

FM 8-34

**FOOD SANITATION
FOR
THE SUPERVISOR**

DECEMBER 1983

HEADQUARTERS DEPARTMENT OF THE ARMY

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.

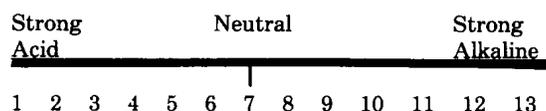


Figure 1-1. pH scale.

(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.

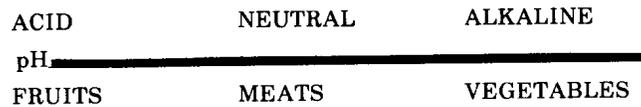


Figure 1-2. pH scale (acid, neutral, alkaline).

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 (108°F to 180°F), moderate-temperature-loving (41°F to 113°F), and cold-loving (31°F to 90°F). 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 45°F or below and 140°F or above.

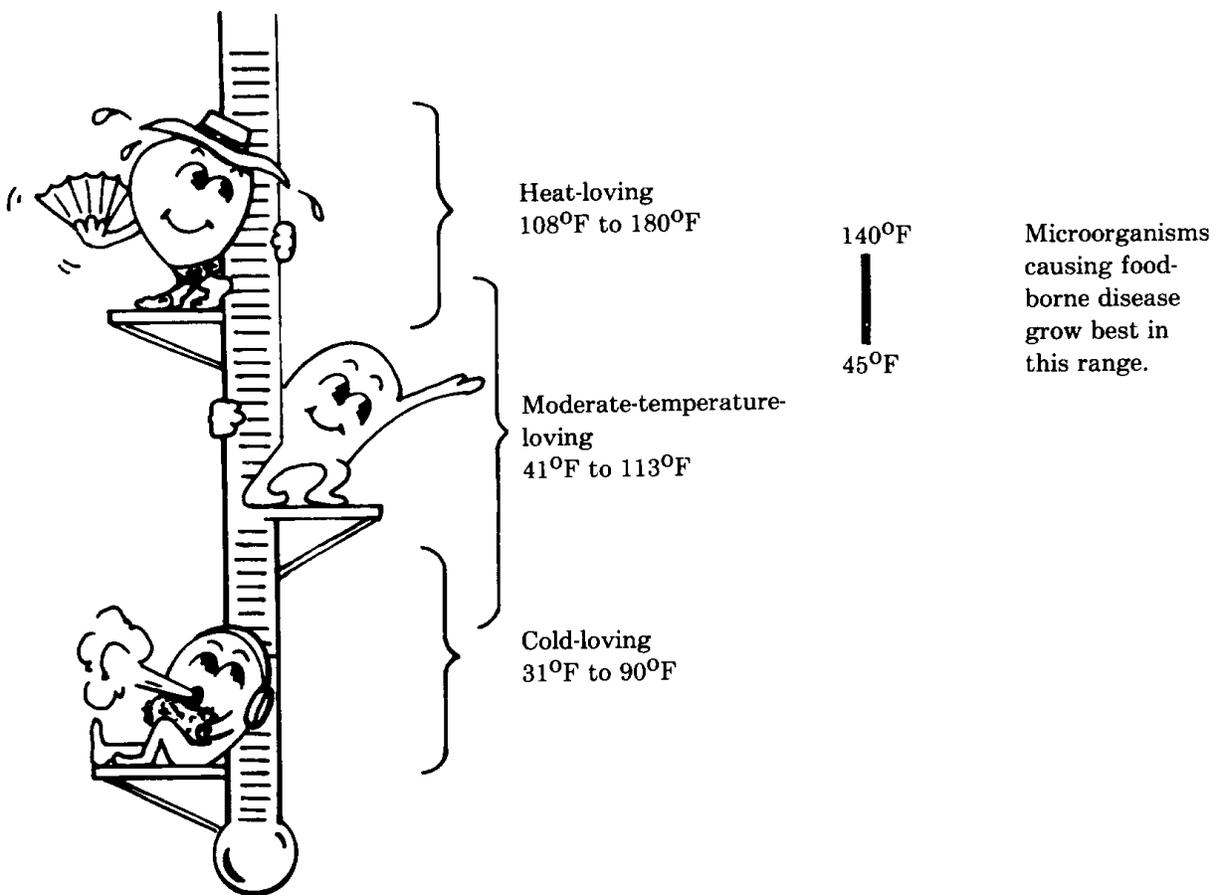


Figure 1-3. Thermometer showing temperatures at which bacteria grow best.

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.

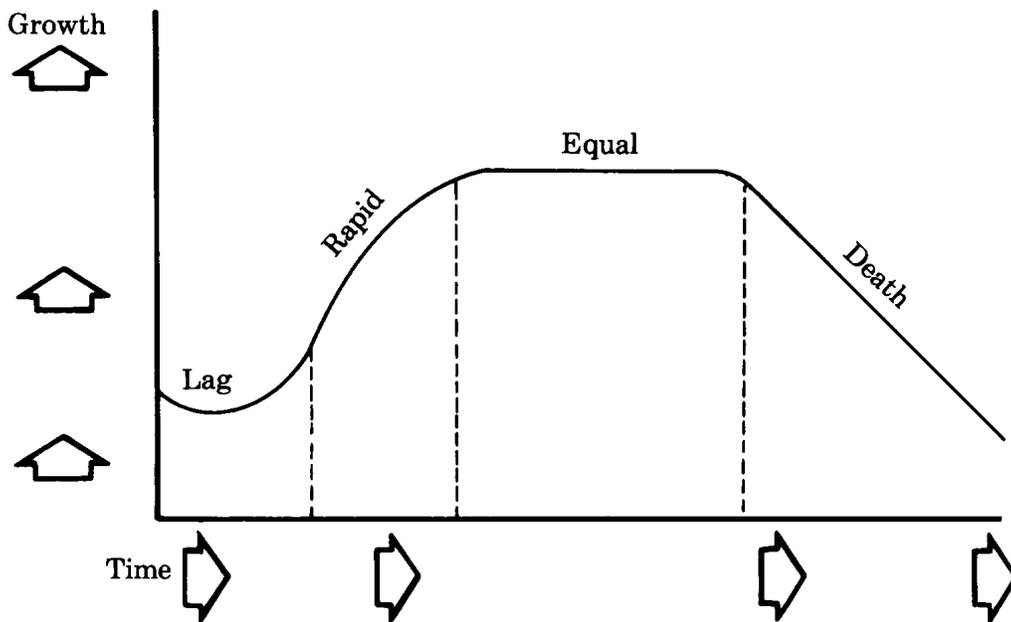


Figure 1-4. Four phases in the growth and death of bacteria.

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 150°F).

(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 140°F, beef to an internal temperature of 145°F, pork to an internal temperature of 150°F, and poultry to an internal temperature of 165°F.

(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 will suffer acute abdominal pain, diarrhea, and nausea, but vomiting is rare. Normal cooking times and temperatures will not kill 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.

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