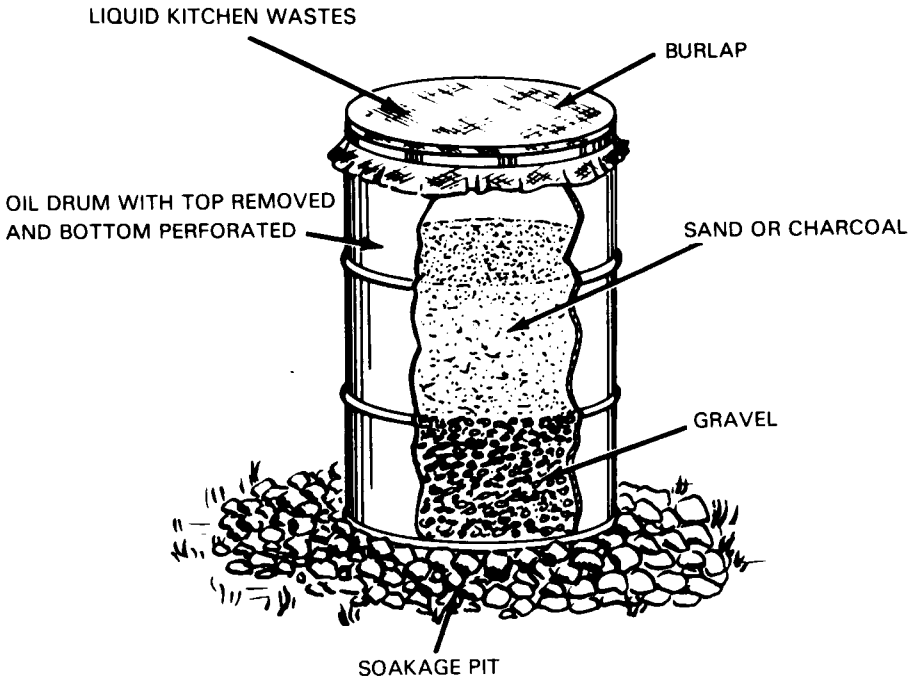


Figure A-27. Baffle grease trap.

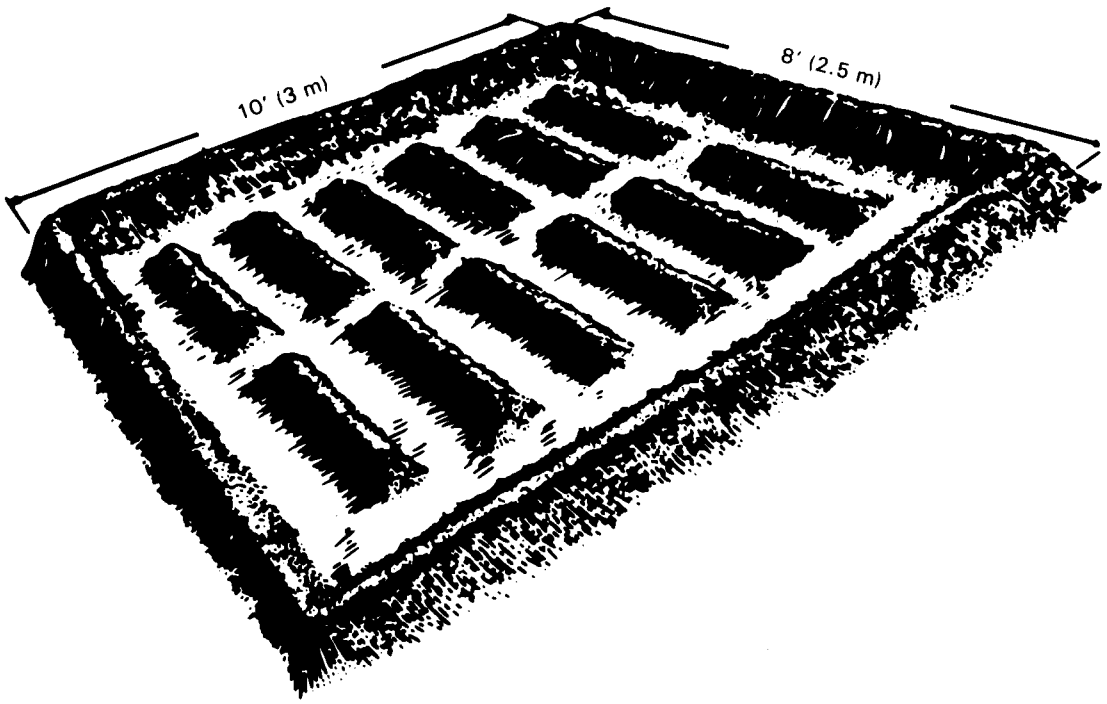


Figure A-28. Evaporation bed.

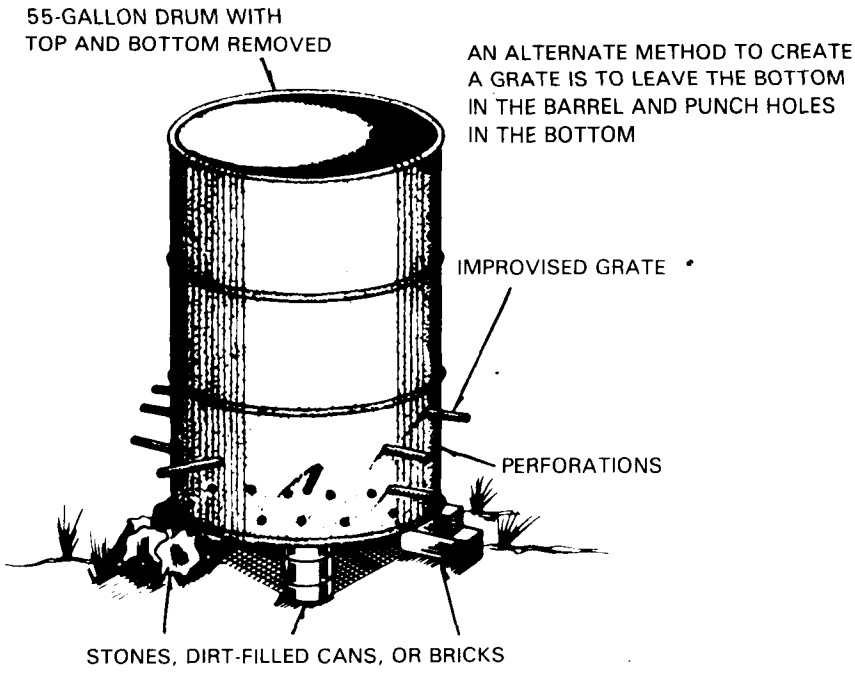


Figure A-29. Barrel incinerator.

IV. Summary (8 minutes)

A. Review of the Main Points.

1 Primary factors considered in the construction of waste disposal facilities.

2 Type of disposal facilities for—

(a) Human waste.

(b) Garbage.

(c) Liquid wastes (kitchen, bath, and wash).

(d) Rubbish.

3 General requirements for constructing and closing waste disposal facilities.

(a) Human waste.

(b) Garbage.

B. Closing Statement. The effectiveness with which you assist your unit commander in the proper wastes disposal will have a vital influence upon the health of the soldiers and the effectiveness of your unit.

LESSON 6: Arthropods and Diseases.
TYPE OF INSTRUCTION: Lecture.
HOURS: One.
TOOLS, EQUIPMENT, AND MATERIAL: None.
PERSONNEL: One instructor.
INSTRUCTIONAL AIDS: Chalkboard with chalk and eraser.
REFERENCES: AR 40-5; FM 21-10; TM 5-632; and Section V, Chapter 2, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform notebook and pencil.
TROOP REQUIREMENTS: None.
TRANSPORTATION REQUIREMENTS: None.

I. Introduction (5 minutes)

A. Opening Statement. Historically more men have been killed or disabled from arthropod-borne diseases than from enemy action. Even today the arthropods which are harmful create one of the greatest environmental hazards to soldiers in the field.

NOTE: Give examples of arthropods which are vehicles of disease and of those which are nuisances. Also relate an example of the ineffectiveness of a unit due to these arthropods.

B. Objective. Explain to other members of your unit the ways in which arthropods may affect their health.

II. Explanation (40 minutes)

A. Direct Arthropod Effects on Human Health.

1 Biting Arthropods

(a) Transient host contact.

(1) Blood sucking.

(2) Nonblood sucking.

(b) Long-Term Host Contact.

(1) Ectoparasites.

(2) Endoparasites.

2 Stinging (envenomizing) Arthropods.

(a) Anteriorly stationed venoms.

(1) Spiders.

(2) Centipedes.

(b) Posteriorly stationed venoms.

(1) Bees, wasps, ants.

(2) Scorpions.

3 Allergy.

B. Arthropod-borne Diseases.

NOTE: See Table 2-1. Arthropod-borne diseases and their vectors.

III. Summary (5 minutes)

A. Review of Main Points.

1 Direct Arthropod Effects on Human Health.

(a) Biting.

(b) Stinging.

(c) Allergy.

2 Arthropod-Borne Disease.

B. Closing Statement. We cannot control climatic conditions which influence the prevalence of arthropods, but we can apply effective defense measures to protect the health of our soldiers. We shall discuss these measures during the following periods.

LESSON 7: Control of Arthropods Through Field Sanitation and Individual Preventive Medicine Measures.
TYPE OF INSTRUCTION: Lecture and demonstration.
HOURS: Two.
TOOLS, EQUIPMENT, AND MATERIALS: Display of arthropod specimens as described below.
PERSONNEL: One instructor and two assistants.
INSTRUCTIONAL AIDS: Chalkboard with chalk and eraser; display of arthropods of medical importance in the various stages of their life cycles (one set per ten students) or transparencies if specimens cannot be obtained; clothing repellent (simulated); 2-gallon pail, field cot with air mattress and blanket, insect bar (T-bar and net), large needle and thread, and aerosol insecticide.
REFERENCES: AR 40-5; FM 21-10; TM 5-632; and Section VI, Chapter 2, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform; notebook and pencil.
TROOP REQUIREMENTS: None.
TRANSPORTATION REQUIREMENTS: None.

FIRST PERIOD

I. Introduction (2 minutes)

A. Opening Statement. The ideal location for a bivouac site is on high, well-drained ground which is at least one mile (1.6 km) from breeding sites of flies and mosquitoes and 1 mile (1.6 km) from habitation of indigenous people which may also be populated with disease-carrying arthropods. Since such a location is not always possible, we must know how to control arthropods which affect the health of soldiers.

B. Objective. Instruct other members of your unit how to recognize arthropods of medical importance and the importance and use of individual preventive medicine measures.

II. Explanation and Demonstration

A. Arthropods of Medical Importance (48 minutes).

NOTE: Indicate the length of time required for the arthropods, as grouped below, to complete their life cycles and explain where they can be found in nature.

1 Life cycles.

(a) Flies.

(b) Mosquitoes.

(c) Fleas.

(d) Lice.

(e) Cockroaches.

(f) Ticks and mites.

2 Denial of breeding sites by use of effective sanitation measures.

NOTE: Divide the students into groups of five to ten students, depending upon the number of arthropod displays available, and allow approximately 35 minutes for students to examine and study the specimens. The instructor and two assistants are to assist the students and answer their questions. At the end of this period the instructor is to give a brief review of the arthropods displayed. During other periods of instruction conducted in the field, the instructor should point out live arthropods of medical importance and their habits.

SECOND PERIOD

B. Individual Preventive Medicine Measures (45 minutes).

1 Preventive medicine measures for the soldier at work.

(a) Clothing.

(b) Clothing repellent.

(c) Insect repellent (DEET).

2 Preventive medicine measures for the soldier at rest.

(a) Screened billets.

(b) Bed net.

(c) Aerosol insecticide.

3 Uniform impregnation (l(b) above).

NOTE: Demonstrate the impregnation of a uniform according to the instructions on the clothing repellent package and instructions issued by the local surgeon.

4 Use of a bed net (2(b) above).

NOTE: Demonstrate how to set up a bed net.

(a) At each end of a field cot which is set up with an air mattress and a blanket, attach overhead T-bars.

NOTE: The bar may be improvised from such material as sticks or limbs. Make sure that the bars are free of sharp points which may tear the net.

(b) Attach the net inside the T-bars.

(c) Inspect the net for holes or tears and demonstrate how to repair it.

(d) Tuck the net under the mattress on both ends and one side.

(e) Before getting under the net, release the spray from the aerosol insecticide for five seconds to kill any mosquitoes which may be present. If such a dispenser is not available, hand-kill the mosquitoes.

(f) Enter the cot on the open side and tuck the net under the mattress afterwards.

NOTE: The demonstration should also include the use of a bed net with a hammock (if available) and with an air mattress on the ground.

III. Summary (5 minutes)

A. Review of Main Points.

1 Preventing the population explosion of medically important arthropods is to deny them suitable breeding sites through the practice of effective sanitation measures. Arthropods of medical importance include flies, mosquitoes, fleas, lice, cockroaches, ticks, and mites.

2 Protecting soldiers from existing arthropods by ensuring that they use individual PMMs correctly.

B. Closing Statement. During the next periods we shall discuss the application of pesticides as another important defensive measure against disease-carrying arthropods.

LESSON 8: Control of Arthropods with Pesticides
TYPE OF INSTRUCTION: Lecture, demonstration, and practical exercise.
HOURS: Two.
TOOLS, EQUIPMENT, AND MATERIALS: Pesticide (Appendix B) authorized for use of unit in sufficient quantity for students to prepare sprayers for use.
PERSONNEL: One instructor.
INSTRUCTIONAL AIDS: Chalkboard with chalk and eraser; insecticide powder hand duster; insecticide hand pressure sprayer; pesticide (Appendix D) authorized for use by the unit.
REFERENCES: AR 40-5; FM 21-10; TM 5-632; SB 3-40; CTA 50-970; and Section VI, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform; FM 21-10; notebook and pencil; and 2-gallon hand pressure sprayer (one from each unit).
TROOP REQUIREMENTS: None.
TRANSPORTATION REQUIREMENTS: None.

FIRST PERIOD

I. Introduction (2 minutes)

A. Opening Statement. Pesticides are valuable in the control of arthropods. They are used to augment, not replace the field sanitation and individual PMMs discussed during the previous periods.

B. Objective. Teach other members of your unit the safe and proper use of pesticides and the 2-gallon hand pressure sprayer for the control of medically important arthropods.

II. Explanation and Demonstration (48 minutes)

A. Properties of Pesticides and Hazards Pertaining Thereto.

B. Precautions.

C. Resistance of Arthropods to Pesticides.

D. Disposal.

E. Equipment used in the Application of Pesticides.

1 Hand duster (Figure A-30).

2 Hand pressure sprayers with instructional manuals (Figure A-31).

3 Personal protective clothing.

NOTE: Demonstrate the following aspects of the hand pressure sprayer (Figure A-31 and A-32).

4 Replacing worn parts (Figure A-33).

(a) Packing in piston-cup.

(b) Pump cylinder valve.

(c) Gun hose.

5 Preparing the sprayer for use.

NOTE: Point out how to release pressure from tank when need arises.

6 Operating the sprayer.

NOTE: Also explain the spraying technique.

7 Cleaning the sprayer.

III. Practical Exercises (40 minutes)

A. Separate the students into a number of small groups, depending upon the number of sprayers available.

B. Have each group member replace parts as demonstrated; then have each member prepare, operate, and clean the sprayer as demonstrated.

NOTE: Water may be used to simulate the pesticide. Have the student measure the required amount of water (pesticide) to mix for spraying. This will prevent exposing personnel to pesticide for training only.

C. Circulate among the groups, correcting any errors made by the students.

D. Instruct the students to wash off solution immediately with soap and water if they spill any on their skin or clothing.

E. Emphasize to students the need to follow instructions on the pesticide container label precisely and without deviation.

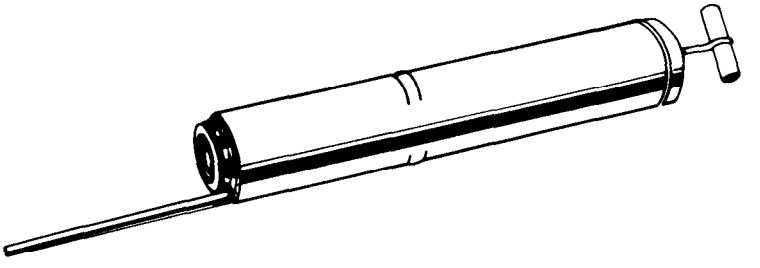


Figure A-30. Hand duster.

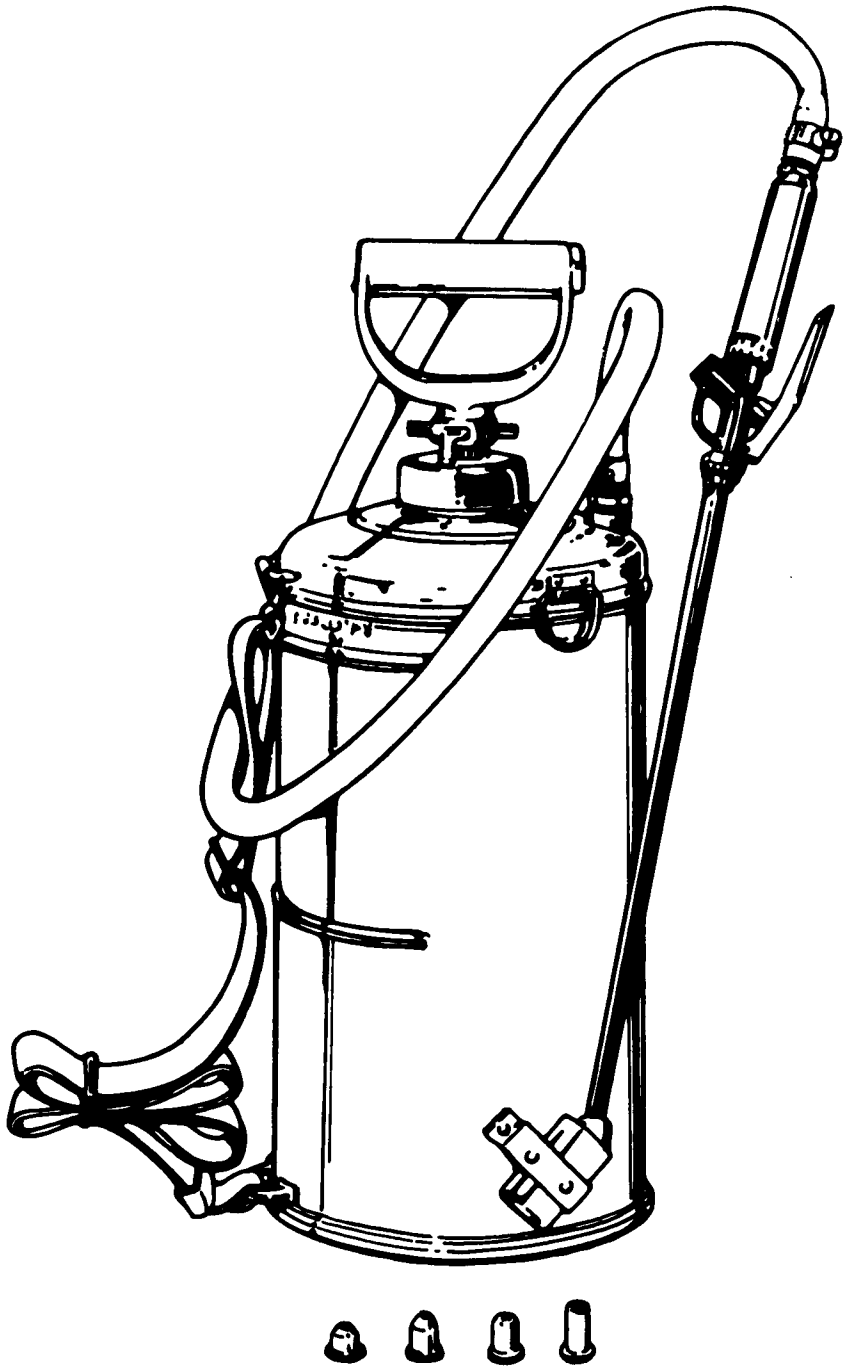
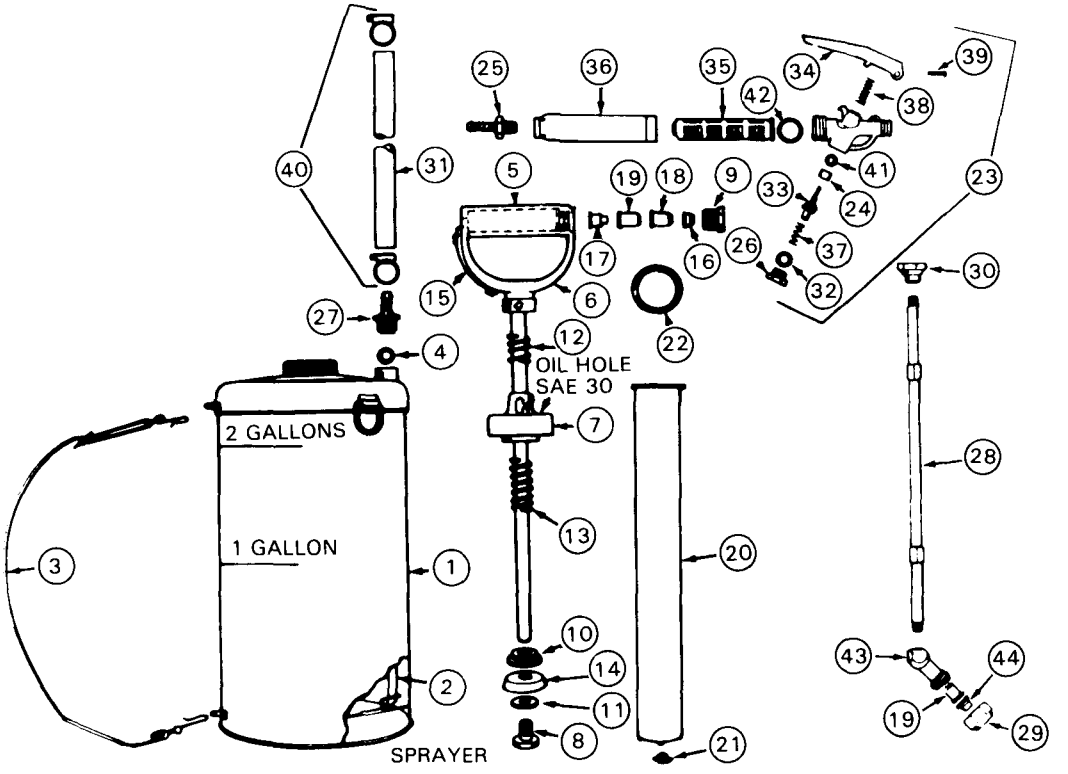


Figure A-31. Two-gallon hand pressure sprayer.



DWG REF NO.	QTY	
		SUPPLY TANK AND PARTS
1	1	TANK ONLY FOR 6700MS SPRAYER
2	1	SUPPLY TUBE
3	1	SHOULDER STRAP ASSEMBLY
4	1	SUPPLY TUBE GASKET
		PLUNGER ASSEMBLY AND PARTS
5	1	PLUNGER ASSEMBLY, COMPLETE
6	1	PLUNGER TUBE AND HANDLE ASSEMBLY
7	1	PUMP CAP, ONLY
8	1	RETAINER NUT
9	1	END PLUG
10	1	BACK DISC
11	1	FRONT DISC
12	1	LOCKING SPRING
13	1	BUMPER SPRING
14	1	LEATHER CUP
15	1	IDENTIFICATION PLATE
16	1	NOZZLE TIP, SOLID STREAM
17	1	NOZZLE TIP, FULL CONE
18	1	NOZZLE TIP, HOLLOW CONE
19	1	NOZZLE STRAINER ASSEMBLY
		PUMP CYLINDER ASSEMBLY AND PARTS
20	1	PUMP CYLINDER ASSEMBLY, COMPLETE
21	1	PUMP CYLINDER BOTTOM VALVE
22	1	PUMP CYLINDER GASKET
		DISCHARGE ASSEMBLY AND PARTS
23	1	SHUT-OFF ASSEMBLY, COMPLETE
24	1	SHUT-OFF VALVE PIN BUSHING
25	1	SHUT-OFF HOSE CONNECTOR
26	1	SHUT-OFF PACKING NUT
27	1	HOSE CONNECTOR
28	1	EXTENSION TUBE, ONLY
29	1	NOZZLE BODY CAP
30	1	EXTENSION TUBE ADAPTOR
31	1	HOSE, ONLY
32	1	SHUT-OFF COPPER GASKET
33	1	SHUT-OFF VALVE PIN ASSEMBLY
34	1	SHUT-OFF OPERATING LEVER ASSEMBLY
35	1	SHUT-OFF STRAINER ASSEMBLY, ONLY
36	1	SHUT-OFF STRAINER HOUSING, ONLY
37	1	SHUT-OFF VALVE PIN SPRING
38	1	SHUT-OFF OPERATING LEVER SPRING
39	1	SHUT-OFF OPERATING LEVER RIVET
40	2	HOSE CLAMP (153-208)
41	1	SHUT-OFF VALVE PIN O-RING
42	1	SHUT-OFF STRAINER GASKET, ONLY
43	1	ANGLE NOZZLE BODY
44	1	NOZZLE TIP, FLAT FAN

Figure A-32. Replacement parts for 2-gallon sprayer.

IV. Summary (10 minutes)

A. Review material covered. Ask the students the following questions:

1 QUESTION: Will pesticides kill humans?

ANSWER: Yes, in sufficient quantity they will kill any animal.

2 QUESTION: What are the principal factors considered in selecting a pesticide for use in the unit area?

ANSWER: The pests to be controlled, the site of pesticide application, and the pesticide label directions.

3 QUESTION: May all of the liquid pesticides issued to the field sanitation team be used around an open flame?

ANSWER: No. They may be flammable.

4 QUESTION: Why does the kerosene or fuel oil used as a solvent for many modern pesticides make the pesticide more hazardous for humans?

ANSWER: The human skin absorbs oil and the pesticide along with it.

5 QUESTION: If the pesticide you are using is not killing the arthropods, what should you do?

ANSWER: Request assistance from the supporting preventive medicine unit.

6 QUESTION: Can all hand pressure sprayers be operated and maintained as demonstrated and practiced here?

ANSWER: No. The instructional manual furnished with each sprayer must be retained and followed.

7 QUESTION: What is the pressure to which the sprayer tank should be pumped?

ANSWER: 40 to 60 pounds (275 to 415 kPa).

8 QUESTION: Should the sprayer fail to operate properly after pressure is in the tank, what safety measures must be taken before checking for malfunctioning parts in the cylinder?

ANSWER: Release the pressure by unscrewing the filler cap one-half turn (or less). Never completely unscrew the filler cap before releasing the pressure.

9 QUESTION: How will you know when you have mastered the sprayer technique?

ANSWER: Able to cover an entire surface with pesticide without its running.

10 QUESTION: After use of the sprayer, why must it be flushed with kerosene or fuel oil and its exterior wiped off?

ANSWER: The pesticide will crystallize and corrode the metal, jam the valves, deteriorate the gaskets, and cause malfunction of the nozzles.

B. Closing Statement. You must keep in mind that the key to controlling disease-carrying arthropods in the field is the practice of effective sanitation; also individual PMMs and the application of pesticides are important augmentations to the sanitation measures.

LESSON 9: Rodent Control.
TYPE OF INSTRUCTION: Lecture, demonstration, and practical exercise.
HOURS: Two.
TOOLS, EQUIPMENT, AND MATERIALS: The following items for each student in class: rodent snap trap; bait station; ½ pound (224 g) of ready-to-use anticoagulant poison bait (simulated); suitable food item for trap bait.
PERSONNEL: One instructor and one assistant for each team during practical exercise.
INSTRUCTIONAL AIDS: Chalkboard with chalk and eraser, rodent snap trap, bait station, anticoagulant poison (simulated), and bait (suitable food item).
REFERENCES: AR 40-5; FM 21-10; TM 5-632; and Section VII, Chapter 2, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform; notebook and pencil.
TROOP REQUIREMENTS: None.
TRANSPORTATION REQUIREMENTS: Vehicle with capacity for students, instructor, and assistant instructors.

I. Introduction (2 minutes)

A. Opening Statement. Rodents are the carriers of several human diseases. The best known and most serious rodent-borne disease is plague.

B. Objectives.

1 Recognize an environment capable of supporting rodents and apply the necessary measures to reduce the rodent potential.

2 Recognize the signs of rodents and eliminate rodents through the application of control measures.

II. Explanation and Demonstration (48 minutes)

A. The Term "Rodents."

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B. Habits of Rodents.

1 General habits.

2 Specific habits of the Norway and roof rats.

C. Relation of Rodents to Human Diseases.

D. Control Measures.

1 Rodent Surveys.

2 Eliminate food.

3 Eliminate water.

4 Eliminate harborage.

5 Rodent trapping.

NOTE: Demonstrate the preparation of the snap trap with bait and the placement of this trap.

6 Chemical control.

NOTE: Demonstrate the preparation of a bait station with poisonous bait and the placement of this station. Use any available material to construct bait station, such as plastic cup, tin can, or cardboard.

7 Disposal of dead rodents.

III. Practical Exercise (40 minutes)

A. Take the students to an area known to be infested with rodents, but do not inform the students that the area is infested.

B. Divide the students into teams and assign one assistant instructor to each team.

C. Provide each team with sufficient rodent traps, bait stations, anticoagulant poison, and bait.

D. Assign each team to survey a specific section of the area and instruct each team member to accomplish the following

1 Determine whether the environment is capable of supporting rodents and list the reasons.

2 List any observed signs of rodents.

3 Set a rodent trap in an appropriate place for trapping rodents.

4 Place a bait station in a site where rodents are likely to visit and feed.

E. Have the team members report to a designated location in the area after 30 minutes.

F. When each team completes the exercise, check the traps and bait stations to determine whether or not they have been appropriately placed and properly set; point out any errors which have been made. Discuss the reasons which the team members listed for believing the environment is capable of supporting rodents and the rodent signs which they observed.

NOTE: This is the responsibility of the assistant instructor for each team.

IV. Summary (10 minutes)

A. Have one member of each team summarize the findings of his team.

B. Review the main points of the lesson—

1 To prevent the infestation of rodents, you must ensure that food, water, and harborage are made inaccessible.

2 To detect the presence of rodents early, you must survey the area regularly for rodent signs.

3 To achieve effective results from mechanical and chemical control measures, you must know the type of rodent present, the extent of infestation, the location of harborage and nest, the types of foods which the rodents like, and how to prepare and place traps and bait stations.

4 To ensure your safety and the safety of others—

(a) Do not use or store poisonous bait in food areas.

(b) Dispose of dead rodents early each morning and follow the self-protective measures prescribed.

C. Closing Statement. During this session you have learned how to conduct rodent surveys; prepare baits; bait boxes; and prepare and set rodent traps. Do not forget that the success or failure of an army, the outcome of a war, and the fate of a nation may rest upon how well diseases are prevented through effective field sanitation control operations. The extent to which diseases are prevented in your unit area depends upon the effectiveness with which you adapt the control measures, which you have learned, to the existing environment of your unit.

LESSON 10: Heat Injuries.
TYPE OF INSTRUCTION: Lecture.
HOURS: One.
TOOLS, EQUIPMENT, AND MATERIALS: None.
PERSONNEL: One instructor.
INSTRUCTIONAL AIDS Chalkboard, chalk and eraser.
REFERENCES: AR 40-5; TB MED 507; and Section VIII, Chapter 2, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform, notebook and pencil.
TROOP REQUIREMENTS: None.
TRANSPORTATION REQUIREMENTS: None.
OBJECTIVE: Instruct FST members to recognize the types of heat injuries; factors that influence heat injury; and how to protect themselves and their unit from heat injuries.

I. Introduction. Army personnel are subject to exposure to extremes of climate and temperature which can have serious effects on their health and efficiency. Although nothing can be done to control the climate or weather in which soldiers must function much can be done to prevent harmful effects on personnel and subsequent deterioration of performance.

A. Recognize the Types of Heat Injuries.

1 Heat cramps. Results from excessive loss of salt from the body.

2 Heat exhaustion. Results from excessive salt and water loss.

3 Heat stroke. Results from breakdown in body's temperature regulator and sweating is blocked. HEAT STROKE ISA MEDICAL EMERGENCY!

B. Recognize Factors that Influence Heat Injury.

1 Unacclimatized personnel.

2 Overweight and fatigue.

3 Heavy meals and hot foods.

4 Alcoholic beverages.

5 Fever.

6 Drugs.

7 Tight clothing.

C. Prevent Heat Injuries.

1 Water.

2 salt.

3 Acclimatization.

4 Physical condition.

5 Work schedules.

6 Protection from the environment.

7 Education.

8 Wet Bulb Globe Temperature Index.

II. Summary.

A. Review Main Points.

1 Types of heat injuries.

2 Factors that influence heat injuries.

3 Prevent heat injuries.

B. Closing Statement: Heat injuries are preventable! Successful prevention requires vigorous command leadership; proper planning in hot weather training; and the provision of adequate water supply.

LESSON 11: Cold Injuries.
TYPE OF INSTRUCTION: Lecture, demonstration, practical exercise.
HOURS: One.
TOOLS, EQUIPMENT, AND MATERIALS: None.
PERSONNEL: One instructor.
INSTRUCTIONAL AIDS: Windchill chart, chalkboard, chalk and eraser.
REFERENCES: AR 40-5; TB MED 81; Chapter 2, Section IX, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform, notebook and pencil.
TROOP REQUIREMENTS: None.
TRANSPORTATION REQUIREMENTS: None.
OBJECTIVE:

1 Instruct FST members in the recognition of signs and conditions that can lead to cold weather injury.

2 Instruct FST members in the procedures to prevent cold injuries.

I. Introduction. Army personnel are subject to exposure to extremes of climate and temperature which can have serious effects on their health, and efficiency. Although we cannot control the climate, or weather in which soldiers must function, much can be done to prevent its harmful effects on personnel and subsequent deterioration of their performance.

A. Recognize the Types of Cold Injuries.

1 Chilblain. Results from exposure to high humidity and temperatures above freezing.

2 Immersion Foot. Results from prolonged exposure in water at temperatures below 50°F.

3 Trench Foot. Results from prolonged exposure to cold and wetness at temperatures above freezing to 50°F.

4 Frostbite. Results from exposure at temperatures of freezing or below. Major Military Significance!

5 General Hypothermia. Results from prolonged cold exposure and body heat loss.

B. Recognize Factors that Influence Cold Injury.

1 Agent Factors–Cold.

2 Environmental Factors

(a) Weather.

(b) Temperature.

(c) Humidity.

(d) Wind.

(e) Combat action.

(f) Clothing.

3 Host Factors.

(a) Age.

(b) Rank.

(c) Previous cold injury.

(d) Fatigue.

(e) Discipline, training and experience.

(f) Psychosocial factors.

(g) Race.

(h) Geographic origin.

(i) Nutrition.

(j) Activity.

(k) Drugs and medication.

C. Practical Exercise Calculate Windchill.

D. Prevent Cold Injuries.

1 Adequate clothing.

2 Avoid immobility.

3 Proper wear of clothing and footgear.

II. Summary

A. Review of Main Points.

1 Types of cold injury.

2 Factors that influence cold injuries.

3 Prevent cold injuries.

B. Closing Statement: Cold injuries are preventable! Successful prevention requires vigorous command leadership; prior planning for cold weather operations; and provision of cold weather clothing and equipment.

LESSON 12: Chemical Hazard (NONNBC).
TYPE OF INSTRUCTION: Lecture.
HOURS: One.
TOOLS, EQUIPMENT, AND MATERIALS: None.
PERSONNEL: One instructor.
INSTRUCTIONAL AIDS: Chalkboard, chalk and eraser.
REFERENCES: AR 40-5; FM 8-250, TB MED 503; Chapter 2, Section XI, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform, notebook and pencil.
TROOP REQUIREMENTS: None.
TRANSPORTATION REQUIREMENTS: None.
INTRODUCTION: The use of major weapon systems to inflict injury on the enemy can have a negative effect in that they can also inflict injury to those who operate the systems. It has been documented through previous conflicts that army(s) suffer casualties through self-inflicted unintentional injury. The recognition of hazards associated with these systems and measures that can be used to protect personnel will significantly increase a unit's combat readiness.
OBJECTIVE: Instruct FST members in the recognition of common nonNBC toxic substances and proper personnel protective measures.

I. Recognize the Toxic Chemical (nonNBC) Threat.

A. Carbon Monoxide.

1 Internal combustion engines.

2 Fueled space heater.

B. Hydrogen Chloride;—exhaust from rocket system.

C. Bore/Gun Gases.

1 Lead.

2 Carbon monoxide.

3 Ammo propellent.

D. Solvents, Greases, Oils. Vehicle maintenance and repair.

II. Recognize the Injury.

A. Carbon Monoxide.

1 Colorless, odorless, tasteless.

2 Causes headache, sleepiness, coma, and death.

B. Hydrogen Chloride.

1 Irritating gas to eyes, throat, and lungs.

2 Causes cough, acid burn, and flu-like lung disease.

C. Bore/Gun Gases. Same as above.

D. Solvents, Greases, Oils.

1 Skin-rash, burns, drying, and infection.

2 Body—damage to liver, blood, brain, and may cause cancer.

III. Protect Yourself and Your Mission From Toxic Chemicals.

A. Carbon Monoxide.

1 Run engines outside.

2 Keep windows slightly open where you sleep.

3 Do not use engine exhaust for heat.

B. Hydrogen Chloride.

1 Position yourself upwind of rocket system.

2 Hold breath until cloud passes by you.

C. Bore/Gun Gases.

1 Use onboard vehicle ventilation systems.

2 Keep bore evacuator well maintained.

D. Solvents, Greases, Oils.

1 Use”safety’’ Stoddard solvent.

2 Never substitute solvents.

3 Use coveralls and gloves.

4 Practice good personal hygiene.

NOTE: The M17A1 Protective Mask has not been tested/certified to protect agents industrial chemical exposure.

IV. Plan for Toxic Chemicals.

A. Identify sources of toxic chemicals in your unit.

B. Develop protective action to reduce sickness or injury.

V. Enforce Individual Preventive Medicine Measures.

A. Ensure that soldiers:

1 Tune engines outside.

2 Ventilate sleeping quarters.

3 Do not use vehicle engine for heat.

4 Use/maintain vehicle ventilation systems.

5 Train in hydrogen chloride protection.

6 Maintain bore evacuation systems.

7 Use" safety'' Stoddard solvent.

8 Have adequate personal protective equipment, such as gloves and goggles.

VI. Summary.

A. Review Main Points.

1 Recognize the nonNBC chemical threat.

2 Recognize the injury.

3 Protect yourself and your mission from toxic chemicals.

4 Plan for toxic chemicals.

5 Enforce individual PMM.

B. Closing Statement: Injuries caused by nonNBC chemicals can be prevented by the use of simple preventive measures. Your mission is to assist the commander in identifying these hazards and implementing corrective actions.

LESSON 13: Noise Hazards.
TYPE OF INSTRUCTION: Lecture.
HOURS: One.
TOOLS, EQUIPMENT, AND MATERIALS: None.
PERSONNEL: One instructor.
INSTRUCTIONAL AIDS: Chalkboard, chalk, and eraser.
REFERENCES: TB MED 501, Chapter 2, Section X, this manual.
STUDY ASSIGNMENT: None.
STUDENT UNIFORM AND EQUIPMENT: Duty uniform, notebook and pencil.
TROOP REQUIREMENTS: None.
TRANSPORTATION REQUIREMENTS: None.
OBJECTIVE:
Instruct FST members in the ability to recognize the types of noise; effects of noise on the soldier and the mission; and how to protect themselves and their mission from the adverse effects of noise.

I. Introduction. All military personnel are exposed to hazardous noise levels at some time during their military duties. It has long been recognized that continuing exposure to loud noise may cause permanent loss of hearing, which can affect combat efficiency. It is also well established that noise-induced hearing loss is the most prevalent health hazard in the military. It is however, a disability which is, in most instances, preventable.

A. Recognize the Types of Noise.

1 Impact noise—very loud, short burst of noise. Examples: small arms fire; cannon/gun fire.

2 Continuous noise–loud, steady noise. Examples: commonly found in the interior of tanks, personnel carriers, and truck cabs; near field electrical generator sets and near or inside aircraft in operations on the ground or in flight.

B. Recognize the Effects of Noise.

1 To the soldier.

(a) Immediate.

(1) Ringing in the ears.

(2) Temporary loss of some hearing (muffling of sound); may last minutes to hours.

(3) Pain–broken ear drum.

(b) Long term–permanent.

2 To the mission.

(a) Soldier—cannot hear important combat noise.

(1) Snap of twigs.

(2) Metal on metal.

(3) Approach of vehicles or aircraft.

(b) Unit.

(1) Position overrun.

(2) Caught by surprise.

(3) Destroyed.

C. Protect Yourself and Your Mission from Noise.

1 Wear hearing protection.

(a) Ear plugs.

(b) Ear muffs.

2 Use on vehicle headgear.

(a) Helicopter crew helmet.

(b) Armor crew helmet.

3 Keep ear plugs and ear muffs clean-prevents ear infection.

4 Avoid noise or limit time around noise to only critical task.

NOTE: If you have to raise your voice to be understood, it's too noisy.

D. Plan for Noise.

1 Identify existing noise in your unit.

2 Ensure all soldiers are medically fit for and are issued multiple sets of hearing protectors.

3 Ensure your medical support unit maintains adequate supply for replacement hearing protectors.

4 Ensure soldiers clean hearing protectors.

5 Control noise sources.

6 Train unit to do mission while wearing hearing protectors.

E. Enforce Individual Preventive Medicine Measures.

1 Ensure soldiers.

(a) Wear ear plugs.

(b) Do not remove inserts from helmets.

(c) Avoid unnecessary exposure.

(d) Limit necessary exposure to mission essential times.

F. Protect Mission.

1 Be aware of short-term noise effect on the soldier's ability to hear combat significant noise.

2 Man listening post/observation post (LP/OP) with soldiers least affected by noise.

3 If noise-unaffected soldiers are not available.

(a) Augment LP/OP with night vision devices.

(b) Increase the number of audible alarms around your position.

II. Summary.

A. Review of Main Points.

1 Types of noise.

2 Effects of noise.

3 Protect yourself and your mission from noise.

4 Plan for noise.

5 Enforce individual PMM.

6 Protect mission.

B. Closing Statement. Your continued ability to hear and the success of your unit in accomplishing its mission are directly dependent on your use of hearing protectors. Without adequate protection you could lose your life and your unit could be destroyed.

APPENDIX B

CHECKLIST OF EQUIPMENT AND MATERIALS FOR FIELD SANITATION TEAM TRAINING

A. Equipment and Materials To Be Supplied.

1 Chalkboard with chalk and eraser.
2 Devices for handwashing, showering, and shaving (Figure A-1 through A-6).
3 Water. Trailer 400 gallons with water.
4 Lyster bags with tripods and clean sticks (1 for 1 to 10 students).
5 Chlorination kits for water purification (1 for 1 to 10 students).
6 Iodine tablets (1 bottle of 50 tablets for 1 to 10 students).
7 Canteen with cup.
8 Insulated food container (Figure A-9).
9 Mess kit washing setup (Figure A-10).
10 Field food service facilities.
11 Field waste disposal facilities or sanitary demonstration area (Figure A-11 through A-29).
12 Problem situations (Appendix C).
13 Displays of specimens of arthropods of medical importance in the various stages of their life cycles (10 or more sets).
14 Container, 15- to 20-gallon (75 liter) capacity.
15 Insect repellent.
16 Pail (2-gallon capacity).
17 Fatigues (1 pair).
18 Field cot with air mattress and blanket.
19 Insect bar (T-bar and net).
20 Needle (large) and thread.
21 Insecticide dispenser (aerosol).
22 Insecticide hand sprayer, 2-gallon capacity.
23 Water to simulate pesticide authorized for unit use (sufficient quantity for instructor and students to prepare sprayers for use).
24 Rodent snap traps (1 for each student and 1 for the instructor).
25 Bait stations (1 for each student and 1 for the instructor-made from available materials).
26 Anticoagulant poison—simulated (1/2 pound (224 g) for students and the instructor).
27 Suitable food item for bait (sufficient quantity for all students and the instructor).

B. Equipment and Materials Which the Student Is To Bring To Class.

1 Notebook and pencil.
2 FM 21-10.
3 Canteen with cup,
4 Each team provides a sprayer for training purposes.
5 MRE spoon.

PROBLEM SITUATIONS–WASTE DISPOSAL

I. DISCUSSION

The type of latrine facility which a unit builds depends upon (1) the soil condition, (2) the water table, (3) the number of persons which the latrine is to serve, and (4) the length of time the latrine will be used.

II. INSTRUCTION

Read the situations described below and provide the best answers.

III. SITUATION A

Company A has recently arrived in an area. A detail is dispatched to dig a latrine. After digging to 1 foot (30 cm) below the surface, the men strike water. The first sergeant asks your advice as to what to do. Illustrate your recommendation to him by drawing a sketch.

ANSWER: Use a pail latrine or burn-out latrine.

IV. SITUATION B

Your unit has 250 men assigned. How many straddle trenches must be dug?

ANSWER: 5.

V. SITUATION C

Your unit is ready to leave an area. How should the latrine be closed?

ANSWER: Spray with insecticide, mound over with 1 foot of earth, and post sign, if tactical situation permits.

VI. SITUATION D

The best device for disposing of urine in the field is a soakage pit. Draw a sketch to illustrate the construction of one.

VII. SITUATION E

The commander has announced that your unit will bivouac in this area for 2 days. What kind of latrine, urinal, handwashing device, and garbage disposal facility will you recommend for construction?

ANSWER: Straddle trench, pipe urinal, tilt can, and continuous trench.

APPENDIX D

FIELD SANITATION TEAM MATERIALS

NATIONAL STOCK NUMBER	DESCRIPTION	UNIT/ ISSUE	ALLOWANCE PER UNIT	AUTHORITY
6810-00-255-0471	CALCIUM HYPOCHLORITE, 6 OZ	BT	3	CTA 50-970
6545-00-914-3480	CHEST, NO. 3, 30x18x10, ALUM	EA	1	CTA 8-100
6850-00-270-6225	CHLORINATION KIT, WATER PURIFICATION	KT	10	CTA 50-970
6840-00-810-6396	DISINFECTANT, FOOD SERVICE, 12s	BX	2	CTA 50-970
3740-00-132-5936	DUSTER, MANUALLY OPERATED, TUBULAR PUMP	EA	1	CTA 50-970
8415-01-012-9294	GLOVE, CHEMICAL AND OIL PROTECTIVE	PR	1	CTA 50-970
4240-00-190-6432	GOGGLES, INDUSTRIAL, NON-VENTED	PR	1	CTA 50-970
6840-01-284-3982	INSECT/ARTHROPOD REPELLENT, PERSONAL APPLICATION, 2 oz	TU	384	CTA 50-970
6840-01-210-3392	INSECTICIDE, CHLORPYRIFOS, 42%, 40 ml, 12's	BX	1	CTA 50-970
6840-01-067-6674	INSECTICIDE, D-PHENOTHRIN, 2%, 12 oz	CN	144	CTA 50-970
6840-00-242-4217	INSECTICIDE, LINDANE, 1%, 2 oz	BT	192	CTA 50-970
6840-00-242-4219	INSECTICIDE, LINDANE, 1%, DUST, 25-lb CAN	CN	1	SB 3-40*
3740-00-252-3384	MOUSETRAP, SPRING, 12's	DZ	2	CTA 50-970
3740-00-260-1398	RATTRAP, SPRING, 12's	DZ	2	CTA 50-970
6840-00-753-4973	RODENTICIDE, ANTICOAGULANT BAIT, 5 lb	CN	2	CTA 50-970
3740-00-641-4719	SPRAYER, INSECTICIDE, HAND, 2 gal	EA	1	CTA 50-909
3740-00-252-3383	SWATTER, FLY, 12's	PG	1	CTA 50-970
6850-00-985-7166	WATER PURIFICATION TABLET, IODINE 50's	BT	400	CTA 8-100

*When authorized by MACOM Medical Authority.

APPENDIX E

SAMPLE UNIT SOP FOR FIELD SANITATION

NOTE: This SOP satisfactorily shows positive actions and specific duties considered suitable for a company-sized unit. Format, actions, time frames, and techniques are shown as examples only and are not intended to apply in all cases or to all units, For most units the scope, actions, quantities, and responsibilities need to be adapted to local commander's requirements.

1. References.
   a. AR 40-5, Preventive Medicine.
   b. FM 21-10, Field Hygiene and Sanitation.

2. Purpose. To reduce disease and nonbattle injury (DNBI) by ensuring that effective preventive medicine measures (PMM) are routinely and habitually practiced under all field conditions.

3. Scope. This SOP specifies for all field exercises and contingencies:
   a. the required field sanitation team (FST) supplies and equipment;
   b. the routine, special, and emergency PMM to be taken; and,
   c. the responsibilities for the accomplishment of PMMs.

4. Field Sanitation Team. The Field Sanitation Team is appointed by the Commander as his special representatives to oversee and observe preventive medicine measures prior to, during, and after field exercises or contingencies. By reason of special training, they know and are authorized to initiate the necessary PMMs to reduce DNBI to the lowest possible level. The PMMs that will always be accomplished by the designated individual(s) are identified below.

5. Key. The individual(s) with the requirement for performing the indicated PMM task is identified in the ACTION column. The SUPERVISE/FOLLOW-UP column identifies the leader/NCO responsible. The individuals are keyed as follows:

AP–Advance Party Leader
CD–Commander
DF—Dining Facility Sergeant
DL–Assigned Detail
FS–Field Sanitation Team
KP–Kitchen Police
ME—Senior Medical Aidman
SS–Supply Sergeant
UL–All OFF/NCO
IC–First Cook
IS–First Sergeant

6. Actions and Responsibilities

	ACTION	SUPERVISE/ FOLLOWUP
a. Planning and Preparations.		
(1) Provide personal PMM instruction to troops.	FS	IS
(2) Check supplies, equipment, and loading.	FS	IS
(3) Water/water trailer.		
(a) Clean/fill/chlorinate/test (5 ppm).	ME	DF
(b) Locate Quartermaster water point(s).	SS	FS
(c) Determine quantity needed.	FS	IS
(4) If potentially hazardous food.		
(a) Get ice chest(s)/container(s).	DF	IS
(b) Locate ice point(s).	SS	FS

	ACTION	SUPPERVISE/ FOLLOWUP
(5) Rubbish/garbage.		
(a) Provide for containers.	SS	FS
(b) Locate disposal point(s).	SS	FS
(6) Assure sufficient insect/rodent-proof food containers.	IC	DF
(7) Plan and train for contingencies in—		
(a) Hot temperatures.	IS	CD
(b) Cold temperatures.	IS	CD
b. Arrival at Field Site.		
(1) Spot/set up dining facility and latrine.	AP	FS
(2) Dig straddle trenches/urinals (1-14 days).	DL	FS
(3) Dig deep pit (7 plus days).	DL	FS
(4) Dig soakage pit (liquid kitchen waste).	DL	DF
(5) Spot/set up rubbish/garbage collection points (if no burial).	DL	FS
(6) Spot/set up water purification bag.	IS	FS
(7) Spot/set up handwashing devices (at dining facility and latrine).	ME	FS
c. Routine Actions.		
(1) Set up/boil water in mess kit laundry.	DF	FS
(2) Test chlorine residual daily.	FS	ME
(3) Chlorinate/disinfect if test fails.	FS	ME
(4) Schedule/remove garbage/rubbish (every 2 days).	SS	IS
(5) Inspect for/destroy fly/mosquito breeding places.	FS	IS
(6) Police food/drink spills to prevent fly breeding and rodent infestations.	UL	FS
(7) Inspect mess kit cleaning.	UL	FS
(8) Inspect utensils/ranges/tables/containers after cleanup following meals.	DF	FS
(9) Observe/inspect personal hygiene of troops.	UL	IS
(10) Police latrine daily; Control flies as required.	DL	FS
d. Special Conditions/Actions.		
(1) Foot marches.		
(a) Prior to.	UL	IS
(b) During and after.	UL	IS
(2) Cold Temperature (below 50° F/10°C):		
(a) Provide for exercise (such as, frequent road halts).	UL	IS
(b) Instruct on wear/drying of clothing/footwear.	UL	IS
(c) Instruct on prevention of trench foot, immersion foot, frostbite, snow blindness, and carbon monoxide poisoning.	ME	FS
(d) Provide for and heat latrine.	DL	FS
(e) Inspect feet/footwear of troops.	UL	IS
(3) Hot temperature (Wet Bulb Globe Temperature Index (WBGT) over 85).		

	ACTION	SUPERVISE/ FOLLOWUP
(a) Obtain WBGT daily.	ME	FS
(b) Schedule work for acclimatization.	IS	CD
(c) Provide adequate water.	FS	IS
(d) Instruct troops on cause and prevention of heat exhaustion, heat stroke, heat cramps, sunburn, prickly heat, and fungus infections.	ME	UL
e. Emergency Conditions/Actions.		
(1) Loss of bath/laundry support.		
(a) Intensify personal hygiene inspections/observations.	UL	IS
(b) Provide expedient shower/laundry devices.	DL	FS
(c) Inspect troops for body lice three weeks after loss of support in cold weather. (Notify medical personnel if body lice are found.)	FS	ME
(2) Loss of water-heating capability.		
(a) Start use of disinfectant for mess kit laundries and utensils.	DF	FS
(b) Provide/improvise expedient water-heating device(s).	DL	FS
(c) Intensify personal hygiene inspections/observations.	UL	IS
f. Departure and Return from Field Site.		
(1) Close latrines, soakage pits.		
(2) Clean, repair, reorder, replace and store equipment/supplies as required.	UL	IS

ACRONYMS AND ABBREVIATIONS

ammo	ammunition
AR	Army Regulation
ATTN	attention
C	centigrade
cm	centimeter
CTA	common table of allowance
DA	Department of the Army
dB	decibel
dB(A)	decibel, A scale
DEET	75 percent N N-diethyl-M-tolumide
DNBI	disease and nonbattle injury
F	Fahrenheit
FM	Field Manual
FST	field sanitation team
ft	feet
g	gram
hp	horsepower
kg	kilogram
km	kilometer
kPa	kilograms per area
lb	pound
LP/OP	listening post/observation post
m	meter
MED	medical
ml	milliliter
mm	millimeter
MOPP	mission oriented protective posture
MOS	Military Occupational Specialty
mph	miles per hour
NBC	nuclear, biological, and chemical
NCO	noncommissioned officer
nonNBC	nonnuclear, biological, and chemical
pH	symbol relating the hydrogen concentration to that of a given standard solution
PHF	potentially hazardous food
PMM	preventive medicine measures
ppm/mgl	parts per million/milligrams per liter
QM	Quartermaster Corps
qt	quart
SB	Supply Bulletin
SOP	standing operating procedure
TB	technical bulletin
TM	technical manual
WBGT	wet bulb globe temperature

DEFINITIONS AND TERMS

Aeration of water— spraying or otherwise exposing water to air in order to reduce objectionable tastes and odors. The same results are obtained by bubbling air through the water.

Aerosol— an atomized fluid in which the fluid particles are very small. An aerosol usually appears as a fog or smoke.

Bacteria— a large group of one-celled microorganisms. The pathogenic bacteria are disease-producing.

Baffles— wood, metal, or masonry deflectors that divert, guide, or agitate the flow of liquid.

Calcium hypochlorite— a chemical compound in powdery or granular form containing chlorine used to disinfect water by chlorination. Common forms: HTH, perchloron, 70-percent available chlorine.

Chlorination— the disinfection (destruction of disease-producing microorganisms) of water by adding chlorine.

Chlorine— a greenish-yellow gas which is used to destroy certain microorganisms in water. In addition to use as a gas, it is combined in other chemical compounds, liquid and solid, for disinfection of water.

Coagulation— process of adding a chemical, usually either aluminum sulfate (alum) or ferric chloride, to create a sticky precipitate to assist in coagulating fine turbidity particles into larger clumps which will settle easier and quicker.

Comparator— apparatus for matching the color of a water sample, to which a dye has been added, with permanent color standards. It is used to determine the level of chlorine residual in water.

Debris— floating trash, suspended sediment, or bed load moved by a stream.

Diseases— any impairment of health which lowers the efficiency of soldiers. The impairment is usually caused by microorganisms.

Disease organisms— microorganisms—such as bacteria, viruses, or protozoa—which impair the health of troops.

Diurnal— active during the daytime.

Dry Point— a water-distribution point to which large volumes of treated water are hauled for distribution to smaller user units.

Expedient— any suitable improvised means of accomplishing a desired end.

Filter— device for separating suspended solids from liquid by passage through a porous medium such as sand or diatomaceous earth.

Filtration— process of passing a liquid through a porous medium to remove suspended matter.

Fungi— small nonchlorophyll plants which may cause disagreeable tastes and odors in water when they decompose.

Germ— any disease-producing microorganism, a pathogen.

Grease trap— device by which grease in sewage is held at the surface of a basin so it can be skimmed off.

Ground water— water in underground deposits which can be recovered by wells or springs.

Impurity— any substance which makes an element unfit for use; contamination and pollution.

Indicator— any water-soluble dye which changes color with variations in pH or chlorine content of the water.

Larva— the immature stages, between the egg and pupa, of an arthropod having complete life cycle change: the six-legged stage of mites and ticks.

Lyster bag— a 36-gallon fabric bag in which water can be chlorinated and held for later use.

Microorganism—tiny, living plants or animals that cannot be seen without a microscope.

Nocturnal— active at night.

Nymph— an immature state (following hatching) of an arthropod which does not have a pupal stage; the eight-legged, immature stage of mites and ticks.

Oxidation— the process of burning. In water treatment, the chemical process of destroying microorganisms by the oxidizing action of chlorine or iodine.

Parasite— an animal that lives in or on the body of another living animal.

Pathogen— a microorganism, either plant or animal, capable of producing an infection or disease if absorbed in the body by a susceptible host.

Percolation— seepage or trickling water or sewage, either horizontally or vertically, through a porous medium such as sand, gravel, soil, or limestone.

Poison— any agent which may produce injurious or deadly chemical effects.

Pollution— water which contains substances of such quantity and character as to make its appearance, taste, or odor objectionable.

Protozoa— single-celled microorganisms of the animal kingdom.

Purification of water— treatment of water to make it potable.

Rickettsiae— microorganisms of an intermediate size between the viruses and the bacteria.

Sewage disposal— riddance of sewage by any method.

Species— a group of individuals or populations that are similar in structure and physiology and are capable of interbreeding and producing fertile offspring and that are different in structure and/or physiology from other groups and normally do not interbreed with them.

Standpipe— a large, elevated tank for storing water in order to meet peak demands and to provide pressure in the water distribution system.

Turbidity of water— condition of water when it contains visible material in suspension. Such material is not necessarily large enough to be seen as individual particles by the naked eye, but the cloudiness in the water is caused by material in suspension, not in solution.

Water-borne disease— disease caused by organisms carried in water. The most common water-borne diseases are typhoid fever, cholera, dysentery, and other intestinal diseases.

Water point— location or installation with equipment for treating and distributing water to soldiers.

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200-1	Environmental Protection and Enhancement

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