U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL
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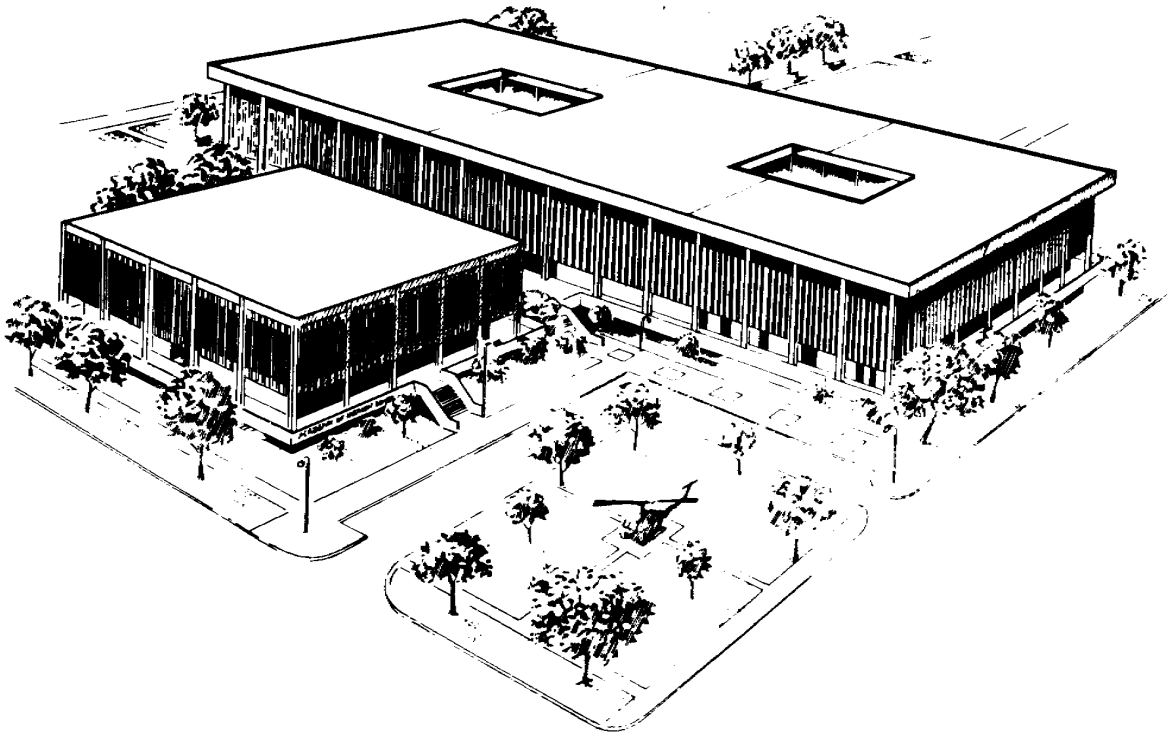

FOOD SERVICE SANITATION AND INSPECTIONS I

SUBCOURSE MD0181 EDITION 100

DEVELOPMENT

This subcourse is approved for resident and correspondence course instruction. It reflects the current thought of the Academy of Health Sciences and conforms to printed Department of the Army doctrine as closely as currently possible. Development and progress render such doctrine continuously subject to change.

When used in this publication, words such as "he," "him," "his," and "men" 'are intended to include both the masculine and feminine genders, unless specifically stated otherwise or when obvious in context.

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Students who desire credit hours for this correspondence subcourse must meet eligibility requirements and must enroll through the Nonresident Instruction Branch of the U.S. Army Medical Department Center and School (AMEDDC&S).

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CORRESPONDENCE COURSE OF
THE U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL

SUBCOURSE MD0181

FOOD SERVICE SANITATION AND INSPECTIONS I

INTRODUCTION

Safe food service operations are critical to the Army since every soldier uses these facilities. An outbreak of illness caused by unsafe food can seriously hinder the Army from achieving its mission, both in garrison and in the field. Due to this threat, an Army food service facility must follow safe food handling practices in all its operations. It is your job as an inspector to determine that a food service facility is providing soldiers with safe food. Subcourse MD0181 will provide you with the knowledge and skills required of a competent food service inspector. This subcourse will describe the microorganisms causing foodborne disease, their growth requirements, and common foodborne diseases. The subcourse will then discuss sanitation for food service operations in the field and at full-service facilities. The factors that produce foodborne disease outbreaks in both situations will be described.

This subcourse consists of 7 lessons and an examination. The lessons are:

Lesson 1, Basic Facts about Microorganisms Important in Food Sanitation.

Lesson 2, Common Foodborne Diseases.

Lesson 3, Food Sanitation in the Field.

Lesson 4, Factors Contributing to Foodborne Disease: Personnel.

Lesson 5, Factors Contributing to Foodborne Disease: Receipt of Food Shipments.

Lesson 6, Factors Contributing to Foodborne Disease: Food Storage.

Lesson 7, Factors Contributing to Foodborne Disease: Temperature and Cross-Contamination.

Credit Awarded:

Upon successful completion of this subcourse, you will be awarded 4 credit hours.

Materials Furnished:

Materials provided include this booklet, an examination answer sheet, and an envelope. Answer sheets are not provided for individual lessons in this subcourse because you are to grade your own lessons. Exercises and solutions for all lessons are contained in this booklet. *You must furnish a #2 pencil*.

Procedures for Subcourse Completion:

You are encouraged to complete the subcourse lesson by lesson. When you have completed all of the lessons to your satisfaction, fill out the examination answer sheet and mail it to the AMEDDC&S, along with the Student Comment Sheet, in the envelope provided. *Be sure that your social security number is on all correspondence sent to the AMEDDC&S*. You will be notified by return mail of the examination results. Your grade on the examination will be your rating for the subcourse.

Study Suggestions:

Here are some suggestions that may be helpful to you in completing this subcourse:

--Read and study each lesson carefully.

--Complete the subcourse lesson by lesson. After completing each lesson, work the exercises at the end of the lesson, marking your answers in this booklet.

--After completing each set of lesson exercises, compare your answers with those on the solution sheet, which follows the exercises. If you have answered an exercise incorrectly, check the reference cited after the answer on the solution sheet to determine why your response was not the correct one.

--As you successfully complete each lesson, go on to the next. When you have completed all of the lessons, complete the examination. Mark your answers in this booklet; then transfer your responses to the examination answer sheet using a #2 pencil and mail it to the AMEDDC&S for grading.

Student Comment Sheet:

Be sure to provide us with your suggestions and criticisms by filling out the Student Comment Sheet (found at the back of this booklet) and returning it to us with your examination answer sheet. Please review this comment sheet before studying this subcourse. In this way, you will help us to improve the quality of this subcourse.

LESSON ASSIGNMENT

LESSON 1	Basic Facts About Microorganisms Important In Food Sanitation.
TEXT ASSIGNMENT	Paragraphs 1-1 through 1-16.
LESSON OBJECTIVE	After completing this lesson, you should be able to:

1-1. Define microorganism.

1-2. Identify the effects of microorganisms on people.

1-3. Identify the ways by which microorganisms contaminate food.

1-4. Identify the types of microorganisms that commonly cause foodborne diseases.

1-5. Identify basic terms used to describe microorganisms important in food sanitation.

1-6. Identify the growth requirements of bacteria.

1-7. Identify situations in a food service facility which are favorable to the growth of bacteria.

1-8. Define potentially hazardous food.

1-9. Identify foods which are potentially hazardous.

SUGGESTION After studying the assignment, complete the exercises at the end of this lesson. These exercises will help you achieve the lesson objectives.

LESSON 1

BASIC FACTS ABOUT MICROORGANISMS IMPORTANT IN FOOD SANITATION

1-1. INTRODUCTION

If you look through a microscope at a piece of food, you can see thousands of tiny moving forms. These forms are actually small animals or plants and are called **microorganisms or microbes.** They are so small that they can be seen only with a microscope. Like all living beings, these tiny plants and animals take in food, give off waste products, and reproduce. Microorganisms are found everywhere in nature. Some exist in and cause undesirable changes in the food or illness to the person eating the food. This lesson will provide you with basic information on microorganisms and their importance in food sanitation. This information is critical for a preventive medicine specialist involved in food service inspections. As an inspector, your greatest concern will be to ensure that conditions favorable to the growth of harmful microorganisms are not present at Army food service facilities.

1-2. GENERAL

a. Fortunately, most microorganisms do not harm people. In fact, some are helpful and even provide benefits. For example, microorganisms are necessary to make cheese, wine, beer, sauerkraut, and vinegar. Another example is the role microorganisms play in the decay of dead matter. Microbes break down dead material and return it to the soil. Without these microbes, dead plants and animals would not decay but would remain unchanged and accumulate where they fall.

b. A small percentage of microorganisms are harmful and cause disease. Microorganisms that cause illness in man are called **pathogenic microorganisms.** Pathogenic microorganisms cause a variety of diseases. This subcourse deals specifically with those illnesses caused by eating or drinking food containing a large number of harmful microorganisms or their toxic products. Such illnesses are called **foodborne diseases**.

c. Food provides an ideal environment for the growth of microbes. Microorganisms can occur in food in four different ways. They can be found naturallv in food, or they may be introduced during slaughter, processing, or preparation (food handling).

1-3. TYPES OF MICROORGANISMS CAUSING FOODBORNE DISEASES

There are many different types of microorganisms. The microorganisms involved most frequently in outbreaks of foodborne diseases are bacteria, viruses, and parasites. Paragraphs 1-4 through 1-6 briefly describe each of these types of microorganisms.

1-4. BACTERIA

a. **Bacteria** (singular is **bacterium)** are single-celled plants. They are all quite small but can vary somewhat in size. The typical bacterium is about 1/25,000 of an inch; it would take as many as 25,000 individual bacteria placed side by side to equal one inch.

b. Some bacteria are able to produce spores. A spore is a stage in the life cycle of a bacterium whereby the bacterium has a thick, hard cell wall. The tough cell wall protects the spore from heat, cold, or other destructive agents. Spore-forming bacteria are much more difficult to destroy than regular bacteria. The resistance of spores to destruction is important in food sanitation. Cooking and refrigeration alone will not kill all spores; other precautions must be taken.

c. There are many bacteria able to produce disease in man. This subcourse will discuss the control of those bacteria causing foodborne disease. Bacteria are the most common cause of foodborne disease.

1-5. VIRUSES

Viruses are microorganisms that are even smaller than bacteria. In fact, they are the smallest and simplest form of life. They can be seen only through a powerful microscope called the electron microscope. Viruses are not able to reproduce on their own; they must enter the cells of a living organism and cause these cells to assist in producing more viruses. Viruses come in a variety of shapes and vary in their resistance to heat and cold.

1-6. PARASITES

Parasites are organisms that live on or in another organism (the **host**). Parasites vary in size. Some are one-celled like bacteria and can be seen only through a microscope while others are multi-celled and can be seen without a microscope. Parasites are a special problem for soldiers stationed overseas in countries which use human fecal matter as a fertilizer.

1-7. REQUIREMENTS FOR BACTERIAL GROWTH

Since bacteria are the most common source of foodborne disease, many of the regulations for food service facilities are designed to prevent or slow bacterial growth. To better understand why a food service facility must follow these regulations, the preventive medicine specialist should know the basics of bacterial growth.

a. Bacteria reproduce simply by dividing in two. Each of the two new cells then divides, and so forth. This type of reproduction leads to an explosive increase in the number of bacteria within a few hours. For example, in just one hour, a single bacteria

cell can produce a thousand new cells and in several hours, billions of new cells. Due to this rapid growth bacteria can contaminate food very quickly.

b**.** In order for bacteria to reproduce and grow, certain requirements must be met. These requirements involve food, pH, temperature, time, oxygen, and moisture. As a preventive medicine specialist, you will be inspecting food service facilities to determine that they are following Army regulations. Most of these regulations involve controlling conditions so that bacteria are not encouraged to grow. Paragraphs 1-8 through 1-13 will discuss each of the requirements for bacterial growth.

1-8. FOOD REQUIREMENTS OF BACTERIA

Like all living organisms, bacteria must have food. Many bacteria consume the same food as humans do and will grow freely in it. This makes a food service facility especially vulnerable to bacterial contamination.

1-9. pH REQUIREMENTS OF BACTERIA

Most bacteria causing foodborne disease grow best in materials that are neither strongly acid nor strongly alkaline.

a. The pH scale is a measurement of how acidic or alkaline a substance is. Most bacteria grow in the middle of the pH scale between a value of pH 6 and pH 8. In fact, most of the bacteria causing foodborne disease will not grow in foods with a pH below 4.5.

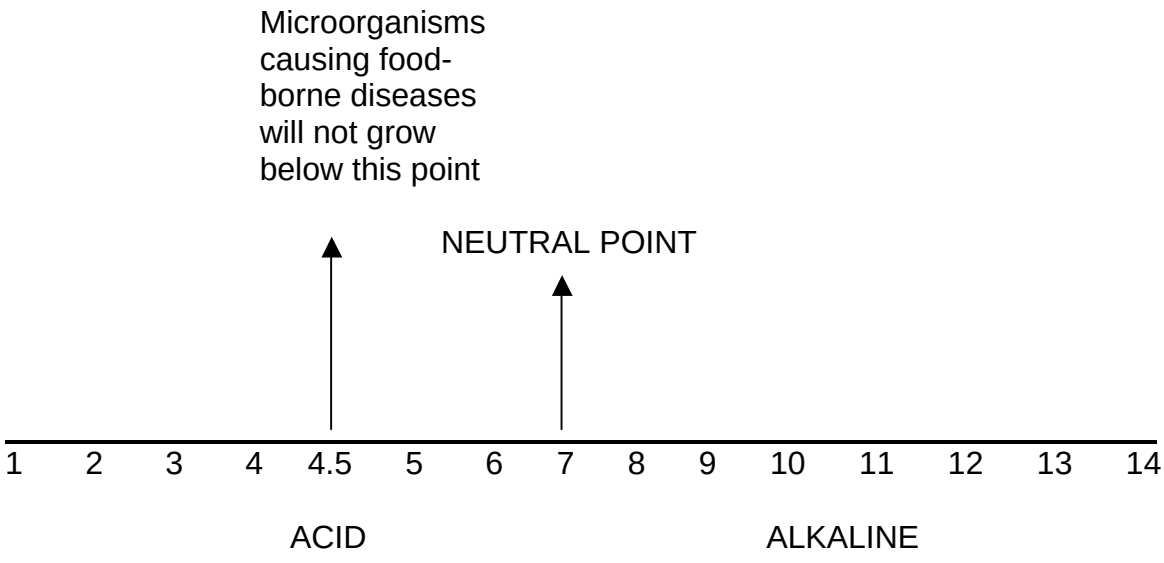


Figure 1-1. The pH scale.

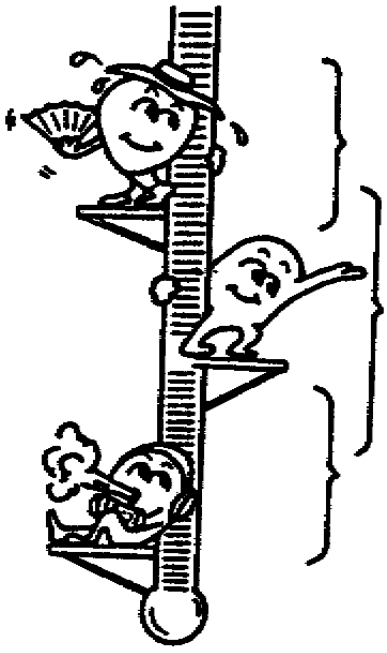
b. How does this relate to the food a person eats? Meat falls in the middle of the pH scale--the area where microorganisms grow freely. Most fruits contain a great deal of acid; most vegetables are alkaline. This makes meats a very likely source of contamination. REMEMBER:

ACID	NEUTRAL	ALKALINE
⇩	⇩	⇩
FRUITS	MEATS	VEGETABLES

1-10. TEMPERATURE REQUIREMENTS OF BACTERIA

a. Bacteria must have a suitable temperature in order to reproduce. Bacterial growth can be controlled by controlling temperature.

b. Bacteria can be divided into three major groups based upon temperature requirements. These three groups are: bacteria that respond to high temperatures; bacteria that respond to moderate temperatures; and bacteria that respond to cool temperatures.



(1) Bacteria that grow best at high temperatures are called **thermophilic** bacteria. They thrive at temperatures of 110°F to 140°F.

(2) Bacteria that grow best at moderate temperatures are termed **mesophilic** bacteria. They thrive at temperatures of 60°F to 110°F.

(3) Bacteria that grow best at cool temperatures are termed **psychrophilic** bacteria. They thrive at temperatures of 32°F to 45°F.

c. In addition to these three major groups, there are other bacteria able to withstand extremely high temperatures. These are called heat-resistant or **thermoduric** bacteria. The spores of thermoduric bacteria can even survive boiling.

d. The bacteria that cause foodborne disease reproduce and grow In the temperature range of 45°F to 140°F. This range is called the **temperature danger zone.** Notice that the danger zone temperatures include normal room temperatures. Bacteria producing foodborne diseases grow rapidly at room temperatures.

e. Knowing how temperature affects bacterial growth is critical in keeping food safe. Generally the dangerous bacteria grow more slowly at lower temperatures. They grow most rapidly at and somewhat above room temperature. When the temperature reaches 140°F, most will die off.

1-11. TIME REQUIREMENTS FOR BACTERIAL GROWTH

a. Given enough time, most bacteria can adjust to different foods, temperatures, or various degrees of acidity.

b. The growth pattern of a bacterial colony can be divided into four distinct phases: the slow phase, the rapid growth phase, the equal phase, and the death phase.

(1) The slow phase occurs when bacteria are introduced into a new environment and must adapt to the new conditions. This adjustment is complete in about 4 hours. The slow phase is also called the **lag phase**.

(2) After the bacteria have adjusted to the new environment, they will grow rapidly, increasing tenfold for every unit of time. This period of accelerated growth is called the rapid growth or **log phase**.

(3) Eventually, the bacteria multiply to such an extent that they begin to compete with each other for food and space. They no longer increase so quickly. Finally the growth of new bacteria equals the death of old bacteria. This period is called the equal or **stationary phase**.

(4) The death phase takes place when more bacteria die than are reproduced. This occurs due to lack of food and the accumulation of waste products. Eventually all the bacteria cells die. The death phase Is also called the **decline phase.** Figure 1-2 shows these phases in graphic form.

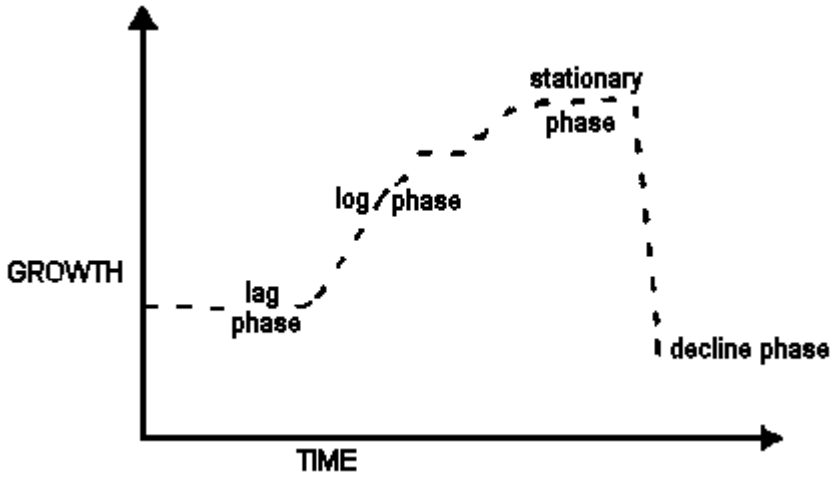


Figure 1-2. The four phases in the life cycle of bacteria.

c. It is obvious that time is important for the growth of harmful bacteria in food. What is especially critical is that it takes only 4 hours for bacteria to adjust to a new environment. Therefore, 3 hours of cumulative time is the maximum amount of time potentially hazardous 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.)

1-12. OXYGEN REQUIREMENTS FOR BACTERIAL GROWTH

a. The oxygen situation also effects bacterial growth. Some bacteria live only in the presence of oxygen; other bacteria live only in its absence. Still others, including many of those that cause foodborne disease, can grow with or without oxygen.

b. The ability of disease-producing bacteria to adjust to different oxygen situations makes them a real threat to a food service facility. Since some bacteria can live in or adjust to an environment without oxygen, they can grow and contaminate foods in sealed containers, such as cans, bottles, and plastic bags or pouches.

1-13. MOISTURE REQUIREMENTS FOR BACTERIAL GROWTH

a. Moisture is a necessity for bacterial growth. Bacteria absorb food through their cell walls. However, their cell walls cannot pass solid food. Bacteria need moisture to break down solid food to the point where they can absorb it. Due to this, bacteria cannot grow well in a material with a moisture content of less than 15 percent.

b. Water activity is the term used to describe the moisture content of food. Water activity values range from 0 to 1. A food that has a water activity value below 0.85 will not support the growth of the bacteria that cause foodborne disease.

c. This fact is extremely important in preventing foodborne illness. It is the principle behind dried foods, such as dried fruits, meats, and milk. However, once the food becomes **wet,** the bacteria can begin to grow and will contaminate the food.

d. The sugar and salt content of a food can affect the water activity. Generally, foods that have a salt content of 15% or more will have a water activity below 0.85; likewise, foods that are 50% to 60% sugar will have a water activity below 0.85. Therefore, very salty and sugary foods will also inhibit bacterial growth.

1-14. BACTERIAL GROWTH AT A FOOD SERVICE FACILITY

The requirements for the growth of bacteria have been discussed separately in paragraphs 1-8 through 1-13. At a real food service facility, however, these conditions often work together to cause dangerous bacterial growth in foods. For example, moist food left out in a warm, damp room for several hours will almost certainly be contaminated. The reverse also applies. Controls on temperature, moisture, time, etc., can greatly reduce the chances of rapid bacterial growth and food contamination. Your duty as an inspector is to ensure that facilities are applying the necessary controls and to be alert to situations favoring bacterial growth.

1-15. POTENTIALLY HAZARDOUS FOOD

a. Potentially hazardous food is food that can support the rapid growth of harmful microorganisms, particularly bacteria. Strictly speaking, when microorganisms occur naturally in or enter a food, the microorganisms have contaminated the food. However, in this subcourse and in many other references, contamination means the situation that occurs when microorganisms grow to dangerous levels in potentially hazardous foods.

b. Not all foods offer the conditions necessary for bacterial growth. Coffee, tea, and dried fruit, with water activities below 0.85, are not hazardous because they do not provide enough moisture for the growth of disease-causing bacteria. Likewise, pastries and candies with a high sugar content (water activity below 0.85) will not support the growth of harmful bacteria.

c. Other foods, termed potentially hazardous foods, support rapid bacterial growth**.** The growth rate may vary depending upon how ideal the environment is. Hamburger, for example, is a potentially hazardous food. Hamburger that has been left out in a warm room for several hours will become contaminated quickly. Refrigerated hamburger will also become contaminated, but much more slowly since cold temperatures decrease bacterial growth.

d. Obviously, food service facilities must take extreme care with potentially hazardous foods as they are the source of most outbreaks of foodborne illness. Many Army regulations for food sanitation are designed to control the conditions under which potentially hazardous foods are stored, prepared, and served.

e. Common potentially hazardous foods are eggs and egg products, milk and milk products, meat, poultry, fish, and shellfish.

1-16. SUMMARY

a. As a preventive medicine specialist, you will be required to inspect a variety of food service facilities. Your most important goal will be to prevent and correct situations that could cause foodborne disease. Since microorganisms are the cause of many foodborne diseases, it is necessary to know some basic information about them.

b. Microorganisms are living plants and animals, which are so small that they can be seen only through a microscope.

c. There are thousands of microorganisms existing everywhere in nature. Most microorganisms are not harmful; some are even beneficial to man.

d. Some microorganisms are capable of producing disease in man. They are termed pathogenic microorganisms and cause a variety of different diseases. This subcourse will deal only with those illnesses caused by consuming food that contains harmful microorganisms or their toxic products.

e. The three types of microorganisms most commonly involved in foodborne disease outbreaks are bacteria, viruses, and parasites. Bacteria present the greatest problem and are the most common cause of foodborne disease.

f. Since bacteria cause most foodborne illnesses, the prevention of these illnesses depends largely on controlling the growth of bacteria.

g. There are six basic requirements for the growth of bacteria. They are:

(1) Food.

(2) Acidity.

(3) Temperature.

(4) Time.

(5) Oxygen.

(6) Moisture.

Controls on bacteria basically involve controlling these requirements and making the environment unfavorable for bacterial growth.

h. At a food service facility, several of the requirements for the growth of bacteria may be present at the same time and create a dangerous situation.

i. Potentially hazardous foods are those foods capable of supporting the rapid growth of harmful microorganisms. Potentially hazardous foods are the source of most outbreaks of foodborne illness. Many Army regulations are concerned with the control of these foods.

Continue with Exercises

EXERCISES, LESSON 1

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the question, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all of these exercises, turn to “Solutions to Exercises" at the end of the lesson, and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. A microorganism is defined as _____
_____.

2. Which of the following statements best describes the effect of microorganisms on mankind?

a. Microorganisms generally do not affect people. They never perform beneficial or helpful activities, and only a few cause disease.

b. Most microorganisms cause disease in man; only a few are beneficial.

c. Most microorganisms are not harmful; some even provide benefits. A few may cause disease.

Exercises 3-5 below are descriptions of microorganisms. Write the name of the correct microorganism in the blank after each description.

3. These are very small, one-celled plants. Typically it would take 25,000 individuals placed side by side to equal one inch. They are the most common cause of foodborne illness. _____

4. These organisms obtain nourishment by living on or in another organism. Some are one-celled; others are multi-celled and can be seen without a microscope. They present a problem in those countries that use human fecal matter as a fertilizer.
_____

5. These are the smallest and simplest type of microorganism and can be seen only through an electron microscope. They must change the structure of a living cell in order to reproduce. _____

6. List the four ways by which microorganisms can occur in food.

   a. _____

   b. _____

   c. _____

   d. _____

Column I contains a list of terms used to describe microorganisms. Column II contains definitions. Match the term in Column I with the correct definition in Column II. You do not need to use every definition (exercises 7-15).

Column I

7. Spore ___
8. Thermophilic bacteria ___
9. pH ___
10. Water activity ___
11. Mesophilic bacteria ___
12. Temperature danger zone ___
13. Psychrophilic bacteria ___
14. Pathogenic microorganisms ___
15. Thermoduric bacteria ___

Column II

a. Bacteria that are able to withstand extremely high temperatures, even boiling.

b. The measurement of the moisture content of food with values of 0 to 1.

b. A stage in the life of certain bacteria, characterized by a thick cell wall.

d. Bacteria that grow best at temperatures of 60°F to 110°F.

e. Clusters of bacteria.

f. The measurement of how acid or alkaline a substance is, with values of 1 to 14.

g. Bacteria that grow best at 110°F to 140°F.

h. Able to produce disease in man.

i. 45°F to 140°F, favorable temperatures for growth of bacteria which cause foodborne diseases.

j. Bacteria that grow best at 32°F to 45°F.

16. Samples were taken of food items prepared at an Army food service activity. Bacteriological studies showed the presence of a bacteria strain capable of forming spores. As an inspector, how would you evaluate this information?

a. The presence of spores is less dangerous than the presence of regular bacteria. Spores can be destroyed easily by heat or refrigeration.

b. The situation is equally dangerous whether the bacteria form spores or not. Both can be killed by the same high temperatures and by refrigeration.

c. Since spores are much more resistant to heat and cold, they are more difficult to destroy than are regular bacteria. Even after thorough cooking, food must be held at safe temperatures to prevent spores from growing.

17. List the six basic requirements for the growth of bacteria.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

Column I contains the names of the four phases in the life cycle of bacteria. Column II contains descriptions of the events that occur in these phases. Match the name of the phase in Column I with the appropriate description in Column II (exercises 18-21).

Column I	Column II
18. Log Phase _____	a. The growth of new bacteria equals the death of old bacteria.
19. Lag Phase _____	b. The bacteria grow slowly as they adjust to a new environment.
20. Stationary Phase _____	c. The bacteria grow rapidly, increasing tenfold for every unit of time.
21. Decline Phase _____	d. More bacteria die than are reproduced.

22. A potentially hazardous food is a food that _____
_____
_____
_____.

Below is a list of foods on a cafeteria serving line at an Army food service facility (exercises 23-30). Indicate whether each food is potentially hazardous or not. Enter "a" in the blank if the food is potentially hazardous and "b" if the food is not potentially hazardous.

23. Baked chicken ___

24. Instant coffee ___

25. Creamed peas ___

26. Sugar ___

27. Egg custard ___

28. Hard, fruit-flavored candy (pH 3.2) ___

29. Thousand Island dressing (pH 4.1) ___

30. Ham salad ___

Exercises 31-34 describe situations at a food service facility. Evaluate each situation based on the requirements for bacterial growth. Enter "favorable" in the blank if the situation would cause rapid bacterial growth. Enter "unfavorable" if the situation would not encourage bacterial growth. Briefly explain the reason for your response.

31. Fresh meat has been left at room temperature (70°F) for more than 5 hours.
_____
_____
_____
_____
_____

32. Packages of dried milk (water activity of 0.80) and dried fruits (water activity of 0.70) are placed in a storage bin with an average temperature of 75°F.

33. Tuna salad has been prepared and then placed in the refrigerator for two hours before being served and eaten.

34. Mixed vegetables were heated to 125°F at 0800 in the morning. They then were sealed into pouches and allowed to cool at room temperature until noon.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 1

1. A plant or animal so small that it can be seen only under a microscope. (para 1-1)
2. c (para 1-2a, b)
3. Bacteria (para 1-4)
4. Parasites (para 1-6)
5. Viruses (para 1-5)
6. a. Microorganisms can occur naturally in food.
   b. They can be introduced during slaughter.
   c. They can be introduced during processing.
   d. They can be introduced during preparation. (para 1-2c)
7. c (para 1-4b)
8. g (para 1-10b(1))
9. f (para 1-9a)
10. b (para 1-13b)
11. d (para 1-10b(2))
12. i (para 1-10d)
13. j (para 1-10b(3))
14. h (para 1-2b)
15. a (para 1-10c)
16. c (para 1-4b)

17. a. Food

    b. pH

    c. Temperature

    d. Time

    e. Oxygen

    f. Moisture (para 1-7b)

18. c (para 1-11b(2))

19. b (para 1-11b(1))

20. a (para 1-11b(3))

21. d (para 1-11b(4))

22. Can support the rapid growth of harmful microorganisms, particularly bacteria. (para 1-15a)

23. a (para 1-15e)

24. b (para 1-15b)

25. a (para 1-15e)

26. b (paras 1-13d; 1-15b)

27. a (para 1-15e)

28. b (para 1-9a; 1-13d; 1-15b)

29. b (para 1-9a)

30. a (para 1-15e)

31. Favorable. Meat has a fairly neutral pH, which encourages bacteria growth. The temperature and the time also encourage bacteria to multiply. (paras 1-9b; 1-10d; 1-11c)

32. Unfavorable. Although these items are stored at room temperature for a long time, they do not have enough moisture to support bacterial growth. (para 1-13b, c, d)

33. Unfavorable. Although tuna has a pH favorable to bacterial growth, the salad was refrigerated after preparation and consumed within two hours. Time and temperature were controlled to prevent bacteria from multiplying. (paras 1-10d, e; 1-11c)

34. Favorable. The cooking temperature of 125° places the vegetables in a temperature range ideal for bacterial growth. In addition, the cooling at room temperature for several hours encourages bacterial growth. Since many bacteria causing foodborne diseases can adjust to an environment without oxygen, sealing the vegetables in a pouch does not guarantee that bacteria will not grow. (paras 1-10d, e; 1-11c; 1-12a, b)

End of Lesson 1

LESSON ASSIGNMENT

LESSON 2	Common Foodborne Diseases.
TEXT ASSIGNMENT	Paragraphs 2-1 through 2-13.
LESSON OBJECTIVE	After completing this lesson, you should be able to:

2-1. List the three major types of foodborne diseases.

2-2. Identify the difference between a foodborne infection and a foodborne intoxication.

2-3. Identify the agents which cause common foodborne diseases.

2-4. Identify common plants, animals, and chemicals involved in foodborne poisonings.

2-5. Identify from descriptions of foodborne disease outbreaks, the specific diseases involved, the reasons for the disease outbreaks, and preventive measures that could have been taken.

SUGGEST ION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 2

COMMON FOODBORNE DISEASES

Section I. GENERAL INFORMATION

2-1. INTRODUCTION

In Lesson 1, you learned some basic facts about microorganisms and their requirements for growth. These facts serve as the basis for controls against foodborne disease. Now you will learn about the diseases that these controls are designed to prevent. Lesson 2 will discuss common foodborne diseases, the microorganisms causing each disease, and the foods involved in disease transmission. This lesson will also provide you with information on poisonous plants and chemicals that can result in foodborne illness. To effectively carry out the duties of an preventive medicine specialist, you must have basic knowledge of these diseases. This knowledge is critical in various ways. When you participate in an investigation of a foodborne disease outbreak, when you explain corrective measures to food service personnel, when you perform inspections, or when you discuss problems with your supervisor, you must draw upon your knowledge of foodborne diseases and their causes.

2-2. TYPES OF FOODBORNE DISEASE

There are three major types of foodborne illness. These are:

a. Foodborne infections.

b. Foodborne intoxications.

c. Poisoning due to toxic plants, animals, and chemicals.

NOTE: These types are discussed in Sections II, lII, and IV of this lesson.

Section II. FOODBORNE INFECTIONS

2-3. GENERAL

a. Foodborne infections occur when harmful microorganisms present in food have the opportunity to grow and multiply. In order to produce an infection, the microorganisms must encounter conditions that allow them to multiply to large numbers before the food is eaten. In the case of foodborne infections, large numbers of microorganisms enter a person's body and cause the disease. This differs from other

situations where the disease results from poisonous products produced by the microorganisms (refer to Section III).

b. There are three basic varieties of foodborne infections:

(1) Those caused by bacteria.

(2) Those caused by viruses.

(3) Those caused by parasites.

2-4. FOODBORNE INFECTIONS CAUSED BY BACTERIA

a. There are many infections caused by bacterial contamination of food. This subcourse discusses only the most common infections: salmonellosis and shigellosis.

b. Salmonellosis.

(1) Salmonellosis is an infection caused by bacteria of the salmonella family. There are more than 1,200 different varieties of salmonella. Salmonella can contaminate food at any time from the handling or processing stage until it is served to the consumer.

(2) A wide variety of foods may contain salmonella bacteria, including poultry products, meat and meat products, eggs and egg products, shellfish, and unpasteurized milk and dairy products. In particular, poultry products are a source of salmonella. Even infected persons who show no outward signs of the disease (carriers) can contaminate food.

(3) It is difficult for a food service facility to eliminate salmonella completely. However, certain basic countermeasures can be taken. Employees should observe strict personal hygiene, particularly hard-washing practices. This is done to prevent fecal contamination. Food preparation procedures should avoid cross-contamination as much as possible, particularly in the preparation of poultry. For example, the same utensils should not be used on raw poultry and cooked foods. Foods should come from reliable sources, and milk and milk products should be pasteurized. Finally, all foods should be cooked for an adequate time and at an adequate temperature and then chilled quickly. There are a wide variety of salmonella symptoms. The more common ones are fever, abdominal pain, diarrhea, frequent vomiting, and chills. Although salmonellosis is rarely fatal, it is a special hazard to those who are in poor physical condition, to the very young, or to the aged.

c. Shigellosis (bacillary dysentery). Shigellosis or bacillary dysentery is caused by bacteria of the shigella family. Shigella tend to contaminate moist prepared foods, such as ham and egg salad and milk or dairy products. Usually the food has been contaminated by the feces of an infected person. Rodents, roaches, flies, and other

insects may also contaminate foods with shigella bacteria. Outbreaks of shigellosis in a food service facility indicate a breakdown in personal hygiene and food protection. Strict hand-washing, personal cleanliness, and waste burial are the best protection from shigellosis. In addition, insects and rodents should be controlled as much as possible. Symptoms consist of diarrhea and cramps, accompanied by fever and vomiting. They usually develop 2 to 3 days after consuming the food containing the bacteria.

2-5. FOODBORNE INFECTIONS CAUSED BY VIRUSES

a. At one time, viruses were not regarded as being a cause of foodborne disease. Now it is known that this is not true. Infectious hepatitis is a serious foodborne disease caused by a virus. Infectious hepatitis may occur after eating shellfish, especially raw oysters and clams; the shellfish are taken from water contaminated by sewage and human fecal matter. Symptoms of hepatitis include extreme fatigue, nausea, fever, and abdominal discomfort. In addition, some people develop jaundice (a yellowish coloring of the skin).

b. Foods such as milk and potato salad may contain other viruses causing foodborne diseases. In these cases, a person who has had the disease or contaminated water is usually the source of the virus. Cooking shellfish, pasteurizing milk, using safe water supplies, and practicing safe food handling techniques will control these viral infections.

2-6. FOODBORNE INFECTIONS CAUSED BY PARASITES

a. Outbreaks of foodborne infections due to parasites are not common in the United States. However, persons returning from foreign countries may bring parasites with them. There are many diseases caused by parasites. This lesson will discuss amoebiasis (amoebic dysentery), a common parasitic disease that may concern a preventive medicine specialist.

b. Amoebiasis occurs when moist, high protein foods, such as meat, eggs, poultry, milk, and milk products, are contaminated with human feces from infected persons. Water contaminated with sewage is also frequently involved. The major symptom of amoebic dysentery is diarrhea of varying severity. The symptoms will usually develop within a few days but may take several weeks or months to appear. Occasionally, amoebic dysentery is a fatal disease.

Section III. FOODBORNE INTOXICATIONS

2-7. GENERAL

a. Foodborne intoxication occurs when certain microorganisms grow in foods and produce chemicals that are **toxic** (poisonous) to the person eating the food. In

other words, unlike a foodborne infection, a foodborne Intoxication results from a poison **(toxin)** and not from the microorganism itself. The toxins do not change the appearance or flavor of the food. Due to this, persons consuming the food are not aware that they are eating something that can make them extremely ill. Some toxins can be easily destroyed; others are difficult to destroy or to inactivate. 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.

b. There are three important foodborne intoxications:

(1) Those due to the toxin of staphylococcal bacteria.

(2) Those due to the toxin of Clostridium botulinum.

(3) Those due to the toxin of Clostridium perfrlngens.

2-8. STAPHYLOCOCCAL FOOD INTOXICATION

a. Outbreaks of foodborne illness are often caused by the toxin of a group of bacteria called staphylococci. Most people are carriers of staphylococci, which are natural inhabitants of our bodies and are found most frequently in the nose and on the skin. Outbreaks of staphylococcal foodborne illness can be traced to food service workers with nasal discharges, skin infections, or infected cuts or boils.

b. The foods commonly involved are cooked ham and other meats, and cream-filled or custard-filled pastries. Salad-type foods, such as potato salad, ham salad, etc., and foods with a high protein content are also associated with staphylococcal food intoxication.

c. The toxins produced by staphylococci can not be destroyed by normal cooking temperature and time.

d. Persons made ill from eating food containing staphylococcal toxins will usually become ill 1 to 6 hours after eating. They will experience nausea, vomiting, diarrhea, and abdominal cramps. Frequently, they will be so ill that they will be confined to bed or even hospitalized. Although people usually recover from this illness, death does sometimes occur. Persons In poor physical condition, the young, and the elderly are at greater risk.

2-9. FOODBORNE INTOXICATION DUE TO CLOSTRIDIUM BOTULINUM (BOTULISM)

a. A toxin produced by the bacterium Clostridium botulinum causes an extremely serious illness commonly called botulism.

b. Clostridium botulinum is able to grow in an environment without oxygen. Due to this, botulism is frequently associated with underprocessed, alkaline, canned foods. In particular, home-canned foods, such as green beans and corn, are involved in outbreaks of botulism. However, commercial and other types of foods, even pickles, can also contain the bacteria producing the deadly toxin. For this reason, food service personnel must be careful when using canned products and reject cans that are damaged, such as those with bulging ends, deep rust pits, and seams that are open.

c. The toxin is extremely poisonous but fortunately can be destroyed by heat. For this reason home-canned, alkaline foods, such as vegetables, should not be tasted before they have been heated to the boiling point. If the toxin is not destroyed by heat, even a small taste can be fatal.

d. Persons suffering from botulism usually become ill within 12 to 36 hours. They experience dizziness, double vision, and muscular weakness, as well as difficulty in swallowing, speaking, and breathing. Although there have been great advances in the treatment of botulism in recent years, it still can be a fatal disease.

2-10. FOODBORNE INTOXICATION DUE TO CLOSTRIDIUM PERFRINGENS

a. The bacterium Clostridium perfringens is frequently associated with outbreaks of foodborne disease. It belongs to the same bacterial category as the botulism organism but does not cause nearly so severe an illness. Clostridium perfringens is a normal inhabitant of the intestinal tract of man and is present in soil, nonpotable water, and unprocessed foods.

b. Most of the outbreaks caused by Clostridium perfringens have been linked to cold, cooked, or reheated meat, stews, or meat pies. These dishes are frequently prepared from leftover foods that have remained unrefrigerated for long periods of time. This provides most of the conditions necessary for bacterial growth. In addition, some strains of Clostridium perfringens are heat-resistant and are extremely difficult to kill by cooking. For this reason, it is necessary to never leave foods unrefrigerated and to take precautions when reheating. If leftovers have been unrefrigerated, they should be discarded.

c. The foodborne illness produced by Clostridium perfringens is caused by a toxin. However, unlike the botulism organism, Clostridium perfringens must be taken into the body for the toxin to be produced. In this way, it resembles the organisms causing a foodborne infection.

d. People with foodborne intoxication due to Clostridium perfringens usually become ill within 8 to 22 hours after eating. They will suffer acute abdominal pain, diarrhea, nausea, and vomiting.

Section IV. THE POISON PROBLEM

2-11. POISONOUS PLANTS AND ANIMALS

a. Certain plants and animals are poisonous and should not be used as food.

b. Plants and animals may be naturally toxic to man. There are hundreds of poisonous plants, including common ones such as certain mushrooms, toadstools, water hemlock, jimson weed, and the castor bean plant. Of particular importance is the mushroom. Poisonous and nonpoisonous mushrooms look alike, so much so that only a trained person can tell the difference. Some clams, mussels, and tropical fish are poisonous and have caused outbreaks of foodborne illness. Examining these poisonous animals for appearance, odor, and discoloration does not clearly indicate whether they are toxic or not. Most animal toxins are resistant to heat and cannot be destroyed by normal cooking temperatures.

c. The tissues of other animals may be naturally safe for man. However, certain circumstances may cause them to become contaminated with poisonous substances and make them toxic if consumed. Some fish, for example, may become poisonous at certain times of the year; other fish and shellfish may be contaminated by polluted waters and are toxic to man if eaten.

d. Illness caused by these toxic foods may occur within a few minutes after their consumption and is often fatal. Cooking the food usually does not destroy the poison in the food that causes the illness. The best way to avoid accidentally eating a poisonous plant or animal is to use approved food sources.

2-12. CHEMICAL POISONING

a. Chemicals are everywhere in our environment. There is always the danger of consuming chemicals with food. Without adequate controls, there would be many more outbreaks of foodborne illness due to chemicals.

b. Chemicals containing toxic metals such as cadmium, zinc (galvanized), antimony, copper, and lead have caused poisonings. All of these metals may dissolve in certain types of acid foods such as fruit punch drinks, and produce a toxic or poisonous substance. When the beverage is consumed, the persons consuming it become ill within minutes.

c. Many of the chemicals used in cleaning and sanitizing solutions are toxic and must be handled so they are not introduced into food.

d. Chemicals used to control insects and rodents are, by their very mature, 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 pesticides is an important part

of food protection. Great quantities and varieties of pesticides are used on crops during production of food supplies. The use of these pesticides is rigidly controlled. Any residue that remains on food should be removed by washing, trimming, and peeling during preparation.

2-13. SUMMARY

a. The preventive medicine specialist must know the common foodborne diseases, their cause, and what foods transmit them in order to perform his duties at a food service facility.

b. There are three major types of foodborne disease:

(1) Foodborne infections.

(2) Foodborne intoxications.

(3) Poisoning from plants, animals, and chemicals.

c. Foodborne infections occur when a person eats food that is contaminated with disease-producing microorganisms. In the case of infections, the microorganisms themselves produce the disease after entering the body. Foodborne infections fall into three categories:

(1) Those caused by bacteria.

(2) Those caused by viruses.

(3) Those caused by parasites.

d. The common foodborne infections that you will most likely deal with as an preventive medicine specialist are:

(1) Salmonellosis, caused by bacteria of the salmonella group.

(2) Shigellosis, caused by bacteria of the shigella group.

(3) Viral infections, especially infectious hepatitis.

(4) Infections caused by parasites, especially amoebiasis.

e. Foodborne intoxications, unlike foodborne infections, are caused by toxins released by microorganisms and not by the microorganisms themselves. The toxins do not change the appearance or taste of the food and a person eating a contaminated food is not aware that he is in danger of becoming ill. The common foodborne intoxications are:

(1) Staphylococcal food intoxication, caused by toxins produced by staphylococci.

(2) Botulism, caused by the toxin produced by Clostridium botulinum. This is an extremely serious, even fatal illness.

(3) Intoxication due to Clostridium perfringens. This illness has characteristics of both an infection and an intoxication. The bacteria must enter a person's body in order to produce the toxin.

f. Foods may also contain poisonous substances that can cause severe foodborne illness. Cases of poisoning can come from a poisonous plant or animal; from a poison introduced into the plant or animal; or from poisonous chemicals, such as those used in cleaning solutions; in pesticides; and in certain metallic containers.

Continue with Exercises

EXERCISES, LESSON 2

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson. For each exercise answered incorrectly, reread the material referenced with the solution.

1. List the three major types of foodborne disease.

   a. _____

   b. _____

   c. _____

2. How does a foodborne infection differ from a foodborne intoxication?

FOR EXERCISES 3-8. Write the name of the agent that is the cause of the foodborne disease in the blank space provided. Choose from among the following agents:

Bacteria
Virus
Parasite
Bacterial toxin

3. Salmonellosis _____

4. Botulism _____

5. Infectious hepatitis _____

6. Shigellosis _____

7. Amoebiasis _____

8. Staphylococcal foodborne illness _____

9. The microorganism involved in outbreaks of botulism is named _____.

10. Why does the foodborne illness caused by Clostridium perfringens have characteristics of both a foodborne infection and a foodborne intoxication?

11. A plant that is especially important in causing foodborne illness is _____; animals commonly involved in foodborne poisoning are _____.

12. List three groups of chemicals commonly involved in cases of poisoning.

a. _____

b. _____

c. _____

13. Personnel at a food service facility are using commercial canned vegetables. You observe an employee open a can with bulges on each end. Would you rate this as acceptable or nonacceptable? Give a brief explanation for your judgment.

14. You observe food preparation procedures at an Army food service facility and notice that employees are preparing a meat stew from leftovers that have remained unrefrigerated overnight. When questioned, employees respond that a high temperature will be used to cook the stew and kill any microorganisms. You rate this as unacceptable. You then discuss the problem with the supervisor.

a. You would caution the supervisor that there is a risk of foodborne illness. What disease is most likely to occur?

b. What specific food preparation practice in this situation would encourage an outbreak of the disease?

c. Why would high cooking temperatures not prevent this disease?

d. What corrective measures would you suggest?

15. Chicken salad was prepared at a food service facility for a large dinner. Personnel cut up the raw chicken and baked it. The baked chicken was removed from the oven and further cut into small pieces. It was left to cool at room temperature for the morning and then refrigerated. During the chicken preparation, personnel were in a hurry and frequently borrowed utensils from each other. As a result, the same utensils were used for the raw and baked chicken. Some of the guests at the buffet became ill 6 to 48 hours after eating the chicken. They suffered headaches, followed by abdominal cramps, diarrhea, vomiting, and fever. A few of the guests had to be hospitalized.

a. What disease was most likely involved in this outbreak?

b. Two basic precautions were ignored in the preparation of the chicken. The two violated precautions were:

(1) _____

(2) _____

16. An employee working at an Army food service facility has a skin infection on his face. While preparing a ham salad, the employee repeatedly fingers and scrapes at his face and then touches the pieces of ham. Two to six hours later, many of the soldiers eating the ham dish become ill with violent nausea, diarrhea, and abdominal pain.

a. What disease did the soldiers most likely have?

b. How was the food contaminated?

c. What would you advise as a preventive measure to avoid further outbreaks?

17. Cooks at a small Army field installation in a foreign country use fish bought on local markets. These markets are not always officially approved sources of food. When questioned about the possibility of using poisonous fish, the cooks state that animal poisons are sensitive to heat and can easily be destroyed by cooking. As an inspector, would you accept this explanation? Why or why not?

18. A party was given for soldiers who had successfully completed an advanced course. The food service facility was charged with providing drinks and refreshments. Food service personnel prepared a large quantity of lemonade and placed it in a container with a lead glaze.

a. What illness could be caused by this method of serving lemonade?

b. Why would this serving method cause the illness?

c. What would you suggest to prevent this illness from recurring?

19. An outbreak of shigellosis occurred during a 10-day march across desert terrain in a foreign combat area. Which of the following factors would <u>most likely</u> have been the immediate cause of the outbreak?

a. The use of locally-produced cooking ware which was glazed with antimony.

b. The use of local food which was heavily sprayed with pesticide.

c. The use of food in cans. Even though the food was protected by the cans, it would become contaminated in the desert heat.

d. The inadequate burial of human waste and inadequate pest control.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 2

1. a. Foodborne infections.

   b. Foodborne intoxications.

   c. Poisoning due to plants, animals, and chemicals. (para 2-2)

2. A foodborne infection is caused by the microorganism itself; a foodborne intoxication is caused by a poisonous substance (toxin) produced by the microorganisms. (paras 2-3a; 2-7a)

3. Bacteria. (para 2-4b(1))

4. Bacterial toxin. (para 2-9a)

5. Virus. (para 2-5)

6. Bacteria. (para 2-4c)

7. Parasite. (para 2-6a)

8. Bacterial toxin. (para 2-8a)

9. Clostridium botulinum. (para 2-9a)

10. Like an intoxication, the illness due to C. perfringens results from a toxin. As with an infection, the organism C. perfringens must enter the body to produce the toxin. (para 2-10c)

11. The mushroom; clams, mussels, tropical fish. (para 2-11b)

12. a. Chemicals containing toxic metals. (para 2-12b)

    b. Cleaning and sanitizing solutions. (para 2-12c)

    c. Chemicals to control rodents and insects. (para 2-12d)

13. Nonacceptable. A can with bulging ends may contain the deadly toxin that causes botulism. The bacterium causing botulism, Clostridium botulinum, grows in sealed, airtight containers. (para 2-9b)

14. a. Clostridium perfringens intoxication.

b. The use of unrefrigerated leftovers.

c. Sorne strains of Clostridium perfringens are heat-resistant and are not destroyed by high cooking temperatures.

d. All leftovers should be refrigerated; any unrefrigerated leftovers should be discarded. (para 2-10b)

15. a. Salmonellosis.

b. 1. Avoid cross-contamination, especially in preparation of poultry. In this case, using the same utensils on both raw and cooked poultry probably spread the salmonella bacteria.

2. Chill foods quickly. In this case, the prepared chicken was left to cool at room temperature. This provided ideal conditions for bacterial growth. (para 2-4b(3))

16. a. Staphylococcal food intoxication.

b. The employee touched his infected face, which probably contained staphylococcal bacteria, and then touched the food. By doing this, he spread staphylococcal bacteria from his face to the food.

c. Do not allow employees with skin infections, infected cuts, or nasal discharges to handle food. (para 2-8a, b)

17. No. In fact, most animal toxins are heat-resistant and are not destroyed by cooking temperatures. (para 2-11b)

18. a. Lead poisoning.

b. An acid drink, lemonade, was served in a container with a lead glaze. The acid in the lemonade dissolved the lead. The soldiers then drank lemonade containing lead and became ill with lead poisoning. (para 2-12b)

c. Never put acidic drinks or foods into serving dishes containing toxic metals. (para 2-12b)

19. d. (para 2-4c)

End of Lesson 2

LESSON ASSIGNMENT

LESSON 3 Food Sanitation in the Field.

TEXT ASSIGNMENT Paragraphs 3-1 through 3-10.

LESSON OBJECTIVE After completing this lesson, you should be able to:

3-1. Identify the significance of foodborne illness in combat.

3-2. Identify the reasons for foodborne disease outbreaks among combat troops described in examples.

3-3. Identify whether various descriptions apply to field or full-service operations.

3-4. Identify the purpose of food service in the field.

3-5. Identify the limitations on providing food to soldiers in the field.

3-6. Identify the three practices that cause foodborne illness among combat troops and the dangers associated with each practice.

3-7. Identify the three preventive countermeasures against foodborne illness in combat.

3-8. Identify the preventive countermeasures that have been violated in descriptions of foodborne illnesses among combat troops.

3-9. Identify the major problems involved in obtaining safe foods in the field.

3-10. Identify the authority responsible for approving foods obtained in a high-risk area in the field.

3-11. Identify the three methods of disinfecting foods in the field.

SUGGESTION

After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you achieve the lesson objectives.

LESSON 3

FOOD SANITATION IN THE FIELD

3-1. INTRODUCTION

Lessons 1 and 2 discussed how microbes contaminate food and the foodborne diseases that commonly result from contamination. This lesson will discuss food sanitation in the field. In combat, perhaps more than in any other situation, it is critical to avoid disease. The preventive medicine specialist must be aware that disease is in fact an enemy and like weapons can cause casualties and loss. Since soldiers obviously must eat and drink during combat, foodborne illness is a constant threat. The preventive medicine specialist must know the ways by which soldiers contract foodborne diseases during combat and ensure that troops are following simple but effective countermeasures.

3-2. HISTORICAL EXAMPLES OF FOODBORNE ILLNESS IN THE FIELD

a. A history of military campaigns clearly shows that foodborne illness can reach serious proportions and weaken the effectiveness of combat soldiers. Some examples will illustrate the effect of foodborne disease upon combat troops.

b. During World War II, in late 1942 and 1943, American troops were sent to countries in North Africa and the Middle East, a large area of combat known as the Mediterranean Theater. The countries in this area generally showed a lack of sanitary facilities and practices. In addition, there was a water shortage and a constant fly control problem. The troops came into this area directly from the United States and had practically no field experience and little knowledge of sanitary procedures in a field situation, including the need for waste and pest control. The outbreak of intestinal disease among troops was dramatic. During June 1943, intestinal disease attacked about 4% of the troops. This meant that during this one month, some 15,000 men or the troops equivalent to one division were hospitalized. During the entire war, the troops in these countries were never more than 6% of the total number of American troops engaged in the war; yet this 6% provided at least 20% of all intestinal disease victims. As the campaign progressed, troops learned through hard experience to practice sanitary discipline, and the rate of intestinal illness among seasoned troops declined. In contrast, new soldiers coming into the Mediterranean Theater experienced high rates of intestinal disease outbreaks until they learned the necessity of following sanitary practices.

c. Another example is the experience of a United States Army airborne brigade during the three-month occupation of Lebanon in the warm months of 1958. At the beginning of the occupation, troops used only C rations and were confined to olive groves away from the civilian population. The term C rations refers to special rations that have been exposed to a limited amount of handling and have been packaged to

prevent the growth of microorganisms in potentially hazardous foods. Their purpose is to provide food that is protected from contamination until consumed by the individual soldier. No diarrhea or intestinal diseases appeared during the early phase of the occupation, even though field sanitation facilities and practices left much to be desired. Later, B rations were introduced. B rations are prepared with kitchen facilities and can become contaminated more readily than can C rations. In addition, troops were allowed to visit civilian areas where many ate local foods and drank local beverages. Intestinal disease soon became a problem. The incidence increased until as many as 85 men per 1,000 were reporting weekly to dispensaries for intestinal disease symptoms. In addition, stool specimens from 2,200 apparently healthy soldiers were obtained in Lebanon; 85 were found to be positive for Shigella contracted In Lebanon.

d. These are two examples of how diseases associated with food weakened the strength of American field troops. Many other examples exist, dating back to Biblical times. There are some basic lessons to be learned from these experiences. These lessons can be summarized in three simple but highly effective countermeasures that will greatly reduce foodborne illness among soldiers in combat. These countermeasures are:

(1) Bury food waste.

(2) Avoid local vendors.

(3) Make sure potentially hazardous foods are kept at safe temperatures.

e. Lesson 3 will discuss food sanitation in field situations and will focus on these three basic countermeasures.

3-3. FIELD AND FULL-SERVICE FOOD FACILITIES

a. The primary goal of field food service operations is to feed soldiers in the immediate area of combat, especially those soldiers at the forward edge of the battle or who are engaged in military operations outside of food supply lines. Food service operations in combat will have very limited or no kitchen and refrigeration capabilities. These operations contrast with full-service facilities that have cooking and refrigeration equipment as well as trained food service personnel.

b. However, the field includes more than the front lines; for example, supply and communication operations are carried on in the field behind the front. Further back in the field, full-service facilities or facilities with similar or partial services may occur. For example, a field food service facility may have a kitchen but not complete refrigeration equipment or the equipment used may be simpler than that found at a large full-service facility.

c. In summary, the full-service type of food facility can exist both in certain areas of the field and in garrison. Field food service operations are designed for soldiers at the front in the area of enemy engagement.

3-4. FOOD SERVICE IN THE FIELD

a. The basic goal of food service in the field is to supply soldiers with sufficient and safe nutrition so they can accomplish their mission.

b. Supplying food in a field situation can present difficulties. An actual combat situation is often chaotic and changeable. Since soldiers are mobile and do not always stay in the same place for any length of time, neither a soldier nor his unit can be weighed down with bulky equipment. For this reason there are two major limitations on food service in the field.

(1) First, there is little time or space for cooking and other food preparation procedures.

(2) Second, there is little time or space for the safeguards, such as refrigeration, that must be taken when potentially hazardous foods are prepared. This is a critical problem since, as you have learned, one of the most serious health threats from food is the growth of disease-causing microbes in potentially hazardous foods.

c. How then is the soldier in the field to receive adequate and nutritious meals that are safeguarded from contamination? The answer is to provide food in a form that is ready-to-eat and that limits the danger from contamination as much as possible. Specifically, potentially hazardous foods are provided in forms that greatly reduce the growth of microbes. Examples are preheated foods placed in airtight cans or pouches or foods in a state of **dehydration** (without moisture). Figure 3-1 shows examples of meals prepared for soldiers to use in a combat situation.

3-5. DANGER OF FOODBORNE ILLNESS IN COMBAT

a. Meals used in the field are designed to limit the contamination of potentially hazardous food. This, however, does not mean that there is no danger from foodborne illness. Two practices present the greatest danger at the front. These are the practices of not burying food waste and buying foods from local vendors. In addition, on those occasions when hot or cold foods are brought up to the front, there is the risk that these foods will not remain sufficiently hot or cold and will enter the temperature range where the microbes causing foodborne illness grow best.

b. The preventive countermeasures against foodborne illness in combat are essentially to avoid the three dangerous practices described above. Each soldier must be sure to BURY FOOD WASTE and NOT BUY FOOD ITEMS FROM LOCAL

VENDORS. In addition, personnel must be sure to KEEP PREPARED FOODS SERVED TO SOLDIERS IN COMBAT AT SAFE TEMPERATURES. These preventive countermeasures will be discussed in paragraphs 3-6 through 3-8.

3-6. BURY FOOD WASTE

It is critical that soldiers in the field bury their food waste. Food waste that is left out wiII attract flies, insects, rodents, and other pests: flies and pests often carry the microbes causing diseases that could seriously undermine the strength of a fighting force. Burying food waste is a primary means of pest control at the front. As a preventive medicine specialist, you must ensure that combat soldiers carry out this simple countermeasure against disease. The experience of the American soldiers in the countries of North Africa and the Middle East during World War II shows what can happen when this important precaution is ignored.

3-7. AVOID BUYING FOOD ITEMS FROM LOCAL VENDORS

Again, this is a simple but effective countermeasure against foodborne illness. Food and beverages obtained from local markets are uncontrolled with respect to sanitary processing and handling. Contamination can occur due to a variety of reasons: flies and other pests could contact the food; the vendors may not practice good personal hygiene; the food could have been left in the temperature danger zone for too long. In some countries, food can be infested with parasites. Soldiers in the field who eat local food items run a high risk of contracting foodborne illness. When inspecting combat areas, you must check to determine that troops are not consuming local foods and beverages. The danger involved in consuming local food items is a lesson learned from the intestinal disease outbreaks among the American troops occupying Lebanon in 1958 (para 3-2c). You will remember that eating food from the civilian areas was one of the main reasons why the American soldiers in Lebanon became ill.

3-8. KEEP PREPARED FOODS AT SAFE TEMPERATURES

a. There wiII be times when prepared food has to be transported long distances. When this occurs, maintaining the food at a safe temperature is critical in preventing foodborne illness. Safe temperature means the temperature ranges that discourage rapid bacterial growth, that is, 140° F and above or 45° F and below.

Menu #1 Pork with rice in barbeque sauce Applesauce Jelly Crackers Cocoa beverage powder Beverage base, powdered Accessory packet, C Spoon	Menu #2 Corned beef hash Freeze-dehydrated fruit Jelly Crackers Oatmeal cookie bar Cocoa beverage powder Beverage base, powdered Accessory packet, B Spoon
Menu #3 Chicken stew Freeze-dehydrated fruit Peanut butter Crackers Cocoa beverage powder Beverage base, powdered Accessory packet, C Spoon	Menu #4 Omelet with ham Potatoes au gratin Cheese spread Crackers Oatmeal cookie bar Cocoa beverage powder Beverage base, powdered Accessory packet, B Spoon
Menu #5 Spaghetti with meat and sauce Maple nut cake Cheese spread Crackers Beverage base, powdered Accessory packet, A Spoon	Menu #6 Chicken a Ia king Freeze-dehydrated fruit Peanut butter Crackers Cocoa beverage powder Beverage base, powdered Accessory packet, C Spoon
Menu #7 Beef Stew Cherry nut cake Peanut butter Crackers Beverage base, powdered Accessory packet, A. Spoon	Menu #8 ham slice Potatoes au gratin Brownie, chocolate covered Jelly Crackers Cocoa beverage powder Beverage base, powdered Accessory packet, A Spoon
Menu #9 Meatballs. beef and rice, in spicy tomato sauce Freeze-dehydrated fruit Peanut butter Crackers Cookie, chocolate covered Beverage base, powdered Accessory packet, A Spoon	Menu #10 Tuna with noodles Chocolate nut cake Cheese spread Crackers Beverage base, powdered Accessory packet, B Spoon
Menu #11 Chicken and rice Freeze-dehydrated fruit Cheese spread Crackers Cookie, chocolate covered Beverage base, powdered Accessory packet, C Spoon	Menu #12 Escalloped potatoes with ham Applesauce Brownie, chocolate covered Jelly Crackers Cocoa beverage powder Beverage base, powdered Accessory packet, A Spoon

Figure 3-1. Sample menus of ready-to-eat meals for combat soldiers

b. Given the often changing situation at the forward edge of the battle, maintaining food at safe temperatures may seem difficult. However, insulated containers exist that make it possible to transport potentially hazardous foods safely. Correct use of these insulated containers will help maintain safe temperatures. It is your responsibility as a preventive medicine specialist to be sure that insulated containers are used to transport prepared food and that they are used correctly. Figure 3-2 shows a typical insulated container used to transport food.

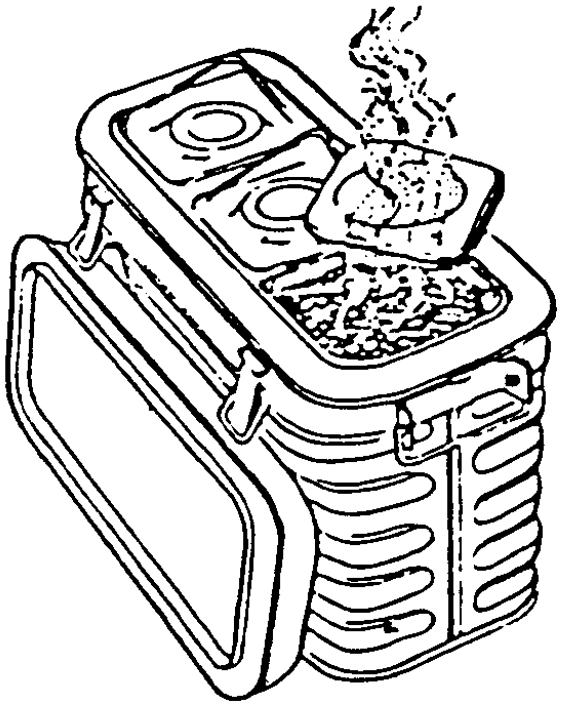


Figure 3-2. An insulated food container.

c. Observe personnel when they are preparing hot foods to be transported to the front. Personnel must use the insulated container correctly for the foods to remain at 140° F or above for an adequate length of time. Basically, the preparation of the container for hot foods involves preheating the container with boiling water. If the container is properly prepared, the food will remain sufficiently hot for 3 to 4 hours. Figure 3-3 illustrates the correct method of preparing the insulated container for hot foods.

- **REMOVE THE INSERTS.**
- **POUR 2 QUARTS OF BOILING WATER INTO THE CONTAINER.**
- **CLOSE AND LET THE CONTAINER STAND FOR AT LEAST 30 MINUTES; THEN POUR OUT THE WATER.**
- **CHECK THAT THE FOOD IS 14O° F OR ABOVE.**
- **PLACE THE HOT FOOD INTO THE INSERTS AND PLACE THE INSERTS INTO THE CONTAINER.**
- **CLOSE AND FASTEN THE CONTAINER LID BY SECURING THE LATCHES DIAGONALLY.**

Figure 3-3. Preheating the insulated container.

d. Insulated containers may also be used to keep foods chilled to 45° F or below. As is the case with hot foods, the insulated container must be properly prepared to obtain the desired degree of cooling. The preparation of the container for chilled foods basically involves prechilling the container with crushed ice or ice water. Also, as with hot foods, a properly prepared container will keep food sufficiently cold for 3 to 4 hours. Figure 3-4 illustrates the correct method of preparing the insulated container for chilled foods.

- **REMOVE THE INSERTS.**
- **PUT CRUSHED ICE OR 2 QUARTS OF ICE WATER IN THE CONTAINER.**
- **CLOSE THE CONTAINER AND LET IT STAND FOR 30 MINUTES.**
- **DUMP THE ICE FROM THE CONTAINER.**
- **CHECK THAT THE FOOD IS 45° F OR BELOW.**
- **PLACE THE COLD FOOD INTO THE INSERTS AND PLACE THE INSERTS INTO THE CONTAINER.**
- **CLOSE AND FASTEN THE CONTAINER LID.**

Figure 3-4. Prechilling the insulated food container.

e. When performing an inspection, be sure that the containers are properly preheated or prechilled and that the foods are sufficiently hot or chilled when placed into the container. This is to ensure that safe temperatures are maintained as long as possible. If safe temperatures are not maintained, the food could enter the temperature danger zone with the risk of rapid bacterial growth and serious foodborne illness among troops.

3-9. PROBLEMS OF OBTAINING SAFE SUPPLIES IN THE FIELD

a. For those food service facilities in the field involved in preparing potentially hazardous foods, obtaining safe food supplies is a special problem. Inspected food supplies may not always be available. Foods procured locally may be heavily contaminated. In areas where human excreta are used as a fertilizer or where gastrointestinal and parasitic diseases exist, the risk of foodborne disease is especially high. In this case, raw fruits and vegetables must be approved for use by the medical authority. When approved for use, this produce must be washed in potable water and then thoroughly disinfected.

b. Hot water, a food service disinfectant, or a chlorine solution may be used as a disinfectant. To prepare the disinfectant:

(1) If possible, a special food service disinfectant (FSN 6840-01-035-5432 or FSN 6840-00-810-8396) should be used. Personnel should follow the preparation procedure stated on the label.

(2) The water must be heated to at least 180° F.

(3) In an emergency, a chlorine solution may be used. Three level messkit spoonfuls of calcium hypochlorite (FSN 6850-270-8225) are placed in a 32-gallon container. One canteen cup of 5% liquid chlorine bleach per 32-gallon container may also be used. This will produce a 250 ppm chlorine solution.

c. To disinfect the food items, personnel should:

(1) Immerse the items in 160° F water for 1 minute.

(2) Immerse the items in the food service disinfectant for 30 minutes.

(3) Immerse the items in the 250 ppm chlorine solution for 30 minutes.

3-10. SUMMARY

a. It is important to avoid illness among troops in the field. Illness is an enemy and can cause casualties and loss. In particular, foodborne illness is a constant threat to combat troops.

b. History presents many examples of the effect of foodborne illness on troops. The two examples given in this lesson were the experiences of American troops in North African and Middle Eastern countries during World War II and in the Lebanon intervention of 1958. Good hygiene and basic countermeasures against foodborne illness could have lowered the disease rate significantly.

c. Food service operations in the field include both field facilities, with very limited or no cooking and refrigeration capacity, and full-service type facilities, with complete or partial cooking and refrigeration capacity.

d. The distinction between field and full-service facilities is important since the method of handling food is quite different.

e. The goal of field food service operations is to supply soldiers with sufficient and safe nutrition so they can accomplish their mission.

f. At the front lines, there is neither the time nor the space to provide the cooking and refrigeration equipment necessary to prevent the growth of microorganisms in food. Food must be supplied to the soldier in a form that limits the danger from contamination of potentially hazardous foods and that is ready-to-eat and portable. Foods provided in a dehydrated state or that have been preheated and sealed in airtight containers or pouches meet these requirements.

g. In the field, the threat from foodborne illness comes in three major ways:

(1) From not burying food waste.

(2) From buying foods from local vendors.

(3) From not maintaining hot and cold prepared foods at safe temperatures on those occasions when prepared foods are brought up to the front line.

h. To counter this threat, each soldier must:

(1) Bury food waste.

(2) Avoid buying food items from local vendors.

NOTE: In addition, foods prepared behind the front lines and brought up to soldiers at the front must be transported and maintained at 140° F and above for hot foods or 45° F and below for chilled foods.

i. Soldiers must bury food waste because exposed food will attract flies and pests that carry the microbes causing serious diseases.

j. Soldiers must avoid buying local foods and beverages since these items can be contaminated for a variety of reasons.

k. Prepared foods must be maintained at safe temperatures in order to discourage rapid bacterial growth in potentially hazardous foods. This would occur if these foods were allowed to enter the temperature danger zone.

l. For full-service type facilities in the field, obtaining safe food can be a serious problem. In areas where human waste is used as a fertilizer or where gastrointestinal or parasitic diseases exist, the medical authority must authorize the use of raw fruits and vegetables. Even when approved, these items must be disinfected by:

(1) Immersing the items in 160° F water for 1 minute.

(2) Immersing the items in a special food service disinfectant for 30 minutes.

(3) Immersing the items in a 250 ppm chlorine solution for 30 minutes.

Continue with Exercises

EXERCISES, LESSON 3

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson, and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. Which of the following statements best describes the significance of foodborne illness in combat?

a. Foodborne illness occurs in combat but not as frequently as other illnesses and does not greatly weaken the fighting strength of troops.

b. Foodborne illness used to be a problem in combat. Now, with modern food preservation techniques, it has almost been eliminated.

c. Foodborne illness is a constant threat in a combat situation and can seriously weaken the effectiveness of combat troops.

2. Indicate whether the following statements apply to a full-service type of food facility, or a field food service facility. Use the following notation to fill in the blank at the beginning of each statement:

A. Field food service facility.

B. Full-service type of food facility.

____ a. This facility has very limited or no kitchen or refrigeration capabilities.

____ b. This facility is located at a large Army medical center in the United States.

____ c. This facility occurs in a combat area but behind the front lines. It has limited kitchen facilities and trained food service personnel.

____ d. This type of facility is used to feed soldiers who are on a special reconnaissance mission where they are not serviced by regular food supply lines.

____ e. This type of facility can occur in both garrison and the field.

3. State the goal of food service in the field.

4. List the two major limitations on food service in the field.

a. _____

_____

b. _____

_____

5. How does the Army overcome limitations on food service in the field and provide field soldiers with adequate and safe food?

6. List the three preventive countermeasures against foodborne illness in the field.

a. _____

b. _____

c. _____

7. The American soldiers who participated in the occupation of Lebanon in 1958 eventually came down with intestinal disease. What were the major causes of this outbreak of foodborne illness?

a. _____

_____

b. _____

_____

8. You are inspecting a front line combat area and notice that soldiers eat their rations and throw the remains on the ground.

a. What preventive countermeasure is being violated?

b. Why is this a dangerous practice?

9. When insulated containers are used to bring prepared foods to soldiers at the forward edge of the battle, the container must maintain a temperature range of _____ or _____.

10. Temperatures must be within this range (as stated in exercise 9) mainly because:

a. There may be delays in reaching the front; foods must be extra hot or extra cold to allow for some cooling or warming during transport.

b. These temperatures discourage the rapid growth of disease-causing bacteria in the food.

c. Hot and chilled prepared foods are brought to combat soldiers as a morale building measure. They must remain sufficiently hot or chilled in order to have this effect.

11. You are watching food service personnel preparing an insulated container of hot spaghetti to be taken to the front lines. You observe the following preparation procedure:

Food service personnel remove the container Inserts and pour 2 quarts of boiling water into the container.

They let the container stand for 5 minutes, then pour out the water.

They then check the spaghetti temperature and find It to be 143° F.

They place the spaghetti into the inserts, replace the inserts into the heated containers, and secure the lid latches.

Did the personnel prepare the container properly? If not, what was unsatisfactory?

12. Chilled potato salad has been prepared to be sent to the front line. Personnel remove the potato salad from the refrigeration unit, and check the temperature, which is 42° F. They then remove the inserts from the insulated container, place the potato salad Into the Inserts, place the inserts back into the container, and close the container. Would you accept this preparation procedure as satisfactory? If not, why?

13. At the front lines of a combat area, soldiers are seen eating various food items bought from local vendors. You report this observation as unsatisfactory. Why is this practice dangerous?

14. The main problem with obtaining food supplies in the field is:

a. Soldiers may not like or accept local foods or the area may not produce commonly eaten food items.

b. Local food may be heavily contaminated, particularly in areas where human excreta are used as fertilizer, or where gastrointestinal or parasitic diseases exist.

c. The process of purchasing local foods Involves time-consuming paperwork. This causes delays and hinders a smooth, consistent supply.

15. List the three food disinfectants used In the field.

a. _____

b. _____

c. _____

16. The _____ is responsible for approving high risk foods obtained in the field.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 3

1. c (para 3-1)

2. a. A (para 3-3a)

   b. B (para 3-3b, c)

   c. B (para 3-3b)

   d. A (para 3-3a)

   e. A (para 3-3c)

3. To supply soldiers with sufficient and safe nutrition so that they can accomplish their mission. (para 3-4a)

4. a. There is little time or space for cooking and other food preparation procedures.

   b. There is no time or space for the safeguards, such as refrigeration, that must be taken when potentially hazardous foods are prepared. (para 3-4b)

5. Food is provided in a form that is ready-to-eat and that limits the dangers from the contamination of potentially hazardous foods. (para 3-4c)

6. a. Bury food waste.

   b. Do not buy food items from local vendors.

   c. Keep prepared foods served to soldiers in the field at safe temperatures. (para 3-5b)

7. a. Soldiers began to eat B rations which are prepared with kitchen facilities and which can become contaminated.

   b. Soldiers consumed local foods and beverages. (para 3-2c)

8. a. Bury food waste (para 3-5b, 3-6)

   b. Food waste that is left out attracts flies, rodents, and other pests that carry the microbes causing serious illnesses. (para 3-8)

9. 140° F and above; 45° F and below. (para 3-8a)

10. b. (para 3-8a)

11. No. Personnel should have waited for 30 minutes before removing the water from the container. (para 3-8c; figure 3-3)

12. No. The container must be prechilled. Otherwise, the potato salad will be exposed to the temperature range where harmful microorganisms grow rapidly. This could lead to an outbreak of foodborne disease. (para 3-8d; figure 3-4)

13. Food items bought on local markets are uncontrolled with respect to sanitary processing and handling and may be contaminated. (para 3-7)

14. b. (para 3-9a)

15. a. Hot water.

b. A food service disinfectant.

c. A chlorine solution. (para 3-9b)

16. Medical authority. (para 3-9a)

End of Lesson 3

LESSON ASSIGNMENT

LESSON 4	Factors Contributing to Foodborne Disease: Personnel.
TEXT ASSIGNMENT	Paragraphs 4-1 through 4-12.
LESSON OBJECTIVE	After completing this lesson, you should *be* able to:

4.1 Identify the basic difference between the cause of foodborne illness in the field and at full-service food facilities.

4.2 Identify the main factors contributing to outbreaks of foodborne illness at full-service food facilities.

4.3 Identify why food service personnel are a major source of foodborne illness at full-service food facilities.

4.4 Identify the hygiene and work practices required of food service personnel to control outbreaks of foodborne disease.

4.5 Evaluate situations of food service personnel in a work environment, and identify any dangerous practices.

SUGGESTION After studying the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 4

FACTORS CONTRIBUTING TO FOODBORNE DISEASE: PERSONNEL

4-1. INTRODUCTION

Lesson 3 discussed the problems encountered in providing safe and nutritious meals to combat soldiers. This lesson and the following lessons will deal with food sanitation at full-service facilities (facilities with both kitchen and refrigeration capabilities). In the field, the main cause of foodborne illness is the mechanical transmission of harmful bacteria. In contrast, at full-service facilities, the primary source of foodborne illness is the contamination of potentially hazardous foods. This occurs because the cooking and food preparation procedures expose potentially hazardous foods to high risk situations. It is critical, then, that personnel at these facilities practice measures to reduce the possibility of contamination. It is your job, as an inspector, to ensure that food service personnel follow proper procedures and precautions when handling food. These procedures must be followed by employees at all full-service facilities, both in garrison and in the field.

4-2. FACTORS CONTRIBUTING TO FOODBORNE DISEASE

Certain factors in the environment of a full-service food facility can cause foodborne disease outbreaks. These factors are:

a. Food service personnel.

b. The source of foods.

c. Storage.

d. Temperature.

NOTE: Lesson 4 will discuss the first factor, food service personnel, and the role personnel play in spreading foodborne disease.

4-3. FOOD SERVICE PERSONNEL AND FOODBORNE DISEASE OUTBREAKS

People working in a full-service food facility are in constant and close contact with food. They touch and handle potentially hazardous foods during storage, during preparation, and during serving. This close contact makes food service personnel a primary source of disease. When you, the preventive medicine specialist, inspect a full-service food facility, you must check to ensure that the employees maintain both personal hygiene and sanitary work practices.

4-4. HEALTH AND PERSONAL HYGIENE OF FOOD SERVICE EMPLOYEES

a. Food service employees must be free of communicable disease when handling food. The supervisor must inspect all food service personnel each day to determine freedom from communicable disease.

b. In addition, the local medical authority may require health cards. However, a health card or even an examination does not mean that a food service employee is free of communicable disease. It is possible to have a health examination one day and be sick the next day. In some parts of the world, health cards for workers will be emphasized more than in the United States.

c. The daily hygiene habits of employees are important in maintaining sanitation. Food service employees must have a neat and clean appearance. They must shower or bathe daily, have clean hair, and trimmed, clean, and unpainted fingernails. Skin, hair, and long, ragged fingernails are primary breeding grounds for bacteria. Dirty employees are not only unattractive but also dangerous since they intensify the possibility of the contamination from bacteria present on the hair, skin, and nails of even clean people.

d. Excessive or ornate jewelry on the hands can also be a problem. Jewelry allows food particles and dirt to accumulate and may interfere with proper handwashing. Army food service personnel should not wear jewelry while preparing or handling food except for plain wedding bands, engagement rings, or wrist watches.

e. Workers with infected cuts, burns, or sores cannot be allowed to handle food. Workers who are coughing, sneezing, or showing symptoms of a cold or an intestinal disease should also be kept from food handling duties. In some cases, the supervisor will assign the worker a nonfood handling job; in other cases, the worker will be required to report to sick call.

4-5. SANITARY WORK PRATICES

All food service employees must follow sanitary work practices. These practices are intended to prevent employees from transferring microbes to food. Sanitary work practices include handwashing, the use of hair restraints, uniform maintenance, restrictions on smoking, and the proper handling of food and utensils.

4-6. HANDWASHING

a. Unclean hands are the most common source of food contamination. An employee's hands are constantly touching articles contaminated with bacteria and then touching food. Due to this, food service personnel must wash their hands often with warm water and soap. Hands should be washed:

(1) Before beginning work.

(2) Before preparing food.

(3) After handling soiled or contaminated equipment or utensils.

(4) After each visit to the toilet.

(5) After smoking.

If workers fail to wash their hands at these times, they can contaminate the food with harmful microorganisms.

b. To encourage frequent handwashing, the food service facility must have enough handwashing basins convenient for employees to use. Handwashing basins should be located in the kitchen, work areas, and restrooms.

c. Sinks for washing dishes or for the preparation of vegetables must not be used for handwashing. Bacteria washed off the hands can contaminate the sink and then later be transferred to the vegetables or to the utensils or equipment cleaned in the sinks. Only single-service paper or cloth towels, continuous roll towels, or a mechanical hand dryer should be used for hand drying. A supply of clean towels should always be available.

4-7. HAIR RESTRAINTS

Hair contains thousands of bacteria and can be a major source of contamination. For this reason, the Army requires personnel working in food preparation and service areas to wear effective hair restraints, such as hair nets or caps. This is to prevent hair from contaminating food or surfaces that food may contact. Hair nets and other hair restraints also discourage employees from scratching and touching their hair and scalp, a habit which further contaminates their hands.

4-8. UNIFORMS

Persons involved in food processing or who handle surfaces that food may contact are required to wear light-colored uniforms. They must keep their uniforms washed and neat. Employees should not wipe their hands on their uniforms and should avoid constantly touching and readjusting clothing. Dirty uniforms are both unattractive and dangerous. The dirt and soil contain bacteria that can contaminate food.

4-9. RESTRICTIONS ON THE USE OF TOBACCO

Smoking is another dangerous practice that can contaminate food. Smoking allows droplets of saliva to fall on the smoker's fingers. These saliva droplets contain thousands of bacteria that will contaminate whatever the smoker's fingers touch, including food. In addition, the end of the cigarette placed in the smoker's mouth will also become contaminated by the bacteria in saliva. If the smoker lays the cigarette

down, the saliva on the cigarette will then contaminate the work surfaces on which the cigarette rests. Smoking or the use of tobacco in any form is prohibited in food preparation areas. A food service facility should designate an area where personnel can use tobacco. Smokers must wash their hands after smoking and before returning to work.

4-10. HANDLING FOOD

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 foods 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 boning of chickens.

4-11. HANDLING EQUIPMENT AND UTENSILS

a. Employees must be careful when handling equipment and utensils. Proper handling techniques will minimize the contamination of clean utensils and equipment. These techniques will also prevent soiled utensils and equipment from spreading harmful microorganisms.

b. Handling clean utensils and equipment. Employees should pick up silverware, cups, glasses, and plates by the handle, the bottom, or the edge.

c. Handling soiled utensils and equipment. Employees should take great care when bussing tables and when handling soiled napkins, glasses, cups, silverware, and other utensils. These items may carry disease organisms from customers. Employees who carelessly handle these soiled articles can pick up microorganisms on their hands. They will then transfer these microorganisms to their own mouths, to customers by recontaminating clean utensils and equipment, or to food that will be served to the customer. For their own and for the customer's protection, employees must handle dirty utensils and equipment in the same careful way clean utensils are handled.

4-12. SUMMARY

a. Full-service food facilities have kitchen and refrigeration capabilities. Due to this, the risk of potentially hazardous foods becoming contaminated is high. Personnel at full-service facilities must be extremely careful to follow measures to reduce or prevent contamination. Your job as a preventive medicine specialist inspecting full-service food facilities is to ensure that employees follow safe food handling procedures and precautions.

b. Several factors contribute to foodborne illness at full-service food facilities. These factors are:

(1) Food service personnel.

(2) The source of foods provided to the facility.

(3) Storage.

(4) Temperature.

NOTE: Lesson 4 discusses the first factor, food service personnel.

c. Employees in a full -service food facility are in constant contact with food during performance of their duties. This makes them a likely source of contamination.

d. Food service employees must be free of communicable disease. All food service employees must undergo an examination each day by the supervisor to determine freedom from communicable disease. The local medical authority may also accept a health card for persons desiring to work in a food service facility. This is useful but does not guarantee that employees are permanently free of disease. You still must check for signs of illness among employees.

e. The daily hygiene habits of food service employees are important in preventing foodborne disease. Employees must shower or bathe regularly and have clean hair and fingernails. Jewelry is prohibited, except for plain wedding bands, engagement rings, or wrist watches. This is because excessive or ornate jewelry allows food particles to accumulate and can interfere with proper handwashing.

f. Workers with infected cuts, burns, or sores as well as workers with colds or with intestinal disease symptoms cannot handle food.

g. In addition to good health and hygiene habits, food service employees must follow sanitary work practices.

h. Employees must wash their hands properly with warm water and soap at those times when their hands are likely to be excessively contaminated.

i. Employees must use effective hair restraints to prevent hair from contaminating food and surfaces that food may touch.

j. Employees must wear light-colored uniforms that are kept clean and neat.

k. Smoking or the use of tobacco in any form is prohibited in food preparation areas. A food service facility should designate a specific area for smoking.

l. Food service employees should avoid unnecessary handling of food.

m. Food service personnel should handle clean equipment and utensils carefully to prevent them from becoming contaminated. Employees should handle dirty equipment and utensils with equal care to prevent these dirty items from contaminating clean supplies, equipment, and personnel.

Continue with Exercises

EXERCISES, LESSON 4

INSTRUCTIONS: Answer the following exercises b*y* marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all the exercises, turn to “Solutions to Exercises" at the end of the lesson, and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. What is the main difference between the cause of foodborne illness at full-service facilities and field facilities?

2. List the main factors contributing to foodborne illness at full-service food facilities.

   a. _____

   b. _____

   c. _____

   d. _____

3. Why are food service personnel a primary source of foodborne disease?

4. The food service supervisor should inspect personnel each day to:

_____

5. An individual has passed a preemployment examination and obtained a health card. Two days later, this person appears at the food service facility to begin work. Which statement best describes the employee's health status?

a. The employee is definitely free of communicable disease. Preemployment examination for the health card is very thorough and would detect any communicable disease for a period of at least 30 days.

b. The employee was free of obvious communicable disease at the time of the examination for the health card. However, the person could have become sick in the 2-day period between the examination and the first day on the job.

c. The preemployment examination would detect chronic medical conditions (high blood pressure, a heart condition, arthritis, etc.), that would lead to absences or hinder the employee's effectiveness. The examination is not concerned with communicable disease.

6. Food service employees must maintain personal cleanliness. List three personal hygiene habits required of food service employees.

a. _____

b. _____

c. _____

7. Dirty food service employees are not only unattractive but also dangerous. Why?

8. Why are unclean hands the most common source of food contamination?

9. Select the time when employees are NOT required to wash their hands.

a. Before leaving work.

b. After smoking.

c. After a visit to the toilet.

d. Before preparing food.

e. Before beginning work.

f. After handling soiled equipment or utensils.

10. Which of the following best describes how personnel should handle food?

a. Personnel must wear sterilized plastic gloves when handling any food item.

b. Provided that they have washed their hands, personnel can handle food as much as they want.

c. Generally, food service personnel should not touch food and should use utensils whenever possible.

11. During an inspection of a full-service food facility, you observe a food service specialist smoking while cutting up vegetables. The employee smokes, lays the cigarette down on the edge of the counter, and then cuts up more vegetables before smoking again. You rate this as unsatisfactory and discuss the problem with the supervisor. The supervisor states that he has told employees about the dangers of smoking while preparing food, but that there is no convenient place where employees can smoke.

a. There are two reasons that make smoking a possible cause of foodborne illness. These reasons are:

(1) _____

_____

(2) _____

_____

b. What would you suggest as a corrective measure?

12. You are inspecting a full-service food facility and make the following observations. Write satisfactory or unsatisfactory after each observation. Briefly explain the reason for your rating.

a. Observation 1. Female employees wear hair nets and male employees wear caps. The hair of all employees is fairy short, clean, and combed.

b. Observation 2. An employee was observed washing his hands after removing dirty dishes from the tables. He washed his hands in the sink used to clean and prepare vegetables. He then dried his hands on a common cloth towel hanging to the side of the sink.

c. Observation 3. A female employee involved in slicing ham had very long, unfiled fingernails.

d. Observation 4. When bussing dirty dishes from the tables, employees picked up dirty knives, forks, and spoons by the handles and held soiled glasses on the bottom. Likewise, when removing clean cups from storage, employees picked up the cups by the handles.

e. Observation 5. In the serving line, employees did not touch butter, bread, and relish Items. Instead, tongs and forks were provided for self-service.

13. A food service employee was told not to wear bracelets and a ring with many different stones while on the job. This is mainly because:

a. Jewelry is often lost while employees are preparing the food.

b. Ornate or excessive jewelry collects dirt and food particles that may carry harmful microorganisms. The jewelry may also interfere with proper handwashing.

c. Foods with a high acid content, such as citrus fruits, may interact chemically to release the gold or silver in the jewelry. This often results in outbreaks of poisoning.

14. An employee came to work with what appeared to be a bad cold. While working in the food preparation area, the employee coughed, sneezed, and wiped his nose. The coughing and sneezing were so frequent that the employee did not have enough time to wash his hands after each cough or sneeze.

a. What is the danger in this situation?

b. What should the supervisor have done to correct the situation?

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 4

1. In combat, the main cause of foodborne illness is the mechanical transmission of harmful bacteria. At full-service facilities, the primary source of foodborne illness is the contamination of potentially hazardous foods. (para 4-1)

2. a. Food service personnel

   b. The source of foods

   c. Temperature

   d. Storage (para 4-2)

3. Food service personnel are in constant and close contact with the food. (para 4-3)

4. Determine freedom from communicable disease. (para 4-4a)

5. b (para 4-4b)

6. a. They must shower or bathe daily.

   b. They must have clean hair.

   c. They must have trimmed and clean fingernails. (para 4-4c)

7. They intensify the possibility of contamination from bacteria present on the hair, skin, and nails of even clean people. (para 4-4c)

8. An employee's hands are constantly touching articles contaminated with bacteria and then touching food. (para 4-6a)

9. a. (para 4-6a)

10. c. (para 4-10)

11. a (1) The smoker's fingers contact saliva which is contaminated with bacteria. The smoker 's fingers will then contaminate whatever the smoker touches.

    (2) The end of the cigarette placed in the smoker's mouth contains bacteria from saliva. It will also contaminate anything it touches.

    b. The facility must make an effort to provide an area specifically designated for smoking. (para 4-9)

12. a. Satisfactory. Clean, well-groomed hair and the use of hair restraints minimize the chance of contamination from hair. (para 4-7)

b. Unsatisfactory. The employee should not wash his hands in the same basin used to clean food as this may contaminate the food. The cloth towel is also a source of contamination. Only single-service cloth or paper towels, continuous roll towels, or a mechanical hand dryer should be used. (para 4-6c)

c. Unsatisfactory. Dirt may easily get under long fingernails. This worker could easily contaminate food. (para 4-4c)

d. Satisfactory. Employees picked up and handled both the clean and dirty dishes in a way that reduced the possibility of contamination. (para 4-11)

e. Satisfactory. Hand contact with food was minimized. This minimizes contamination from bacteria present on hands. (para 4-10)

13. b. (para 4-4d)

14. a. The employee may transfer disease organisms to the food through coughing and sneezing.

b. The supervisor could have assigned the worker duties that did not require contact with food or utensils. The supervisor could also have sent the worker on sick call. (para 4-4e)

End of Lesson 4

LESSON ASSIGNMENT

LESSON 5	Factors Contributing to Foodborne Disease: Receipt of Food Shipments.
TEXT ASSIGNMENT	Paragraphs 5-1 through 5-7.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

5.1 Identify why the receipt of safe foods is the first defense against foodborne illness.

5-2. Identify the government and military agencies responsible for inspecting foods before arrival at a full-service food facility.

5-3. Identify the main ways by which foods can become contaminated before arrival at a full-service food facility.

5-4. Identify the precautions taken by food service personnel against the receipt of contaminated food items.

5.5 Identify the procedures involved in inspecting food shipments arriving at a full-service food facility.

5-6. Identify sources of contamination of food shipments arriving at full-service food facilities described in various situations and state how food service personnel should handle each shipment.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 5

FACTORS CONTRIBUTING TO FOODBORNE DISEASE: RECEIPT OF FOOD SHIPMENTS

5-1. INTRODUCTION

It is important that safe foods be used in a full-service facility. If contaminated foods arrive at a facility, all other precautions are worthless. Receipt of safe food items is the first defense against foodborne illness.

5-2. AGENCIES INSPECTING FOODS BEFORE ARRIVAL AT A FOOD FACILITY

a. The Veterinary Corps is responsible for inspecting foods before they are purchased by the Army. The Veterinary Corps ensures that quality specifications for certain foods are met. For example, hamburger is checked to make sure that the fat content does not exceed specified limits. Fruits and vegetables are inspected to ensure that set quality standards are met.

b. The Veterinary Corps also checks the sanitation of food processing plants. Food processing companies desiring to sell food to the Army must maintain high levels of sanitation. These inspections help to prevent contamination of foods during processing.

c. There are other Federal agencies that inspect Army food supplies. These are the Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA). Meats that have been inspected and approved will be stamped "inspected and passed."

d. The first precaution, then, that a full-service food facility must follow is to obtain food from approved sources; that is, from sources whose food items have been inspected and approved by government and military agencies.

5-3. POSSIBILITY OF CONTAMINATION BEFORE ARRIVAL

a. There are three basic ways by which food can become contaminated before arrival at a food service facility:

(1) During transport to the full-service food facility.

(2) From pesticides.

(3) From natural contamination.

b. Foods can easily become contaminated while in transit to the full-service food facility. Since government inspectors do not follow a specific product through all points of transport, they will not discover that it has been contaminated.

(1) Refrigerated and frozen food items can rise into the temperature danger zone (above 45° F). For example, frozen fish shipped to a food service facility may be safe when it leaves its point of origin, but may thaw and then be refrozen in the truck carrying it to the food service facility. The thawing allows harmful microbes to grow. The refreezing may damage the taste and appearance and will not permanently kill the harmful microbes.

(2) Dry foods, such as cereals, flour, and rice may be infested with disease-carrying Insects. Dry foods, although not hazardous when dry, may be moistened while in transit. This raises the chances of contamination.

(3) Even canned foods can be damaged while being transported to the food service facility. Cans that are severely bent, that show signs of leakage, or that have popped ends may have contaminated contents.

c. Pesticides are another possible health hazard. Most inspection agencies do not routinely sample for pesticides.

d. Some foods may be naturally contaminated. Poultry is commonly contaminated with salmonella. In one study, it was found that 43 percent of the poultry products in one area were contaminated with salmonella.

5-4. PRECAUTIONS AGAINST UNSAFE FOODS

Since government and military inspection agencies are not able to eliminate all cases of dangerous contamination, it is important that food service personnel take precautions to ensure that the food received will be safe. Two basic precautions should be taken:

a. Food service personnel must check food when it arrives.

b. Whenever possible, foods should be washed, peeled, or otherwise processed before and during preparation to reduce the risk of contamination. When you inspect a full-service food facility, observe personnel handling received food items to ensure that they examine the incoming items, and that they wash, peel, and process foods before preparation.

5-5. INSPECTING RECEIVED FOODS

When a shipment of food arrives at a full-service facility, personnel should check the Items to determine that they are in acceptable condition. When a food service facility receives and checks food items, a few simple procedures should be followed.

a. First, personnel should check the food items immediately upon receipt. This will prevent the food from becoming contaminated.

b. Second, the inspection should be a brief but inclusive sampling of items in the shipment. Personnel should check samples of each kind of food. They must not accept food items that appear contaminated.

c. Third, adequate storage space should be prepared in advance for an incoming shipment. This is especially true of freezer or refrigeration space. Again, this is done to place potentially hazardous foods in proper storage conditions as quickly as possible.

5-6. PROCESSING RECEIVED FOODS

After food items have arrived at a full-service food facility and have been checked and stored, there are still some precautions to take when preparing these foods. This generally involves washing or processing the foods in order to further reduce the possibility of contamination. For example, the leaves of even acceptable lettuce will normally be contaminated with dirt and pesticides. This dirt may carry harmful bacteria. In addition, the farm worker picking and packing the lettuce may have had poor hygiene habits. In this case, the outer leaves could be contaminated with numerous bacteria as well as pesticides. For these reasons, it is necessary to wash raw fruits and vegetables before preparation and serving. Fruits and vegetables may also be contaminated with pesticides. This is another reason for washing raw fruits and vegetables. In some cases, fruits and vegetables may be peeled. In other cases, such as the possibility that chicken may be contaminated with salmonella, it is necessary to cook poultry to 160° F. The problem of temperature will be discussed In Lesson 7.

5-7. SUMMARY

a. A full-service food facility must receive safe food items. Otherwise, all other precautions would be of no use.

b. Certain government and military agencies are responsible for inspecting food processing plants to ensure that high levels of sanitation are maintained. These agencies also inspect food items for quality before the items arrive at a full-service food facility. The major agencies performing this function are:

(1) The Veterinary Corps.

(2) The Food and Drug Administration (FDA).

(3) The U.S. Department of Agriculture (USDA).

c. The first precaution that a full-service food facility must follow is to obtain food that has been inspected and approved by these agencies.

d. Inspection by these agencies does not guarantee completely safe food. Food may become contaminated while being transported to the food service facility. A food may be contaminated by pesticides; inspection agencies do not routinely check for pesticides. A food may also be naturally contaminated.

e. Due to this, full-service food facilities must take precautions when receiving shipments of food items. The precautions are intended to further reduce contamination. They must:

(1) Check food when it arrives.

(2) Wash or process foods before and during preparation.

f. It is your job as a preventive medicine specialist to ensure that personnel at full-service food facilities take required precautions with newly received food supplies.

Continue with Exercises

EXERCISES, LESSON 5

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson, and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. Why is the receipt of safe foods the first defense against foodborne illness?

2. List government and military agencies responsible for inspecting food plants and food items before they arrive at a full-service food facility.

   a. _____

   b. _____

   c. _____

3. You can determine that meats have been inspected and approved prior to arrival at the food service facility because:

   a. They will be stamped “Inspected and passed.”

   b. They will be stamped “approved for human consumption."

   c. They will be stamped with an inspection serial number.

4. List three ways by which foods may become contaminated before arrival at a full-service food facility.

   a. _____

   b. _____

   c. _____

5. List the two basic precautions that food service personnel must take against receipt of unsafe foods.

a. _____

b. _____

6. A shipment of dry foods arrived at a food service facility. The packages containing the foods were wet. You observed that personnel immediately stored the packages without checking them.

a. Could these items be contaminated?

b. If so, how could contamination occur?

c. Did food service personnel act correctly?

d. If not, how should they have handled the shipment?

7. You are inspecting a food service facility that has received cartons of fresh lettuce. Food service personnel check the lettuce, which appears clean and in a condition that meets quality standards. Personnel accept the lettuce and the next day use the lettuce to prepare a salad. How would you expect personnel to handle the lettuce during preparation?

a. Since the personnel have checked the lettuce and found It to be satisfactory, they no longer need to worry about contamination and can use the lettuce as is.

b. The lettuce may be contaminated with pesticides, but there are no precautions against contamination from pesticides. Personnel will have to use the lettuce as is.

c. Despite its satisfactory appearance, the lettuce may be contaminated with pesticides. Personnel must wash the lettuce before using it in salad preparation.

8. A truck is carrying shipments of frozen beef to three Army food service facilities. The weather is warm. When the truck stops at the first facility, the doors are left open during unloading. The same thing happens at the next stop.

a. By the time the truck arrives at the third stop, could the beef have become contaminated?

b. If the beef is contaminated, what is the most likely cause?

c. How should personnel at the third facility handle the shipment in order to receive a satisfactory rating?

9. Which of the following best describes how personnel should inspect a shipment of food items that has just arrived?

a. They should clear storage space, then spot check Items, and store them. Foods should not be left out of storage for more than 5 hours.

b. They must check every item in the shipment immediately upon receipt. They must then obtain the supervisor's approval before storing the items.

c. They must immediately check the items. They should not check every Item but sample Items from each kind of food. They then must place the food as quickly as possible into storage areas that have already been prepared.

10. Chicken may be naturally contaminated with _____. Due to this, it is necessary to cook the chicken to _____ ° F.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 5

1. If contaminated foods are received, all other precautions are useless. (para 5-1)

2. a. The Veterinary Corps.

   b. Food and Drug Administration (FDA).

   c. U.S. Department of Agriculture. (para 5-2a, b, c)

3. a. (para 5-2c)

4. a. They become contaminated during shipment to the full-service facility.

   b. Pesticides.

   c. Natural contamination. (para 5-3a)

5. a. Food service personnel must check food when It arrives.

   b. Food service personnel should wash or process foods before and during preparation. (para 5-4)

6. a. Yes. (para 5-3b(2))

   b. The packages were moistened. The food inside could also be moistened which could result in contamination. (para 5-3b(2))

   c. No.

   d. Personnel should check the Items in the shipment. They would notice and not accept wet packages. (para 5-4)

7. c. (paras 5-3c; 5-6)

8. a. Yes.

   b. The open door and the warm weather could cause the beef to thaw and bacteria to grow. The beef could be heavily contaminated by the time it reaches the third stop.

   c. They must check the shipment to discover and reject the thawed and potentially contaminated beef. (paras 5-3b(1); 5-5)

9. c. (para 5-5)

10. Salmonella; 160. (para 5-6)

End of Lesson 5

LESSON ASSIGNMENT

LESSON 6	Factors Contributing to Foodborne Disease: Food Storage.
TEXT ASSIGNMENT	Paragraphs 6-1 through 6-9.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

6-1. Identify the problems that result from incorrectly stored food.

6-2. Identify the general principles of food storage.

6-3. Identify the problems involved in the storage of potentially hazardous foods and foods that are not potentially hazardous.

6-4. Identify the requirements for the storage of potentially hazardous foods.

6-5. Identify the refrigeration facilities used to properly store potentially hazardous foods.

6-6. Identify the basic procedures personnel must follow to maintain adequate temperatures in refrigeration and freezer units.

6-7. Identify the requirements for the storage of toxic or hazardous products.

6-8. Evaluate given storage situations and identify any unsafe practices.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 6

FACTORS CONTRIBUTING TO FOODBORNE DISEASE: FOOD STORAGE

6-1. INTRODUCTION

Once foods have been received, checked, and accepted, they must be stored until needed. Foods must be stored properly to prevent deterioration and the growth of harmful microorganisms. Food items that are stored incorrectly can cause significant waste and outbreaks of foodborne illness.

6-2. GENERAL PRINCIPLES OF STORAGE

Food supplies are to be stored only in areas designated for food storage. When storing food items, personnel should practice the following general principles of food storage:

a. Store all foods immediately after inspection.

b. Eliminate rough and unnecessary handling of food items.

c. Select old stocks from storage first. The first stocks in should be the first out.

d. Provide suitable temperatures for all stored food items.

e. Provide special handling for ripening fruits and vegetables.

f. Maintain insect and rodent control. The most effective control measure against rats and mice is to prevent their entry into the storage area.

g. Ensure that proper air circulation and ventilation are maintained.

h. Use dunnage (scrap lumber) or pallets (storage platforms) to permit mechanical handling of stocks. This will reduce the likelihood of contamination from human contact. It will also protect stock from water and dampness around the floor of storerooms or refrigerators.

i. Ensure that storage areas are kept clean and in a sanitary condition at all times.

j. Remove spoiled, damaged, or contaminated items promptly from storage.

k. When inspecting a full-service food facility, the preventive medicine specialist must observe carefully to ensure that personnel adhere to these principles when storing food items.

6-3. STORING POTENTIALLY HAZARDOUS FOODS

a. **Storage Requirements**. Contamination is the most critical problem in the storage of potentially hazardous foods. Storage requirements to prevent contamination of these foods include suitable temperature, humidity, air circulation, and sanitation. These requirements can be met by properly refrigerating or freezing potentially hazardous food. The refrigerators and freezers must be sanitized and cleaned on a regular basis. They should be 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, such as fish, poultry, and meats. Only the amount of foods needed for immediate use should be removed from refrigerators and freezers. Personnel should carry out the following four procedures to maintain adequate storage temperatures for potentially hazardous foods.

(1) The refrigerator and freezer should not be overloaded.

(2) Air circulation in refrigerators and freezers should not be blocked by careless storage.

(3) The refrigerator and freezer should be opened only when necessary so that adequate cooling or freezing temperatures are maintained.

(4) A thermometer should be used to maintain correct temperature in refrigerators and freezers. The thermometer should be checked regularly.

b. **Types of Refrigeration**. For proper storage of potentially hazardous foods, full-service food facilities are provided with 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.

6-4. FROZEN FOOD CABINET

Frozen foods should be stored in a frozen food cabinet. Personnel should group packages of frozen foods according to size and type and stack them so that all packages of the same size and type are together. Items placed in the freezer should be wrapped, either in the original wrapper or in suitable wrapping supplied by the food service facility. When new items are received, personnel should move older items already in the cabinet to the top for ready use and follow the "first-in, first-out" rule. The temperature in the frozen food cabinet should be kept between -10° F and 0° F.

6-5. REACH-IN REFRIGERATOR

The reach-in refrigerator is to be kept sanitary. Personnel must arrange potentially hazardous items so that they get proper air circulation. Personnel must also separate food items that impart or absorb odors from other items. The temperature in the reach-in refrigerator should be kept between 32° F and 40° F.

6-6. WALK-IN REFRIGERATOR

This type of refrigerator is generally used to store large quantities of fresh fruits and vegetables, eggs, dairy products, and meats. As stated in Lesson 5, before fresh fruits and vegetables are stored, food service personnel inspect them and discard spoiled or damaged items. Personnel must then stack the acceptable items on shelves or pallets in a manner that is neat and allows for proper air circulation. Foods must not be stored against walls or on the floor. This is to prevent pest infestation and to promote adequate air circulation. The temperature should be kept between 32° F and 40° F.

6-7. STORING FOODS THAT ARE NOT POTENTIALLY HAZARDOUS

a. Foods that are not potentially hazardous are more durable and much less likely to become contaminated than are potentially hazardous foods. However, they still must be stored with care. Significant loss can result from improper storage.

b. Improper or careless storage can lead to rodent and pest infestation or to deterioration from excessive heat, dryness, or moisture. In some cases, improper storage can damage the containers of foods that are not potentially hazardous and cause contamination. For example, if cans are stored carelessly and are punctured, the exposed contents could support bacterial growth. This, in turn, could lead to contamination and possibly to an outbreak of foodborne disease.

c. Correct storage will promote the proper rotation of these foods and will ensure their use on a first-in, first-out basis.

d. Each unit or consolidated dining facility should have areas specifically for the storage of these food items. Storerooms should be clean, well ventilated, well lighted, and free of rodents, insects, and undesirable odors. The storerooms should have enough shelving for storing canned or packaged items and enough dunnage for stacking items in cases or bags.

6-8. STORAGE OF TOXIC OR HAZARDOUS PRODUCTS

All toxic or harmful products such as cleaning supplies, insecticides, and poisons must <u>not</u> be stored in the same room as food items. In addition, foods should not be stored where they run the risk of mechanical pollution. Overhead lights, for example, must have protective coverings. This is to prevent broken glass from falling into food. Food items should never be stored under sewer drain pipes or any other leaking pipes or lines. Like-wise, equipment requiring maintenance should not be kept in storage areas for nonperishables. Needless to say, garbage or rubbish should never be placed in the storage area, since this waste could be a source of contamination and would encourage pest infestation.

6-9. SUMMARY

a. Correct storage is important in preventing damage or contamination of foods that have arrived at a full-service food facility in satisfactory condition.

b. Food supplies must be stored according to the general principles of food storage. These principles have been specified in the text.

c. As potentially hazardous foods can readily support the growth of pathogenic microorganisms, they must be promptly refrigerated or frozen. Refrigeration units must maintain adequate temperatures and must be clean and free of pests and odors. Personnel must carry out procedures to ensure these requirements are met.

d. The three types of refrigeration facilities used to store potentially hazardous food items are: frozen food cabinets, reach-in refrigerators, and walk-in refrigerators.

e. Although foods that are not potentially hazardous are less likely to become contaminated than are potentially hazardous foods, they still must be stored with care. Improper storage of these items can result in considerable loss from pest infestation, from deterioration, and even from a possible outbreak of foodborne disease.

f. Toxic or harmful products must never be stored with food items.

Continue with Exercises

EXERCISES, LESSON 6

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all the exercises turn to “Solutions to Exercises" at the end of the lesson, and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. The improper storage of foods can result in _____

_____

_____

2. Below are general principles that food service personnel must follow when storing food items. Indicate whether the statement is true or false by entering "T" or "F" in the blank before each statement. If the statement Is false, write the correct principle in the space provided below each statement. Make no entry if the statement is true.

a. ____ Eliminate rough and unnecessary handling of food items.

b. ____ Inspect all foods immediately after storage.

c. ____ Maintain insect and rodent control.

d. ____ Provide suitable temperature for a stored food items.

e. ____ Select new stocks from storage first.

f. ____ Use dunnage or pallets only in refrigerated areas.

g. ____ Ensure that proper air circulation and ventilation are maintained.

h. ____ Store damaged items in special areas for immediate use.

i. ____ Ensure that storage areas are kept clean and in a sanitary condition at all times.

j. ____ Provide special handling for canned products.

3. Storage requirements for potentially hazardous food items include suitable:

a. _____

b. _____

c. _____

d. _____

4. The refrigeration facilities used for proper storage of potentially hazardous food items are:

a. _____

b. _____

c. _____

5. Which of the statements below best describes the importance of correct storage for both potentially hazardous foods and foods that are not potentially hazardous?

a. Potentially hazardous foods can become contaminated much more quickly than can foods that are not potentially hazardous. Due to this, the storage of potentially hazardous food items is more critical than the storage of items that are not potentially hazardous.

b. Although foods that are not potentially hazardous do not have a high risk of contamination, they deteriorate quickly to the point where they cannot be served. To prevent this, greater care must be taken to maintain the right environment in storage areas for these items.

c. Different problems are encountered in storing potentially hazardous and non-potentially hazardous food items. Both can become nonusable or a health hazard if stored incorrectly. Personnel must carefully follow requirements when storing both types of food.

6. Which of the following is not an acceptable procedure for maintaining adequate temperature in refrigeration units?

a. Personnel should not overload the refrigerator.

b. Personnel should use a thermometer to ensure the correct temperature is maintained.

c. Personnel should not block air circulation by careless storage.

d. Personnel should open the refrigerator periodically to prevent air from becoming stale and from absorbing odors.

7. You are inspecting a walk-in refrigerator. The temperature in various areas is between 36° F and 38° F. Crates are stacked on pallets. Some areas of the refrigerator have crates that are stacked nearly ceiling high. Other areas are almost vacant. In some stacks, the bottom crates have broken, and fruits and vegetables have either spilled or been crushed.

a. What would you consider as satisfactory in this situation?

b. What would you consider as unsatisfactory?

8. While inspecting the freezer storage units at a full-service food facility, you notice employees remove food items that are to be used in the preparation of the next meal. Employees seem to spend much time searching for the required items. When you look inside the freezer, you observe that items are stacked haphazardly with meat items on top of vegetables and small items hidden under large items. Personnel state that newly arrived items are placed in the freezer wherever there is space, frequently on top of older items.

a. Why is it dangerous to have employees spend a long time searching for specific food items?

b. What is the main cause of this problem and what would you suggest as a correction?

c. Have personnel stored newly arrived items correctly? If not, how should these items be stored?

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 6

1. Significant waste and outbreaks of foodborne illness. (para 6-1)

2. a. T (para 6-2b)

   b. F Store all foods Immediately after inspection. (para 6-2a)

   c. T (para 6-2f)

   d. T (para 6-2d)

   e. F Select old stocks from storage first. (para 6-2c)

   f. F Use dunnage or pallets to permit mechanical handling of stocks and to protect stock from dampness in storerooms or refrigerators. (para 6-2h)

   g. T (para 6-2g)

   h. F Remove spoiled, damaged, or contaminated Items promptly from storage. (para 6-2j)

   i. T (para 6-2i)

   j. F Provide special handling for ripening fruits and vegetables. (para 6-2e)

3. a. Temperature.

   b. Humidity.

   c. Air circulation.

   d. Sanitation. (para 6-3a)

4. a. Frozen food cabinets.

   b. Reach-in refrigerators.

   c. Walk-in refrigerators. (para 6-3b)

5. c. (paras 6-3a; 6-7a, b)

6. d. (para 6-3a)

7. a. The temperature is within the required ranges for a walk-in refrigerator (32° F to 40° F). Pallets are used to protect items from mechanical handling and water or dampness on the floor. (paras 6-2h; 6-6)

   b. The food items are stacked carelessly. This will block air circulation and cause damage to the contents of the crates, as shown by the spilled or crushed vegetables. (para 6-6)

8. a. When employees take a long time to locate specific frozen food items, they leave the freezer door open. This can cause the temperature to rise and increase the possibility of contamination. (para 6-3a(3))

   b. The food items are stored haphazardly. You would suggest that food items be stored so that all packages of the same size and type are together. (para 6-4)

   c. No. New items should not be on top. Instead, employees should move older items to the top so that the first-in, first-out rule applies. (para 6-4)

End of Lesson 6

LESSON ASSIGNMENT

LESSON 7	Factors Contributing to Foodborne Disease: Temperature and Cross-Contamination.
TEXT ASSIGNMENT	Paragraphs 7-1 through 7-10.
LESSON OBJECTIVE	After completing this lesson, you should be able to:

7-1. Identify the results of inadequate temperature control.

7-2. Identify the temperature danger zone and the length of time that potentially hazardous foods can remain in the danger zone.

7-3. Identify the basic principles and related techniques of food cooling.

7-4. Identify the proper methods for thawing frozen foods.

7-5. Identify the proper method for determining the temperature of hot and cold food Items.

7-6. Define cross-contamination.

7-7. Rate the temperature control practices described in various situations and suggest necessary corrections.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 7

FACTORS CONTRIBUTING TO FOODBORNE DISEASE: TEMPERATURE AND CROSS-CONTAMINATION

7-1. INTRODUCTION

In Lesson 1, you learned that the bacteria causing the major foodborne illnesses require certain temperatures for growth and that these temperatures correspond to the temperatures involved in food handling and preparation. Due to this, temperature control is critical in all aspects of food handling.

7-2. TEMPERATURE AND FOODBORNE DISEASE CONTROLS

Failure to maintain a safe product temperature (45° F and below, or 140° F and above) is the leading cause of foodborne disease. A survey of foodborne disease outbreaks showed that temperature was a critical factor in producing these outbreaks (see table 7-1). Five of the top six factors causing foodborne disease outbreaks are directly related to temperature control.

Factor	Rank	*Percent of Outbreaks in Which Factor Was a Cause
INADEQUATE COOLING……	1	46
LAPSE OF A DAY OR MORE BETWEEN PREPARING AND SERVING……	2	21
INFECTED PERSON……	3	20
INADEQUATE THERMAL PROCESSING, CANNING, OR COOKING……	4	15
INADEQUATE HOT STORAGE……	5	16
INADEQUATE REHEATING……	6	12

*More than one factor may be involved in the same foodborne disease outbreak.

Table 7-1. Important factors contributing to outbreaks of foodborne disease.

7-3. TEMPERATURE AND LOSS OF SERVING QUALITY

In addition to disease prevention, temperature control prevents food deterioration and loss of serving quality. When food temperature is not controlled, deterioration will be faster. In some cases, food taste and appearance will be changed; this will make the food unpleasant to eat and result in considerable waste.

7-4. FOOD PREPARATION AND THE TEMPERATURE DANGER ZONE

Safe temperatures mean 45° F or below and 140° F or above. Any temperature between 45° F and 140° F is considered to be in the TEMPERATURE DANGER ZONE. Food products have to be in the danger zone at some time during their preparation. However, 3 hours is the maximum time that a food can be in the danger zone without becoming dangerously contaminated. After 3 hours in the danger zone, enough bacteria can grow to cause foodborne disease outbreaks. Unfortunately, a food does not have to be in the danger zone for 3 consecutive hours to become a health hazard. The time accumulates; that is, each separate period which exposes the food to danger zone temperatures counts toward the 3-hour limit. For example, a frozen food is to be prepared. First, the food has to be thawed. The thawing period places the food in the danger zone. Later, the food may be mixed with other food items or chopped or cut. This again exposes the food to dangerous temperatures. In addition, the food may be contaminated from contact with other foods or utensils. If the food is left sitting at room temperature, it once again is in the danger zone. From this example, you can see that it is very easy for food to stay in the danger zone for 3 hours or more. When inspecting food preparation procedures at a full-service food facility, you must determine that personnel are following procedures to minimize the time that potentially hazardous food items remain in the danger zone.

7-5. BASIC PRINCIPLES OF FOOD COOLING

a. To be able to determine whether personnel are minimizing the time that a food spends in the danger zone, you must know the basics of how foods cool.

b. As a general rule, heat is conducted more rapidly through liquid products than through solid products. This means that solids cool at a slower rate than liquids and remain in the danger zone for a longer period of time. Due to this, personnel must take care to cool solid food items as quickly as possible after preparation.

c. Foods that have a high fat or starch content tend to cool slowly. These products must also be cooled rapidly.

d. Foods with a large surface area cool more rapidly than foods with a small surface area.

e. Of particular importance is the fact that small, shallow portions of food cool more rapidly than large, deep portions.

Figure 7-1 illustrates the relationship between size of portion and time required for cooling. For example, assume that a 4-inch high portion of food in a container would take 4 hours to cool to a safe temperature (container A in figure 7-1). It would require 16 hours for an 8-inch portion of the same food in the same container to reach a safe temperature (container B in figure 7-1). A 12-inch portion of this food would require 36 hours for sufficient cooling (container C in figure 7-1).

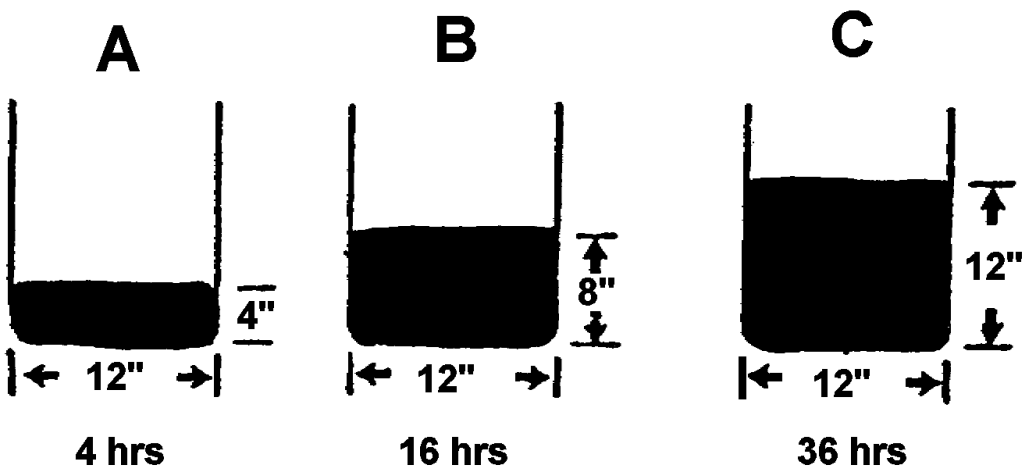


Figure 7-1. Time required to reach a safe temperature for different portions of food.

7-6. COOLING HOT FOODS

a. The principles governing how foods cool form the basis for food cooling techniques. You must ensure that food service personnel follow these techniques.

b. Check to be sure that food service personnel use shallow containers for cooling foods in the refrigerator. The maximum depth of the container for rapid cooling is 3 inches. Shallow containers that expose a large surface area of the food will accelerate cooling even more. Cutting or slicing foods into smaller portions will also increase surface area and promote rapid cooling. In addition, food service personnel can stir or agitate the contents of the container to encourage cooling and to ensure that the inner portion of the food is also cooled.

c. You should also be aware that placing large amounts of hot food in a refrigerator can raise the temperature of the refrigerator unit. The unit may reach a temperature where it no longer cools satisfactorily. This will prevent the hot foods from cooling adequately and could endanger the food items already in the refrigerator. When performing your inspection, check to determine that personnel are not overloading a refrigeration unit with hot foods.

d. Also be 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. Food service personnel must cool foods as quickly as possible. Two effective methods are to:

(1) Immerse hot foods in an ice bath for rapid cooling. This should be done before placing food items in refrigeration units.

(2) Use larger refrigeration units for initial cooling.

7-7. THAWING FROZEN FOODS

Allowing frozen foods to thaw at room temperature is as dangerous as allowing hot foods to cool at room temperature. Both practices permit food to remain in the temperature danger zone too long. Thawing should be done by one of the following methods:

a. In a refrigerator at a temperature of 45° F or below.

b. As part of the cooking process.

c. In a microwave oven.

(1) If food is to be cooked in a microwave oven, then cooking should immediately follow thawing.

(2) If food is to be cooked in a conventional oven, then food should be immediately transferred from the microwave oven after thawing.

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

(1) The food product should be in a sealed plastic bag.

(2) This is the least preferred method for tempering or thawing.

7-8. USING A THERMOMETER TO DETERMINE FOOD TEMPERATURE

The temperature of a refrigeration unit does not give a true reading of the temperature of the food products that it contains. A thermometer placed in a food item is the only way to accurately determine the temperature of the item. The supervisor of the food service facility must frequently monitor the temperature of potentially hazardous foods. The serving line is another area where food product temperature must be monitored. Hot foods that are held must be maintained at 140° F or above. When inspecting a food service facility, observe the supervisor or responsible food service personnel to ensure that they have a pocket thermometer, that they know how to use it, and that they do use it. Use of a thermometer is the best way to determine that foods are maintained at safe temperatures.

7-9. CROSS-CONTAMINATION

Cross-contamination occurs when a food product receives harmful microorganisms from contact with other food items, personnel, utensils, equipment, and surfaces. Cross-contamination is not specifically related to temperature but to all phases of food handling, including storage and personnel control. It will be discussed here since it frequently occurs during food preparation and intensifies the problems caused by inadequate temperature control. For example, chicken could be contaminated if it is mixed with other contaminated foods; if it is cut by a knife used on another contaminated chicken; or if touched by the contaminated hands of a food service employee or by contaminated surfaces. During an inspection, check that the food service employees are taking steps to minimize cross-contamination. These steps include cleaning and sanitizing equipment, utensils, and surfaces after use; requiring employees to wash their hands after handling raw foods; covering foods; and not using the same utensils and equipment for raw and cooked foods.

7-10. SUMMARY

a. Failure to maintain safe temperatures during food handling is the leading cause of foodborne disease.

b. Failure to maintain adequate temperature also causes significant waste due to deterioration and loss of a pleasing taste and appearance.

c. Safe temperatures mean 45° F or below and 140° F or above. The temperature range between 45° F and 140° F is called the temperature danger zone.

d. Three hours is the maximum time that a potentially hazardous food can be in the danger zone without becoming dangerously contaminated. A food does not have to be in the danger zone for 3 consecutive hours for contamination to occur. Each separate period of time that exposes the food to danger zone temperatures counts toward the 3 hours.

e. There are certain basic facts about food cooling that form the basis of food cooling techniques. These are:

(1) Solid foods cool more slowly than liquids.

(2) Foods with a high fat or starch content cool slowly.

(3) Foods with a small surface area cool more slowly than foods with a large surface area.

(4) Large, deep portions of food cool more slowly than small, shallow portions.

f. When cooling foods, food service personnel should use shallow containers with a depth no greater than 3 inches. The container should expose a large surface area of the food product. Cutting food into small pieces and stirring the food will also promote rapid cooling.

g. Food service personnel should not overburden refrigeration units with an excessive quantity of hot foods to be cooled.

h. Food service personnel should never allow hot foods to cool at room temperature.

i. Likewise, frozen foods must not be thawed at room temperatures. Frozen foods should be thawed in a refrigeration unit, in a conventional or microwave oven, under potable running water, or during cooking.

j. The temperature of a refrigeration unit does not give an accurate indication of the temperature of the food products that it contains. Due to this, the food products in the refrigeration unit must actually be checked with a food thermometer. Likewise, food products on the serving line must be checked with a thermometer. A thermometer placed in a food item is the only way to determine if the temperature is safe.

k. Cross-contamination occurs when foods are contaminated by contact with other contaminated food items, personnel, utensils, equipment, and surfaces. It can occur in all phases of food handling and processing, but frequently intensifies problems arising from inadequate temperature control during food preparation.

l. Measures to prevent cross-contamination include:

(1) Cleaning and sanitizing equipment, utensils, and surfaces.

(2) Requiring employees to wash their hands.

(3) Covering foods.

m. It is your job as an inspector to determine that Army food service personnel follow the procedures designed to establish adequate temperature control and to prevent cross-contamination.

Continue with Exercises

EXERCISES, LESSON 7

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the exercise, by completing the incomplete statement, or by writing the answer in the space provided at the end of the exercise.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson, and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. The leading cause of foodborne disease is _____.

2. Temperatures between _____ and _____ are considered to be in the temperature danger zone.

3. Below are a series of statements stating the principles of food cooling. Indicate whether the statement is correct by writing "T" (true) or "F" (false) in the blank before each statement. If the statement is false, write the correction in the space below the statement. Make no entry if the statement is correct.

a. ____ Foods with a high fat or starch content cool slowly.

b. ____ Foods with a small surface area cool more rapidly than foods with a large surface area.

c. ____ Small, shallow portions of food cool at a slower rate than large, deep portions.

d. ____ Solid foods cool at a slower rate than liquid foods.

4. The maximum time period that a food can be in the danger zone without becoming dangerously contaminated is:

a. 2 hours.

b. 1 hour.

c. 3 hours.

d. 4 hours.

5. Frozen beef was removed from the freezer in the morning and left to thaw at room temperature for 2 1/2 hours. It was replaced in a refrigerator for 2 hours. The beef was then removed from the refrigerator and sliced, covered, and placed on the counter while vegetables were prepared. This took 45 minutes. The ingredients were combined into a stew and cooked at a temperature of 150° F. When finished, the stew was left to cool at room temperature for 15 minutes and then refrigerated until served that afternoon. About 1 1/2 hours prior to reheating for serving, a food service employee removed the stew from the refrigerator, placed it on the counter and because he was rushed, forgot about it. The stew remained on the counter and was then heated to about 140° F and served. Which of the following statements describes the <u>most likely</u> result of this procedure?

a. The beef was not contaminated. Although carelessly prepared, it did not remain in the danger zone long enough for contamination to occur.

b. The beef was not contaminated. It was exposed to the danger zone for the time period required to produce serious contamination, but it was not exposed in one continuous time span. The intermittent refrigeration prevented contamination.

c. The beef was contaminated. It remained in the danger zone long enough for serious contamination to occur. It is true that it was not exposed to danger zone temperatures for one consecutive time span; however, each separate exposure adds up to the time limit necessary to produce dangerous contamination.

6. Below is a list of food-cooling practices that you have observed during an inspection of a food service facility. Rate the practice as acceptable or not acceptable by entering satisfactory or unsatisfactory in the space below each statement. Indicate the reason for your rating.

a. Personnel used large containers to cool a meat sauce; the containers are about 7 inches deep.

b. Before placing cooked beef in a container, personnel cut the beef into smaller pieces.

c. Personnel filled the top rack, the middle rack, and part of the bottom rack of a refrigeration unit with containers of hot vegetables. The refrigerator has 3 racks.

d. Personnel placed hot soup in 'a container, stirred the soup for awhile, and then immediately placed the soup in a refrigeration unit.

7. Frozen foods should never be thawed at _____; instead, food service personnel should use one of the following methods:

a. _____

b. _____

c. _____

d. _____

8. A food service facility prepared turkey and roast beef for a holiday celebration. An employee used a cutting board to prepare a raw turkey for cooking. Later, as time became short, the same board was used for slicing the cooked roast. The board was not cleaned. The sliced roast was then put on the serving line at 135° F for 6 hours. Twelve hours later, people attending the celebration became sick with symptoms of a foodborne illness.

a. What was the most likely source of the illness?

b. How did the contamination occur?

c. This type of contamination is called _____ and is produced by contact of a food item with _____.

d. What could have been done to prevent this problem?

9. You are a member of a team investigating reports of cases of foodborne illness at an Army food service facility. You check the refrigeration units and find that they have acceptable temperature ranges. Employees state that the thermometers in the refrigeration units and freezers are checked every day. The foods inside are not checked. Likewise, hot foods held on the serving line are not checked.

a. What is the dangerous practice in this situation and a likely cause of the cases of foodborne illnesses?

b. What is the only way to know if foods are being maintained at adequate temperatures?

c. What would you suggest as a correction for this situation?

10. Inadequate temperature control at a food service facility can result in foodborne illness. What other significant problem can result from dangerous temperatures?

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 7

1. Failure to maintain a safe product temperature. (para 7-2)

2. 45° F, 140° F (para 7-4)

3. a. T (para 7-5c)

   b. F Foods with a large surface area cool more rapidly than foods with a small surface area. Or foods with a small surface area cool at a slower rate than foods with a large surface area. (para 7-5d)

   c. F Large, deep portions of food cool at a slower rate than small, shallow portions. Or small, shallow portions of food cool more rapidly than large, deep portions. (para 7-5e)

   d. T (para 7-5b)

4. c. (para 7-4)

5. c. The beef was exposed to danger zone temperatures for periods of time that totaled 5 hours, 2 hours more than the 3 hour limit.

   150 minutes (thawing)
   45 minutes (on counter)
   15 minutes (cooling)
   90 minutes (on counter)
   300 minutes = 5 hours (para 7-4)

6. a. Unsatisfactory. Food service personnel should use shallow containers with a maximum depth of 3 inches. Shallow containers allow foods to cool rapidly. (para 7-6b)

   b. Satisfactory. Cutting food into smaller pieces increases surface area. A large surface area promotes rapid cooling. (para 7-6b)

   c. Unsatisfactory. Personnel should not overload a refrigeration unit with hot foods to be cooled. This prevents the refrigeration unit from cooling adequately and endangers the foods inside the unit. (para 7-6c)

   d. Satisfactory. Stirring or agitating the contents of a container encourages cooling and allows the inner portion of the food to cool. (para 7-6b)

7. Room temperature:

   a. In a refrigerator not above 45° F.

   b. As part of the cooking process.

   c. In a microwave or conventional oven.

   d. Under potable running water at a temperature of 70° F or below. (para 7-7)

8. a. A contaminated raw turkey.

   b. The raw turkey contaminated the cutting board. The unclean cutting board later contaminated the cooked roast beef. The contaminated roast was then left at a dangerous temperature for more than 4 hours.

   c. Cross-contamination; other food items, personnel, utensils, equipment, and surfaces.

   d The same cutting board should not be used for raw and cooked products. Also the roast should have been held at 140° F or above. (paras 7-4; 7-9)

9. a. The temperature of the foods inside the refrigeration unit and on the serving line have not been checked with a thermometer. Checking the refrigerator temperature does not give a true reading of the temperature of the foods.

   b. A thermometer placed in the food items.

   c. You would suggest that the supervisor or responsible food service employee use a thermometer to frequently check the temperatures of hot and cold foods. (para 7-8)

10. Waste due to deterioration and undesirable changes in food taste and appearance. (para 7-3)

End of Lesson 7

COMMENT SHEET

SUBCOURSE MD0181 Food Service Sanitation and Inspections I EDITION 100

Your comments about this subcourse are valuable and aid the writers in refining the subcourse and making it more usable. Please enter your comments in the space provided. ENCLOSE THIS FORM (OR A COPY) WITH YOUR ANSWER SHEET **ONLY** IF YOU HAVE COMMENTS ABOUT THIS SUBCOURSE..

FOR A WRITTEN REPLY, WRITE A SEPARATE LETTER AND INCLUDE SOCIAL SECURITY NUMBER, RETURN ADDRESS (and e-mail address, if possible), SUBCOURSE NUMBER AND EDITION, AND PARAGRAPH/EXERCISE/EXAMINATION ITEM NUMBER.

PLEASE COMPLETE THE FOLLOWING ITEMS:

(Use the reverse side of this sheet, if necessary.)

1. List any terms that were not defined properly.

2. List any errors.

paragraph	error	correction

3. List any suggestions you have to improve this subcourse.

4. Student Information (optional)

Name/Rank _____
SSN _____
Address _____
_____
E-mail Address _____
Telephone number (DSN) _____
MOS/AOC _____

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