FM 8-34

FOOD SANITATION FOR THE SUPERVISOR

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HEADQUARTERS DEPARTMENT OF THE ARMY

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FOOD SANITATION FOR THE SUPERVISOR

PREFACE

Purpose and Scope. This manual is for the use of supervisors of food sanitation. It tells the food service supervisor–

- Why food sanitation is important.
- Why some foods spoil.
- Why some foods are potentially hazardous.
- How germs (microorganisms) contaminate foods.
- How people get sick from food.
- What the supervisor can do to stop foodborne illness.

User Comments. The proponent of this publication is the Academy of Health Sciences. Submit changes for improving this publication on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to: **Commandant, Academy of Health Sciences, US Army, ATTN: HSHA-TLD, Fort Sam Houston, Texas 78234**.

Neutral Language. When used in this publication, "he," "him," "his," and "supervisor" represent both masculine and feminine genders.

*This Field Manual Supersedes TM 8-525, 19 May 1971.

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CHAPTER 1

The Foodborne Disease Problem In The Army

Section I. INTRODUCTION

1-1. Diseases and the Military

Entire armies have been defeated by such disease outbreaks as dysentery, typhoid, yellow fever, plague, and malaria. Mishandling of food and food-related waste has been responsible for some of the diseases. Military leaders like Frederick the Great and Napoleon lost more soldiers to disease than to war-related causes. As late as the Korean Conflict, 25 percent of a division force was incapacitated by foodborne-related diseases. Military installations in the US are not immune to this problem. At a southwest military post, more than 800 soldiers were made sick by foodborne disease. The outbreak was traced to a sick foodhandler who was allowed to continue working. About 200 disease outbreaks affecting nearly 10,000 individuals are reported annually in the United States. Of these outbreaks, about 3 percent are waterborne, 4 percent are caused by milk or milk products, and the rest, or 93 percent are associated with other foods, especially poultry, fish, and meat products. Because of reporting deficiencies, this represents only the "tip of the iceberg" with far more cases going unreported.

1-2. Responsibilities of the Food Service Supervisor

Food service supervisors are the most important factor in the control of foodborne diseases. To prevent these diseases, the food service supervisor must take supervisory actions to-

- Prevent food contamination.
- Retard the growth of microorganisms in food.
- Train and motivate personnel.

To do this job, you need to know about-

- Food microbiology.
- Common types of foodborne disease.
- Factors that contribute to foodborne disease outbreaks.
- Methods used to protect foods from contamination.
- Sanitation standards and how to train personnel.

NOTE

The study and the use of the information in this manual will help you prevent foodborne disease outbreaks in both field and garrison facilities.

Section II. FOOD MICROBIOLOGY FOR THE SUPERVISOR

1-3. Microorganisms in Food

a. Microorganisms are small "plants" and "animals" that require the use of the microscope to be seen. They take in food and water, reproduce, and give off waste products. Many microorganisms may be found in food since it provides an ideal place in which they can live and grow. Some microorganisms may cause illness in the person who eats the food item that the microorganism contaminates. This section will provide general information on microorganisms. The next section will provide information on specific types of foodborne diseases.

b. Some microorganisms occur naturally in foods; some are introduced during the slaughter process; and others are introduced during preparation of the food in a food service facility.

c. Fortunately, most microorganisms do not harm people. Some are helpful and serve a necessary and useful purpose. Useful microorganisms are those necessary in making cheese, wine, beer, sauerkraut, and vinegar. Other useful microorganisms are essential in our digestion of food, and still others are needed for the decay of dead matter. They assist in breaking down dead material and returning it to be part of the soil. Without them, dead trees, leaves, animals, and other matter would not rot, but would remain in their present form.

d. Harmful microorganisms are those that cause disease. All microorganisms that cause illness in man are said to be pathogenic microorganisms. Many organisms cause illness. This manual is specifically concerned with those that can cause illness when taken **into** the body through food. For example, typhoid fever, dysentery, and botulism are diseases that may be transmitted by the consumption of food.

1-4. Growth of Microorganisms in Food

The growth of microorganisms is dependent on several factors:

a. Food Living things must have food. Many microorganisms grow freely in and eat the same food that humans eat.

b. pH Scale. Most microorganisms grow best in material that is neither strongly acid nor strongly alkaline. Pathogenic microorganisms will not grow at a pH below 4.5.

(1) The amount of acid or alkali contained in something is measured on the pH scale. Figure 1-1 shows the pH scale. Microorganisms grow best in the middle of the pH scale, between pH 6 and pH 8.

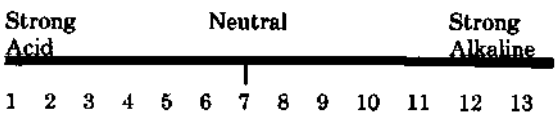


Figure 1-1. pH scale.

(2) Meat falls in the middle of the pH scale--the area where microorganisms grow freely. Figure 1-2 shows that most fruits contain a great deal of acid and that most vegetables are alkaline.

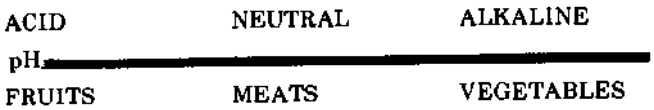


Figure 1-2. pH scale (acid, neutral, alkaline).

c. Temperature. For microorganisms to grow, they must have a suitable temperature. By regulating the temperature, the growth of microorganisms can be controlled.

(1) Bacteria can be divided into three groups with respect to temperature. They are heat-loving (108ºF to 180ºF), moderate-temperature-loving (41ºF to 113ºF), and cold-loving (31ºF to 90ºF). These temperature ranges are shown in Figure 1-3. See Appendix A for a comparison of Fahrenheit and Celsius temperatures.

(2) Most microorganisms causing foodborne disease will not grow at temperatures of 45ºF or below and 140ºF or above.

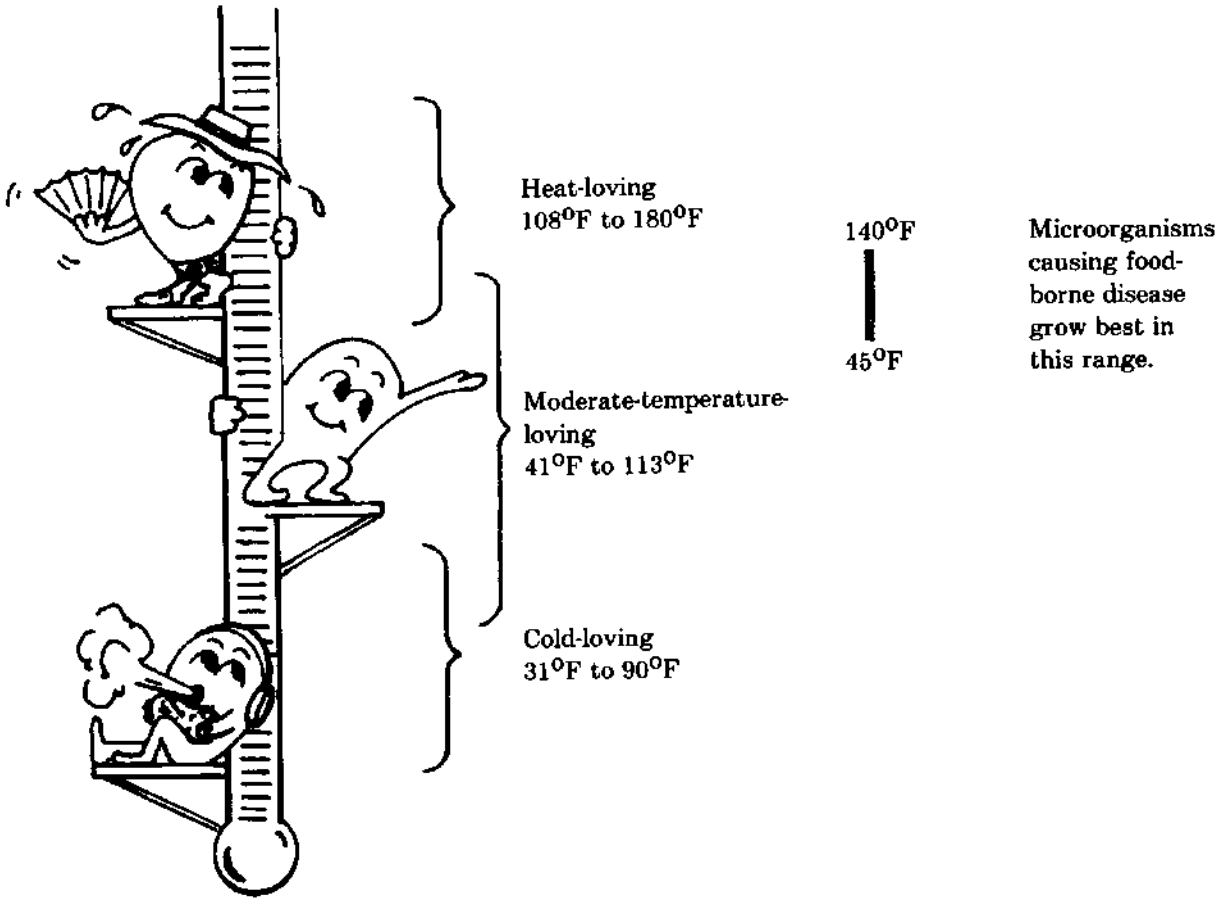


Figure 1-3. Thermometer showing temperatures at which bacteria grow best.

d. Moisture. Microorganisms absorb their food through their cell walls. They cannot absorb solid food. They need moisture to break down the food to the point where they can absorb it.

e. Time. Given enough time and the right conditions, most microorganisms can adjust to different foods. The time can be an accumulative period, not necessarily one continuous exposure period. Figure 1-4 shows how the time required for the growth and death of microorganisms may be divided into four phases.

(1) The lag (slow-growth) phase occurs when microorganisms adjust to a new environment. Most microorganisms can adjust to a new environment in about 4 hours although some require considerably less time.

(2) After they have adjusted, the rapid-growth phase occurs. The growth rate increases ten times for every unit of time.

(3) The equal phase occurs when the production of new microorganisms equals the death rate of old microorganisms.

(4) The death phase occurs when microorganisms compete for food and are poisoned by the accumulation of their own waste.

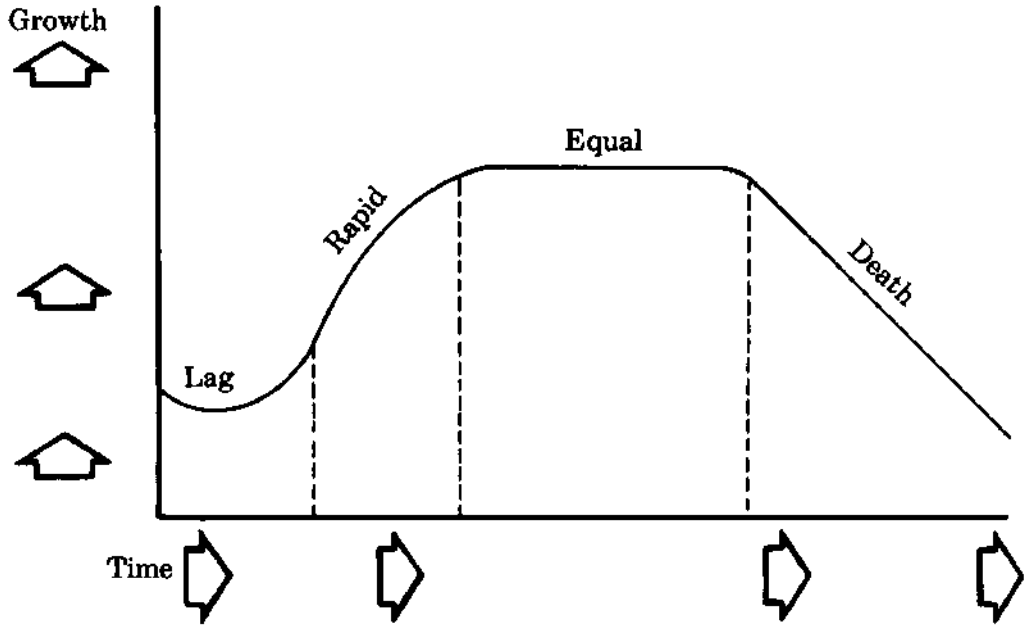


Figure 1-4. Four phases in the growth and death of bacteria.

1-5. Types of Microorganisms Causing Foodborne Disease

a. Bacteria. Although different types of microorganisms cause foodborne illness, most outbreaks are caused by bacteria. Bacteria are single-celled plants. They are very small, but vary in size. Generally, they are 1/25,000 of an inch (.00101 mm) in size. It takes about 25,000 individual bacteria placed side by side to equal 1 inch (25.4 mm).

b. Viruses. Viruses are microorganisms even smaller than bacteria. Viruses can only be seen with the aid of the most powerful microscopes. At one time, it was thought that viruses did not cause foodborne diseases; however, it is now known that viruses can cause foodborne diseases. One example of a virus-caused foodborne disease is hepatitis.

c. Parasites. Parasites are organisms that live on or in another organism. Some parasites are small like other microorganisms and can be seen only through a microscope, while others can be seen without a microscope. Parasites are a problem for soldiers stationed in underdeveloped countries. In areas where night soil (human waste) is used as fertilizer, parasites can be a special problem.

1-6. Potentially Hazardous Foods

Food items that can support the rapid growth of microorganisms causing foodborne diseases are called *potentially hazardous foods.* Foods high in protein, high in moisture, and 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 the following foods.

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

Section III. FOODBORNE DISEASES IN THE MILITARY

1-7. Types of Foodborne Diseases

This section will provide information on common types of foodborne diseases and the specific microorganisms that cause the disease. In addition, information will be provided concerning poisonous plants and chemicals that can contribute to foodborne disease outbreaks. The common types of foodborne diseases are--

a. Foodborne Infections. Foodborne infections occur when pathogenic microorganisms contaminate food. Unlike the illness caused by the presence of a toxin, it is the organism itself that causes the illness. The three general types of foodborne infections are those caused by bacteria, parasites, or viruses,

(1) Bacterial infections. A number of specific bacterial organisms cause infection through food. This manual will only discuss those that are most frequently involved in outbreaks of foodborne illness.

(a) Salmonella. There are more than 1,600 different varieties of salmonella. The illness is called salmonellosis. Eggs, poultry, fish, and meat products are frequently involved in outbreaks, of salmonellosis. Contamination of these foods can occur at any time from the handling or processing stage until the food is served to the consumer. It takes 6 to 48 hours for symptoms of foodborne-infection illness to occur. There are a wide variety of salmonellosis symptoms. The more common ones are fever, abdominal pain, diarrhea frequent vomiting, and chills. Although the illness is not often fatal, it is a special hazard to those who are in poor physical condition, or to the very young and to the aged. Typhoid fever is a type of salmonellosis. The symptoms of typhoid fever may take as long as 3 weeks to appear. Salmonellosis can be prevented by thoroughly cooking food and by educating foodhandlers in the correct food handling procedures.

(b) Bacillary dysentery (shigellosis). Bacillary dysentery is caused by an organism of the genus Shigella Outbreaks of bacillary dysentery in a food service establishment indicates a breakdown in personal hygiene and food protection. Strict foodhandler handwashing, especially after use of the bathroom, and personal cleanliness are the best preventive measures for shigellosis. Symptoms vary considerably in severity and may consist of bloody, diarrhea, cramps, fever, and vomiting. Symptoms usually develop in 2 to 3 days after eating the food containing the organisms.

(2) Parasitic infections. Outbreaks of foodborne illness due to parasites are not common in the United States. Outbreaks may occur at any time in overseas areas. There is an increased risk of an outbreak in areas where human waste is used as a fertilizer. Persons returning to the United States from foreign countries may bring parasites with them. A supervisor should know some of the characteristics of parasites.

(a) Amebic dysentery (amebiasis). Amebic dysentery occurs when food or water is contaminated with human feces from infected persons. The major symptom of amebic dysentery is diarrhea of varying severity. The symptom will usually develop within a few days but may take several weeks or months.

(b) Trichinosis. Trichinosis is caused by a tiny worm that infects hogs and other animals used for food. Much of the pork in the United States is infected. These tiny worms burrow into the muscles of animals. Humans become infected when they eat raw or insufficiently cooked meat that contains the live larvae. Although it is not often fatal, there is no known cure and full recovery is slow. Prevention of trichinosis is accomplished by fully cooking all pork or pork products (internal temperature above 150ºF).

(c) Tapeworms. Infection of humans by tapeworms found in fish, beef, pork, and poultry occurs infrequently and is not as serious a problem as that associated with trichinosis. These infections result from eating raw or insufficiently cooked infected meat or meat products. Fish should be cooked to an internal temperature of 140ºF, beef to an internal temperature of 145ºF, pork to an internal temperature of 150ºF, and poultry to an internal temperature of 165ºF.

(3) Viral infections. The most common viral infection seen in foodborne illness is infectious hepatitis. Infectious hepatitis may occur after eating shellfish, especially raw oysters and clams that were harvested from sewage-contaminated water. When foods, such as milk or potato salad, are involved, the source of the virus is usually contaminated water or someone who has the disease that handled the food. Viruses can be easily controlled by cooking the food, pasteurizing the milk, purchasing shellfish from approved sources, using safe water supplies, and practicing proper foodhandling procedures

b. Foodborne Intoxication. Foodborne intoxication occurs when certain microorganisms grow on food and produce chemical waste products (toxins) that are poisonous (toxic) to the person eating the food. Toxins produced do not change the appearance or flavor of the food. The persons consuming the food are not aware that they are eating something that may make them extremely ill. Some of these toxins are difficult to destroy or render inactive; others can be easily destroyed. The toxins produced by, certain strains of microorganisms can withstand boiling temperatures for long periods of time and are virtually impossible to destroy by normal cooking methods.

(1) Food intoxication due to staphylococcal enterotoxin. Outbreaks of foodborne illness are often caused by the toxin of staphylococcal organisms. Most people are carriers of staphylococci, which are natural inhabitants of our bodies. The organisms are most frequently found in the nose and on the skin. Outbreaks of staphylococcal foodborne illness can be traced to food service workers with nasal discharge and skin infections such as infected cuts or boils. The toxins (waste products) produced by staphylococcal bacteria are difficult to destroy by heat. Normal cooking times or temperatures will not destroy the toxins. Persons eating food containing staphylococcal toxins will usually become ill 1 to 6 hours later. They will experience a sudden onset of nausea, vomiting, diarrhea, and abdominal cramps. Frequently, they will be so ill that confinement to bed or even hospitalization is required. Although people usually recover from this illness, death does sometimes occur. Persons in poor physical condition, the very young, and the older age groups are more susceptible to this illness. The most effective preventive measure is to keep food at a safe temperature so that the bacteria cannot grow and produce the toxins.

(2) *Food intoxication due to Clostridium botulinum*. Botulism is caused by a toxin which is produced by the organism Clostridium botulinum. It is most frequently found in underprocessed food that has a low acid content. Foods in this group are canned green beans, chili peppers, mushrooms, and corn. Persons suffering from botulism usually become ill within 12 to 36 hours after eating. They experience dizziness, double vision, and muscular weakness, with difficulty in swallowing, speaking and breathing. The toxin is extremely poisonous; a very small taste of infected food can be fatal. The toxin is easily destroyed by heat. Heating food items to the boiling point and maintaining this temperature for 3 minutes destroys the toxin.

(3) Food intoxication due to Clostridium perfringens. The organism *Clostridium perfringens* is frequently associated with outbreaks of foodborne illness. This organism is not as severe as botulism and results in few deaths. The *Clostridium perfringens* organism is a normal inhabitant of the intestinal tract of man, as well as a constant contaminant of soils, nonpotable water, and underprocessed foods. Most of the outbreaks caused by this type of organism have been associated with cold, precooked, or reheated meat, stew, or meat pies. These dishes are frequently prepared from foods that have been held at unsafe temperatures for extended lengths of time. Persons suffering from *Clostridium perfringens* will usually become ill within 8 to 24 hours after eating. They win suffer acute abdominal pain, diarrhea, and nausea, but vomiting is rare. Normal cooking times and temperatures will not kin the toxin spores. The spores will germinate and reproduce during the cooling and rewarming times. Since they are difficult to kill by heating or cooking, it is important that precautionary measures to prevent the growth of toxins be taken with foods that are to be reheated.

c. Chemical Poisoning. There is always the possibility of consuming poisonous chemicals with food. Without adequate control and proper use, there would be many more outbreaks of foodborne illness caused by chemicals. Toxic chemicals such as cadmium, zinc (galvanized), antimony, copper, and lead have been involved. All of these metals will dissolve in certain types of acid foods, such as fruit punch and drinks, and produce a toxic or poisonous substance. Individuals can become ill within minutes of consuming foods or drinks contaminated with chemicals. Many chemicals used in cleaning and sanitizing solutions are toxic. Chemicals used to control insects and rodents are, by their nature, intended to kill. If used improperly or accidentally mixed with food or drink, they can cause severe illness or death. The care and handling of cleaning products, sanitizing compounds, and pesticides is an important part of food protection. The supervisor is responsible for their safe use in the food facility. Great quantities and varieties of pesticides are also used on crops during production of food supplies. The use of these pesticides is rigidly controlled. Food service personnel must insure that any residue that remains on food is removed by washing, trimming, and peeling during preparation.

d. Poisonous Plants and Animals. Certain plants and animals are poisonous and should not be used as food. Examples include certain mushrooms, toadstools, water hemlock, jimson weed, and the seeds from the castor bean plant. Shellfish, such as mussels and clams, taken from certain waters at particular times of the year and certain species of fish have also been involved in outbreaks of foodborne illness. Illness caused by consuming these toxic foods may occur within a few minutes after eating and is often fatal. Cooking the food does not usually destroy the material in the food that causes the illness. The best way to avoid the possibility of eating a poisonous plant or animal is to obtain food products only from approved sources.

CHAPTER 2

Factors that Contribute to Foodborne Disease Outbreaks

Section I. PERSONNEL FACTORS

2-1. Practices

Personnel factors that contribute to foodborne disease outbreaks are many and varied but can be grouped into two areas. These are practices related to personal health and practices related to work and food handling.

a. Practices Related to Personal Health. The supervisor must be concerned about the personal health of food service personnel everyday. At the start of each work shift, workers should be inspected by the supervisor and questioned about their health. Workers with infected cuts, burns, sores, or diarrhea cannot be allowed to handle food. Workers coughing or sneezing or showing symptoms of a severe cold should be used where they will not contaminate food or equipment. The supervisor must be able to determine if the worker should be assigned a nonfood-handling job. When in doubt, the worker should be referred to the medical facility for evaluation.

b. Practices Related to Work and Food Handling.

(1) Health cards (foodhandler certificates) for food service workers may be required by the local medical authority. *DO NOT* make the mistake of thinking that a health card means that workers are disease-free. It is possible to have a health examination one day and to be sick the next day. In some parts of the world, health cards for workers will be emphasized more than in the states.

(2) The supervisor's inspection at the start of the work shift is a must for disease prevention. Things the supervisor should look for include -

- Infected cuts, sores, burns.
- Unclean hands (have workers wash hands).
- Diarrhea (known or suspected; must ask workers).
- Signs of respiratory illness (coughing, sneezing).
- Excessive jewelry that could be a safety problem or that allows food particles to accumulate (some rings may interfere with good handwashing).

(3) Food service workers should not smoke in food preparation areas. Saliva with its disease organisms contaminates the smoker's hands, the tobacco product/pipe, and any work surface that the tobacco product touches. Hands should be washed after smoking and before returning to work.

2-2. Hands of the Worker

a. Unclean Hands. Food becomes contaminated from unclean hands probably more frequently than by any other method. Bacteria are found everywhere. A person's hands are continuously touching or coming into contact with contaminated articles. Fingernails should be closely trimmed and clean. Hands must be washed often with warm water and soap to keep them clean. At a minimum, hands must be washed -

- Before beginning work.
- After each visit to the toilet.
- After handling soiled or contaminated equipment or utensils.
- After smoking.
- Before preparing food.
- After preparing one food item, but before preparing another one.
- After handling garbage or other refuse.

b. Handwashing Facilities. To encourage frequent handwashing before and during the preparation and serving of food, there should be sufficient and convenient handwashing sinks in the kitchen and work areas as well as in or immediately adjacent to the restrooms. Sinks for washing dishes or for the preparation of vegetables are not handwashing sinks and should not be used as such. Organisms washed off the hands can contaminate the sink and then contaminate the vegetables, utensils, or equipment cleaned in the sinks. Only single-service paper towels, or approved continuous roll towels, should be used for hand drying. Soap and clean towels must always be available. If workers do not wash their hands frequently (para 2-2a), they are contaminating the food with disease organisms.

c. Food handling Techniques. Food service workers should avoid unnecessary hand contact with food. Whenever possible, food should be handled with clean utensils, such as tongs, scoops, spoons, or forks. Frequently, food service workers unnecessarily use their hands to serve food such as butter slices, ice cubes, and bread. Single-service plastic gloves should be used when it is necessary to handle food extensively, as in the preparation of meatloaf.

2-3. Sanitary Work Habits Must Be Developed by Food Service Personnel

a. Handling Clean Utensils and Equipment. Pick up silverware, cups, glasses, and plates by the handle, the bottom, or the edge.

b. Handling Soiled Utensils and Equipment. Great care should be taken in bussing tables and in handling soiled napkins, glasses, cups, silverware, and other utensils. They may carry disease organisms from the consumer. Personnel who carelessly handle these soiled articles can pick up microorganisms on their hands and transfer them to their own mouths or to other consumers by recontaminating clean utensils and equipment, or to food that will be served to the consumer. For their own protection and for the consumer's protection, personnel must be trained to handle dirty utensils and equipment in the same careful way that clean utensils must be handled, or wear gloves.

Section II. OPERATIONAL FACTORS

2-4. Factors That Most Often Cause Foodborne Disease Outbreaks

Although the supervisor does not have to memorize every sanitary standard and regulation, he must use common sense. He must be aware of factors that contribute to foodborne disease outbreaks in both garrison and field operations. 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 foods properly and maintain cold food at a product temperature at 45°F or below (see Figure 2-1).

Figure 2-1. Report unsafe temperatures or faulty thermometers to your supervisor.

- Failure to maintain potentially hazardous hot foods at a product temperature of 140°F or above.
- Failure to cook potentially hazardous foods thoroughly.
- Failure to protect foods from cross-contamination (see Figure 2-2).

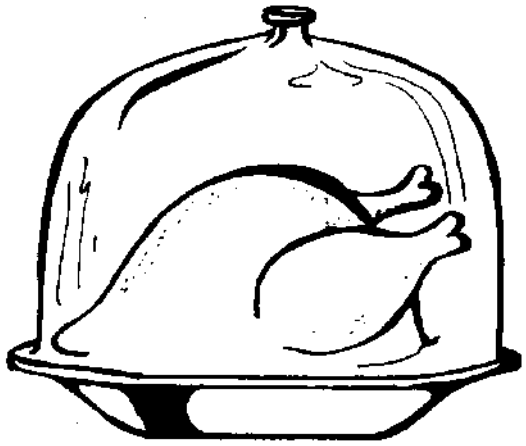


Figure 2-2. Covered foods.

- Failure to use proper storage practices (see Figure 2-3).

Figure 2-3. Example of poor storage practices.

2-5. Supervisory Actions

A person can be just a supervisor or he can be a SUPERvisor. The SUPERvisor is aware of factors that cause foodborne-disease outbreaks and he takes action to eliminate them. By being aware of these factors and by taking SUPERvisory actions, foodborne disease can be stopped. Here is how to be a SUPERvisor:

a. Maintain Potentially Hazardous Foods 45ºF or Below.

Examples of Poor Supervision	Examples of SUPERvisory Actions
• Allows personnel to keep foods at room temperature too long.	• Observes how long foods kept at room temperature. • Insures that foods that are not being prepared are kept refrigerated. • Insures that personnel check product temperatures often to maintain the food at a safe temperature. • Enforces the use of thermometers. • Insures that personnel defrost frozen food in the refrigerator or as part of the cooking process.
• Allows personnel to refrigerate hot items without prechilling.	• Insures that hot foods are prechilled within 2 hours to a product temperature of 70ºF by using an ice bath or temporary freezer storage before being placed into the refrigerator.
• Allows personnel to store foods in large containers.	• Insures that personnel use containers--3-inches (7.62 cm) maximum depth for potentially hazardous foods. • Insures that foods are sliced or portioned for quicker cooling.
• Maintains refrigerators at unsafe temperatures.	• Checks refrigerator temperature on a frequent basis, maintaining it at 32ºF to 40ºF to insure safe food product temperature. • Insures that personnel do not pack foods tightly, but allow space for free cold air circulation around food products.

b. Maintain Potentially Hazardous Hot Foods at 140ºF or Above.

Examples of Poor Supervision	Examples of SUPERvisory Actions
• Fails to maintain steam table at 140º or higher.	• Monitors food temperature hot-holding devices. Keeps hot foods at 140ºF or above.

• Allows personnel to let food cool at room temperature.	• Limits time that foods remain at room temperature.

c. Thoroughly Cook Potentially Hazardous Foods.

Examples of Poor Supervision	Examples of SUPERvisory Actions
• Does not use food thermometer when cooking.	• Uses thermometer to monitor cooking temperatures. • Insures that all foods are cooked to temperatures recommended on recipe cards. • Insures that leftovers are heated rapidly to 160°F.

d. Protect Foods From Cross-Contamination.

Examples of Poor Supervision	Examples of SUPERvisory Actions
• Allows cross-contamination from equipment, food handlers, and storage.	• Insures that personnel clean and sanitize equipment after use. • Insures that personnel wash hands before and after handling food items. • Insures that personnel cover foods to protect them.

e. Use Proper Storage Practices.

Examples of Poor Supervision	Examples of SUPERvisory Actions
• Permits personnel to store cleaning products, poisons, and insect sprays with food products.	• Insures that personnel store all poisons and toxic products separate from foods.
• Permits personnel to store foods under leaking pipes.	• Insures that personnel do not store food items under sewer drains or leaking pipes.
• Pays no attention to insect/rodent infestations.	• Insures that pest management personnel do their jobs. Follows up on work orders for repair. • Establishes good housekeeping program in foods storage areas.
• Allows for the possibility of broken glass from overhead lights falling in food.	• Insures that overhead lights have protective coverings.

Section III. TEMPERATURE CONTROL FACTORS

2-6. Safe Product Temperature

Failure to maintain a safe product temperature (45°F and below or 140°F and above) is the leading cause of foodborne disease outbreaks. A four year survey of foodborne disease outbreaks showed that temperature was a critical factor. 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. In some cases, food taste and appearance will not be changed.

2-7. Maintaining Safe Temperatures

Safe temperatures are 45°F or below and 140°F or above. Any temperature between 45°F and 140°F is considered to be 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, or chopped, or formed, it is in the danger zone. At each stage of preparation and serving, the product may be exposed to unsafe temperatures and the chance of becoming contaminated.

2-8. Danger Zone Times

The goal for the supervisor in temperature control is to minimize the time potentially hazardous foods 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.

2-9. Minimizing Danger Zone Times

By knowing more about how foods cool and heat, the supervisor will be able to minimize the time foods remain in the danger zone. As a general rule, heat will travel more rapidly through liquid foods than through solid foods. It is also easier to cool foods in smaller portions than in large bulk portions. For a food portion that is 4-inches thick, it may take 4 hours to reach a safe temperature. Increase the thickness to 8-inches and it may take 16 hours. Increase the thickness to 12-inches and it may take 36 hours (see Figure 2-4). When selecting pans to be used for cooling foods in a refrigerator, use shallow pans (see Figure 2-5). The maximum depth for rapid cooling is 3 inches.

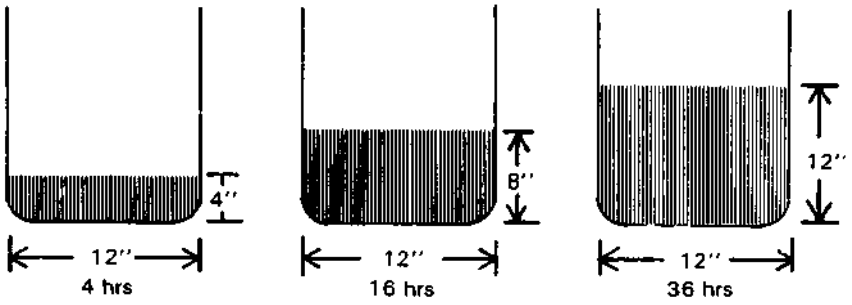


Figure 2-4. Times to reach a safe low temperature.

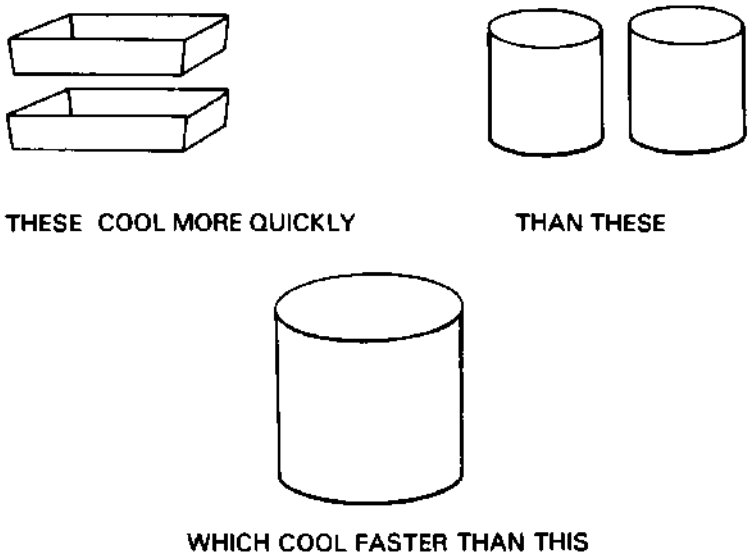


Figure 2-5. Selection of containers for cooking foods.

The supervisor should be on the alert for hot foods left to cool at room temperature. This practice will allow foods to remain in the danger zone for a long period of time. He must insure that foods are cooled as quickly as possible. Some methods that can be used include-

- Immerse hot foods in an ice bath for rapid cooling before placing them in a refrigerator.
- Agitate foods during cooling.
- Use larger freezer units for initial cooling.
- Use shallow containers for cooling--a maximum depth of 3 inches is recommended.
- Cut or slice foods into smaller portions.

2-10. Thawing Frozen Foods

Thawing at room temperature will allow foods to enter the danger zone. Thawing should be done by one of the following methods:

- In a refrigerator, at a temperature not to exceed 40°F.
- As part of the cooking process.
- In a microwave oven.
    - o If food is to be cooked in a microwave oven, then cooking should immediately follow thawing. If food is to be cooked in a conventional oven, then food should be immediately transferred from the microwave oven after thawing.

- Under potable running water, at a temperature of 70°F or below.

    - The food product should be in a sealed plastic bag. This is the least preferred method for tempering or thawing.

2-11. Using a Food Thermometer

A thermometer placed in the food is the only way to determine the temperature of a food product. The supervisor must continually monitor the temperature of potentially hazardous foods. The temperature of the refrigerator does not give a true indication of the product temperature. The only way to determine product temperature is to measure it with a suitable thermometer. The serving line is another area where the supervisor must monitor product temperature. A supervisor should have a pocket thermometer and know how to use it. The monitoring and controlling of food product temperature is one of the most important responsibilities the supervisor has.

CHAPTER 3

Food Protection

Section I. FOOD INSPECTION

3-1. Responsibilities

a. The Veterinary Corps is responsible for the wholesomeness inspection of all Army food supplies. The Veterinary Corps is also responsible for providing quality assurance inspections to insure specified requirements for foods are met. For example, meat shipments are checked to make sure they originate from sanitarily approved processors and are in a wholesome condition at the time of delivery; dairy products are sampled and tested for proper butterfat content; fresh fruits and vegetables are inspected to insure that set quality standards are met.

b. The Veterinary Corps is also responsible for approval of food processing, storage, and distribution facilities. Companies desiring to sell food to the Army must maintain high levels of sanitation during processing, handling, and delivery. Enforcement of these sanitation standards helps prevent contamination of food supplies.

c. Certain other agencies in the US such as the Food and Drug Administration (FDA) and the US Department of Agriculture (USDA) are relied upon by the Veterinary Corps to assist in providing inspection of the Army food supplies.

d. Questions concerning the source of food items or wholesomeness of Army-owned supplies should be directed to the supporting Veterinary Activity.

3-2. Food Contamination Safeguards

a. It should not be assumed that foods inspected by government and military personnel are wholesome and free of all contamination. For instance, lettuce will normally be contaminated with dirt and other debris. If the farm worker picking and packing the lettuce had poor personal hygiene habits, the outside parts could be contaminated with numerous bacteria. Therefore, lettuce and other leafy foods must be thoroughly washed before serving.

b. Another example of contamination is pesticides on fruits and vegetables. Most food inspection programs do not sample for pesticides on a routine basis. Therefore, it is important to wash fruits and vegetables before serving.

c. Fresh fruits and vegetables are a major source for soil bacteria. *Clostridium* is one form of soil bacteria that can result in food intoxication (see Chapter 1, Section III), creating another need for washing fresh fruits and vegetables.

d. Some foods may be naturally contaminated. Poultry is commonly contaminated with salmonella. In one study, it was found that as much as 43 percent of all poultry products in one area were contaminated with salmonella. For this reason, it is important to cook poultry products to at least 165°F internal temperature.

3-3. Food Supplies in Combat Areas

Obtaining safe, wholesome food supplies in combat areas can be a special problem faced by Army cooks. Inspected food supplies may not always be available. In the event foods must be procured locally, they may be heavily contaminated. In areas where human excreta is used as a fertilizer or where gastrointestinal and parasitic diseases are known to exist, raw fruits and vegetables must be approved for use by the medical authority. When approved for use, the medical authority will establish special handling requirements. A method of preparing these products is to wash them in potable water and then thoroughly disinfect them by one of the following methods:

a. Immerse them in 160°F water for 1 minute;

b. Immerse them in a solution of Disinfectant, Food Service, for 30 minutes;

c. Immerse them for 30 minutes in a 250 parts per million (ppm) chlorine solution.

3-4. Food Service Disinfectant Preparation

The water used for preparing the disinfectant solution should be from a potable source.

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

b. In an emergency, use three level messkit spoonsful of calcium hypochlorite per 32-gallon (121 liters) container of water or use one canteen cup of 5 percent liquid chlorine bleach per 32-gallon (121 liters) container of water.

3-5. Approved Food Sources

*Obtaining foods from approved sources*is the number one rule for food service supervisors. Without the inspections provided by the Veterinary Corps, FDA, and USDA, there would be numerous problems with food quality and wholesomeness.

a. Food quality would vary.

b. Some foods would be grossly contaminated with organisms that are capable of causing disease. There would be an increase in foodborne disease outbreaks.

c. Once foods have been received from approved sources, it is the food service supervisor's responsibility to prevent contamination and to control the growth of organisms that cause disease during storage, preparation, cooking, and serving.

Section II. PROTECTING FOOD FROM CONTAMINATION DURING STORAGE

3-6. Delivery of Foods

a. The importance of inspecting foods for possible shortages and damages before acceptance cannot be overemphasized. Refrigerated products must be checked with a thermometer. If refrigerated products are not in the safe temperature zone (45°F or below), request assistance from the local veterinary activity or preventive medicine activity. Frozen foods that are thawed when delivered must not be refrozen. Potentially hazardous foods accepted at unsafe temperatures may later result in a foodborne disease outbreak.

b. Canned foods will be examined for damage. Cans that are severely bent, show signs of leakage, or have popped ends cannot be used. Any of these conditions may mean that the product has been contaminated and that growth of pathogenic microorganisms has occurred.

c. Dry products (flour, rice, beans) that are unknowingly accepted with insects can spread an infestation throughout an entire food service operation. To avoid this condition, the food service supervisor must inspect all dry products prior to acceptance.

3-7. General Principles of Storage

The first step in keeping food supplies in a sound and wholesome condition is proper food storage. Foods must be stored to prevent deterioration and growth of foodborne disease organisms. A good supervisor applies the following general principles of storage:

- Stores all foods immediately following inspection.
- Eliminates rough and unnecessary handling of food items.
- Selects old stocks from storage first. The first stocks in should be the first stocks out.
- Provides required temperatures for all stored food items.
- Provides special handling for ripening fruits and vegetables.
- Maintains insect and rodent control. The most effective control measure against rats and mice is to prevent their entry into the storage area.
- Insures that good air circulation and ventilation are maintained.
- Stores food on shelving to protect it from water and dampness around the floor in storerooms or refrigerators.
- Insures that storage areas are kept clean and in a sanitary condition at all times.

- Removes spoiled, damaged, or contaminated items promptly from storage.

- Stores cleaning supplies and toxic items separate from food items.

3-8. Types of Refrigeration

For storage of perishables, dining facilities are provided frozen food cabinets, reach-in refrigerators, and walk-in refrigerators. The number and type of refrigerators depend upon the size of the unit and the number of persons being served.

a. Frozen Food Cabinet. Frozen foods should be stored in a frozen food cabinet. Packages of frozen foods should be grouped according to size and type. When new items are received, items stored in the cabinet from earlier issues should be moved to the top for ready use. The temperature in the frozen cabinet should be kept between 0°F and -10°F.

b. Reach-in Refrigerator. The reach-in refrigerator must be kept clean; all perishable items must be arranged so that they get proper air circulation. All items that impart or absorb odors from other items must be stored separately. The temperature in the reach-in refrigerator should be kept between 32°F and 40°F.

c. Walk-in Refrigerator. This type of refrigerator is generally used for storing large quantities of fresh fruits and vegetables, eggs, dairy products, and meats. Before fresh fruits and vegetables are stored, they are removed from crates and inspected. Spoiled or damaged items are discarded and the remainder are stacked on the shelves allowing for proper air circulation. The temperature in the walk-in refrigerator should be kept between 32°F and 40°F.

3-9. Storage of Perishable Food

Storage requirements to prevent deterioration of perishable foods include suitable conditions of temperature, humidity, air circulation, and sanitation. These requirements can be met by properly refrigerating perishable foods. The refrigerators must be kept clean and free of odors, insects, and rodents. Air circulation must be complete, and the coldest sections of the refrigerator should be used for items that require low storage temperatures to prevent deterioration. The following procedures should be monitored to maintain an adequate temperature for storing perishables:

a. Do not overload the refrigerator.

b. Do not block the air circulation by careless storage.

c. Open the refrigerator only when necessary.

d. Use a thermometer to monitor the temperature.

3-10. Storage of Semiperishable Food

Even though semiperishable foods are more durable than perishable foods, they must be stored with care. Improper storage of semiperishable foods can result in loss from rodent or insect infestation or from deterioration caused by heat, dryness, or excessive moisture. Correct storage will aid in the proper rotation of semiperishable items and will insure their usage on a first-in, first-out basis. Space is made available in each unit or consolidated dining facility for the storage of semiperishables. Storerooms must be clean, well ventilated, and free of rodents, insects, and foreign odors. The storerooms must have enough shelving for storing loose canned or packaged semiperishable items and enough dunnage for stacking semiperishable items in cases or bags. Foods must not be stored under pipes or other potential sources of contamination. Pesticides and cleaning supplies must be stored in a separate storage area, never with food items.

Section III. PROTECTING FOODS FROM INSECTS AND RODENTS

3-11 Insect and Rodent Control

Like man, insects and rodents must have food to live. Insects and rodents feed upon and contaminate man's food supply. The supervisor must know about insects and rodents that destroy or contaminate food products. Some of the main problems are flies, cockroaches, and rats. Chapter 1, Section III, discussed diseases that can be spread to man by several means. One way diseases are spread to man is by insects and rodents. The fly, the cockroach, and the rat can spread disease and filth through food. Although a food service area may have an occasional pest, food and utensils must be protected from those that do get in despite preventive measures taken. It is the continual presence of insects or rodents that cause the major problems. The continual presence of high numbers of insects and rodents indicates a lack of good sanitation.

3-12. Basic Elements of an Insect and Rodent Control Program

No single measure will completely control insects and rodents that infest kitchens and dining areas. An effective insect and rodent control program is composed of two phases.

a. Phase I-Environmental Sanitation. Sanitary measures, such as proper refuse disposal, garbage disposal, and installation of screens to prevent the entry of pests into the kitchen or dining area, are the first steps in a good insect and rodent control program.

b. Phase II-Effective Mechanical Control of Pests. Trapping, chemicals, or pesticides are used to control insects and rodents that do gain entrance to the premises. All pesticides used must be approved by the medical authority for use on the military installation.

3-13. Flies

a. There are many kinds of flies, but the one that concerns the food service supervisor is the common housefly. The principal breeding place of houseflies is in moist organic materials, such as piles of garbage, rotting vegetables, manure, decaying animal matter, sewage, and if we allow it, in our food. They will even breed in the soil where liquids from garbage cans or garbage can wash racks have drained. The flies hatch during warm weather or inside at any time when a good breeding place is available.

b. The fly transmits disease germs indirectly. When a fly walks over filth, some of the material sticks to its hairy body. If disease organisms are present, they also stick to the fly's body. Also the housefly cannot chew; to soften food the fly vomits on it. The vomit may spread contaminants on the food. When the fly feeds on the waste material, it also ingests bacteria that may be in the waste. The fly then buzzes off to the kitchen area, where it walks over the food and utensils. As the fly walks, some of the bacteria are brushed off its body and onto the food or utensils. Bacteria are also spread with the fly's excreta (fly specks).

c. Flies transmit the organisms of more than 30 diseases, such as dysentery, salmonellosis, typhoid fever, tuberculosis, cholera, and even pinworms. A single fly can carry as many as 6 million bacteria on the outside of its body and as many as 25 million in its intestines. It is easy to see how flies carry bacteria and spread disease and why it is important to control flies.

3-14. Control Measures

a. The best way to control flies is to do away with their breeding places. This means that decaying vegetables, animal matter, garbage, and manure piles must be frequently cleaned up and removed. Such material must never be allowed to remain for more than four days. If the breeding places are removed, the fly population will be greatly reduced.

b. Flies may travel as much as 500 yards (455 meters) from their breeding places. The supervisor does not always have control over areas this far from the food service areas. This is why it is necessary to use other fly-control methods as well. The most familiar methods are screening doors and windows in garrison and using mosquito netting in the field. Screening is effective only when the screens are kept in good repair and all openings are actually screened. Air curtains may be used at doors that are used a great deal or where screens are not practical. Electric flying insect control devices may also be used when following procedures outlined in TB MED 530. A routine should be established for the control of flies that find their way into the establishment. Sprays, baits, and other insecticide formulations are effective, but they must be safe to use and used only as listed on the container label. If one application is recommended, use one only. Insecticides can kill people just as they do flies.

NOTE

Before any pesticide is used in a control program, the Medical Department should be consulted for guidance.

c. Keep food covered to prevent contamination by flies. Scrupulous cleaning of floors, tables, garbage cans, and garbage can wash areas reduces the amount of food accessible to flies and makes the establishment less attractive to them. Toilet fixtures should be kept clean.

3-15. Establishing Control Measures

The food service supervisor must establish good fly-control measures by-

- Removing all fly-breeding places.
- Screening the food service area thoroughly, using fans or other control methods as necessary.
- Killing the flies that do get in by spraying, swatting, poisoning, and trapping.
- Keeping food protected from flies.
- Keeping garbage cans clean and covered when not in use.
- Keeping toilets and the entire food service area clean.

3-16. Cockroaches

Cockroaches are capable of carrying disease organisms and are very offensive. Scientists have found that cockroaches take bacteria into their bodies when they feed on waste. Later, these organisms may be found in the body wastes of the cockroaches. They also carry microorganisms on the outsides of their bodies as they crawl from toilets to the foods and utensils in the kitchens and dining areas. They actually drag disease organisms from place to place. Few things are more disgusting to consumers than the sight of cockroaches in the kitchen where the food is prepared.

3-17. Life Cycle

a. Cockroaches hatch from eggs laid by the female. Eggs are laid, in bunches of 25 to 30, inside a small leathery sack. The sack is dropped almost anywhere the cockroach happens to be. The cockroach produces a glue that attaches the sack wherever it is dropped.

b. Cockroaches like to live in dark damp places where there is plenty to eat. They hide in cracks, behind cabinets, in boxes, and inside hollow wags. Cockroaches come out to feed at night when it is dark and quiet. If cockroaches are seen during the day, it is certain that many, many more can be found at night. The way to find out is to enter a room suddenly and turn on the lights. The cockroaches will immediately run for cover. These are the areas that must be remembered for future pest control operations.

3-18. Control Measures

a. The control of cockroaches is difficult and must be made a routine affair. The most important control measure is cleanliness. If floors, tables, walls, equipment, and storage areas are kept clean, little food will be available for cockroaches. Carefully check all food and supplies brought in for cockroaches. Store supplies off the floor and in an orderly method to make cleaning easy and to reduce the number of hiding places. Frequent cleaning of all parts of the food service area will help remove the eggs that may have been laid and, hence, reduce the number of cockroaches that can hatch.

b. Tight-fitting doors and windows help keep many cockroaches out. Close openings or cracks in walls and floors with caulking, putty, plastic wood, or a similar material to do away with entry ways and hiding places.

c. It is hard to entirely prevent cockroaches from getting into a building. Once they are in, they must be killed. Many types of insecticides are effective for the control of cockroaches; however, they must be applied safely by trained individuals. Personnel from the post engineers will normally provide this service to you.

3-19. Establishing Control Measures

The most important points in the control of cockroaches are to-

- Fill cracks and other entry ways with caulking, putty, plastic wood, or similar materials.
- Provide tight-fitting doors and windows.
- Inspect incoming supplies.
- Keep the entire food service area neat, clean, and free of all food scraps.
- Keep food covered.
- Use effective chemical control measures.

3-20. Rats

a. Rats may carry a number of diseases. They eat and damage large amounts of food. Salmonellosis, leptospirosis, plague, and murine typhus fever are examples of diseases that may be spread by rats.

b. Rats cause a tremendous money loss because of the food they eat or spoil and the damage they do to buildings and property. It has been estimated that each rat in the United States eats at least $5.00 worth of food in a single year and destroys or damages about ten times as much food and property. It has been estimated that there is at least one rat for every person in the United States. This means that the rat population of the country is greater than 200 million.

c. Rats have to gnaw constantly to keep their front teeth worn down. Because of this gnawing, they damage all types of property: buildings, electrical wiring, plumbing pipes, books, cloth, and leather.

d. Rats contaminate everything they touch and foul much more. Food is contaminated by their droppings, their urine, and by the disease organisms that they carry on their bodies.

e. Rats prefer to travel and hunt for food at night. They are creatures of habit. They normally travel from their nests, to their food sources, and to the outside over the same paths. Their paths are in narrow, out-of-the-way places, such as overhead pipes and beams, or along walls. When rats run from place to place, they hug the wall. Rat runs are easy to find because dirt and oil from the rat's hair rubs off and blackens the surfaces that they touch. Some rats are good climbers and can go up rough brick walls and even travel along telephone and power lines. Rats have been called man's most cunning and intelligent enemy, and a lot of planning and thought must be used to get rid of them.

3-21. Life Cycle

Rats are born in litters. A female rat has from three to five litters per year, with an average of seven or eight per litter. Their average life span is 2 to 3 years. Rats nest in convenient hiding places, such as trash piles, hollow walls, and the spaces between a wooden floor and the ceiling below. They like to live close to a good food supply. This is why they live near or in homes and food establishments.

3-22. Control Measures

The most permanent method of controlling rats is to build them out. This means that the building should be constructed so that there are no hidden places for rats to nest in and no openings for them to enter. An important part of rat control is the removal of trash piles and refuse dumps that provide good nesting places. Another important consideration is to keep the building and premises clean and free of food scraps that will attract rats. Garbage must be kept in cans with tight-fitting lids. The lids must be kept on the cans at all times during storage. When supervisory measures fail to control rats, it is necessary to use either traps or chemical control. It is a good idea to request a survey by your local preventive medicine activity. They can help coordinate control activities with the post engineers.

CHAPTER 4

Food Service Dishwashing Operations in Garrison

4-1. Disease Outbreaks

During a one year period of time, 460 foodborne disease outbreaks were reported in the US. Of these 460 outbreaks, 51 were caused by contaminated equipment and utensils. Good washing and sanitizing procedures would have prevented these outbreaks. As a supervisor, it is your job to make sure that all utensils and equipment have been washed and sanitized correctly.

4-2. Dishwashing Problems

Sanitary inspections conducted during the last few years show that dishwashing is a problem throughout the Army. The reason for this is simple--supervisors are not familiar with correct dishwashing procedures. The consumer's impression of the entire food service operation is influenced by the cleanliness of the dishes and utensils. The purpose of this chapter is to provide information on how to supervise dishwashing operations. Two types of dishwashing operations that the food service supervisor will need to know about are machine dishwashing and hand dishwashing.

Section I. MACHINE DISHWASHING OPERATIONS

4-3. Dishwashing Machines

Machines that are not operated correctly can cause several problems. One major problem is a foodborne disease outbreak. Other problems include injury to workers and costly repairs to equipment and utensil replacement.

4-4. Types of Dishwashing Machines

There are four basic types of dishwashing machines used in the Army-

a. The Single-Tank Stationary Rack Machine. Dishes are put in racks and then placed in the machine. When the wash, rinse, and sanitizing cycles are completed, dishes are removed and allowed to air dry. A typical single-tank stationary rack machine is shown in Figure 4-1.

b. The Single-Tank Conveyor Machine. Dishes are put in racks. The racks are then automatically pulled through the machine by the conveyor. In some machines, conveyors have built-in racks for dishes.

c. The Multiple-Tank Conveyor Machine. Dishes are put in racks. The racks are automatically pulled through the machine by a conveyor. The machine consists of one or more wash tanks, one rinse tank, and one sanitizer tank.

d. Chemical-Type Machines. Chemical-type machines are being developed and may be used. Any machine used must meet National Sanitation Foundation Standards.

4-5. Machine Parts and Functions

Although the make and model of dishwashing machines vary, the same basic procedures can be followed. To effectively supervise the machine dishwashing operation, the supervisor should know the following machine parts and their functions.

Machine Part	Function
drain valve	drains water from the machine
fill valve	fills wash tank with water
scrap tray	catches and prevents food waste and other objects from entering the wash tank
curtains	prevent splashing water and retains heat
wash and rinse arms	furnish spray wash and rinse water under pressure
overflow	controls the wash water tank level and prevents the tanks from overflowing
detergent reservoir	holds detergent for dispensing
tank	holds wash water for pumping on dishes
pump	circulates wash water
temperature indicators	show temperature of wash, rinse, and sanitizing water
tank heater	heats water for washing
booster heater	heats water for sanitizing rinse
automatic controls	operates machine wash, rinse, and sanitizing cycles automatically

4-6. Setting up the Machine

The following steps should be taken when setting up a dishwashing machine operation:

a. Inspect the machine, inside and out, to insure that it is clean. Check to see that there is no silverware or other debris in the wash tank that could be sucked into the pump. Check the overflow, make sure it is in place and not clogged with food particles or lime deposits.

b. Check wash and rinse arms. Make sure the arms turn freely. Inspect the arms for clogged or damaged nozzles. Food particles or lime deposits clogging nozzles indicate that the machine is not being thoroughly cleaned.

c. Close the drain valve. Open the fill valve and fill the wash tank. The machine is full when the water level reaches the top of the overflow.

d. Turn on the wash tank heater.

e. Inspect the scrap trays for cleanliness and damage. Trays that are damaged can allow food particles to enter the wash tank and clog the pump. Place the scrap trays in the machine.

NOTE

When removing food particles from scrap trays, personnel should never hit or bang the trays, this will damage the trays. To clean scrap trays, rinse them under running water. When necessary, soak them in lime remover.

f. Add dishwashing compound to the dispenser reservoir. Use machine dishwashing compound. *Never* use hand dishwashing compound in a dishwasher. When necessary, add extra detergent to the reservoir.

g. Run the machine through one or two cycles. This will mix the wash solution.

4-7. Preparation of the Dishwasher Area

Before the operator starts to use the machine, there are several steps that must be taken to insure that the dishwashing area is clean and orderly at all times. The operator will-

- Set up a soak solution for silverware. This can be a pan or a small tank. Presoaking silverware will keep foods from drying and make washing easier.
- Layout a *target* plate before dishes start to arrive.
- Set up the waste cans.

4-8. Dishwashing Process

After the operator inspects the machine and the dishwashing area, he is ready to begin washing dishes. The entire dishwashing operation consists of six steps. These are-

- Scraping dishes to remove large food particles.

- Prerinsing dishes to remove smaller food particles.

NOTE

These two steps will keep wash water cleaner
and reduce clogging the spray nozzles.

- Racking dishes in proper racks. See Figure 4-2 for methods of racking.

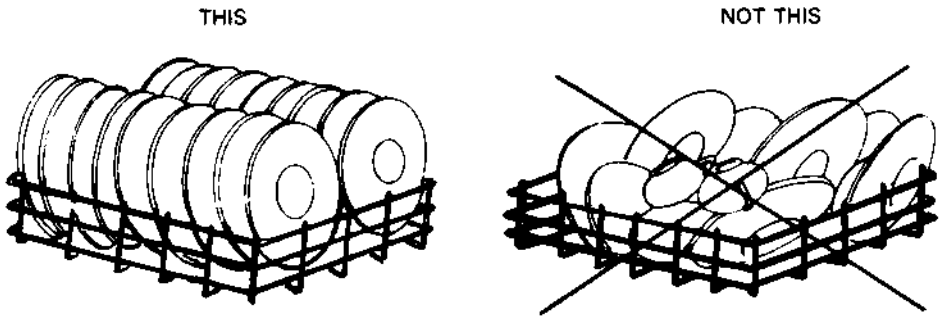


Figure 4-2. Racking dishes properly.

- Placing rack in machine and checking temperature gages to insure proper temperature- wash, 150º - 165ºF; rinse, 170ºF and sanitize, 180ºF.

NOTE

Refer to machine data plate for specific temperatures.

- Air drying dishes after cycle is completed. Towels are *never* used to dry dishes. Towel drying can contaminate dishes.

- Removing and storing dishes in a clean area.

4-9. During Operation Checks

During the operation, the supervisor should insure that dishes are washed and sanitized correctly. Items to check during the operation are:

- *Amount of detergent.* If more detergent is needed, instruct the operator.

- *Wash water temperature.* Keep it between 150º - 165ºF. Lower temperatures will not remove greasy foods. Higher temperatures can bake foods on dishes.

- *Clear water rinse temperature.* It should be at least 170ºF.

- *Sanitizing rinse temperature.* The final rinse should be between 180º - 190ºF. Temperatures below this will not adequately kill germs.

- *Method of drying.* Dishes must always be air dried.

4-10. Closing Down the Dishwasher

Once the dishes are washed, removed from the machine, and stored in a clean area, the operator must use correct close-down procedures. By performing the following steps, the dishwashing machine will be ready for the next work shift.

- Turn off the wash-tank heater.

- Open the drain valve.

- Remove and empty scrap trays. Wash trays in soap and water and allow them to air dry. Do not bang the trays.

- Clean and flush out the inside of the machine. Remove the curtains and wash them in soapy water. If necessary, use a lime remover.

- Check the rinse and wash arms. Remove the arms for cleaning. If lime deposits are present, use a lime remover and follow the directions printed on the label.

- For gas heated machines, close the drain valve and allow 3-4 inches of water to run into the wash-tank. This will protect the washtank from the pilot light heat.

Section II. HAND DISHWASHING

4-11. Process for Washing Dishes by Hand

Washing dishes by hand is necessary when a machine is not available. Hand dishwashing is also necessary for large pots and pans (See Figure 4-3). Hand dishwashing requires at least a three-compartment sink. The steps employed are similar to those discussed under machine dishwashing.

a. Scrape food residues from all utensils.

b. Check the wash water temperature. It should be between 110º and 120ºF. Higher temperatures will result in burns and scalding. The scrubbing action in handwashing will remove the grease. Thus, the lower temperature is permissible, as opposed to machine dishwashing.

c. Wash utensils in a detergent solution, in the first compartment of a three-compartment sink, until all visible food particles and grease have been removed. Never use machine dishwashing compounds for hand dishwashing.

d. Rinse off the soapy water that clings to the utensils and tableware from the washing process in clear, warm rinse water in the second compartment.

e. Sanitize the utensils and tableware in clear, hot water in the third compartment.

f. Air dry on clean racks.

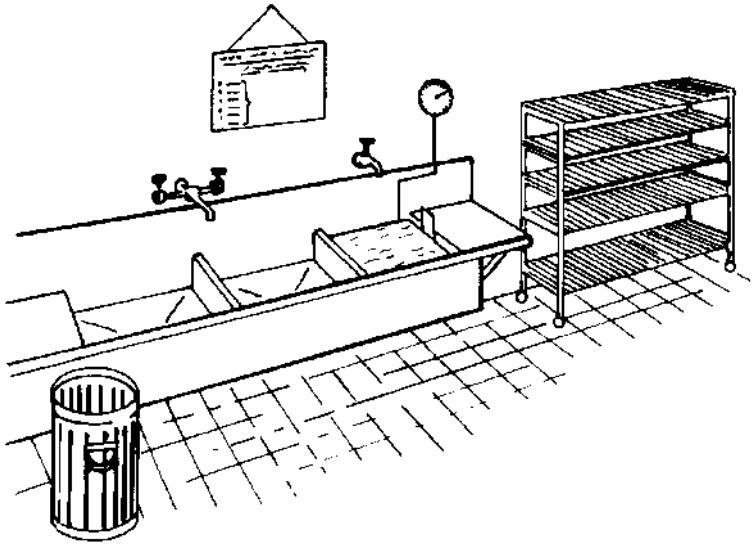


Figure 4-3. Hand dishwashing laundry.

4-12. Methods for Sanitizing Utensils, Tableware, and Equipment

a. The Hot Water Method

(1) Completely immerse utensils for at least 30 seconds in hot water maintained at a temperature of 170°F. Use a thermometer to insure that the water temperature is maintained at 170°F. Since the water will be too hot for a person to put his hands in, he must use a dishbasket, a dishrack, a flatware container, or some other container with a handle to contain the dishes while immersing them in the sanitizing water. This permits easy removal of the utensils from the sanitizing compartment of the dishwashing sink for drying.

(2) Maintaining water in the sanitizing compartment at a temperature of 180°F poses a number of problems for the supervisor. First, the water in hot water heating systems is usually 140°F or below. This means that it must be *booster-heated* to raise it to the desired 180°F. A number of other methods can be used for this purpose, but they all have their limitations. A properly installed electric immersion heater in the third compartment of the dishwashing sink is one of the better methods. Gas burners under the third compartment have been used but are a fire and safety hazard. In any case, it is not a simple problem. The method used should be discussed with and approved by the preventive medicine activity and fire marshal before the auxiliary heating equipment is installed.

b. *The Chemical Method.* The active ingredient, or the material in the compound that actually does the sanitizing, is our primary concern. Only a limited number of chemicals are acceptable as active ingredients. Two of the more acceptable chemicals used for sanitizing agents are chlorine and iodine. Immersion time, solution water temperature, and concentration of active ingredients require rigid control during the use of the chemical method.

(1) Concentration of active ingredients.

(a) When using chlorine, the minimum concentration or least amount of available chlorine permitted is 50 parts per million.

(b) When using iodine, the minimum amount is 12.5 parts per million. In addition, the water must be controlled at a level not higher than 5.0 pH as a measure of the acidity for the solution being used. Before using chemicals for sanitizing solutions, the preventive medicine personnel should be contacted to insure the chemicals will be effective.

(2) *Solution water temperature.* Chemicals react differently at different temperatures. To assure that they will react the same each time, the solution temperature must be maintained between 75ºF and 110ºF. This insures an effective kill of organisms remaining on the utensils.

(3) *Immersion time.* The period for effective sanitizing is a minimum of 1 minute. This requirement does not permit the person washing utensils or tableware to dip them into the sanitizing solution and to rack them immediately for drying. The practice of just dipping tableware, especially glasses, frequently occurs in hand dishwashing operations. This practice is incorrect and must not be permitted.

4-13. Methods for Preparing and Testing Chemical Sanitizing Solutions

When preparing fresh solutions of chemical sanitizers, it is recommended that the concentration or strength be double the minimum requirement. Therefore, *chlorine solutions will have a strength of 100 parts per* million while *iodine solutions will have astrength of 25 parts per* million.

4-14. Storage of Cleaned and Sanitized Utensils, Tableware, and Equipment

a. No matter what procedure is used for washing utensils, tableware, and equipment, they should always be air dried. Towels of any kind must never be used. Towels can quickly become contaminated or may be contaminated before use. This contamination is quickly spread to those utensils or tableware that are dried by the towel later. Utensils that are immersed in water of 170ºF or more will air dry very quickly. There are a number of rinse additives available that will aid in preventing water spotting. There is not a necessity for drying with a towel.

b. Food-contact surfaces of all cleaned and sanitized equipment and utensils must be handled in a manner that will protect them from contamination. Cleaned spoons, knives, and forks should be stored with their handles up. Clean cups, glasses, bowls, and plates should be stored with the food-contact surface down.

c. Portable equipment and utensils must be stored above the floor in a clean, dry location. Suitable space and facilities, such as shelves, cabinets, or movable carts, should be protected from splash, dust, and other contamination.

d. Food-contact surfaces of fixed equipment such as slicers, mixers, or grinders should be protected from splash, dust, and other contamination. Utensils also should be air dried before being stored or should be stored in a self-draining position on hooks or racks. Stored containers and utensils should be covered or inverted.

CHAPTER 5

Food Service Sanitation in the Field

Section I. WATER SUPPLY AND WASTE DISPOSAL

5-1. Water Supply

In previous chapters, sanitation in garrison food service facilities was discussed. However, the Army food service supervisor is also required to prepare and serve food in the field. When operating in the field, the same basic sanitation rules are followed as in a garrison operation. Even though new advances are being made in the development of improved field rations and new types of field kitchen facilities, problem situations will still be faced. This chapter provides information on how to handle special problems that may be encountered in the field.

a. A safe water supply for preparing food is a must. Normally, treated water is provided to the unit in the field. Yet, there may be times when the combat situation does not allow this. When this happens, the food service supervisor must insure that all water used for food preparation has been correctly disinfected.

b. There are six sources of water in the field. These sources are surface (streams and lakes), ground, rain, ice, snow, and sea water. Select the clearest source available, then disinfect before use.

CAUTION

All sources of water in the field are considered to be contaminated and require disinfection.

c. Water disinfection can be accomplished in the individual canteen, the 36-gallon (163.76 1) water purification (Lyster) bag, or other clean containers used in food preparation. Disinfection is accomplished by using iodine tablets, chlorine ampules, household liquid bleach, or boiling. For larger amounts of water (2-5 gallons+) (9.09-22.73+ l), chlorine ampules or liquid bleach are normally used.

d. Disinfecting water in the Lyster bag is a simple task. The preferred method using chlorine ampules includes the following steps:

1. Insure that the Lyster bag is clean before filling with water.

2. Fill bag to the 36-gallon mark which is 4 inches (10.16 cm) from the top. BE CAREFUL--when full, the Lyster bag weighs approximately 300 pounds (136.08 kg).

3. Mix a stock solution of chlorine by adding 3 ampules to 1/2 canteen cup (120 ml) of water. Stir with a clean device.

4. Add the solution to the Lyster bag of water. Stir with a clean device.

5. Cover the Lyster bag.

6. Flush all faucets.

7. Wait 10 minutes, then using the chlorine color test kit, check for chlorine residual.

8. If residual is less than 5 parts per million (ppm), add one more ampule. Repeat steps 7 and 8 until a 5 ppm residual is achieved.

9. Wait an additional 30 minutes before drinking or using for food preparation.

e. If chlorine ampules are not available, use household liquid bleach. Initially use 1 tablespoonful (15 ml) per Lyster bag. The unit field sanitation team has been trained to check the chlorine residual and will provide assistance when asked. When other sized containers are used, follow guidelines in Table 5-1 to determine how much chlorine to use.

Table 5-1. Amount of Chlorine for Disinfecting Water in Common-Sized Containers to 5 PPM.

CONTAINER SIZE (GAL)	CHLORINE AMPULES	AMOUNT OF 5% CHLORINE
5 (18.93 l)	1/2	0.06 oz (1/16 tbs) (15/16 ml)
10 (37.85 l)	1	0.13 oz (1/8 tbs) (1 7/8 ml)
20 (75.70 l)	2	0.26 oz (1/4 tbs) (3 3/4 ml)
32 (121.10 l)	3	0.41 oz (1/2 tbs) (7 1/5 ml)
100 (378.50 l)	8	1.23 oz (1 1/2 tbs) (22 1/2 ml)
200 (757.00 l)	16	2.56 oz (5 tbs) (75 ml)
300 (1135.50 l)	24	3.84 oz (8 tbs) (120 ml)

f. When the water supply is disrupted or the safety of the water supply is questionable, disinfect. Insure that the container is clean, follow directions provided on labels or guidelines in this manual, allow 30 minutes total contact time before drinking or using in food preparation, and insure a 5 ppm chlorine residual or follow command guidelines.

g. Water from water supply points may require additional treatment before use.

5-2. Waste Disposal

a. In a garrison facility, disposal of kitchen waste is easy. Waste is flushed down a sanitary drain or is stored in a covered container and someone is assigned to pick it up. In field operations, kitchen waste disposal can become a major health problem. Unless correct procedures are followed, kitchen waste can attract large numbers of disease-carrying flies and rodents.

b. The two basic methods for the disposal of solid waste in the field are to burn it or bury it. If this is not done, insects and rodents will soon take over the area of operation. A method of constructing a garbage burial pit is shown in Figure 5-1. A simple means of burning waste, the grate incinerator, is shown in Figure 5-2.

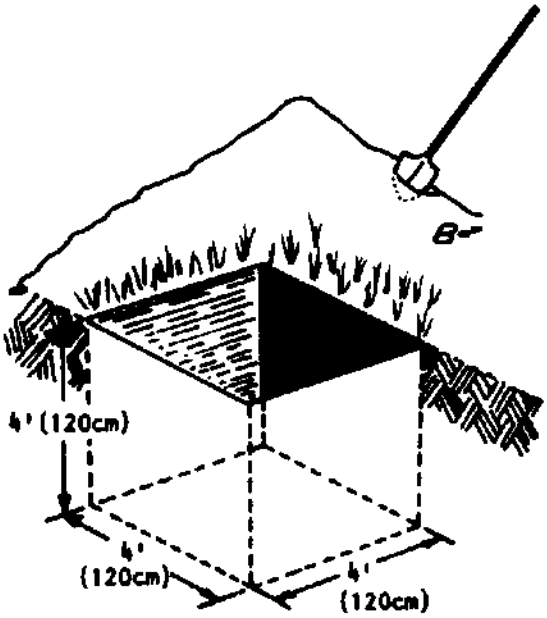


Figure 5-1. Garbage burial pit.

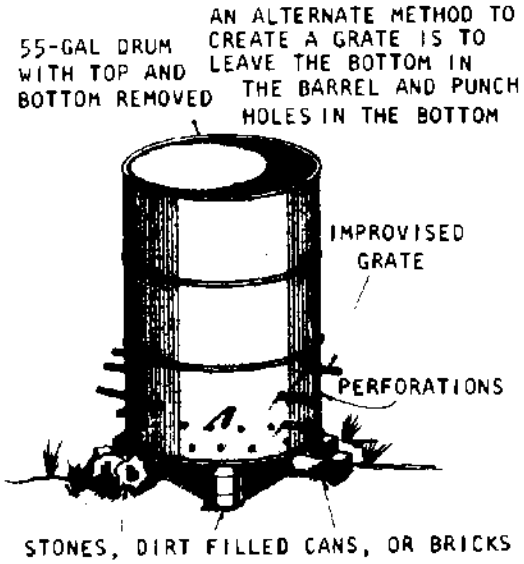


Figure 5-2. Grate incinerator.

c. For disposal of kitchen liquid waste, a soakage pit must be constructed. Liquid waste that has a high grease content may clog the soakage pit. A "grease trap" is needed in conjunction with the soakage pit for this type of waste. Figures 5-3 and 5-4 are examples of a soakage pit and a grease trap.

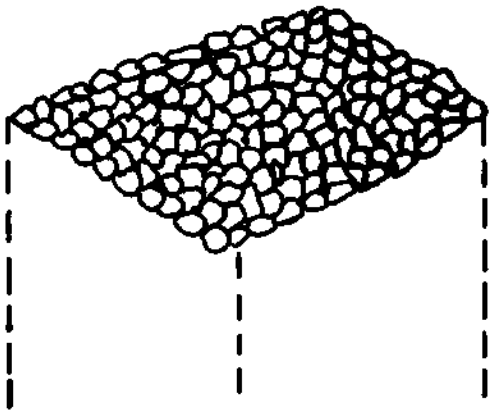


Figure 5-3. Soakage pit for liquid waste.

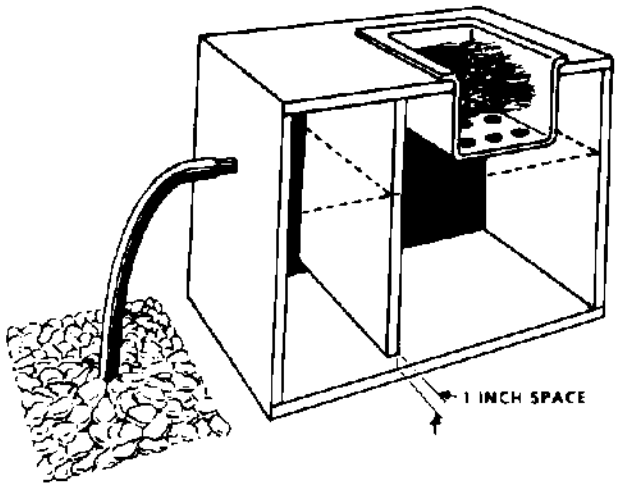


Figure 5-4. Grease trap.

d. As a food service supervisor, it is not only important to know how to construct these disposal devices but also who constructs and maintains them. In some units, food service personnel may be responsible. This is not a desirable practice since the same personnel will be handling food products. In other units, detail personnel will be assigned to construct and maintain disposal devices. This responsibility should be outlined in a field standing operating procedure (SOP). Field sanitation team personnel have also been trained in construction requirements. They should be asked for assistance in determining the number of disposal devices required and where to locate them.

Section II. SAFE PRODUCT TEMPERATURES IN THE FIELD

5-3. Safe Product Temperatures

a. Decisions for type of rations issued are beyond the control of the supervisor. It is of utmost importance that all product temperatures be monitored. Perishables must be stored immediately in the best refrigeration unit available to maintain a safe product temperature. The refrigeration unit may be an ice box or a mechanical refrigerator.

b. When serving hot or cold meals in the field, maintaining safe product temperatures (45°F and below or 140°F 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.

NOTE

Review Chapter 2, Section III, for the importance of maintaining safe product temperatures.

c. Transporting potentially hazardous foods from a base camp to troops at other locations will require the use of insulated food containers. Correct use of the insulated food container will help maintain safe product temperatures (see Figure 5-5).

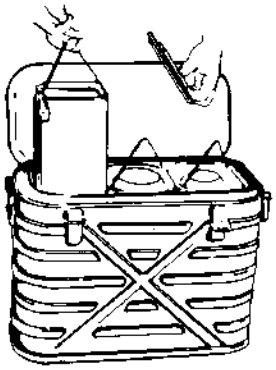


Figure 5-5. Insulated food containers.

d. For hot foods, preheat the insulated container by using boiling water. Let the boiling water remain in the container for at least 30 minutes. This will preheat the container and help maintain safe temperatures of potentially hazardous foods. When correctly preheated, foods should remain at safe temperatures for 3 to 4 hours. See Figure 5-6 for specific directions. Take the following steps:

1. Remove the inserts.

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

3. Close and let 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 inserts and then place the insert in the container.

6. Close and fasten the container lid.

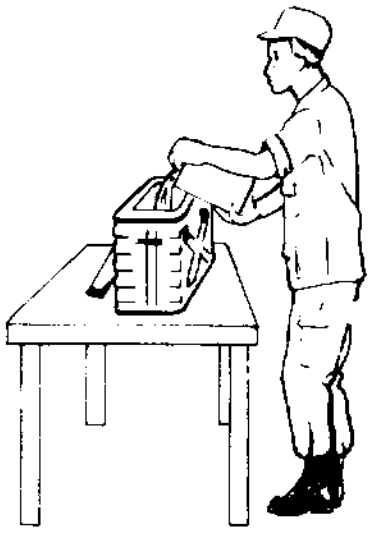


Figure 5-6. Preheating the insulated food container.

e. For potentially hazardous foods that must remain cold, put 2 quarts/liters of crushed ice into the container to prechill it. Let the ice remain in the container for at least 30 minutes. When correctly prechilled, cold foods should remain at safe temperatures for 3 to 4 hours. See Figure 5-7 for further directions for prechilling. Take the following steps:

1. Remove the inserts.

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

3. Close and let stand for 30 minutes.

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

5. Place the cold food (should be below 45◦F) into the inserts and then place the inserts in the container.

6. Close and fasten the container lid.

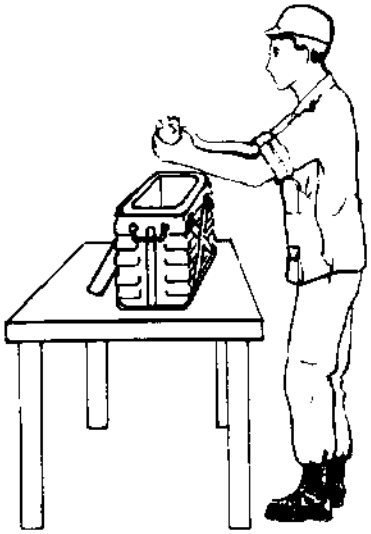


Figure 5-7 Prechilling the insulated food container.

5-4. Supervisory Techniques

Good supervisory techniques include labeling each insulated container with the product, the temperature of food when placed in the container, and the time that the food was placed in the container. When the container is opened for serving, the temperature should be checked again. Insulated containers must be checked for defects such as gaskets that do not fit right or that are missing, lids that do not close tightly, or any other discrepancy. Maintaining potentially hazardous food at safe temperatures prevents disease outbreak and contributes to the good health of the entire unit.

Section III. EQUIPMENT CLEANING AND SANITATION

5-5. Messkit Laundry

The food service supervisor plays an important role in the proper operation of a messkit laundry. The messkit laundry is used to wash and sanitize individual messkits and kitchen utensils and equipment. Newly developed portable facilities to replace the messkit laundry are being tested. Until these facilities have been thoroughly tested, approved, and supplied throughout the Army, the messkit laundry will be used. The messkit laundry can present many problems. The problems are obtaining water, maintaining "clean" water, preventing "giant mudholes" from forming, and preventing burns from the hot water/immersion heaters.

a. It is not always an easy task to obtain enough water for field operations. A normal messkit laundry requires about 60 gallons (227.10 l) of water. This amount can increase when the water becomes heavily soiled with food waste. Good supervisory actions will keep the water clean longer.

b. To keep the water clean until all personnel have washed their messkits, always provide a can for scraping out food waste from the messkit. A senior person must supervise soldiers as they use the messkit laundry, making sure that food waste has been scraped out. This simple action will help keep the water in the containers clean for a longer period of time. If the water does becomes heavily soiled, it should be replaced with clean water. To conserve water, the soiled wash water is discarded. The rinse water is used as the wash water by adding detergent to it. The sanitizing water is used as the rinse water. A clean container is added as the sanitizing water. This way only one container of water is replaced.

c. Soldiers should not have to wade through mudholes to use the messkit laundry. But experience shows that most messkit laundries become giant mudholes after one or two uses. This can be avoided by improving the area around the messkit laundry. Providing a rock walkway in front of the cans will help eliminate this problem. Enough rocks should be used to allow splash water to soak through to the soil.

d. Before a field training exercise or military operation, TRAIN personnel in the use of immersion heaters. Burns resulting from the use of immersion heaters range from minor to third degree that require hospitalization. New personnel should not be allowed to light immersion heaters until they have demonstrated that they can use them safely. The first person to blame for injuries from an immersion heater is the negligent supervisor.

e. Figure 5-8 describes how the messkit laundry should be set up and maintained. More detailed instructions for operating the field messkit laundry can be found in FM 10-23, Army Food Service Operations.

Messkit laundry: Enough water is placed in each can to allow 1 quart (0.95 l) for each person. One laundry can accommodate 80 persons. If an immersion heater is not available, a chemical disinfectant must be used in the last can. When the chemical disinfectant preparation is used, the following steps should be followed:

(1) If possible, use the Disinfectant, Food Service, as specified on the label.

(2) In an emergency, use three level messkit spoonsful of calcium hypochlorite powder/granule in a 32-gallon container.

OR

(3) Use 1 canteen cup of 5 percent liquid chlorine bleach in a 32-gallon container.

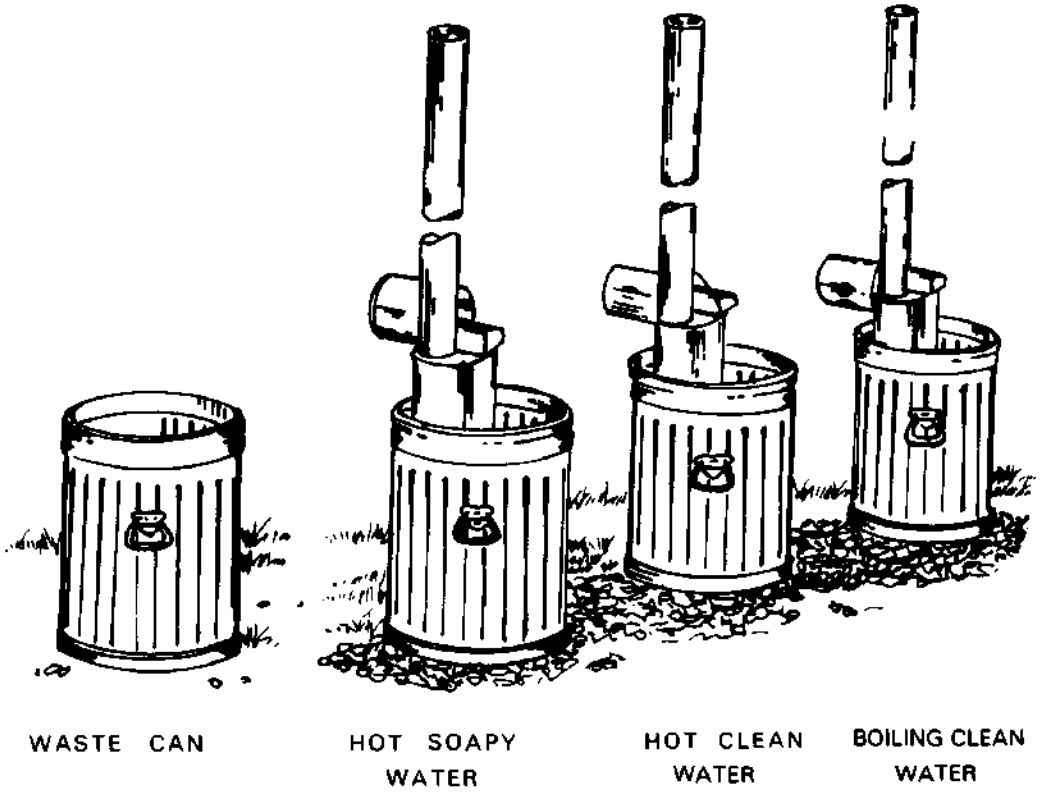


Figure 5-8. Messkit Laundry.

5-6. Field Conditions

Field conditions are no excuse for lowering standards of personal hygiene. Maintaining high levels of health and hygiene of food service personnel is critical. There are many ways to construct improvised handwashing facilities in the field. Two of these are shown in Figures 5-9 and 5-10.

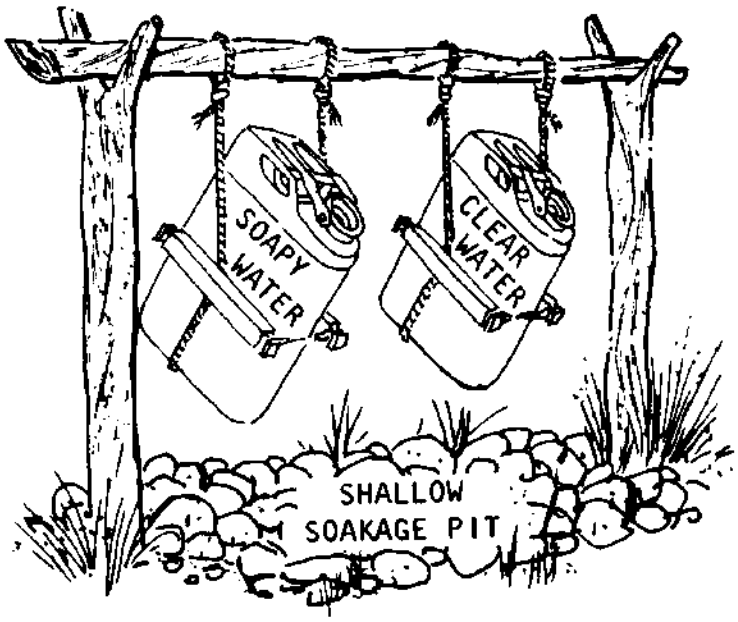


Figure 5-9. Handwashing device--tipping 5-gallon can.

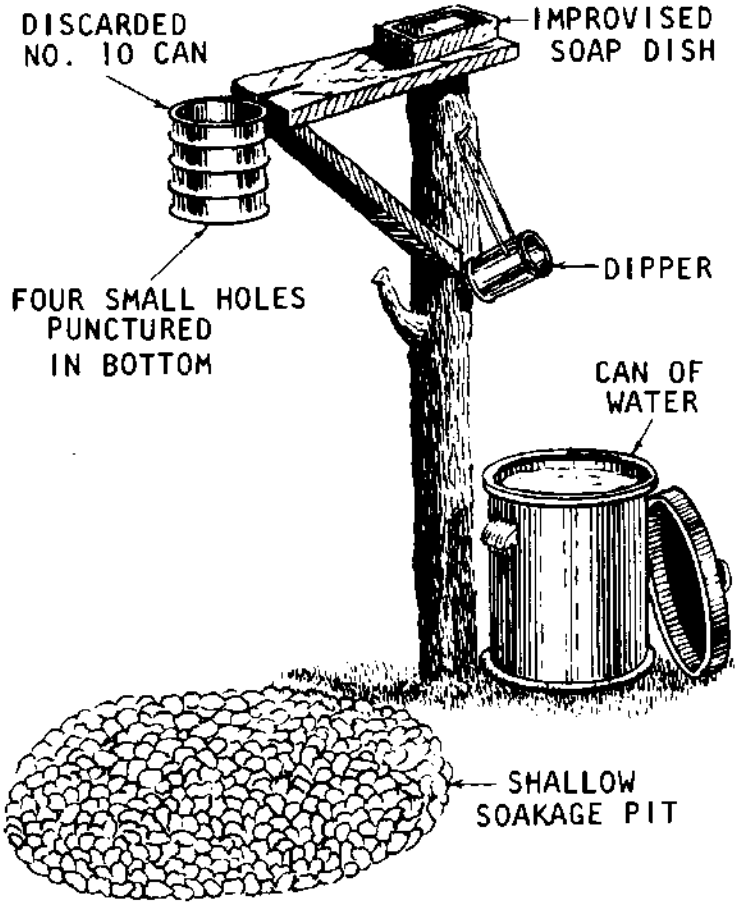


Figure 5-10. Handwashing device.

CHAPTER 6

EFFECTIVE SANITATION PROGRAM

6-1. Supervision That Works

Information in this chapter can help the supervisor maintain a clean facility; keep food service equipment clean, sanitized, and in good working condition; train personnel in critical sanitation procedures; and perform quality control inspections.

6-2. Supervising Housekeeping

a. The importance of good housekeeping and general cleaning practices cannot be overemphasized. Food items prepared in a "dirty" kitchen will more than likely become contaminated. "Dirty" equipment also makes it easier for bacteria to grow. Equipment must be washed before it can be sanitized or disinfected.

b. A clean food service operation does not just happen. It must be planned and supervised. The supervisor plans what is to be done, specifies how it is to be done, provides the right supplies and equipment for the job, and then makes sure that the job is done. An excellent way to plan housekeeping work is to draw a floor plan of the kitchen (Figure 6-1). The names of individuals assigned to clean each area are placed on the floor plan. When using this method everyone knows what his housekeeping duties are.

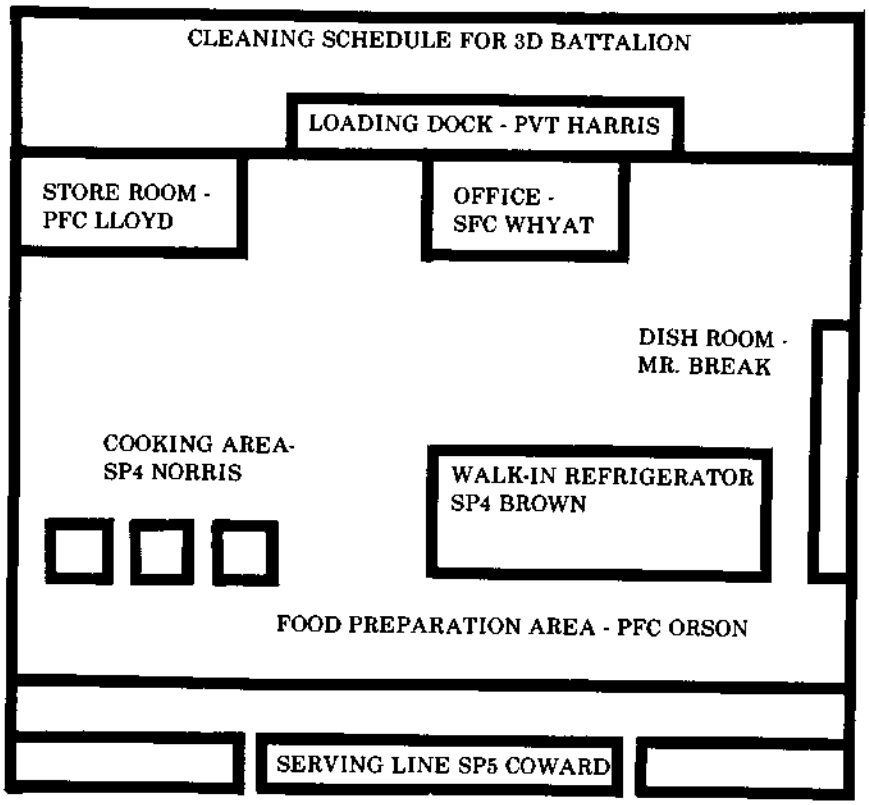


Figure 6-1. Example of cleaning responsibilities using floor plan.

c. A cleaning schedule is maintained for each work shift. Each person has a specific area of responsibility for cleaning and housekeeping duties.

d. The right cleaning supplies and equipment must be used. Too much of a cleaning product may damage equipment, result in injury to workers, or leave a toxic residue in foods. Label directions must be followed on all cleaning products.

e. One way to make sure that personnel use correct methods is to establish written cleaning procedures for each area and for each major item of equipment. An example of a written cleaning procedure appears below:

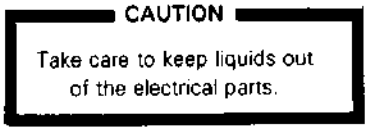
CLEANING PROCEDURES FOR MEAT AND FOOD SLICERS

As a safety precaution, always disconnect the electric cord before starting to clean the slicer. Set blade control at 0 to reduce the possibility of accidental cuts. Leave the blade guard in place until ready to clean the blade. Always replace the guard as soon as the blade is cleaned. Clean the shafts and all parts under the frame.

1. Dismantle and remove parts to pot sink. Soak parts for 5 minutes in a detergent cleaning solution. Brush all parts. Rinse with 125°F water.

2. Dip parts in sink containing a sanitizing solution.

3. Clean the stationary parts in place. Be careful of the blade. Use same solution as in number 1, above. Scrub with a good nylon-bristled brush. Check inside and outside, especially corners, handle connections, underneath rolled rims, receiving trays, and the area between the chute and frame of the unit.



4. Swab with a saturated clean brush or disposable cloth squeezed out of detergent cleaning solution.

5. Sanitize with a clean disposable cloth wrung out of the sanitizing solution.

6. Reassemble the slicer and store in a location that will prevent recontamination before it is needed again.

7. Sanitize immediately after each use with the same solution as in 5 above.

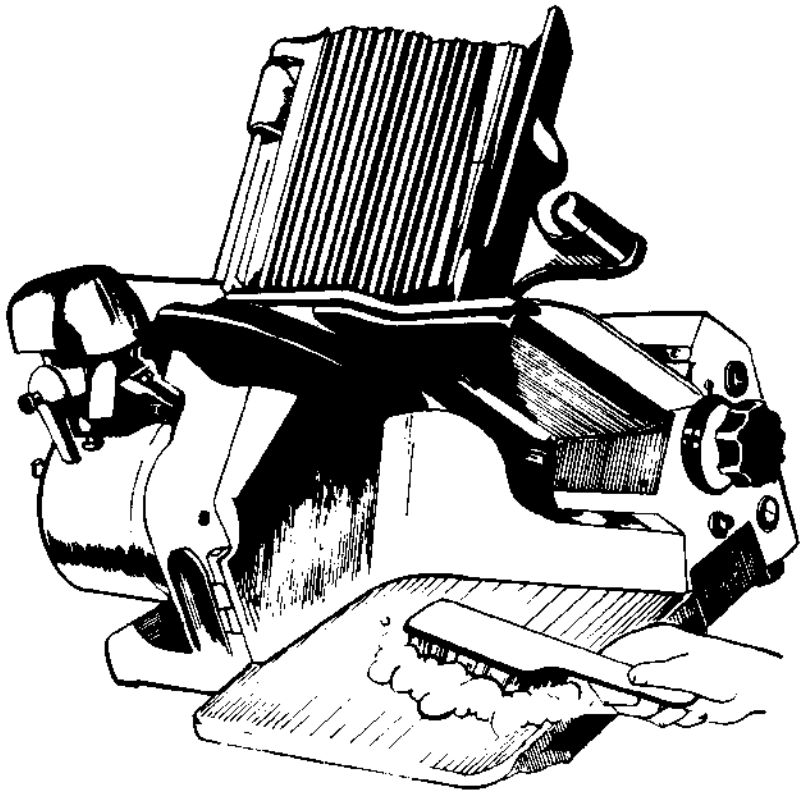


Figure 6-2. Meat and food slicer.

6-3. Training Management

a. Establishing an effective food sanitation training program may be a supervisor's hardest job. Without a good training program, all other efforts will fail.

b. The dining facility manager should maintain a training schedule for the entire year. An example of a training schedule is shown in Figure 6-3. A training schedule showing what sanitation subjects are to be discussed each month will help everyone plan each weekly personnel training session.

c. Five to ten minutes is the recommended length for weekly training sessions. It is best to keep these sessions informal and to encourage personnel discussion. The facility manager should provide each supervisor with training materials that can be used for personnel discussions. An example of training material that can be used is shown in Figure 6-4.

d. Setting a good example is one of the best methods of training. Supervisors and shift leaders must set the example by practicing good personal hygiene, such as washing their hands before and after handling food or food-contact items. They must immediately correct any personnel who are observed using procedures that could contaminate food or that places food in the temperature danger zone.

YEARLY TRAINING SCHEDULE
FOOD SERVICE SANITATION

MONTH	TRAINING SUBJECT	MONTH	TRAINING SUBJECT
January	Foodborne disease germs	July	Food handling
	Worker's view "Super Chef" film	August	Cleaning and sanitizing equipment
February	Source of contamination		Schedule preventive medicine personnel to conduct an in-depth inspection of dishwashing operation
March	Food service safety and accident prevention. Schedule post or unit safety officer to inspect facility and conduct training session		
April	Ways to control foodborne disease	September	Insect and rodent control
May	Importance of temperature control	October November	Special sanitation problems associated with Thanksgiving and Christmas dinners
June	Sanitation problems in food storage areas	December	Schedule preventive medicine personnel to conduct training on new sanitation problems

Figure 6-3. Yearly training schedule.

DISCUSSION

1. GIVE YOUR OWN PERSONAL REASON WHY YOU AS A FOOD HANDLER SHOULD BE CONCERNED ABOUT GERMS.

2. NAME FIVE IMPORTANT FACTS ABOUT GERMS.

3. WHAT ARE THE BEST TEMPERATURES FOR GERM GROWTH?

4. HOW CAN YOU PREVENT CONTAMINATION OF FOOD?

Figure 6-4. Example of training aids for supervisors.

e. As the supervisor advances in rank and responsibility, he will need more training in food service sanitation. The Army has a goal of providing all food service facility managers (E7s-E8s) with training that meets the Food and Drug Administration requirements. Many posts have already established training programs that meet Food,and Drug Administration standards. Most of these programs provide certification in food service sanitation management that is recognized by state and local health departments.

f. The food supervisor can obtain assistance in training from-

- The post preventive medicine activity. Their assistance can mean the difference between a quality food service operation and a foodborne disease outbreak.

- The post or unit safety officer. He can provide training and information on accident prevention and food service safety.

6-4. Supervisor Inspections

The importance of the supervisor's inspection of personnel at the start of each work shift has already been discussed. It is also important for the supervisor to conduct daily inspections of each work area for factors that contribute to foodborne disease outbreaks. Using Figures 6-5 and 6-6, determine what factors are present that could contribute to foodborne disease outbreaks and what factors could be corrected through supervisory actions. It is recommended that a formal supervisor's inspection be conducted at least once a week and that findings be recorded for future training use.

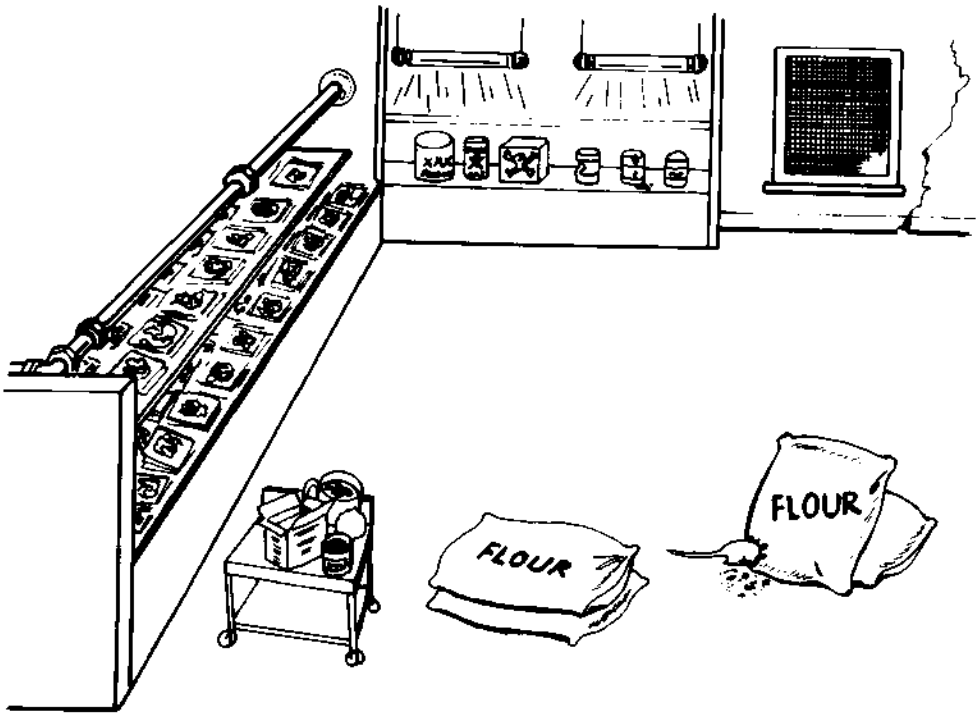


Figure 6-5. Food storage sanitation problems.

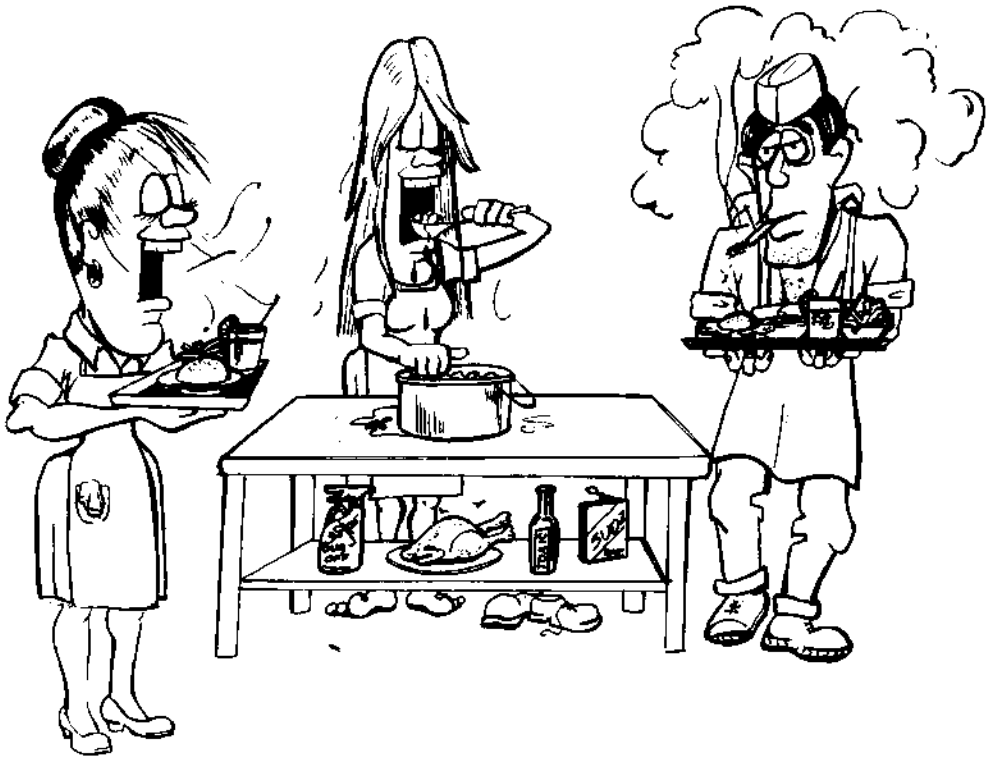


Figure 6-6. Food handler problems.

6-5. Preventive Medicine Personnel Inspection

Even though preventive medicine personnel conduct sanitary inspections, it is important for supervisors to conduct inspections. Many problems found during preventive medicine inspections only indicate that the supervisor is not getting the job done. Preventive medicine personnel can assist with problems that the supervisor cannot handle.

APPENDIX A

COMPARISON OF FAHRENHEIT AND CELSIUS TEMPERATURES

Fahrenheit	Celsius	Fahrenheit	Celsius	Fahrenheit	Celsius	Fahrenheit	Celsius
-20	-28.89	38	3.33	96	35.56	154	67.78
-19	-28.34	39	3.89	97	36.11	155	68.34
-18	-27.78	40	4.44	98	36.67	156	68.89
-17	-27.22	41	5.00	99	37.23	157	69.45
-16	-26.67	42	5.56	100	37.78	158	70.01
-15	-26.11	43	6.11	101	38.34	159	70.56
-14	-25.56	44	6.67	102	38.89	160	70.12
-13	-25.00	45	7.22	103	39.45	161	71.67
-12	-24.45	46	7.78	104	40.00	162	72.23
-11	-23.89	47	8.33	105	40.56	163	72.78
-10	-23.34	48	8.89	106	41.11	164	73.34
-9	-22.78	49	9.45	107	41.67	165	73.89
-8	-22.22	50	10.00	108	42.23	166	74.45
-7	-21.67	51	10.56	109	42.78	167	75.01
-6	-21.11	52	11.11	110	43.34	168	75.56
-5	-20.56	53	11.67	111	43.89	169	76.12
-4	-20.00	54	12.22	112	44.45	170	76.67
-3	-19.45	55	12.78	113	45.00	171	77.23
-2	-18.89	56	13.33	114	45.56	172	77.78
-1	-18.33	57	13.89	115	46.11	173	78.34
0	-17.78	58	14.45	116	46.67	174	78.90
1	-17.22	59	15.00	117	47.23	175	79.45
2	-16.67	60	15.56	118	47.78	176	80.01
3	-16.11	61	16.11	119	48.34	177	80.56
4	-15.56	62	16.67	120	48.89	178	81.12
5	-15.00	63	17.22	121	49.45	179	81.67
6	-14.45	64	17.78	122	50.00	180	82.23
7	-13.89	65	18.33	123	50.56	181	82.78
8	-13.33	66	18.89	124	51.12	182	83.34
9	-12.78	67	19.45	125	51.67	183	80.90
10	-12.22	68	20.00	126	52.23	184	84.45
11	-11.67	69	20.56	127	52.78	185	85.01
12	-11.11	70	21.11	128	53.34	186	85.56
13	-10.56	71	21.67	129	53.89	187	86.12
14	-10.00	72	22.22	130	54.45	188	86.67
15	-9.45	73	22.78	131	55.00	189	87.23
16	-8.89	74	23.34	132	55.56	190	87.78
17	-8.33	75	23.89	133	56.12	191	88.34
18	-7.78	76	24.45	134	56.67	192	88.90
19	-7.22	77	25.00	135	57.23	193	89.45
20	-6.67	78	25.56	136	57.78	194	90.01
21	-6.11	79	26.11	137	58.34	195	90.56
22	-5.56	80	26.67	138	58.89	196	91.12
23	-5.00	81	27.22	139	59.45	197	91.67
24	-4.44	82	27.78	140	60.00	198	92.23
25	-3.89	83	28.37	141	60.56	199	92.79
26	-3.33	84	28.89	142	61.12	200	93.34
27	-2.78	85	29.45	143	61.67	201	93.90
28	-2.22	86	30.00	144	62.23	202	94.45
29	-1.67	87	30.56	145	62.78	203	95.01
30	-1.11	88	31.11	146	63.34	204	95.56
31	-.56	89	31.67	147	63.89	205	96.12
32	0	90	32.22	148	64.45	206	96.67
33	.56	91	32.78	149	65.01	207	97.23
34	1.11	92	33.34	150	65.56	208	97.78
35	1.67	93	33.89	151	66.12	209	98.34
36	2.22	94	34.45	152	66.67	210	98.90
37	2.78	95	35.00	153	67.23	211	99.45
						212	100.00

GLOSSARY

C	Celsius
cm	centimeter
F	Fahrenheit
FDA	Food and Drug Administration
gal	gallon
hrs	hours
kg	kilogram
l	liter(s)
ml	milliliter
mm	millimeter
oz	ounce
pH	symbol for hydrogen ion concentration. PH 7 is neutral; above 7 is alkaline; below 7 is acid
ppm	parts per million
SOP	standing operating procedures
tbs	tablespoon
USDA	United States Department of Agriculture

REFERENCES

Technical Bulletin

TB MED 530	Occupational and Environmental Health Food Service Sanitation

Field Manuals

FM 8-33	Control of Communicable Diseases in Man, 13th edition
FM 10-23	Army Food Service Operations
FM 10-23-1	Commander's Guide to Food Service Operations
FM 10-25	Preparation and Serving of Food in the Garrison Dining Facility

Technical Manual

TM 10-415	Dining Facility Equipment: Operation and Operator Maintenance

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30 DECEMBER 1983

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
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