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Public Health Journeyman

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THIS VOLUME covers food microbiology and chemistry, along with food procurement and inspections, surveillance inspections, and facility evaluations. The following discussions give you an introduction to the four units contained in this volume.

Unit 1 introduces the bascis of food microbiology and chemistry. It also explains the causes of food deterioration and spoilage, as well as food preservation, packaging, and storage.

Unit 2 discusses food procurement and inspections. We'll explore approved food sources and how this approval process is accomplished. It also discusses the safety of facilities and the security of the food.

In Unit 3 you'll learn about surveillance inspections and procedures and inspecting semiperishable and perishable food items. The unit will wrap up with operational rations and consumer protection programs.

Unit 4 covers food facility evaluations to include foodborne disease outbreak factors, microbial contamination and the role you play in facility design. You'll also learn about mobile facilities and special evalutions conducted by Public Health. Additionally, public facility evaluations and requirements will be discussed. And finally, you'll learn about the directives used to conduct food and public facility evalutions.

A glossary is included for your use.

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NOTE:

In this volume, the subject matter is divided into self-contained units. A unit menu begins each unit, identifying the lesson headings and numbers. After reading the unit menu page and unit introduction, study the section, answer the self-test questions, and compare your answers with those given at the end of the unit. Then complete the unit review exercises.

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Please read the menu for Unit 1 and begin ➔

Unit 1. Food Microbiology and Chemistry

ALL OF US, at one time or another, have been exposed to spoiled food. Remember that forgotten bowl of leftovers? When you found it, it had become a jungle. It looked bad and smelled worse! How about that loaf of bread? Just when you wanted a sandwich, you found black and green splotched bread. Or the milk left sitting out? The point is—food goes bad. It spoils and deteriorates. At some point, food reaches a state where it's no longer edible. It's not appetizing, wholesome, or safe to eat.

As a public health journeyman, you need to know more about food spoilage than other folks. As part of your job, you evaluate food. Is the food spoiled or can it still be used? Is the food safe to eat or will it make someone sick? These are questions you'll ask yourself daily. To get answers to these questions you need knowledge—knowledge about how and why food spoils. You need to know what can be done to prevent or delay food spoilage, and you need to be able to recognize food spoilage. These are the things you'll learn from this unit. Let's begin our study by looking at basic information about food chemistry and microbiology.

1–1. Food Microbiology and Chemistry

Obviously, food does not stay fresh forever. Over time it undergoes a series of chemical, biological, and physical changes that affect their appeal, nutritional value, and safety. The causes of these changes are numerous, but of particular importance are microorganisms, enzymes, and nonenzymatic chemical reactions in the foods. Let's look at each of these.

Microorganisms cause the most food spoilage. The particular microorganisms that cause food spoilage are found everywhere—in dust and soil, in water and air, and certainly in the food items we consume. It's interesting that the tissues of the healthy plants and animals from which we derive our food are generally sterile and devoid of microorganisms. However, after we harvest these plants or slaughter the animals, there are many opportunities for the food to become contaminated. The result is foods that are no longer sterile and contain many different microorganisms. Some of these microorganisms cause the food to spoil, while other microorganisms can make a person sick. The microorganisms that are particularly important in foods are bacteria, molds, and yeasts.

401. Bacteria (singular bacterium)

Bacteria are found just about anywhere you look. We often think of bacteria doing harmful things such as causing disease or food spoilage. It's true bacteria causes disease and food spoilage. However, the majority of bacteria do beneficial things such as helping break down waste materials in the environment and even producing beneficial changes in food items, as we'll see later.

Identifying factors of bacteria

Bacteria are simple, single-celled organisms. Most are small, only a few micrometers in length and diameter, and are not visible to the naked eye, but can be seen with a microscope. With a microscope, you can see the different shapes of bacteria—some are spherical, which are called cocci, others are rod-shaped, which are called bacilli, others look like commas or spirals, and still others show a variety of other shapes. In addition to their shape, bacteria often form characteristic groupings. For example, *Staphylococcus* bacteria are cocci that group together in grape-like clusters. *Streptococcus* bacteria, on the other hand, form chains of cocci.

Shape and grouping are important characteristics in identifying bacteria. Staining reactions are also important. Gram stain is frequently used, and bacteria are often referred to as either gram-positive or gram-negative. The gram-positive bacteria retain the stain, and the gram-negative bacteria do not. Motility (Movement), colony appearance, and results of biochemical and serologic tests are also useful in identifying specific bacteria. Other interesting properties of bacteria relate to their reproduction and survival.

Reproduction

The major method of bacterial reproduction is binary fission. This is simple cellular division where one cell divides to form two cells. The time lapse from one cell division to the next is called the generation time. Under favorable environmental conditions, generation time may be as short as 10 minutes. This means if you start with 1,000 bacteria, in 10 minutes, you'll have 2,000 bacteria. In 10 more minutes, you'll have 4,000 bacteria. After an hour, those initial 1,000 bacteria will have multiplied to 64,000 bacteria! You can easily see when bacteria in food are allowed to grow and multiply, the numbers of bacteria rapidly increase.

Survival

Although certain environmental conditions are favorable and allow bacteria to multiply, other environmental conditions inhibit bacterial growth. Some environments kill bacteria. However, some bacteria are able to form endospores within the cells to survive such adverse conditions. Endospores contain the genetic material plus limited amounts of other cellular components from the bacteria. A thick, tough spore coat surrounds these materials. The process of forming the endospore is called sporulation. After the endospore forms, the rest of the bacterial cell may disintegrate. Endospores can resist heat, cold, drying, and many disinfectants. A number of food spoilage and food-borne disease bacteria, such as *Clostridium* species, form spores making their control more difficult.

Molds

Molds are a subclass or subgroup of fungi. Fungi (singular, fungus) are frequently classified as plants. However, they differ from the plants we are most familiar with because they lack chlorophyll and other photosynthetic pigments. Therefore, fungi are not able to use the energy from the sun for their metabolic needs. Instead, fungi secrete digestive enzymes into their environment that break down organic materials and then they absorb the resulting nutrients.

Hyphae

Molds are fungi consisting of filamentous structures called hyphae. The mass of hyphae making up the mold colony is called a mycelium. A good example of mold is the black bread mold *Rhizopus* which we all have seen at one time or another. Some hyphae, called vegetative hyphae, grow on the surface, but can also penetrate foods such as bread. These hyphae secrete the digestive enzymes and

absorb nutrients. Other hyphae, called fertile hyphae, extend into the air. At the tips of these hyphae are specialized reproductive bodies that produce spores. Reproduction occurs primarily through the production of asexual spores. Frequently these spores give a mold its characteristic color.

Helpful and harmful mold

Just like bacteria, molds can be both helpful and harmful. Certain molds can cause such problems as food spoilage and disease. However, other molds help us produce such food products as Bleu, Roquefort, and Camembert cheese. Additionally, the antibiotic penicillin was first isolated from the mold *Penicillium notatum*.

Yeasts

Yeasts are also fungi, but they are single-celled, microscopic organisms. Yeasts have a wide variety of appearances, but most common yeasts are spherical or ovoid. Reproduction occurs primarily by budding. In this process a smaller new cell is pinched off from a larger existing yeast cell. Harmful yeasts in food can lead to spoilage. However, other yeasts are used for such processes as producing wine and leavening bread.

402. Food, acid, time, temperature, oxygen, and moisture

We need to know about the various factors that influence microbial growth if we are to understand food deterioration and ultimately be able to delay food spoilage. You may remember the pneumonic from technical training—food, acid, time, temperature, oxygen, and moisture (FATTOM). This is an easy way to remember the factors that influence microbial growth. The type food, acid content, time prepared, the temperature, the amount of oxygen and moisture are factors that essentially allow or prohibit growth of deteriorative conditions and/or microorganisms that cause illness.

Food nutrients

Different microorganisms have different nutritional requirements for growth. Many foods are excellent sources of nutrients for microorganisms. For example, foods of animal origin are typically rich in a variety of nutrients and can support the growth of many microorganisms. Thus, the nutrient composition of foods can influence the microorganisms that will grow and can also influence the metabolic products formed during microbial growth. Foods are complex substrates for growth of microorganisms. Various compositional factors of foods certainly have an impact on microbial activity. Prominent factors are nutrients, natural inhibitors, and microbial flora.

Natural inhibitors

Another food factor influencing the activity of microorganisms is the presence of various inhibitory substances in foods. Many foods contain naturally occurring substances with antimicrobial activity. For example, egg whites contain lysozyme, conalbumin, avidin, and ovomucoid, all of which are natural antimicrobials. Milk also contains antimicrobial substances such as lysozyme, lactoferrin, and lactoperoxidase. Cranberries have relatively high concentrations of benzoic acid, the same compound added by food processors to other foods because of its preservative effects. Various spices have long been recognized for their preservative qualities, and a number of antibacterial agents have been isolated from such spices as cinnamon and cloves. Many other foods also contain an extensive variety of natural inhibitors. The effects of these inhibitors are not the same on all microorganisms. For example, gram-positive microorganisms are more often affected by such inhibitors than gram-negative organisms. Thus, the presence of natural inhibitors will influence which microorganisms can grow in food to cause spoilage.

Microbial flora

A final food factor that affects the growth of microorganisms in food is the microbial flora of the food. Microbial flora refers to the microorganisms present in the food. As noted earlier, foods are not sterile. Foods frequently contain many microorganisms that interact with one another. The growth of one microorganism may inhibit or stimulate the growth of other microorganisms in a variety of ways.

For example, microorganisms may compete for nutrients. One microorganism, therefore, may consume nutrients needed by a second; thus, inhibiting the growth of the second microorganism. On the other hand, a certain microorganism may provide essential nutrients needed by another microorganism. In this case, growth of the second microbe will be stimulated in the presence of the first. Some microorganisms may consume oxygen as they metabolize, changing an oxygen-containing (aerobic) environment to an oxygen-deficient (anaerobic) environment. As we'll see, this change can influence which microorganisms grow.

Many microorganisms produce substances such as acids and antibiotics. Such substances are inhibitory to other microbes. Spoilage of milk is a good example of how the growth of microorganisms can be affected by other microorganisms. Streptococci may grow in milk and convert lactose, or milk sugar, to lactic acid. The resulting drop in potential hydrogen (pH) allows streptococci to grow but inhibits other bacteria. As lactic acid continues to accumulate, the pH drops to a point where streptococci are inhibited, but lactobacilli, another group of bacteria, are able to grow. Lactobacilli will continue to ferment lactose to lactic acid. The milk becomes sour. As pH continues to drop, yeasts and molds are able to become the dominant microorganisms. However, yeasts and molds convert lactic acid to nonacid products, and pH rises. The increase in pH allows other bacteria to grow. Thus, we can see how microorganisms can alter a food so that other microorganisms are either helped or hurt.

Acid and potential hydrogen

Defined as the negative logarithm of hydrogen ion concentration, pH is essentially a measure of acidity. The values of pH range from 0 to 14. A pH value of 7 is neutral. Values less than 7 are acidic—the lower the value, the greater the acidity. Values greater than 7 indicate alkaline conditions.

Growth range

Different organisms have different pH ranges in which they can grow. Each microorganism has an optimum pH as well as maximum and minimum pH values for growth. In general, molds can grow in more acidic conditions than yeasts. Yeasts, in turn, can grow at a lower pH level than most bacteria. Most bacteria grow best at pH values around neutral. However, there is great variability. For example, some bacteria will grow at a pH as low as 4, and others will grow at a pH as high as 11.

Different ranges

The different pH ranges for microorganism growth account, in part, for the types of microorganisms most commonly associated with spoilage of specific food items. For example, fruits are relatively acidic. Since molds and yeasts can tolerate acid environments better than bacteria, fruit spoilage is usually due to molds or yeasts and less due to bacteria. Meats, on the other hand, have a pH closer to neutral and, therefore, are often spoiled by bacteria.

Stability

In general, lower pH results in a food item with greater stability. The acid to cause this low pH can come from a variety of sources. Some foods, such as citrus fruits or tomatoes, are naturally acidic. Other foods, such as sauerkraut, are produced by fermentation. During fermentation, nonharmful bacteria break down carbohydrates in food to lactic acid. As the lactic acid accumulates, the pH drops resulting in a more stable product. In other foods, pH is adjusted by adding chemicals such as acetic acid or citric acid. When used to adjust pH in foods, these materials are called acidulants. Interestingly, when adding acidulants to food products, the inhibitory effect on microorganisms is due not only to the lowering of pH but also to the specific acid used. For example, at the same pH, acetic acid has greater inhibitory effects than lactic acid.

Temperature

Temperature is one of the most important environmental conditions influencing microbial growth. In fact, temperature not only has dramatic effects on microbial growth, it also can affect the very

survival of microorganisms. As you might expect, different microorganisms have different minimum, optimum, and maximum temperatures for growth. These different growth ranges allows us divide microorganisms into three groups—psychrophilic, mesophilic, and thermophilic.

1. Psychrophiles grow at relatively *low* temperatures.
2. Mesophiles grow at *moderate* temperatures.
3. Thermophiles grow at relatively *high* temperatures.

Another microorganism you may encounter is psychrotroph. Psychrotroph grows best at moderate temperatures but also can grow at low temperatures.

Typical temperatures

There is no general consensus on the exact temperature ranges for these groups. However, some typical values can be given. For example, psychrophiles typically grow best between 32 and 70 degrees (°) Fahrenheit (F) (0 to 21° Celsius [C]) with a full range for growth between 19 and 86°F (–7 to 30°C). Psychrophiles include microbes that spoil refrigerated foods. Mesophiles grow best between 70 and 110°F (21 and 43°C) with a range of growth between 68 and 110°F (20 to 43°C). Most food-borne illness bacteria are mesophiles. Thermophiles grow above 110°F (43°C) with best growth between 131 and 150°F (55 to 66°C).

Optimum temperatures

The rate of growth is most rapid at the optimum temperature. At temperatures above and below the optimum, the rate of growth decreases. This decrease is particularly dramatic as the temperature is raised above the optimum. No growth occurs below the minimum temperature. However, microorganisms can often survive at temperatures well below the minimum. On the other hand, as temperatures increase above the maximum, not only does growth stop, but microorganisms are also killed. Exceptions to this are bacteria that form spores that can often tolerate temperatures much higher than the maximum temperature for growth.

Bacterial growth

To understand some factors that influence microbial growth we should discuss the four growth phases:

1. lag,
2. log,
3. stationary, and
4. decline.

Lag phase

The first phase is called the lag phase. During this phase, there is no increase in the number of bacterial cells. In fact, there might even be a slight decrease. During this phase, the bacteria are probably adjusting to their environment and preparing for cell division. Thus, even if we put a particular bacterium in an environment ideally suited to its growth and reproduction, there will be a period of time before the number of bacteria begins to increase. Therefore given the name “lag” phase.

Log phase

The lag phase is followed by the log phase—or period of logarithmic growth. Bacteria have now become adapted to their environment and begin rapid cell division. The phase is called the log phase because the bacterial numbers increase logarithmically. That means if you start with one cell, it quickly becomes two, which become four, which become eight, and so on. The result is a very rapid increase in cell numbers.

Stationary phase

The next phase is the stationary phase. During this phase, there is no net increase in the number of cells. In other words, the death rate equals the reproductive rate.

Decline phase

Finally, there is the death or decline phase. Here the death rate exceeds the reproductive rate. Bacteria begin dying because of the accumulation of waste materials and depletion of nutrients. Therefore, the number of cells decreases.

Time

One factor that certainly influences microbial growth is time. As time progresses, we can expect different bacteria numbers. Of particular importance is the lag phase—the phase where the number of microorganisms is not increasing. If we can keep the microorganisms contaminating foods in the lag phase, they will not increase to levels that cause food spoilage. One way to do this would be to only keep foods a very short time. Generally, this is not practical. However, by making the environment around the microorganism less favorable for growth and reproduction, we can essentially lengthen the lag phase. We can increase the time during which the number of microorganisms do not increase.

Oxygen availability

Different microorganisms differ in their abilities to grow in the presence or absence of oxygen. Some microorganisms can live and grow in the presence of free oxygen. These are called aerobic microorganisms, and this group includes all molds and many bacteria and yeasts.

On the other hand, some bacteria grow only in the absence of oxygen. These are called anaerobic microorganisms or anaerobes. Another group of microorganisms can grow either in the presence or absence of oxygen. These microorganisms are referred to as facultative. Oxygen availability determines which microorganisms can reproduce and cause spoilage in specific food items. For example, since molds require oxygen for growth, we would expect mold growth and resulting food spoilage to begin on the surface of a food exposed to air. As we'll see later, by controlling the exposure of certain foods to oxygen, microbial deterioration can be delayed.

Moisture

Microorganisms need water to grow and reproduce. Most foods have fairly large moisture content. However, moisture content (the total amount of water in the food) is not a reliable indicator of water usable by microorganisms. This is because water in foods exists as both "bound" and "free" water. Bound water is held by large molecules in the food and, therefore, cannot be used by microorganisms. Free water is the water available to microorganisms for their metabolic activities. This discussion on water content in foods introduces the term "water activity" (Aw).

Water activity measurements

Although there are various formulas for calculating Aw—simply put, Aw is the measurement of the availability of water for chemical reactions and microbial metabolism in food. The Aw for distilled water is 1.0. Foods have Aw values less than 1.0. When the Aw is a small number it means there is less amount of free water available to microorganisms for their metabolic activities. For example, fresh fruits and vegetables typically have Aw values around 0.97 to 0.99. Jams and jellies, which have less free water, have Aw around 0.80. Dry products such as cereals may have Aw values as low as 0.10 to 0.20.

Water activity requirements

Different microorganisms have different water requirements. Generally, bacteria require high Aw values for growth and reproduction, often in the range 0.96 to 0.99. An exception to this is halophilic (salt-loving) bacteria that may grow at Aw values as low as 0.75. Yeasts grow at Aw values lower than those needed for most bacteria. Many grow at Aw values around 0.90. Others grow at Aw

values of 0.78 or lower. Molds typically can grow at lower Aw values than other microorganisms. Some grow at Aw values as low as 0.62. Just as we saw with pH, the type of microorganism involved in spoiling a particular food might be explained by the minimum Aw for growth of the microorganism. Thus, we might expect jams and jellies to be more likely spoiled by yeasts and molds than by bacteria.

Water activity adjustments

Lowering the Aw of a food item can increase its stability. Typically, one of three methods is used to decrease Aw. First, food can be dried or dehydrated which removes water from the food. Second, freezing food turns water into ice, a form in which the water is not available to microorganisms—decreasing the Aw. Finally, solutes such as sugar or salt can be added to a food. These substances bind water, therefore, decreases Aw. You'll learn more about how such procedures are used to preserve foods later.

Interaction of factors

An important point to remember about the factors influencing microbial growth is that they do not act independently. These factors exert their effects simultaneously, and often the effect of one factor on microbial growth will alter the effect of a second factor. For example, Aw and temperature interact. At the optimum temperature for growth, a microorganism can grow at lower Aw values. As the temperature approaches the extremes of the growth range, Aw values approaching the optimum are needed for growth. Similar interactions occur between Aw and pH and pH and temperature.

Enzymatic activity

The second largest cause of food spoilage is the deterioration of foods by enzymes. Some of the same control methods for microbial growth also control enzyme breakdown.

Enzymes types

There are two types of enzymes that affect foods—enzymes of the food itself (food enzymes), and the enzymes of the microorganisms (microbial enzymes) in the food. Enzymes are catalysts that often cause breakdowns of substrates such as carbohydrates, fats, and proteins in foods. The enzymes are released from the reactions unharmed and unchanged.

Beneficial enzymes

Some enzymes are beneficial. Enzymes are involved in ripening fruits and vegetables. Enzymes can also be responsible for changes in color, texture, and nutritional properties of many foods. Heating food products often controls enzymes. For example, in fermented food products microorganisms are added to produce the necessary enzymes to break down carbohydrates. Later, the products are heated to inactivate the enzymes so that the reactions will cease.

Results of enzyme activity

There are many uses of enzymes in the food industry. However, many preservatives, antibiotics, inhibitors, poisons, and insecticides constrain many enzymes in foods. Tests can be performed on foods to determine the activity level of specific enzymes to detect the presence of the antibiotics, poisons, preservatives, and insecticides.

Heat tests

Since enzymes are heat sensitive, there are enzyme tests that can be performed to determine the efficiency of the heating of foods during processing. For example, if the enzyme phosphatase is found in milk, the efficiency of the milk pasteurization was poor. The diatase (enzyme) test is used to determine the heat process of honey, while peroxidase is used as an indicator of proper blanching of vegetables.

Enzyme separation

Many enzymes are used in food processing. For example, carbohydrates and proteases are used in the bakery industry for converting proteins to amino acids for improving the dough in baking. Proteases are also used for meat tenderizing, as enzymes in cheese, and for chill proofing beer.

Lipases, another form of enzyme, is used for making Italian cheeses. Advanced technology has made it possible to separate the enzyme from the food product making the enzyme reusable. This procedure is being used in the beer, wine, juice, and syrup industries.

Results of microbial growth in foods

Later, when we discuss specific food items, we'll describe some results of specific microbial growth. However, we can make some general comments about the desirable and undesirable results of microbial growth in foods.

Desirable results

As mentioned earlier, sometimes microorganisms in foods produce desirable results. Products such as beer, wine, some cheeses, sauerkraut, and many others depend on changes produced by bacteria, yeasts, or molds.

Undesirable results

On the other hand, some microorganisms produce undesirable changes. For example, if bacteria like *Staphylococcus aureus*, *Salmonella typhimurium*, *Clostridium perfringens*, or *Clostridium botulinum* are allowed to grow in foods, people consuming them may get sick.

403. Food pathogens—Illness organisms

One type of undesirable change in foods is the growth of food-borne illness organisms making foods unsafe to eat. It's important to point out that growth of such microorganisms doesn't always cause observable changes in foods. The foods may look, smell, feel, and taste normal and still make you sick.

Common foodborne illnesses

The next few lessons will explain the causes, signs and symptoms, and preventive measures of foodborne illness. Of course, preventing a foodborne illness is our ultimate goal. Foodborne illnesses are of two general categories—infections and intoxications.

Foodborne infections

These illnesses are caused by ingesting food or drink containing pathogenic organisms (viruses, bacteria, protozoa, and various parasites). The delayed onset of symptoms suggests the growth of organisms after ingestion, and, therefore, the illness is not necessarily related to the amount of food ingested.

Salmonellosis

One of the more common foodborne infections that might adversely affect the mission at your base is salmonellosis. More than 1,700 serotypes of *Salmonellae* exist, and *Salmonella* organisms cause a high percentage of foodborne infections. *Salmonella* infections are common in animals, especially birds. Therefore, infection may result from eating improperly prepared, preserved, or cooked poultry and meats. Ground meat and sausage are especially vulnerable due to the amount of processing and possibility of cross-contamination. Outbreaks can result from cross contamination between contaminated foods, such as poultry, to uncontaminated, ready to eat foods. Food handlers are usually responsible for this cross-contamination via their hands, utensils, or food contact surfaces. Specific circumstances permit the transmission of salmonellosis such as: contamination of food capable of supporting growth of *Salmonella* such as poultry and favorable temperatures for *Salmonella* growth, 40 to 115ºF (4-46ºC). There is also a time factor, sufficient time for organisms to multiply to a dangerous level is about four hours.

Symptoms

Symptoms of *Salmonella* infection occur between 6 and 72 hours after ingestion, with an average of 12 to 36 hours. The symptoms vary from nausea to severe headache, chills, fever, violent retching, colic, and diarrhea. Recovery may take from one to three days or up to a week. Death is rare and usually occurs mainly in highly susceptible groups such as young children, the elderly, and those with compromised immune systems.

Control measures

Control measures are similar to those involving other foodborne illnesses and include chilling foods rapidly; cooking foods thoroughly; cleanliness of food handlers and maintaining cleanliness of food and equipment; restricting sick employees from food handling duties; ensuring proper handling of foods, and adequate storage, especially adequate refrigerated storage; using pasteurized dairy and egg products; using eggs whose shells have not been cracked; and sanitizing equipment.

Streptococcal infections

The causative circumstances surrounding a streptococcal foodborne infection generally parallel those of a *Salmonella* outbreak. The incidence of streptococcal foodborne infection is less and the symptoms are milder than those of salmonellosis.

Symptoms

Symptoms may begin one to three days after ingestion of infective food and often include red sore throat, high fever, and vomiting. The infectious agent is *Streptococcus pyogenes* which causes sore throats and scarlet fever, and may be transmitted to food through droplet infection (spread by talking, coughing, and sneezing) or direct contact such as with food handler's hands. Susceptible foods include poultry and eggs, potato salad, meat dishes, and low-acid foods.

Control measures

Control measures include chilling foods rapidly; cooking foods thoroughly; practicing good personal hygiene; using pasteurized milk products; and excluding workers from handling foods if suffering from respiratory illness or infected skin lesions.

Hepatitis A

Because of the long incubation period of hepatitis A virus (HAV), it's very difficult to identify the source of the virus when investigating an outbreak. Control and epidemiological investigation center around possible transmission by food or water. Special efforts should be made to improve sanitation and personal hygiene. Reduction of fecal contamination of foods and water should be stressed. It's important to remove any infected food handler from the kitchen until their infections are resolved.

Campylobacter jejuni

C. jejuni is a common inhabitant of the intestinal tract of cattle, swine, sheep, chickens, turkeys, and other animals such as dogs, cats, rodents, and monkeys. Raw or undercooked animal origin foods are the most likely source of human infection. Unchlorinated water has also been a vehicle in several major outbreaks of *C. jejuni*. The disease is known as campylobacteriosis or campylobacter enteritis and is more common than salmonellosis and shigellosis combined! In fact it's the most common bacterial pathogen associated with foodborne illnesses.

Symptoms

The symptoms include nausea, abdominal cramps, headache, fever, and diarrhea which might be bloody if severe. The symptoms begin about two to five days after infection. Individuals remain ill for about two to three days, but illness can last weeks or months when complications set in. Complications include meningitis, cholecystitis, urinary tract infection, and reactive arthritis.

Control measures

C. jejuni does not grow or survive well in foods. It's usually killed easily with heat, and prevented by acid, salt, and drying. The organism will not multiply at temperatures below 85°F (29ºC). In the past, this organism was not considered important because it was not identified. One of the reasons it was not identified was due to the special laboratory procedures needed to grow and identify the organism. It takes an experienced lab technician using darkfield microscopy to identify the organism. The lab needs to know if you suspect this organism as a causative agent. The darting, motile, corkscrew-shaped organisms may be easily mistaken and misidentified. Your job is to help pinpoint the cause of an outbreak. As public health officials and laboratory personnel become more aware of *C. jejuni*, the identification of this organism in foodborne illness outbreaks will probably increase. The control measures are the same as used for *Salmonella* infections.

Listeria monocytogenes

Infection with *Listeria monocytogenes* is known as listeriosis.

Symptoms

Listeriosis is frequently associated with women who are pregnant and newborn babies. It often results in meningitis and prenatal septicemia. Infections can result in stillborn or acutely ill infants or can cause abortions, which usually occur in the last half of pregnancy. If infected infants survive birth, they often either die shortly after birth or develop meningitis leading to either death or permanent mental deficiency. Individuals with malignancy, cirrhosis, or other immune-deficiency conditions are also at high risk.

Control measures

The causative organism *Listeria monocytogenes* is widely distributed in nature, but has been isolated from humans and cow's milk. It's also isolated from fermented silage (vegetables in storage silos that have fermented), leafy vegetables, and soil. It survives longer in sewage and sludge than *Salmonella*. The organism is sensitive to heat and is destroyed during pasteurization, but if it survives these processes, it's capable of growth under refrigeration temperatures.

L. monocytogenes's distribution in the environment, ability to survive for long periods of time under adverse conditions, and ability to grow while under refrigeration make it a potentially important cause of foodborne illness in the future. Although the dairy industry closely polices its procedures, mistakes are made and procedures are by passed, which puts raw milk into a finished product and causes listeria outbreaks.

Miscellaneous foodborne infections

There are many other pathogens that can be transmitted through foods. However, they do not occur as often as those previously mentioned. Among these are numerous intestinal parasites such as pork, beef, and fish tapeworms, and other helminths; intestinal viruses; and bacterial diseases such as brucellosis.

Symptoms

Many of these diseases are primarily diseases of animals but are capable of infecting humans if the organisms are ingested from improperly prepared or processed foodstuffs. Undercooked meats may contain infective tapeworms or trichinae; and raw milk can be a prime source of brucellosis, diptheria, Q-fever, or bovine tuberculosis. In most instances, veterinarians control these diseases through vaccination of herds or slaughter of infected animals, if a cure is not possible or feasible. In trichinosis control, cooking of raw garbage to be used as hog food is one preventive measure. Additionally, our society has been taught over the years to cook pork until well done which assures destruction of trichinae. A veterinarian meat inspection, before and after slaughter, further controls the transfer of most animal diseases.

Control measures

Transmission control, in some instances, is the best method of prevention. Pasteurization of milk is the intermediate control in brucellosis, Q-fever, and bovine tuberculosis. Pork must be thoroughly cooked to prevent trichinosis, and all other meats should be cooked adequately to control parasites. Thorough cooking of all pork products to an internal temperature of 170°F (77ºC) is a realistic and satisfactory positive control.

Foodborne intoxications

The most common cause of foodborne intoxication is bacteria, although poisonous plants, animals, and chemical intoxication are occasionally the cause of serious outbreaks. Bacteria cause illness under the right conditions, by releasing a toxin into the food. Many of these bacteria are constantly present in healthy individuals. However, they are not a problem until the bacteria are allowed to reproduce and form a toxin in the food. This only occurs if foods are mishandled or improperly stored. Chemical intoxication can be caused by preparing or storing acidic foods in containers made of materials toxic to humans, such as a galvanized container used to hold tomatoes or fruit juice. This can also be a problem if chemicals are stored with food and inadvertently added during preparation. Some plants and animals are naturally poisonous to humans but are sometimes prepared as food.

Staphylococcal foodborne intoxication

Staphylococcus organisms are usually present on our bodies, but luckily, not all types cause food poisoning. Only specific types that can produce toxins in food will cause trouble. Toxin-producing organisms may be found in the mouth and nose, infected cuts, boils, pimples, feces, and on dirty hands and arms. Two ways to prevent staphylococcal food poisoning are to prevent the bacteria from getting into food and by storing food under conditions that prevent growth of the organism and production of toxin.

Growth and survival

Staphylococci like to grow and reproduce in warm, moist, high-protein foods. They can survive in higher salt and sugar concentrations than most pathogens. Therefore, cooked hams, custards, and cream filled pastries are especially conducive to the growth of staphylococcus organisms. A staphylococcal outbreak usually involves cooked foods. This is because this organism is a poor competitor and does not do well when other bacteria are present.

Cooking destroys most bacteria, but staphylococci present on hands recontaminate food, they could grow and cause problems. Meats, egg products, and salads made from meat or eggs, and unacidified mayonnaise are also frequent offenders. At temperatures between 67 and 115° F (19-46ºC), the organism can multiply to sufficient numbers and begin toxin formation. Cold does not kill the bacteria, but it prevents multiplication and toxin formation. High temperatures kill the organism, but cannot destroy the toxin already produced. Even boiling does not destroy the toxin. For this reason, the toxin is considered “heat stable.”

Symptoms

Symptoms of staphylococcal intoxication usually occur in two to four hours after consuming the toxic food. Symptoms may vary from mild nausea to extreme prostration with cramps, diarrhea, and often projectile vomiting. Recovery usually occurs within 24 to 36 hours; deaths have occurred as a result of staphylococcus food poisoning, but are very rare.

Control measures

Prevention of contamination and proper refrigeration are the keys to control. Food handlers with open sores, boils, cuts, skin rashes, or gastrointestinal upsets should not be allowed to work until they have been cleared for duty by a healthcare provider. Daily examination of food handlers by their supervisors is especially important to detect these problems. Educating food handlers to wash their hands after coughing, blowing their noses, touching their faces, and visiting the latrine, is a basic step

in preventing this illness. Use of wholesome products, clean utensils, proper handling techniques, and adequate refrigeration are vital. Nothing can be done to destroy the toxin except to throw out the food. An important rule to teach is "keep hot food hot and cold food cold."

Botulism

The causative agent for this disease is *Clostridium botulinum*. This spore-forming organism grows in the absence of oxygen and produces a neurotoxin which is highly fatal even in small amounts. *C. botulinum* lives in decaying matter, soil, lake silt, and is often found in animal intestinal tracts. Food that comes in contact with contaminated soil picks up this organism which releases a toxin as it grows under anaerobic conditions. The toxin is destroyed by boiling for five minutes, but the botulinum spores are much more resistant. They may be killed by boiling for five hours at 212°F (100ºC), or for 40 minutes at 238°F (114ºC), using a pressure cooker. The spores' resistance to heat is the reason why under processed, home-canned, garden vegetables has been the source of numerous cases of botulism. Nonacid foods such as peas, beans, corn, and meat are the worst offenders. Smoked, vacuum-packed fish, fermented meats, baked potatoes, and sautéed onions have also been causes of outbreaks.

Symptoms

Symptoms of botulism vary considerably, depending upon the amount of toxin ingested. Patients may experience symptoms in two hours to eight days, but usually within 12 to 48 hours after consuming the toxin. Common early symptoms include nausea, vomiting, abdominal pain, and diarrhea followed by double vision, loss of eye movement, and difficulty with speech, swallowing, and breathing. A descending symmetrical flaccid paralysis may progress until there is complete respiratory paralysis. Without treatment, the mortality rate is usually high at about 50 to 60 percent, and death may occur within three to 10 days after poisoning.

Control measures

Prevention of botulism is based upon proper preparation of foods. Foods should be stored at proper temperatures and cleaned prior to canning to prevent the growth of the organisms. Home-canned (which includes jars), nonacid foods should be avoided. Inspect all canned foods and discard bulging cans. When in doubt, throw it out. Do not taste it to determine safety.

Clostridium perfringens

This is another anaerobic spore-forming organism that has gained considerable attention in recent years. It inhabits the intestinal tract of humans and animals and is extremely common in the soil.

The organism sporulates when the environment is not to its liking and the spores can contaminate food. All of the spores may not be destroyed during cooking. Once the spore is in the food and the proper conditions exist (i.e., temperatures of 113 to 120°F (45−49ºC)—temperatures to 127°F (53ºC) with moisture and time to grow), the organism germinates or returns to its original state. The organism begins to multiply and produce a toxin. Both the organism and toxin can be destroyed by temperatures of at least 165°F (74ºC). This makes it very important for foods to be cooled properly after cooking and thoroughly reheated to 165°F (74ºC). Cooked meats and poultry have been the chief offenders in outbreaks of foodborne illness involving *C. perfringens*. Unrefrigerated chicken broth provides an ideal culture medium. Rolled meat roasts, meat pies, and turkey are often the source of outbreaks. These types of foods or conditions set up a slightly anaerobic environment, which promotes the growth and reproduction of *C. perfringens*. Improper handling and processing of poultry and cooling of meat increase the hazard.

Symptoms

Symptoms of *C. perfringens* foodborne illness are generally of short duration, usually 1 day or less, and complete recovery usually follows. The symptoms, which appear in 8 to 12 hours, include acute

abdominal pain, gas, diarrhea, chills, and fever. Nausea is mild, if present, and vomiting is uncommon, since this is primarily a lower intestinal syndrome.

Control measures

Controls and preventive measures generally involve proper preparation and storage of meat and poultry dishes.

1. Serve foods hot, immediately after preparation. Cool leftovers rapidly (from 135 to 70°F [57-21ºC] in two hours, and from 135 to 41°F [57−5ºC] within a total of six hours) and reheat them rapidly to 165°F (74ºC). In a refrigerated storage unit, it's best to leave foods uncovered until the cooling temperature has been reached, then cover the foods. The supervisors must continually monitor the temperatures during the cooling process.
2. Use a meat thermometer to guarantee adequate, thorough cooking of thick cuts and interior portions.
3. Limit the depth of food such as stews and gravies, and use small containers for refrigerated storage.
4. Handle and clean vegetables and poultry using proper techniques.

Nonbacterial poisons

In addition to bacterial poisons, chemicals from plants, animals, and seafood may be toxic when consumed. Among the offenders that have caused outbreaks of poisoning are fava beans, water hemlock, uncooked rhubarb leaves, mussels, some species of fish, shellfish that have eaten poisonous plankton, and some mushrooms. Two mushroom species of the genus *Amanita* (*A*) are very dangerous. These species can cause neurologic disorders, including brain damage, which may even result in death. Consumption of *A. muscarine* mushrooms may lead to symptoms within 2 minutes to 2 hours, and symptoms associated with *A. phalloidis* normally occur 6 to 15 hours after ingestion.

Inorganic chemicals

Other types of nonbacterial poisons are inorganic chemicals. Included in this group are insecticides used on fruits and vegetables; copper and cadmium-plated, enameled (antimony), or galvanized (zinc) pots and pans used to prepare and store acidic foods; lead, fluorides, and cyanides. These chemical poisons often cause violent symptoms shortly (between ten minutes and two hours) after ingestion.

Be careful

Why do these illnesses occur? They occur mainly because people who prepare and serve food fail to apply known food protection measures. Carelessness and ignorance lead to contamination of food with bacteria or with material that cause foodborne illness.

404. Foodborne illness investigations

When investigating foodborne illnesses we need to consider the factors involved and our responsibilities for the investigation.

Factors

There is a certain sequence of events that must take place before a foodborne illness can occur. There must be an offending agent (pathogen) present, a vehicle to transmit the pathogen, a susceptible consumer, and an abuse of a food handling procedure. We do not live in a sterile world and must eat to survive; thus the agent, the vehicle, and the consumer will always be present. Foodborne illnesses are eliminated if safe food handling procedures are applied and practiced. Let's take a closer look at each sequence of events.

Agent

An analysis of data compiled by the Center for Disease Control and Prevention (CDC) reveals that over 68 percent of all confirmed cases of foodborne illnesses for the 10 years studied were attributed to a bacterial agent. Other agents involved in foodborne illnesses include the following:

- Chemical—23 percent.
- Parasite—6 percent.
- Viral—3 percent.

These small percentages should not be equated with lack of importance! Chemical poisonings are high on the list as far as numbers of illnesses, and this type of illness could easily occur if we do not do our job in educating the food handler.

Vehicle

Some foods are better suited to bacterial growth. These foods are called potentially hazardous foods (PHF). PHFs are usually moist, with high protein, and low acid. However, all foods are susceptible to post-preparation contamination with pathogens or chemicals by food handlers. Be alert to all food handling deficiencies.

Consumer

This is the individual who eats the meal, buys the food at the commissary, or consumes the sandwich from a vending machine. Certain individuals are more susceptible to foodborne disease than others. The person's size, age, present health, and eating habits as well as the dose of the pathogen determine the effect the food has on an individual. These effects can vary from nausea to death.

Abuse of food handling procedures

Although this is our last consideration, it's the first to occur when a foodborne illness strikes a consumer. Food handling procedures actually begin when an item enters the food chain either at harvesting or during preparation.

Responsibilities

Now that you know the different types of foodborne illnesses, you need to know how public health (PH) investigates these illness outbreaks. The key to a successful investigation is developing and practicing a foodborne illness outbreak investigation plan. Each base has a slightly different plan, but the process is basically the same everywhere. At a minimum, you should exercise the foodborne illness investigation plan at your base annually. Hospital or medical personnel with initial patient contact should also receive training from PH in the proper procedures to follow during a suspected foodborne illness outbreak.

Preparation

Even if your base has a good food service sanitation program, a foodborne illness outbreak could still occur, and your office should be prepared to respond rapidly. Creating a foodborne illness outbreak kit will make certain that all necessary items are ready to go in case something happens. The kit should contain such items as sterile bottles, gloves, tongs, spatulas, pencils, paper, and a supply of forms used in the investigation. The forms used are AF Form 431, Food Poisoning Outbreak—Individual Case History; AF Form 432, Time Distribution of Persons Affected; and CDC Form 52.13, Investigation of a Foodborne Outbreak. Be sure to inventory your kit annually, and after each use, to make sure all needed items are present, and the sterile items are still intact.

Notification

To guarantee a rapid response, the medical treatment facility (MTF) should develop a notification plan or recall roster. As soon as medical authorities realize an actual outbreak may be in progress, implement the recall plan.

Investigation

To properly investigate an outbreak, you need to understand the causes of an outbreak. Let's begin with a review of the factors involved in a foodborne illness outbreak. First, an infective agent or pathogen must be present. Then there must be a reservoir or source. Where did the organism come from? Is it common to a specific food item? Is it on a food contact surface that was not cleaned and sanitized properly? Microorganisms are nonmotile for all practical purposes; therefore, a mode of transmission is needed to move the organism from place to place. Did a gust of wind blow it into the food? Did a food handler transfer the organism on their hands or a utensil from its source to food?

There must be food present for the organism to grow. The temperatures must be adequate to support growth of the specific organism. There must be enough time for the organism to grow. This usually takes more than four hours.

Finally, there must be someone who is susceptible to a foodborne illness. While providers and medical personnel are examining and treating patients, other hospital personnel are collecting stool and vomitus samples for laboratory analysis. PH personnel and designated augmentees interview patients to try to determine the suspected food item. Questions should include foods eaten, times, and where the food was consumed. After interviewing patients, review the forms. The forms should identify a common meal or facility.

Once a common facility, meal, or food is suspected, an effort should be made to interview others who ate the suspected meal and are not ill. This will be used as a comparison later in the investigation. A sanitary evaluation of the suspect facility should be conducted immediately along with the collection of food samples, if available. Laboratory work should be progressing to identify the agent responsible for the outbreak.

Sample collection

Two types of samples must be collected. Human samples (vomitus and stool) are the first type of specimens collected. The second type is food samples from the suspected facility or facilities.

Human samples

Vomitus and stool must be collected in sterile airtight containers and submitted to the medical laboratory for analysis. Only under extreme conditions should samples be sent out to other local area labs. TIME IS CRITICAL! The sooner the agent is identified, the sooner patients can be treated and the suspected foods eliminated. However, the agent may not be identified until long after the outbreak is over. Remember to advise the lab of your suspicions as to the cause or abnormal condition of the outbreak. If you suspect an anaerobic organism such as *C. perfringens*, the lab must attempt to grow the organism in an anaerobic as well as aerobic environment. Also, remember to make lab personnel aware of the possibility of *C. jejuni* and *L. monocytogenes* causing foodborne illnesses.

Food samples

While the human samples are being collected, PH and augmentee personnel are collecting food samples from facilities. There should be two teams of PH personnel. One team can interview patients while the other is collecting food samples for laboratory testing. The teams keep in contact to ensure food samples are taken from common sources identified during the interviewing process. All samples must be aseptically collected to guarantee the foods are not contaminated prior to testing. To implicate a specific agent, the same agent should be identified in the foods and the human stool and vomitus samples and also fit the symptoms exhibited by the patients.

At this point PH should have gathered information required to complete the investigation. As many people as possible should have been interviewed, including both sick people and well people who ate the suspected foods, and people who did not eat the suspected foods. A comparison of individuals eating and not eating specific foods is very important to complete the investigation.

If at any point in the investigation you become overwhelmed with work or are stumped as to the common food or facility, there is help available. The Air Force Institute for Operational Health, Surveillance Directorate, the Epidemiological Surveillance Division (AFIOH/SDE) also has a team of experts that investigates foodborne illness outbreaks. If you need them, contact your MAJCOM PHO to request assistance. They will help you, and they will make recommendations on how to improve your investigation capabilities.

Reporting

The best way to teach the proper method for completing the necessary forms for a foodborne illness outbreak is to create a hypothetical situation and complete the forms. So, that's what we'll do.

Situation

Assume that 100 people are at a picnic. The group consists of 50 couples, ranging in age from 21 to 40. At the picnic, the following menu is available: cold chicken, sliced ham, potato salad, baked beans, Jell-O, cola, beer, coffee, rolls, and butter. About three or four hours after eating, people from the picnic begin to appear at the hospital complaining of diarrhea, cramps, nausea, and vomiting. In order to plan a study of the cause of the outbreak, you implement your plan and interview the people involved and record the results of the interviews. What questions do you ask and to whom? What information do you want to obtain from the people interviewed? How will you tabulate the data so that it may be easily studied?

Questions

This is why the plan developed prior to the outbreak is very important. While planning, you decide what questions must be answered by the PH investigation. The questions to ask yourself might include the following:

1. What organism caused the outbreak?
2. What food or foods contained the organism?
3. How could the outbreak have been prevented?
4. What caused the food (or foods) to become contaminated?

Answers

In order to answer these questions quickly, first interview the sick people who are readily available. However, a representative number of well people should also be interviewed. To be more thorough, if time permits, all 100 people should be interviewed.

What questions are necessary to establish the identity of the organism? You know from previous study that organisms that cause foodborne illness have fairly predictable incubation times and symptoms. From this you can analyze the data to determine the common denominator. However, you must first determine three things:

1) What symptoms each person displayed and what were the common symptoms.
2) Which foods each person ate and the time the meal was consumed.
3) What time the symptoms began.

To identify the contaminated food item, you must establish a common denominator or meal, and the food or beverage from that meal that was consumed by those who became ill. To do this, obtain a 3-day food history from each individual. Using this information, complete an AF Form 431, on each individual. This form is designed to obtain data during food poisoning outbreaks. Study and note that the form has ample space to record physical symptoms, onset, and duration. It also has space to record a chronological history of food consumed for the past three days, including snacks, along with the date, hour, and place.

Record history

After interviewing all individuals and recording food histories on AF Form 431, you should have an idea of how many people consumed each food item and the number of people who are ill in relation to each food item. Include a food history for the past 72 hours during the interview.

Forms

CDC Form 52.13 has been designed for recording your data analysis. This form puts a special emphasis on section 7, Food-Specific Attack Rates, to help determine the suspected food item (or items). Complete and distribute the form in accordance with AF Instruction (AFI) 48–116, *Food Safety Program.*

Time the symptoms

Next, you need a tabular picture of what time the symptoms of the illness began. Use AF Form 432, Time Distribution of Persons Affected, for this purpose. Use one of these forms for each foodborne illness (FBI) outbreak. All you have to do is enter the calculations from individual case histories.

Start solving the problem

Now that you have stated the problem, collected the pertinent facts, and tabulated or charted the data, it's time to solve the problem. Why did the food cause illness and what must be done to prevent its recurrence? When you analyze the data collected, you should get a partial answer. You know that staphylococcus organisms create toxins that have an average incubation period of two to four hours. Therefore, you have a definite clue to the causative agent in your foodborne illness outbreak. You know that staphylococcus grows readily in high protein salads, pastries, custards, and sliced meats. The scenario has suspected carriers, such as the ham, chicken, and potato salad. The table of foods consumed by the affected persons may supply the exact answer, or it could show as many as two, three, or more, likely suspects. The mathematical approach is the method most likely to give the most accurate solution. First, determine the number and percent of people involved in the "food specific attack rates."

Start drawing conclusions

On the example, of the 75 persons who provided histories, 46 ate the potato salad but only 29 of these people got sick. Of the 29 people who did not eat the potato salad, 17 became ill. Based on these findings, the potato salad is probably not the source of infection. The most likely suspect was the sliced ham, with 80 percent of those who ate it becoming ill. Fourteen percent of the people who did not eat the ham (three people out of 21) became ill. However, 11 people ate sliced ham and did not get sick. This is not unexpected. Those who were exposed and were not affected may have received a smaller dose of toxin than those who became ill, or their serving of the food item may not have contained the agent, or some data may be incorrect because of faulty memory concerning foods actually eaten. There could be other factors. At any rate, from analysis of the data, you can make an *assumption* that the causative agent was staphylococcus enterotoxin and that the probable vehicle was sliced ham.

Confirm conclusions

In order to confirm that sliced ham was the vehicle, perform laboratory analysis on all items from the picnic, if available. However, to save time, you must assume that you have drawn the correct conclusion and look for the source and method of contamination. By questioning the picnic organizer, you can determine how the meat was prepared, sliced, and delivered. Also, by careful, diplomatic investigation, you may even discover the source of the staphylococcus contamination in the ham. In this part of the investigation, tact and diplomacy are vital factors in producing facts. No one likes to admit carelessness or oversight, especially if it's the cause of an outbreak of illness.

Educate

Most importantly, after an investigation of this kind, use your data analysis to educate people about the dangers of FBI, thereby, future outbreaks may be prevented.

Complete the investigation

If an outbreak should result from a meal served in a dining hall, additional steps may be required to complete the investigation. These include obtaining a menu, a thorough inspection of the dining hall, interviewing personnel who prepared the suspected foods, and obtaining food samples, if available.

Cost of outbreaks

Obviously, outbreaks of FBI can be costly when you compute lost hours on the job, hospitalization costs, human suffering, and even death. In most instances, these occurrences can be prevented. Do not think that a FBI cannot happen at your base. It can happen! The AF has had many FBIs due to base facilities, which PH personnel had to investigate the cause. You must be prepared for any FBI outbreak investigation. If you don't have a plan ready to use—get to work on it now!

Self-Test Questions

After you complete these questions, check your answers at the end of the unit.

401. Bacteria (singular bacterium)

1. What causes the most food spoilage?

2. What are spherical-shaped bacteria called?

3. What are rod-shaped bacteria called?

4. If you start with 1,000 bacteria, how many will you have after 10 minutes?

5. What conditions can endospores resist?

6. What do fungi secrete to meet their metabolic needs?

7. What is the mass of hyphae called that makes up a mold colony?

8. How do yeasts reproduce?

402. Food, acid, time, temperature, oxygen, and moisture

1. What prominent factors have an impact on microbial activity?

2. What do cranberries have a relatively high concentration of?

3. What becomes the dominant microorganism as the pH drops in foods?

4. What does a pH value of 7 represent?

5. In what pH condition do molds grow better in?

6. What most often causes meat spoilage?

7. What happens during fermentation that affects the pH level?

8. What is one of the most important environmental conditions influencing microbial growth?

9. What are the three temperature groupings of microorganisms?

10. What temperature grouping promotes microbial growth at relatively low temperatures?

11. Thermophile microorganisms grow relatively well at what temperature range?

12. What is a psychrotroph?

13. What are the four bacterial growth phases?

14. Describe the lag phase of bacterial growth?

15. What happens during the log phase of bacterial growth?

16. In what bacterial growth phase does the reproductive rate equal the death rate of bacterial cells?

17. What bacterial growth phase begins when cells start dying because of the accumulation of waste materials and depletion of nutrients?

18. What microorganisms can live and grow in the presence of free oxygen?

19. What are the two ways water exists in foods?

20. What is Aw in foods?

21. What is a halophilic bacteria?

22. What are the three methods typically used to lower Aw?

23. What does a microorganism at optimum temperature for growth provide?

24. What substance is a catalyst that breaks down substrates such as carbohydrates, fats, and proteins in foods?

25. What food process are beneficial enzymes involved in?

26. What items in the food industry inhibit enzymes in foods?

27. What does it indicate if phosphatase is found in milk?

28. What are carbohydrates and proteases used for in the baking industry?

29. What are some examples of undesirable microorganism changes?

403. Food pathogens—Illness organisms

1. What are the favorable temperatures for *Salmonella* growth?

2. How soon after the ingestion of *Salmonella* contaminated foods will illness symptoms occur?

3. What are the symptoms of a streptococcal infection transmitted through food?

4. What is a common inhabitant of the intestinal tract of cattle, swine, sheep, chickens, turkeys, and other animals such as dogs, cats, rodents, and monkeys?

5. What are the symptoms if a person is infected with *C. jejuni*?

6. What are the manifestations of *Listeria monocytogenes*?

7. Why is *L. monocytogenes* an important pathogen?

8. What is a realistic and satisfactory positive control for an internal cooking temperature for pork products?

9. What is the most common cause of foodborne intoxications?

10. How is the toxin produced from Staphylococcus organisms destroyed?

11. What causative agent lives in decaying matter, soil, lake silt, and is often found in animal intestinal tracts?

12. Cooked meats and poultry have been the chief offender in foodborne illness outbreaks for what organism?

13. What are the symptoms of *C. perfringens* foodborne illness?

14. In a refrigerated storage unit, what is the best control measure for cooling foods until the ideal temperature is reached?

404. Foodborne illness investigations

1. What factors must be present for a foodborne illness to occur?

2. What factors determine the effect a food pathogen has on an individual?

3. How often should you exercise your bases foodborne illness investigation plan?

4. What organization develops a notification plan or recall roster in case of a foodborne illness outbreak?

5. What must be present first for a foodborne illness to occur?

6. What should the patient interview identify after an outbreak of a foodborne illness?

7. After notification of a foodborne illness, when should a sanitary evaluation be conducted at a suspected facility?

8. What two PH teams collect food samples after a foodborne illness?

9. Where can you get help investigating a foodborne illness, if you are overwhelmed?

10. On what form do you record food history for each individual interviewed?

1–2 Causes of Food Deterioration and Spoilage

Another type of undesirable change caused by microbial growth is food spoilage. With spoilage, the food item has deteriorated to the point where it's unacceptable to the consumer. It may or may not be unwholesome or unsafe to eat. Spoilage is associated with changes in the food that can be detected organoleptically, in other words related to the qualities of the food. That means we can use our senses to detect the problem. The food looks spoiled, feels spoiled, smells spoiled, or tastes spoiled. For example, the appearance of food may change in a number of ways. Pigmented bacterial colonies may be present, or the food may be covered with whiskery mold growth. Clear liquids may become cloudy. Some microorganisms degrade food pigments such as chlorophyll, carotene, or myoglobin changing the characteristic color of the food.

The feel or texture of foods may change. Some microorganisms degrade pectin and cellulose in fruits and vegetables, making them soft and mushy. A number of bacteria metabolize sugars in foods to produce levans or dextrans. These substances make the surface of meat, poultry, or fresh fish feel slimy. Taste and odor may become unacceptable due to microbial degradation of proteins, carbohydrates, and fats.

Specific foods such as meats, water foods, egg and dairy products, fresh fruits and vegetables, and semiperishables have common deteriorative conditions. This lesson only discusses some of the more common examples of deteriorative conditions.

405. Meats

Common deteriorative conditions of meat are related to flavor, odor, texture, and appearance. Flavor includes rancidity, putrefaction, souring, and gassing. Greening and other deteriorative conditions affect appearance.

Rancidity

Hydrolysis or oxidation causes rancidity. Enzymes (lipases) in the microorganisms on the meat cause hydrolysis of triglycerides. This release of free fatty acids is called hydrolytic rancidity. The oxidative deterioration of fat is called oxidative rancidity. Both of these reactions produce foul odors and flavors. Most of the rancidity problems in meats are caused by the reaction of oxygen with unsaturated fats or oxidative rancidity. The oxidation of fats is influenced by the amount of oxygen, the temperature of the meat, the light present, and the pro-oxidant enzyme present. Microorganisms are not a major factor in most rancidity problems due to the environment on the meat inhibiting the growth of microorganisms. The free fatty acids and the peroxides formed through oxidation and hydrolysis are toxic to most microorganisms.

Putrefaction

Putrefaction is a type of spoilage where bacteria metabolize meat proteins or free amino acids. The bacteria produce enzymes that metabolize the proteins causing the foul-odor and flavor. Putrefaction is commonly found in canned meat products and with bacon.

Souring and gassing

Anaerobic bacteria sometimes metabolize carbohydrates in the meat products causing the production of organic acids such as lactic acid. This acid brings the pH of the meat down and develops a sour flavor in the meat. Other forms of anaerobic bacteria can also grow in meat products such as sausage products or vacuum packed meats. Certain species of anaerobic bacteria can form gasses such as carbon dioxide, which is colorless, odorless, and tasteless and causes the package to become distended. Usually when a gas is produced, acids are also produced causing a foul-flavor. Souring and gassing is commonly found in fresh meats, bacon, hams, sausages (gassing), and canned meats.

Greening

There are three types of greening—green cores, green rings, and surface greening.

Green cores

Green cores are an appearance condition that usually occurs in large sausages such as bologna. Bacteria such as *Lactobacillus viridescens* produce hydrogen peroxide. Hydrogen peroxide is a strong oxidizing agent that degrades the meat pigment turning it green. When greening bacteria are introduced into the sausage mixture and not destroyed by the cooking process, green cores result. However, this condition does not occur until the meat is cut. This is because the bacteria are aerobic and do not grow until exposed to the air. The greening usually starts in the middle and spreads to the outside. This spreading is characteristic of microbiological greening and not of the other sources of greening such as with chemicals or metals. Cooking the meats during processing to an internal temperature of 160ºF (71ºC) will destroy the greening microorganisms.

Green rings

Green rings are similar to green cores except that the greening occurs in rings at varying depths within the meat. This greening usually develops within one to two days after processing the meat. The reason for the rings is not really understood. However, the most common reason for this zone or ring area is that the oxygen tension is low and the environment is conducive to *Lactobacillus viridescens* growth, which produces a green discoloration of the pigment.

Surface greening

Surface greening is caused from the same bacteria that cause green cores and green rings. The major difference is in the time it takes for the product to turn green. Surface greening is not usually noticeable until about five days after processing and sometimes not until two weeks later. This condition occurs in nonvacuum packed meats. Since the bacteria are aerobic, surface greening usually does not occur on vacuum packaged meats while still packaged. However, it will show up on vacuum packaged meats after opened and exposed to the air for five days to two weeks.

Other deteriorative conditions

There are other conditions affecting meats you need to be aware of when conducting inspections. These are not all of the conditions associated with meats, but are some of the more common problems you'll find.

Slime

Slime is a condition where bacteria and yeasts contaminate the meat products and multiply to excessive numbers. On nonvacuum packaged meats, slime appears in characteristic beads that are sticky to the touch and give off odors sometimes described as yeast-like**.** Slime is rarely a problem with vacuum packaged meats because the environment is not conducive for the bacteria that commonly cause slime. However, after a period of time the environment inside the vacuum package can change to allow these bacteria to multiply to extreme numbers forming a milky white liquid that can be seen with the naked eye.

Molds

Molds are a common contaminant of processed meats such as dry sausages and country-cured hams. Molds need oxygen and room to grow. Thus, they are not normally a problem with vacuum packaged meats. Some of the molds produce carcinogenic substances known as aflatoxins that are extremely toxic. Therefore, the conditions favorable for mold growth should be avoided and any meat products with mold growth should be discarded or trimmed.

406. Water foods

Fresh fish held at about 32ºF (0 ºC) can last up to seven days. However, this is not true for all species. The reasons fresh fish spoils rapidly are due to microbiological, chemical, and physiological factors. The flesh of healthy live fish is basically sterile. However, there are large numbers of many varieties of bacteria on the surface and in the digestive tracts of the fish. These bacteria move to all tissues of

the fish when the fish is killed. These bacteria are well adapted to the cold, since they live in the cold-blooded fish usually in the cold waters and will continue to grow well under refrigeration.

Trimethylamine

When a fish is killed, there is little or no odor present. A short time after death, a substance called trimethylamine is produced by breakdown of the fat or proteins in the fish due to enzyme and bacterial action. Trimethylamine causes the typical fishy odor. This odor may be accompanied by other odors resulting from fat degradation. The fats of fish are highly unsaturated and become easily oxidized, resulting in rancid foul-odors and -flavors.

Glycogen

After death, glycogen in fish is broken down to lactic acid, lowering the pH and, therefore, acting as a preservative and limiting bacterial growth. However, fish usually struggle prior to being caught. This causes some glycogen in the muscles to be used up. The more fish struggle, the more glycogen is depleted. Little or no lactic acid builds up allowing the pH to stay higher. This allows more rapid bacterial growth and tissue breakdown.

407. Egg products

Before we discuss the deteriorative conditions associated with eggs, here is a short course in the formation of an egg. Yolks containing the female germ cell are formed in the ovaries of the hen. These yolks drop into the mouth of the oviduct and slowly pass down the oviduct, having layers of egg white added from albumen-secreting cells along the way. Further down the oviduct, protein-secreting cells add the membranous tissue along with calcium and minerals to form the shell. If the egg is to be fertilized, the sperm must travel up the oviduct and reach the yolk prior to the albumen and shell being formed.

Formation

Knowing the process of egg formation helps explain some defects of eggs. Fertilized eggs produce embryos or baby chicks. Ruptures in the oviduct or ovary will produce blood spots and sometimes meat spots. Diseases of the ovary or oviduct can produce eggs infected with bacteria or even parasites inside the sound shell.

Porous shells

Shells are porous allowing gases to pass in and out of the egg. An older egg is identified by a large air cell at the top of the egg. When the eggs are washed, the cuticle or bloom on the outside of the shell is removed which exposes the open pores of the shell. Eggs are then usually treated with a solution that coats the outer layers of the shell, sealing the pores to guard against microbial contamination. If the eggs are improperly washed or processed, bacteria can easily enter the shell through these open pores.

Salmonella

Another problem with eggs is contamination by *Salmonella* bacteria. These bacteria are found in chicken fecal material. Also, *Salmonella enteriditis* is found in the reproductive tract and can easily enter the eggshell as it's forming. This is why *Salmonella* is found inside the eggs. Since it's difficult to keep *Salmonella* out of the egg products, all portions of commercially processed eggs out of the shell must be pasteurized. This still makes whole uncracked eggs very dangerous because of the *Salmonella* bacteria inside the egg. If the egg goes through further processing under heat, then the problem is minimized. However, if the eggs are to be used raw and do not undergo further processing, the products can be considered dangerous.

408. Dairy products

Some of the most common defects with milk include souring, usually caused by *Streptococcus lactis*; ropiness; sweet curdling or slight coagulation caused by bacteria that produce enzymes; malty, rancid, yeasty, bitter, fruity, and putrid flavors; and purple and reddish colors. All of these conditions are

caused by microorganisms. The intensity of the foul-flavor depends on the extent of microbial action on milk proteins, fats, and lactose. Most of the organisms that affect milk flavor are post pasteurization, gram-negative, psychrotrophic contaminants belonging to the *Pseudomonas, Flavobacterium, Chromobacterium, Alcaligenes* species and coliforms.

Ice cream

Hardened ice cream usually does not have spoilage problems since there is not much time between pasteurization and freezing. Time between pasteurization and consumption, temperature abuse, and possible contamination are all problems associated with soft serve ice cream. Often, the facilities and cleaning practices for soft serve machines are marginal at best, which increases the risk of microbial contamination.

Cheeses

Cheeses are subject to abnormal microbial fermentation that leads to putrid, unclean, yeasty, fermented, and rancid flavors. The microbes most often associated with cheese spoilage are molds, yeasts, and anaerobic spore-formers that can oxidize lactate and various protein and fat products. Controlling the humidity, wrapping the cheese with plastic or wax, and keeping the storage shelves clean are all methods of reducing these problems.

Gas production

Gas formation too early in cheese production can cause defects also. For example, growth of coliforms during cottage cheese production may produce sufficient gas to cause the curd to float. The cheese will have an off-flavor and soft and shattered curd particles. Other sources of gas production during cheese processing include using raw milk, inadequate heat treatment, contamination after pasteurization, and slow acid production by the starter bacteria such as *Streptococcus lactis*.

409. Fresh fruits and vegetables

There are many problems associated with fruits and vegetables. However, there are not many problems that would make someone ill.

Vegetable spoilage

Most vegetable spoilage is caused by bacteria. However, molds also cause some of the more common rots in vegetables. Some examples of bacteria and mold spoilage include soft rots, spots, blights, and wilts. Some spoilage problems associated with the more common vegetables are black rot of carrots; watery, soft rot of celery; downy mildew of lettuce and spinach; smudge and black mold rot on onions; wilt and *Rhizopus* soft rot on green beans; tuber rot on potatoes; gray mold rot on cabbages; and black rot on cauliflower.

Fruit spoilage

Fruits are usually very acidic, therefore, the primary spoilage organisms are fungi and predominantly molds. The spoilage starts on the surface of the fruit and spreads internally. Once the spoilage spreads to the inside, washing the fruit to make it usable is basically ineffective. Some of the more common spoilage problems are listed in the table below.

COMMON SPOILAGE PROBLEMS	
Fruit	**Problem**
Oranges	Spoil from blue rot, green rot, gray mold rot, and blossom-end rot. Citrus products with blue rot exhibit soft, watery, tan to light brown areas that are readily gouged out with the tissue inside having a moldy or musty odor and flavor. There are typical bluish-green spores on the fruit.
Apples	Spoil from blue rot, black rot, core rot, and brown rot. The blue rot is the same as the rot in oranges. However, this type of rot is more common in apples than oranges. Black rot causes the tissue to become soft and watery. Brown rot causes unsunken, decayed areas, turning dark brown to black in the center. The mold spore masses are yellowish-gray, and the skin clings tightly to the center of the old lesion.

Strawberries	Spoil from gray mold rot, tan rot, and leather rot. Gray mold rot is evidenced by light brown, fairly firm, watery decay. Grayish-brown velvety spots may be seen in more advanced spoilage.
Peaches	Spoil from brown rot, pink and Rhizopus rot. Pink rot is evident by the pink spore masses on the spots.
Bananas	Spoil from finger rot, black rot, and crown rot. Black rot is the same as the black rot described for apples.
Pears	Spoil from black rot, blue and brown rot, and powdery mildew. Powdery mildew causes a white powdery looking substance on the skin.
Lemons and limes	Spoil from cottony rot, brown rot, and sour rot.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

405. Meats

1. What does the bacteria metabolizing sugars in foods produce?

2. What conditions does flavor deteriorative include?

3. What causes rancidity in meats?

4. What is putrefaction?

5. What causes a sour flavor in meat?

6. What are the three types of “greening” in meats?

7. How does the “greening” of meat occur?

8. How is the greening organisms destroyed during processing?

9. Describe “green rings” as it pertains to meats.

10. Why doesn’t surface greening occur in vacuum packed meats?

11. How does slime appear on nonvacuum packaged meats?

12. Why should meats with molds be discarded or trimmed?

406. Water foods

1. At 32ºF (0ºC) how long can fresh fish be kept?

2. After death explain what causes the typical fishy odor in fish?

3. Why does fish struggling before being caught cause the pH to be higher?

407. Egg products

1. Explain the formation of an egg.

2. How is knowing the formation of an egg helpful?

3. Why are shell eggs porous?

4. Why is *Salmonella* found inside an egg?

408. Dairy products

1. Most organisms that affect the flavor of milk belong to what species and coliform?

2. What is some spoilage problems associated with soft serve ice cream?

3. What is the most common spoilage organisms associated with cheese?

4. What can cause gas production during cheese processing?

409. Fresh fruits and vegetables

1. What type of organism causes most vegetable spoilage?

2. What does blue rot look like on oranges?

1–3. Food Preservation

You have studied what microorganisms need to survive and how they grow in foods. Food technology has provided several methods for controlling microorganisms. These methods range from heat treatment to substances being added to foods to control microorganism growth. Now you need to learn the different preservation methods used in the food industry. We start this section with a short explanation of the more common types of food preservation and then we'll focus on one preservation method—using additives.

410. Types of food preservation

The common types of food preservation are thermal or heat processing, refrigeration and freezing, drying and dehydrating, fermenting, irradiating, controlled atmospheres, and smoking. Let's begin this lesson by learning about food heat treatments.

Thermal or heat processing

The first and probably most often used method of food preservation is thermal or heat treatment of foods. Most organisms grow easily between 61 and 100°F (16−38°C). However, temperatures of at least 140°F (60°C) will start to kill pathogenic bacteria and most organisms start to die at 179°F (82°C). Some of the commercially used methods of heat processing include canning, pasteurization, and blanching.

Canning

Canning is the process where food is prepared and placed into a can. A vacuum is created, the can is sealed, and then it's heated to the proper temperature. These heat-processed products are considered to be commercially sterile. This means that all organisms that might be a health hazard, as well as spores that might cause spoilage under normal nonrefrigerated storage conditions are destroyed. Some extremely heat-resistant thermophilic spores might remain in the product. With normal storage temperatures, these organisms will not grow. The vacuum reduces the stress on the container during heat processing, holds the ends in a collapsed concave position during storage, and reduces the headspace oxygen that retards the growth of the remaining microorganisms.

Agitation

Most cans are agitated while the heating takes place. This agitation allows all of the food in the can to heat on a more even basis. If the can were still while heating, the food might be "cooked" to the can wall with the center of the food not reaching required temperatures. Agitation also allows higher temperatures to be used during heating without harming the product.

Can seal

The seal of the can is very important in protecting the product from contamination. There are different types of seals on a can. There are end seals or end seams, side seams, and a newer type of can with only one top seam. This newer type has only one seal because the rest of the can is one piece of metal molded into a can. Can defects will be discussed later in this unit.

Pasteurizing

Pasteurization is a process using heat treatment to either eliminate pathogenic organisms or eliminate other organisms to extend the product's shelf life. For example, milk and liquid eggs are pasteurized to eliminate the pathogenic organisms to make the product safe for consumption. There is a difference between pasteurization and commercial sterilization. A temperature below 212ºF (100°C) is called pasteurization while a temperature of 212ºF (100ºC) and above is referred to as sterilization. Some organisms are killed during pasteurization, some are attenuated or just injured, and some spores may be stimulated to germinate.

Various methods

There are various methods of pasteurization used in the industry, ranging from the holding method where milk is kept at a temperature of 145ºF (63°C) for 30 minutes to the flash method where milk is brought to a temperature of 161ºF (72°C) for 15 seconds. There is also an ultra-high temperature (UHT) method where milk is heated to 207ºF (97ºC) for three seconds, making it sterile milk. This milk can be placed in a box and put on the shelf without refrigeration for several months. Other pasteurized dairy products are chilled rapidly immediately after pasteurization, which must be kept under refrigeration.

Extending the shelf-life

Beer, wine, and fruit juices are examples of using pasteurization to eliminate organisms to extend the product shelf life, since these products do not normally carry pathogenic organisms. Pasteurization is not limited to liquid foods. In fact, even oysters can be pasteurized in the shell to lower bacterial counts.

Blanching

Blanching is a kind of heat treatment that is generally applied to fruits and vegetables primarily to inactivate the natural food enzymes. This process is used on products that are to be frozen since freezing does not stop the enzyme activity. Blanching also destroys some organisms in foods. Fruits and vegetables are passed through either water or steam at temperatures of 190ºF (88ºC) to 212ºF (100ºC) (steam).

Refrigeration and freezing

Refrigeration and freezing have been methods of food preservation for a long time. Most organisms are controlled at temperatures of 41ºF (5ºC) or lower and even the psychrotrophic organisms are effectively controlled at temperatures 14ºF (–9ºC) and below. Through research and technology, we have learned that it's important to cool products as soon as possible to extend the shelf life. For example, meat is cooled immediately after the animal is slaughtered. Another example is fruits and vegetables being placed into a hydrocooler or water bath to bring down the product temperature. This method slows down the enzymatic activity that, in turn, slows the deterioration process.

Effectiveness

Refrigeration and freezing have little or no effect on the taste, texture, nutritive value, or other attributes of the food. This makes refrigeration and freezing two of the best methods of food preservation in the food industry in terms of not changing the food. However, refrigeration and freezing are not as efficient at stopping the deterioration process as heat, dehydration, irradiation, and fermentation.

Storage problems

Air circulation and relative humidity must be carefully controlled to prevent food spoilage problems. Air circulation removes heat from the food which cools it down. Proper air circulation helps to cool food more rapidly. Air containing too much humidity can cause moisture to condense on the surfaces of the foods, allowing psychrophilic organisms to grow. For example, molds will grow at common refrigeration temperatures if there is too much humidity. However, if the air gets too dry, the food

will dry out. Therefore, the humidity must be carefully controlled. Since not all foods require the same humidity or air circulation, an optimum balance must be reached for the cold storage area.

Drying and dehydrating

The terms "drying" and "dehydrating" have basically the same meaning and there are many different ways to dry food products. This lesson will only mention some of the more common methods. Both dehydrating and drying reduce the Aw of foods. As the Aw is lowered, microbes will not grow, and the food is preserved. Many foods are also dehydrated to reduce the weight and bulk of the product. For example, fruit juices are dehydrated into a powder and weigh about 1/8 of the wet weight. All forms of drying foods use heat. However, there are a variety of ways to accomplish the actual drying of foods such as: solar, drum or roller, hot air, freezing, and concentration.

Solar drying

The foods most commonly dried by solar drying are fruits, fish, rice, and other items such as grains and coffee. Fruits are usually prepared before drying. For example, stone fruits are halved, pitted and placed on trays in the open sunlight. Sometimes sulfur dioxide is added to preserve the color and flavor of the fruits. This method is most effective where the dry season coincides with the harvest. When fish are solar dried, salt is usually added to prevent microbial growth. All products must be protected from rain, birds, dust, insects, and halophilic (salt loving) bacteria.

Drum or roller drying

Drum or roller drying requires foods to be put into a drum or roller, which is preheated to assist with rapid drying. The liquefied food is run as a thin layer into the revolving heated drum. The moisture is removed almost immediately. This process is used for products like instant breakfast cereals, starch, and soup mixes. This process is inexpensive, and some foods, such as tomato flakes, acquire a "cooked" flavor.

Hot air drying

There are several methods using hot air to dry foods, which include placing food stacked on trays in a tunnel of hot air until the food is completely dried. Two of the most common methods are rapid drying and spray drying. Rapid drying is done by passing particulate foods, such as vegetables, over a porous plate with hot air being blown up through the plate. Egg products are placed in a pan with hot air blown over the top of the food surface. Spray drying is commonly used for milk, coffee, and egg albumen. Small droplets of liquid are sprayed into a stream of very hot air. These droplets dry rapidly with little or no off-flavor or discoloration, and form particles that rehydrate readily.

Freeze drying

In freeze drying, heat is applied to a frozen food under a vacuum. The vacuum increases the vapor pressure of the food. This forces the moisture out of the food, allowing the moisture to condense into ice on a cold surface. The food does not thaw during the process, so shrinkage does not occur and microbial growth is prevented. The ice, under vacuum conditions, dissipates directly as a water vapor, a process called sublimation. This gentle drying process protects all food quality attributes such as texture, color, flavor, and nutrients.

Concentration

This term refers to removing water without the product actually being changed to a dry state. For example, frozen concentrate orange juice is derived from orange juice, but water has been removed. The process can be used as a preservation method or it can be a means of conserving space. The latter is the common reason for using this process. For most concentrates, the Aw is still relatively high, so there is not much of a preservation effect.

Fermenting

Fermenting consists of a chemical change or anaerobic breakdown of food brought about by the use of enzymes or microorganisms. There are three basic chemical changes made through fermentation:

1. Acidulation of milk as in cultured buttermilk.
2. Oxidation of nitrogenous organic compounds as in bakers' yeast used in bread.
3. Decomposition of starches and sugars into ethyl alcohol, carbon dioxide, and organic acids as in sausages and pickles.

Fermentation usually increases the nutritional value of the foods affected. For example, Riboflavin, Vitamin B_{12}, and the precursor of Vitamin C are processed through the fermentation process.

Lactic acid

Lactic acid-producing bacteria are used to process cucumbers into pickles, cabbage into sauerkraut, and Taro root into the Hawaiian dish of Poi. These same bacteria are used on meats to produce Salami sausage and Lebanon bologna. The same class of bacteria can be used on dairy products to produce cheeses such as Ricotta, Cheddar, and Edam and other milk products such as yogurt, acidophilus milk, and buttermilk.

Acetic acid

Acetic acid-producing bacteria can convert wine, cider, honey, and any other product high in sugar into vinegar. Yeasts by themselves can produce wines from fruits, rum from molasses, whiskey from grain mashes, and bread from dough. Soy sauce is made from the fermentation of yeasts in combination with bacterial fermentation. Acetic acids are used in other foods such as catsup, salad dressings, and cucumber pickles. This acid usually lowers pH to 5.0 or below, which is inhibitory to most bacteria. However, a lower pH is needed to inhibit most molds and yeasts.

Irradiating

The United States is experiencing a resurgence of interest in food irradiation as an alternative to harmful chemical additives. Consumer concern over the use of pesticides and other chemical additives necessitates extensive study into the increased use of radiation as a food preservation process. Additionally, radiation is becoming more cost effective to use as a preservation technique. However, there is substantial consumer concern regarding safety of irradiated foods.

Objectives

Objectives for the use of ionizing radiation are to control certain parasites in beef and pork, slow the maturation in fresh fruits and vegetables (FF&V), and provide microbial disinfection and disinfestation of arthropod pests in certain foods.

Dosage

The various applications of food irradiation can be classified by dosage. Low dose applications up to 1 KGy (1 Kilogrey = 100 kilorads) are used to inhibit sprouting, control insect infestation and delay maturity. Medium dose applications (Ca. 1–10 KGy) are used to reduce the microbial load, prolong shelf life and reduce the load of nonsporing pathogens. High dose applications (10–50 KGy) are used to achieve commercial sterilization, enabling food products to be stored at ambient temperatures with suitable packaging.

Accumulating data

Even though irradiation seems to be an ideal preservation technique, the Food and Drug Administration (FDA) is still accumulating data and trying to find answers to very important questions such as, "Will irradiation create an environment in which microorganisms can adapt and flourish?" "Will the public become careless when purchasing and handling certain foods, such as

foods that are salmonella-free due to irradiation, like poultry products?" Salmonella is one of the major causes of FBI in this country. Packaging and labeling are also of concern to the FDA.

Approvals

Eleven countries, including the United States, have already approved, with certain restrictions, the use of radiation to preserve foods. Thirty-two other countries are seriously considering its use. Therefore, the PH field will face the challenge of enforcing standards and obtaining data on possible health hazards associated with consumption of irradiated foods.

Controlled atmospheres

Fresh fruits and vegetables respire (breathe) during storage, and this respiration contributes to the loss of quality and results in the release of carbon dioxide. The atmosphere must be controlled to decrease respiration. A controlled atmosphere (CA) is the regulation of O_2 and CO_2 for storage of fresh foods. A CA is usually used for apples and other fruits that respire and ripen during cold storage. The amount of respiration depends upon the availability of oxygen. There are three ways to control respiration—reduce the temperature, deplete the oxygen, or increase the level of carbon dioxide. For example, Macintosh apples respire the fastest at about 87 percent relative humidity, about 21 percent oxygen and .03 percent carbon dioxide. To properly store these apples, a cold storage room should be gastight, brought to the desired temperature, filled with the apples, and sealed. Then the carbon dioxide can be increased to 3 percent for the first month, the oxygen reduced to 3 percent, and either nitrogen or an inert gas can be used to fill in the balance of the atmosphere. This is maintained for about a month when the carbon dioxide is increased to about 5 percent and maintained for up to six months of storage.

Ethylene gas

Another example of a controlled atmosphere would be the use of ethylene gas to speed the ripening of bananas. The gas stimulates ripening, which changes the color of the bananas from green to yellow. The gas also brings out the sweetness of the product.

Energy savings

A CA can be used with many other products. It's practiced whenever food is packaged in any container under a vacuum, nitrogen, carbon dioxide, or any atmosphere without the normal composition of air. A CA can change the rate of microbial and enzymatic spoilage. The possibility of energy savings by using less refrigeration is of great interest to the industry instead of storing foods at freezing temperatures.

Smoking

Smoking meats is an age-old practice probably going back to prehistoric times when meats were hung next to a smoke vent. The keeping time (time the product is at the plant) for food items such as meats and fish was improved by hanging them next to a smoke vent. Today, smoke is usually combined with heat treatment to achieve a drying effect with a smoke flavor added to the food. Other desirable effects achieved from smoking food include fixing the color (altering the color to make the product more desirable) of the lean portion of meats, tenderizing the food by the heat and smoke, adding a desirable finish or gloss to the skin of meats, adding antioxidants to the fat, adding a favorable odor to the food, reducing microbial organisms, and adding the particles of smoke to the food that acts like a preservative.

411. Food additives

Federal law defines a food additive as "any substance the intended use of which results or may reasonably be expected to result directly or indirectly in its becoming a component or otherwise affecting the characteristics of any food." This law excludes those substances that are generally recognized as safe (GRAS) under the conditions of their intended use.

Food additives

The FDA must approve all food additives. In most cases, foods must be prepared with some form of additive or preservative that may affect the food product. As a food inspector, you need to be aware of the different types of additives that might affect the foods you inspect.

Curing

Curing is preserving food by adding salts or other substances to inhibit microbial growth. The process alters the food's color, flavor, texture, as well as susceptibility to microbes. There are two types of curing—dry and wet.

Dry curing

Dry curing is the adding of salt, nitrates, or nitrites to a food product to inhibit microbial growth. Using salt is known as a salt cure. Most cured meats are heated along with the salt cure. However, there are some meats that are not heated, but there are two levels of heat that can be added to other cured meat products. Only those products that are not heated or mildly heated need refrigeration after curing. Those with thorough heating do not require refrigeration. Salt cures reduce the Aw in the food. Nitrates and nitrites are added primarily to fix the color of the foods, such as meats, even though a small amount of preservation takes place to inhibit the growth of microbes. One exception is nitrites are added to inhibit the growth of *Clostridium botulinum*.

Wet curing

A wet cure is also known as a pickle cure and uses the same ingredients as a dry cure (salt, nitrates, or nitrites) but the ingredients have been put into a brine (saline or salt water) or some other solution for easier placement into the food products. The most common food pickled is meat. Meats, such as hams, are either immersed or injected with pickle cure. Injecting the cure into the arteries of meat provides a uniform pickle. Other meats are just immersed or sprayed with the pickle to cure the product.

Curing defects

Color defects can result from either nonbacterial or bacterial reasons. Nonbacterial defects are usually a result of under curing or fading of the cure. Under curing is exhibited by a brown or grayish-green color due to a poor reaction with the nitrites and the meat pigments. Fading of the cured meat results from oxidation and is accelerated by light. The bacterial reasons for curing defects in color are nitrite burns, surface greening, green core, and green rings. Microbes can be the cause of nitrite burns because there are bacteria that reduce the nitrates in the meat. This reduction of nitrates increases the effectiveness or amount of the nitrites in the meat, causing a nitrite burn. Green core, green rings, and surface greening have been previously discussed. There are many other defects associated with curing agents. We cannot list all the defects here; however, there are several good books published on food technology that list and explain most of the curing defects.

Sugar

Sugars such as glucose, sucrose, and lactose are added to foods as sweeteners. However, if they are added in high concentrations, such as in syrup, jellies, jams, and honey, they act as preservatives. Sugar, in high concentrations, reduces the food Aw. This inhibits the microbial growth. There are a few yeasts and molds that can still grow on the surface of these highly sugared foods.

Chemicals

Technology has provided many chemicals that can be added to foods to preserve the characteristics of that food. These chemicals preserve or change the flavor, color, taste, and texture of foods. The following table lists some chemicals and their uses.

CHEMICALS ADDED TO FOOD	
Chemical	**Use**
Nitrites And Nitrates	Added to foods to fix the color, and have limited inhibitory use. Most of the time they are mixed with other chemicals for curing foods such as meats.
Sulfur Dioxide And Sulfites	Used to fix the flavor (add a certain flavor) and color of fruits and vegetables. They have limited inhibitory use against microbes. When dissolving sulfite salts in water, a sulfurous acid is formed that is used to inhibit yeasts, molds, and bacteria. This solution is used mainly in the wine industry as well as for dried fruits and vegetables.
Sorbic Acid And Sorbates	Sorbic acid is an unsaturated fatty acid used to protect acid foods from mold and yeast growth. This acid is added to cheese, orange juice, fruit and fruit syrups, margarine, pickles, and yogurt.
Propionic Acid And Propionates	These are effective against molds and bacteria but not against yeasts. These are commonly used to prevent mold growth on baked goods and cheeses, and in artificially sweetened jams, jellies, and preserves.
Benzoic Acid And Benzoates	Used to preserve acidic foods such as carbonated beverages, fruit juices, cider, pickles, and sauerkraut. These are more effective against bacteria and yeasts and less effective against molds.
Ethylene Oxide And Propylene Oxide	These are gaseous chemicals used to inactivate microorganisms in certain products if further processing is to be performed. These products include cocoa, gums, processed spices, starch, and processed nuts (except peanuts). Propylene oxide can also be used as a fumigant for dry prunes and glazed fruit.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

410. Types of food preservation

1. What temperature in the thermal or heating processing begins to kill pathogenic bacteria?

2. Why are canned foods vacuum packed?

3. What heating process prevents canned food from being cooked to the can walls at high temperatures and prevents harming the product?

4. What important function does the seal on canned food provide?

5. What is pasteurization?

6. What is the difference between pasteurization and commercial sterilization?

7. What method of pasteurization is used, and for how many seconds is milk heated to 161°F (72°C)?

8. What do beer, wine, and fruit juices have in common concerning pathogenic organisms?

9. What is blanching?

10. Most organisms are controlled at what temperatures for food preservation?

11. Refrigeration and freezing have little or no effect on what attributes of food?

12. What control problem can cause psychrophilic organisms to grow?

13. What are the different methods of drying and dehydrating foods?

14. With solar drying, what must all products be protected from?

15. In drum or roller food drying process, what is the thin layer of liquefied food run through?

16. What hot air drying method is commonly used for milk, coffee, and egg albumen?

17. What is the process of sublimation in freeze drying?

18. Define “concentration.”

19. What are the three basic chemical changes made through fermentation?

20. What acid is used to make cucumbers into pickles and cabbages into sauerkraut?

21. What acid can convert products high in sugar (such as wine, cider and honey) into vinegar?

22. In the United States what food preservation technique is being studied because of consumer concerns over the use of pesticides and other chemicals used in or on foods?

23. What are the objectives of using ionizing radiation on foods?

24. What can the various applications of food irradiation be classified by?

25. What is a major cause of FBI in this country?

26. What challenge will the PH field face with the consumption of irradiated foods?

27. What is a controlled atmosphere?

28. Another example of a controlled atmosphere would be the use of ethylene gas on bananas. What is the effect of the gas on the bananas?

29. What two things can a controlled atmosphere change?

30. What age-old practice goes back to prehistoric times concern meats?

411. Food additives

1. How does the federal law define a food additive?

2. What is curing?

3. What is dry curing?

4. What is another name for a wet cure where the same ingredients as a dry cure (salt, nitrates, or nitrites) have been put into a brine (saline or salt water) or some other solution for easier placement into the food products?

5. What is the common characteristic of under curing a food product?

6. What does sugar in high concentrations do to foods?

7. Why are chemicals added to foods?

8. What is a common use for propionic acids and propionates?

1–4. Food Packaging and Storage

As a food inspector you'll need to have an understanding of how foods are packaged, packed, and stored in order to be able to make good sound judgments or recommendations on foods. What caused the swell in the can of applesauce you are inspecting? How long can I expect this can of dehydrated shrimp to last in the warehouse under hot conditions? How do I know that the foods stored in the freezer and walk-in refrigerators are actually stored properly? These are just a few questions that inspectors ask almost every day! You'll now embark on an educational journey through the food packaging industry with stops at the canning factory, glass company, and paper mill to see how these materials are able to protect the foods we eat. Then you'll endthe trip with a look at how these foods are properly stored. Keep in mind, that packaging designed for a specific food item will also impact the amount of time a food will be stored.

412. Types of food packaging

Food packaging employs a wide variety of materials, which include the following:

- Glass used in jars and bottles.
- Rigid metals used in cans and drums.
- Flexible metals such as aluminum foils.
- Cardboard, paper, and wood products used in boxes and bags.
- Plastics used in canisters and squeeze bottles, as well as flexible pouches.
- Laminates of paper, plastic, and foil combined and used to protect food products.

There are specific requirements and functions that containers must meet to protect foods. These include being nontoxic; sanitary; protection from moisture, gas, odor, light, and unwanted intrusion such as with tamper-resistant or tamper-evident packages; easy opening; easy disposal; fitting the size, weight, and shape limitations of the food product; and being neat and appealing in appearance. There are other requirements and functions for packaging that are specific to certain food items but are too lengthy to mention here.

Hermetic and nonhermetic food containers

It's important to explain the difference between a hermetic container and a nonhermetic container. Hermetic means the container is impermeable to or not allowing the entry of gases and vapors. This impermeability also keeps out bacteria, yeasts, molds, and dirt or dust. A hermetic container protects a food product from moisture gain or loss and is essential for strict vacuum and pressure packaging.

The most common examples are properly sealed metal cans and glass bottles. However, a nonhermetic container also prevents the entry of microorganisms, but is permeable to or allows the entry of gases. Common examples include flexible packaging such as cellophane and paper or cardboard packaging, which are not completely impermeable. Even cans can become permeable if the seal is broken or weakened.

Cans

Cans have been used to preserve and protect foods since the mid–1800s. It was not until the early 1900s that the sanitary can was produced—that is, a can produced by a machine, filled, and sealed without being handled by a person. Cans not only offer good protection for the food product, but also allows high-speed production. Stores can easily display the canned products and with today's pop-top lids, they are easy for consumers to use.

You have probably heard of the term "tin can." Most cans are made of steel and have a thin coating of tin over the steel to prevent corrosion. When the tin might react with the food product, a thin coating of enamel can be added or substituted to prevent a reaction. Chromium and chromium oxide have also been used to coat the interior linings of cans. However, an organic coating such as citrus enamel can be used to further protect the product.

Reaction

In time, if a tin coating is used, the tin will gradually disappear while the amount of exposed steel increases. There will eventually be a reaction between the food and the steel. This reaction produces a hydrogen gas, which can build up enough to extend the ends of the can. However, a hydrogen swell does not usually occur until almost all of the tin has disappeared.

Aluminum

Aluminum, a lighter weight metal, has a lower chance for atmospheric corrosion and is easier to shape. Although aluminum is not as strong as steel, the aluminum can be strengthened by injecting a small amount of liquid nitrogen into the can prior to final closure. The gas expands and provides an internal pressure, which adds rigidity.

Advantage of aluminum

One advantage of aluminum is when it's mixed with oxygen it forms aluminum oxide, which prevents corrosion. Oxygen is readily available outside the can. However, oxygen is not generally available inside the container because of the food processing techniques used to prevent the presence of oxygen. To help protect the food products and to prevent corrosion with this low oxygen environment, an organic enamel coating similar to the ones used for tin and steel cans is used to prevent a reaction. If these enamel coatings wear out, several flavor and color defects might result.

Disadvantage of cans—defects

There are many defects associated with using cans. In order to get a better understanding of these defects, you need to know their classifications. The classification of defects is divided into critical, major, and minor. A critical defect, such as a leaking can, affects product safety. A major defect can result in failure of, or materially reduce, the usability of the can. A minor defect limits the product's serviceability, therefore, does not meet the standards for that particular item.

Dents

Dents are the most common defect associated with cans. Dents can be classified as either a major or minor defect. A dent *cannot* be classified as a critical defect

- A major dent is also known as a severe dent. A severe dent can be a body dent with very sharp edges or apexes that might affect the ability of the metal or interior enamel to protect the product. A severe dent also may be a body dent that affects the side seam or end seam

where the hermetic seal may be broken or weakened considerably. The countersink or rings on the top of the can are usually affected when the end seam is involved.

- A minor dent is also known as a moderate dent. A moderate dent can affect the body of the can including the side seam with only moderate or slightly rounded edges. With cans that do not have a side seam, a moderate dent might affect the end seam. However, the end seam cannot be weakened and the countersink or rings at the top of the can *cannot* be affected by a moderate dent.

Paneling

Paneling is sometimes confused with can dents. Paneling occurs when at least one side of a can is flattened or collapsed. The defect can range from a minor buckling of one side where the metal is not weakened, to a major collapsing of all sides where the metal is weakened with sharp ridges. This defect is usually caused from excessive exhausting or a vacuum too strong for the product and can. Another cause is excessive headspace in the can or under filling of the can, causing a very strong vacuum. This results in buckling on both sides of the can.

Flipper

A "flipper" is a can that appears normal but has little or no vacuum. The way to determine if the can is a flipper is to strike one end of the can on the surface of a table and watch the action of the other end. The opposite end usually pushes outward, which can be pushed back in without the other end being pushed out. It would take another strike on a flat surface to get the end to distend. There are a few causes for this problem. Microbial action or a chemical reaction between the lining of the can and the product produces gas that distends the end of the can. Either overfilling the can or insufficient exhausting of the can also might produce a flipper. A flipper is classified as a critical defect.

Springer

A "springer" can is similar to the flipper, except one end of the can is always distended. When you pick up the can, you can push in one end of the can and the opposite end pushes or springs out. This condition is caused by gas production either from microbial or chemical action. A springer is a critical defect.

Sweller

A "sweller" can is a critical defect that occurs when both ends of a can are distended at the same time. The gas produced from either microbial or chemical actions can cause swellers. A "soft swell" can be depressed by hand, but the distended ends return to the original swollen shape. A "hard swell" is more dangerous. If you try to depress it by hand, the can might explode! One reason for a sweller can might be foods with large amounts of sugar breaking down chemically when storage temperatures become too high. This can release carbon dioxide gas, resulting in the product swelling the can. Another reason for swelling might be cans with a low initial vacuum that have been transported to areas of higher altitude or elevated temperatures.

Buckled

A 'buckled" can is the opposite of a paneled can. Sometimes, during processing, a can is overfilled or pressurized to the extent that internal pressure causes the sides or ends to distend. The countersink or rings are usually distorted first before the sides are affected. The buckled can is a minor defect if the end seam or side seam is not affected. However, if the end or side seam is affected, then the can becomes a major defect.

Manufacturing and external defects

There are several manufacturing defects that you might see when inspecting cans. These conditions can range from minor to critical defects.

Internal can defects

Not all defects occur on the outside of a can. Some of the most common defects found on the inside of the can include scarred enamel, flaked enamel, spangling, detinning, discoloration of the can, and pinholing. The process of canning sometimes creates scars on the enamel coating inside the can; thus, allowing a reaction with the food product. Flaked enamel is a loosening of the enamel in spots caused by improper heating during canning. Both scarred enamel and flaked enamel are major defects.

Spangling is a dark gray discoloration or etching on the tin part of the can. This is due to a reaction of acids such as citrus juices with the tinplate causing a spotty or mottled appearance somewhat like galvanized containers. Spangling can range from insignificant to major defects.

Detinning can range from an insignificant to a major defect. Detinning is due to the product reacting with the tinplate or exposed steel causing the tin to be removed from the can.

If sulfur-bearing foods such as corn, peas, fish, meats, and poultry react with the tin; the tin turns black and iron sulfides are produced as a waste product. This condition is usually caused by an improper interior coating of enamel.

Another interior defect occurs when an acid product reacts with the tinplate and causes erosion. This erosion can lead to small holes, usually on the lid, where the code numbers are embossed into the metal. These pinholes are critical defects because microorganisms can enter and grow in the food. This type of defect is usually found in brine-packed items, vinegar-packed items, or water-packed fruits.

Plastics

Modern technology has provided a number of flexible packaging materials. One of these materials is used extensively in the food industry—plastic. There are a variety of plastics used to protect foods. Some examples include cellophane, nylon, Mylar or Scotch-Pak, polyethylene, polypropylene, polystyrene, Saran, and polyvinyl chloride. Most of these materials are transparent, provide moderate protection from sunlight, can be used for a variety of foods, and can withstand moderate amounts of pressure (bursting strength). The technology associated with the plastics' industry is rapidly changing and improving. Plastic packaging materials are improving in terms of bursting strength, protection of food, and the use for a wider range of products.

Glass

Glass has been used in the food industry for a long time. As a matter of fact, the majority of glass containers in the United States are used in the food and beverage industry. As a food package, glass is chemically inert or unreactive with most substances. Some of the advantages of glass include the following:

- Chemically inert.
- Can be transparent, if desired.
- Capable of being manufactured into virtually any shape.
- One of the strongest materials on earth in its virgin condition.
- Compares favorably to other materials in its energy requirements.
- Capable of being made "easy to open" and then resealed for later use.
- Made of raw materials that are plentiful, inexpensive, and of no strategic importance.

Breakage

One of the most common problems with glass is the possibility of breakage. Breakage can be minimized with proper thickness and coating treatments such as waxes and silicones. These coatings help prevent breakage because the bottles and jars glance off each other instead of taking direct hits. Glass containers are often scratched during processing, which creates a weak point in the glass. The coatings also strengthen these weak areas.

Closure

The typical glass closure is a metal lid with either a rubber or plastic gasket that forms a hermetic seal. The metal lid must be protected against reactions with the food product, just as metal cans are protected with enamel coatings.

Cardboard and other paper materials

Paper in itself is not a good material to use to protect food products. Most paper, when used in primary containers, must be treated, coated, or laminated to improve its protective qualities. Paper is bleached, coated, or impregnated with waxes, lacquers, plastics and laminations of thin metals, such as aluminum foil, to improve its water vapor and gas impermeability, flexibility, tear resistance, grease resistance, sealability, appearance, and burst strength. All paper and cardboard products that touch the food must meet FDA standards for chemical purity, and the coatings must be nontoxic and meet rigid microbiological testing standards.

413. Food storage

Proper food storage practices are important in preventing deterioration or total loss of products. Do not take storage techniques lightly. Your recommendations on the proper storage practices for foods may afford the government substantial savings. You'll find some storage practices are similar for both perishable (refrigerated) and semiperishable (dry) foods. This lesson focuses on perishable foods, since these foods are more susceptible to deterioration. Use DLAM 4145.12, *Joint Service Manual (JSM) for Storage and Materials Handling*, as a guide for storing foods, and determining shelf life and humidity requirements of both perishables and semiperishables. Also, Defense Commissary Agency (DeCA) Directive 40–1, *Commissary Operations*, contains information on how to properly store and handle both perishables and semiperishables purchased for DeCA accounts.

Chilling foods and cold storage

All chilled and frozen foods are perishable and can deteriorate rapidly when improperly stored. Storing foods at improper temperatures and humidity, in poor air circulation, and under unsanitary conditions can lead to spoilage and eventual product loss. You'll first learn about the types of refrigeration and then the proper storage practices for both chilled and frozen products.

Types of refrigeration

There are four basic types of refrigeration used in cooling foods:

1. Room cooling device that uses cooled air.
2. Hydrocooling—uses cooled water to lower food temperature.
3. Vacuum cooling—evaporates water and removes heat from foods.
4. Icing—either chopped or flaked ice is put on foods and is the best method for short term cooling.

You'll see the room cooling method most often. A good example of room cooling would be the walk-in refrigerators you see in the back of restaurants and grocery stores. Hydrocooling and vacuum cooling are used for fresh fruits and vegetables immediately after harvesting.

Chilled and frozen storage

When the product first arrives at the warehouse, it's inspected using the procedures outlined in the receipt and surveillance inspections' units later in this volume. Warehouse workers mark items with a date arrived, so later identification is easier for proper rotation practices. There has been a long-standing rule of first in, first out (FIFO) for proper rotation of products. However, this is not always the case. If a product comes in with noticeable deterioration and the same product that has been in the warehouse is in excellent condition, which product do you think should be issued and used first?

Use the product with noticeable deterioration first to prevent total loss of the product. FIFO is only a guide for warehouse personnel to use. You may need to recommend not using this guide for specific products.

Temperature of chilled rooms

Because of a wide range of required temperatures, usually three separate rooms are used to store chilled products. The temperature of chilled rooms can range from 32 to 50ºF (0 to 10ºC). One room should be 32 to 35ºF (0 to 1.67ºC), the second room at 45 to 50ºF (7 to 10ºC), and the third room is air-conditioned between 50 and 80ºF (10 to 27ºC) for fruits and vegetables not needing refrigeration, but that cannot be exposed to hot temperatures. The rooms should have a thermometer placed near the warmest part of the room (that is usually by the door). The temperature requirements for frozen foods are below 0ºF (−17.78 ºC). The products must be properly packaged in a material that will prevent moisture from escaping, so freezer burn will not be a problem.

Freezer burn is a condition where moisture in the product is greater than moisture in the freezer, causing the moisture to be drawn from the food to the freezer air if the food is not properly packaged. Freezer burn produces a shriveled, discolored product. If a freezer is clean, sealed, and temperature controlled and the product is handled and packaged properly, then defects can be prevented. Refer to AF Joint Manual (AFJMAN) 23–210, *Joint Service Manual (JSM) for Storage and Materials Handling*, for more details about freezer storage.

Amount of humidity

Another important aspect of chilled storage is room humidity. Some fruits need high levels of water in the air, while some vegetables need very low levels. The proper levels of humidity inhibit the gain or loss of moisture in the food item. Storing food at a high humidity can cause condensation and allow the food to absorb the water, while at a lower humidity the food can dry out and shrink.

Separation

Separate food products according to their temperature and humidity requirements, and their ability to give off or absorb odors. Some foods, like onions, give off strong odors. These foods should not be stored with foods, like eggs or apples, which easily absorb odors.

Air circulation

When food products are stored in a chilled room or freezer, air circulation becomes extremely important for maintaining the proper temperature. The foods must be stored on pallets that will lift them up off the floor to allow air circulation under the foods. This also allows proper cleaning under the foods. The pallets must be placed at least four inches from the wall and no closer than about 24 inches from the ceiling. Fans must be in good working condition. Check the doors for leakage. Freezers will develop ice around areas where air leaks in or out. This ice buildup is a safety hazard but not much of a public health threat.

Atmosphere

Another factor in storing chilled products, mainly fresh fruits and vegetables, is the atmosphere. A controlled atmosphere can be used to increase the storage life of many products. One example is the use of carbon dioxide in large rooms filled with apples to extend their shelf life to almost a year or more. Modifying the atmosphere to reduce the oxygen and controlling the temperature of the storage room allows the control of growth of many of the pathogenic and deteriorative microorganisms found on most foods.

Segregation

Another thing to remember for either frozen or chilled perishables is to segregate bad food items, such as a rotten potato, before the entire area becomes either rotten or absorbs the smell of the rotten potato. Inspect these items according to surveillance inspections covered in Unit 2 of this volume.

Dry storage

The term *semiperishable* refers to foods that are canned, dried, dehydrated, or otherwise processed to the extent that the items may, under normal conditions, be stored without being refrigerated. Semiperishable foods are not as susceptible to deterioration as perishables. However, if stored improperly, mishandled, or stored for excessive periods of time, semiperishables can deteriorate. The length of storage is based on the packing date and not the date of receipt. Proper storage practices, such as proper rotation, segregating infested or contaminated foods, cleaning up spills and leaks, and locating foods away from heat sources are used to help protect products and lengthen storage time of foods. Pallets are also used to lift foods above the floor for air circulation; easier cleaning and better sanitation; applying insecticides and rodenticides; checking for evidence of infestations; and providing for clearance from the wall, ceiling, and floor. The wall clearance must be about 6 to 8 inches, while the ceiling must be at least 18 inches away from the tallest container stored in the warehouse. To prevent food contamination, another important practice is to ensure nonfood items are *not* stored with food items. Refer to AFJMAN 23–210 or DeCA Directive 40–1 for more information on the proper storage practices of semiperishables.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

412. Types of food packaging

1. List the requirements and functions that containers must meet to protect foods.

2. What does hermetic mean?

3. What not only offers protection for the food product, but also allows high-speed production?

4. What thin coating might be added to a steel can to prevent corrosion?

5. What causes a hydrogen swell reaction in a steel can?

6. How can aluminum cans be strengthened just prior to final closure?

7. What is one advantage of using aluminum cans for food storage?

8. What is a critical can defect?

9. What are the two classifications of dents?

10. What causes buckling on both sides of a can?

11. What is a flipper defect in a can?

12. What causes a springer can condition?

13. What is a sweller can defect?

14. Describe a buckled can defect.

15. What is spangling?

16. List the varieties of plastics used to protect foods?

17. List the advantages of using food glass containers?

18. How can breakage be minimized when using glass food containers?

19. Why is paper bleached, coated, or impregnated with waxes, lacquers, plastics and laminations of thin metals, such as aluminum foil?

413. Food storage

1. List the four basic types of refrigeration used in cooling foods?

2. What are the three separate storage room temperature requirements for storing chilled foods?

3. What happens to foods stored in a refrigerator with low humidity?

4. Why should onions be separated from foods like eggs or apples?

5. How far away from the wall and ceiling should pallets of food be stored in a refrigeration unit?

6. What is the purpose of storing food in a controlled atmosphere?

7. What is the purpose of segregating either frozen or chilled bad food items, such as a rotten potato, from the good food?

8. What is the required wall and ceiling clearance from the tallest container in a semiperishable or dry storage warehouse?

Answers to Self-Test Questions

401

1. Microorganisms.
2. Cocci.
3. Bacilli.
4. 2,000.
5. Heat, cold, drying, and many disinfectants.
6. Digestive enzymes.
7. Mycelium.
8. By a process called budding, which is where a smaller new cell is pinched off from a larger existing yeast cell.

402

1. Nutrients, natural inhibitors, and microbial flora.
2. Benzoic acid.
3. Yeasts and molds.
4. Neutral, it’s not acidic or alkaline.
5. Acidic.
6. Bacteria.
7. Nonharmful bacteria break down carbohydrates in food to lactic acid. As the lactic acid accumulates, the pH drops resulting in a more stable product.
8. Temperature.
9. Psychrophiles, mesophiles, and thermophiles.

10. Psychrophiles.
11. High.
12. A microorganism that grows best at moderate temperatures, but can also grow at low temperatures.
13. Lag, log, stationary, and decline.
14. The first phase of bacterial growth where there is no increase in the number of cells and the bacteria are adjusting to their new environment and preparing for cell division.
15. Bacteria grow logarithmically or very rapidly.
16. Stationary phase.
17. Decline phase.
18. Aerobic microorganisms.
19. Bound and free.
20. A measurement of the availability of water for chemical reactions and microbial metabolism.
21. Salt-loving bacteria.
22. Foods are dried or dehydrated, frozen, or treated with a solute of sugar or salt.
23. For the microorganism to grow at lower Aw values.
24. Enzymes: either enzymes from the food itself or enzymes from microorganisms in the food.
25. Ripening fruits and vegetables.
26. Preservatives, antibiotics, inhibitors, poisons, and insecticides.
27. The efficiency of the milk pasteurization was poor.
28. Converting proteins to amino acids for improving the dough in baking.
29. If bacteria like *Staphylococcus aureus*, *Salmonella typhimurium*, *Clostridium perfringens*, or *Clostridium botulinum* are allowed to grow in foods, people consuming them may get sick.

403

1. 40F to 115F (4−46ºC).
2. 6 to 72 hours, with an average of 12 to 36 hours.
3. Red sore throat, high fever, and vomiting.
4. C. jejuni.
5. Nausea, abdominal cramps, headache, fever, and diarrhea which might be bloody if severe.
6. Meningitis, abortion, prenatal septicemia, permanent mental deficiency, or death.
7. Its distribution in the environment, ability to survive for long periods of time under adverse conditions, and ability to grow while under refrigeration.
8. 170ºF (77ºC).
9. Bacteria.
10. Nothing will destroy it.
11. *C. botulinum*.
12. *C. perfringens*.
13. Acute abdominal pain, gas, diarrhea, chills, and fever.
14. Leave foods uncovered.

404

1. An agent, a vehicle, a susceptible consumer, and an abuse of a food handling procedure.
2. The person’s size, age, present health, eating habits, and dose of the pathogen.
3. Annually.
4. MTF.
5. Infective agent or pathogen.
6. A common meal or facility.
7. Immediately after interviewing patients and finding a common facility, meal, or food.

8. Patient interview and collecting food sample team.
9. AFIOH/SDE.
10. AF Form 431.

405

1. Levans and dextrans.
2. Rancidity, putrefaction, souring, and gassing.
3. Hydrolysis or oxidation.
4. A type of spoilage where bacteria metabolize meat proteins or free amino acids.
5. Anaerobic bacteria metabolize carbohydrates in meats causing lactic acid that brings down the pH and develops a sour flavor.
6. Green cores, green rings, and surface greening.
7. Bacteria such as *Lactobacillus viridescens* produce hydrogen peroxide. Hydrogen peroxide is a strong oxidizing agent that degrades the meat pigment turning it green.
8. Cooking the meat to an internal temperature of 160ºF (71ºC).
9. Green rings are similar to green cores except that the greening occurs in rings at varying depths within the meat.
10. Since the bacteria are aerobic, surface greening usually does not occur on vacuum packaged meats while still packaged.
11. In characteristic beads that are sticky to the touch and give off odors sometimes described as yeast-like.
12. Some molds produce carcinogenic substances known as aflatoxins that are extremely toxic.

406

1. Seven days.
2. A short time after death, a substance called trimethylamine is produced by breakdown of the fat or proteins in the fish due to enzyme and bacterial action. Trimethylamine causes the typical fishy odor.
3. The glycogen is depleted which is usually broken down into lactic acid that lowers the pH. With the glycogen depleted, fewer amounts of lactic acid are produced causing the pH to be higher.

407

1. First, egg yolks are formed in the hen's ovaries; second, the yolk passes down the hen's oviduct where layers of egg white are added; third, further down the oviduct the membranous tissue along with calcium and minerals are added to form the shell.
2. It helps to explain some defects of eggs.
3. Allow gases to pass in and out of the egg.
4. *Salmonella enteriditis* is found in the reproductive tract and can easily enter the eggshell as it's forming.

408

1. Pseudomonas, Flavobacterium, Chromobacterium, and Alcaligenes.
2. Time between pasteurization and consumption, temperature abuse, and possible contamination.
3. Molds, yeasts, and anaerobic spore formers that can oxidize lactate and various protein and fat products.
4. Using raw milk, inadequate heat treatment, and contamination after pasteurization, and slow acid production by the starter bacteria such as Streptococcus lactis.

409

1. Bacteria.
2. Soft, watery, tan to light brown areas that are readily gouged out with the tissue inside having a moldy or musty odor and flavor. There are typical bluish-green spores on the fruit.

410

1. At least 140°F (60°C) will start to kill pathogenic bacteria.
2. It reduces the stress on the container during heat processing, holds the ends in a collapsed concave position during storage, and reduces the headspace oxygen that retards the growth of the remaining organisms.
3. Agitation
4. Protecting the product from contamination.
5. A process using heat treatment to eliminate either pathogenic organisms or other organisms to extend the product's shelf life.
6. A temperature below 212°F (100°C) is called pasteurization while a temperature above 212°F (100°C) is referred to as sterilization.
7. Flash method brings milk to 161°F (72°C) for 15 seconds
8. They do not normally carry pathogenic organisms.
9. A heat treatment applied to fruits and vegetables primarily to inactivate food enzymes by passing the products through water or steam at temperatures of 190°F (88°C) to 212°F (100°C).
10. 41°F (5°C) or lower.
11. The taste, texture, and nutritive value.
12. Air containing too much humidity can cause moisture to condense on the surfaces of the foods, allowing psychrophilic organisms to grow.
13. Solar drying, drum or roller drying, hot air drying, freeze drying, and concentration.
14. Rain, birds, dust, insects, and halophilic bacteria.
15. The revolving heated drum.
16. Spray drying.
17. The ice, under vacuum conditions, dissipates directly as a water vapor.
18. Removing water from a product without it actually being changed to a dry state.
19. Acidulation, the oxidation of nitrogenous organic compounds, and the decomposition of starches and sugars into ethyl alcohol, carbon dioxide, and organic acids.
20. Lactic acid.
21. Acetic.
22. Food irradiation.
23. To control certain parasites in beef and pork, slow maturation in FF&V, and provide microbial disinfection and disinfestation of arthropod pests in certain foods.
24. Dosage.
25. Salmonella.
26. Enforcing standards and obtaining data on possible health hazards.
27. The regulation of O_2 and CO_2 for storage of fresh foods.
28. It stimulates ripening, which changes the color of the bananas from green to yellow. The gas also brings out the sweetness of the bananas.
29. Rate of microbial and enzymatic spoilage.
30. Smoking meats next to smoke vents. The keeping time for food items was improved by hanging them next to a smoke vent. Today, smoke is usually combined with heat treatment to achieve a drying effect with a smoke flavor added to the food.

411

1. Any substance the intended use of which results or may reasonably be expected to result directly or indirectly in its becoming a component or otherwise affecting the characteristics of any food.
2. Method of preserving food by adding salts or other substances to inhibit microbial growth.
3. The adding of salt, nitrates, or nitrites to a food product to inhibit microbial growth.
4. Pickle cure.

5. Brown or grayish-green color due to a poor reaction with the nitrites and the meat pigment.
6. Reduces the Aw.
7. To preserve the characteristics of that food. These chemicals preserve or change the flavor, color, taste, and texture of foods.
8. They are used to prevent mold growth on baked goods, cheeses, and in artificially sweetened jams, jellies, and preserves.

412

1. These include being nontoxic, sanitary, protecting from moisture, gas, odor, light, and unwanted intrusion.
2. A container that is impermeable to or not allowing the entry of gases and vapors.
3. Cans.
4. A thin coating of tin over the steel.
5. The tin will gradually disappear while the amount of exposed steel increases. There will eventually be a reaction between the food and the steel. This reaction produces a hydrogen gas, which can build up enough to distend the ends of the can.
6. By injecting a small amount of liquid nitrogen into the can. The gas expands and provides an internal pressure that adds rigidity.
7. When aluminum is mixed with oxygen it forms aluminum oxide, which prevents corrosion.
8. Defects that affects product safety.
9. Major or minor defect.
10. Excessive headspace or under filling of the can, causing a very strong vacuum.
11. A can that appears normal but has little or no vacuum.
12. This condition is caused by gas production either from microbial or chemical action.
13. Critical defect where both ends of the can are distended at the same time.
14. It's when a can is overfilled or pressurized to the extent that internal pressure causes the sides or ends to distend.
15. Dark gray discoloration or etching on the tin part of the can caused from a reaction of the acids of the foods with the container.
16. Some examples include cellophane, nylon, mylar or Scotch-Pak, polyethylene, polypropylene, polystyrene, Saran, and polyvinyl chloride.
17. It is one of the strongest materials in its virgin form; chemically inert; transparent; capable of manufacturing into any shape; made from materials that are plentiful, inexpensive, and of no strategic importance; compares favorably to other materials in energy requirements; and is capable of being made easy to open and reseal.
18. By using proper thickness and coating treatments such as waxes and silicones.
19. To improve its water vapor and gas impermeability, flexibility, tear resistance, grease resistance, sealability, appearance, and burst strength.

413

1. Room cooling, hydrocooling, vacuum cooling, and icing.
2. 32 to 35ºF (0 to 1.67ºC), 45 to 50ºF (7 to 10ºC), and foods stored in air conditioning between 50ºF and 80ºF (10 to 27ºC).
3. The foods dry out or lose moisture to the air in the refrigerator and shrink.
4. They easily absorb odors.
5. At least 4 inches from the wall and 24 inches from the ceiling.
6. The storage life of many products can be increased.
7. To prevent the entire food lot from becoming either rotten or absorbing the smell of the rotten potato.
8. At least 6 to 8 inches from the walls and at least 18 inches from the ceiling.

Complete the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field-Scoring Answer Sheet.

Do not return your answer sheet to the Air Force Career Development Academy (AFCDA).

1. (401) Which is the time lapse from one cell division to the next called?
   a. Growth.
   b. Division.
   c. Cellular time.
   d. Generation time.

2. (401) Which process is the forming of the endospore during bacterial growth?
   a. Fission.
   b. Serologic.
   c. Exospore.
   d. Sporulation.

3. (402) Besides microbial flora and natural inhibitors, which other prominent factor has an impact on microbial activity?
   a. Protein.
   b. Vitamins.
   c. Nutrients.
   d. Microbes.

4. (402) Which chemical can be added to food to adjust the potential hydrogen (pH)?
   a. Salt.
   b. Water.
   c. Acetic acid.
   d. Lactic acid.

5. (402) Which describes facultative microorganisms?
   a. Microorganisms that grow only in an oxygen environment.
   b. Yeasts, bacteria, and molds that can grow at any temperature.
   c. Yeasts, bacteria, and molds that grow only in an anaerobic environment.
   d. Microorganisms that can grow with or without oxygen in the environment.

6. (402) Which describes the water activity value of a food?
   a. Amount of water bound by a food.
   b. Total availability of water in a food product.
   c. Amount of water in a form unusable by microorganisms.
   d. Total availability of water in a food for chemical reactions.

7. (403) Which disease is more common than both salmonellosis and shigellosis?
   a. Botulism.
   b. Clostridialenteritis.
   c. Campylobacter enteritis.
   d. Listeria monocytogenes.

8. (403) Which toxin is considered “heat stable”?
   a. Staphylococcal foodborne intoxication.
   b. Hepatitis A.
   c. Salmonella.
   d. C. jejuni.

9. (403) Which toxin causes a descending symmetrical flaccid paralysis which may progress until there is complete respiratory paralysis?
   a. Botulism.
   b. Salmonella.
   c. Staphylococcal.
   d. Listeria monocytogenes.

10. (404) Which agent causes over 68 percent of foodborne illnesses?
    a. Viral.
    b. Parasite.
    c. Chemical.
    d. Bacterial.

11. (404) Which are the two types of samples collected during a foodborne illness outbreak investigation?
    a. Blood and vomitus.
    b. Food and beverage.
    c. Human and food.
    d. Stool and blood.

12. (405) Hydrolysis or oxidation in meats is caused by
    a. oxygen reacting with fats.
    b. mold reacting with lipases.
    c. yeast reacting with myoglobin.
    d. bacteria reacting with enzymes.

13. (405) Which causes putrefaction spoilage in meats?
    a. Oxygen reacting with fats.
    b. Molds reacting with lipases.
    c. Yeast reacting with myoglobin.
    d. Bacteria reacting with amino acids.

14. (405) Which produces aflatoxins?
    a. Yeast.
    b. Mold.
    c. Bacteria.
    d. Enzymes.

15. (406) The glycogen in fish is broken down to lactic acid causing
    a. higher enzymes, preserving the fish.
    b. lower pH, limiting bacterial growth.
    c. higher pH, limiting bacterial growth.
    d. lower glycogen, causing tissue breakdown.

16. (407) Which bacteria is found in the reproduction tract of chickens?
    a. *Staphylococcal.*
    b. *Campylobacterjejum.*
    c. *Listeria monocytogens.*
    d. *Salmonella enteriditis.*

17. (408) Which product does *not* usually have spoilage problems since there is not much time between its pasteurization and freezing?
    a. Fruity yogurts.
    b. Soft ice cream.
    c. Cottage cheese.
    d. Hardened ice cream.

18. (409) Most vegetable spoilage is caused by
    a. fungi.
    b. yeasts.
    c. bacteria.
    d. enzymes.

19. (409) Which is the *predominant* fruit spoilage organism?
    a. Molds.
    b. Yeasts.
    c. Bacteria.
    d. Enzymes.

20. (410) In thermal or heat processing most organisms start to die at which degrees Fahrenheit?
    a. 179.
    b. 159.
    c. 139.
    d. 119.

21. (410) Newer cans have which type of seam?
    a. Side.
    b. Top.
    c. Bottom.
    d. Top and bottom.

22. (410) At which degrees Fahrenheit is milk kept for three seconds making it an ultra-high temperature (UHT) pasteurizing for milk?
    a. 207.
    b. 165.
    c. 145.
    d. 125.

23. (410) Acetic acid usually lowers the potential hydrogen (pH) level in catsup, salad dressings, and pickles to which level or below?
    a. 5.0.
    b. 6.0.
    c. 7.0.
    d. 8.0.

24. (410) Which method is becoming more cost effective to use as a food preservation technique?
    a. Irradiating.
    b. Fermenting.
    c. Refrigeration and freezing.
    d. Thermal or heat processing.

25. (410) Which organization accumulates data and tries to find answers to very important questions such as, "Will food irradiation create an environment in which microorganisms can adapt and flourish?"
    a. Food Safety Program.
    b. Human Safety Association (HSA).
    c. Center for Disease Control (CDC).
    d. Food and Drug Administration (FDA).

26. (411) Nitrates and nitrites are added to foods, such as meats, to
    a. fix the color.
    b. aid in enzymatic action.
    c. reduce the water activity.
    d. assist with starter bacteria in fermentation.

27. (412) Which function or requirement must food containers meet to ensure foods are protected?
    a. Allow the contents to breath.
    b. Be made from glass or metal.
    c. Allow for five percent content expansion.
    d. Protect against moisture, gas, odor, and light.

28. (412) Most cans are made of
    a. steel.
    b. paper.
    c. plastic.
    d. aluminum.

29. (412) Which metal has a lower chance for atmospheric corrosion and is easier to shape into cans?
    a. Tin.
    b. Lead.
    c. Steel.
    d. Aluminum.

30. (412) Which type of critical defect occurs when both ends of a can are distended at the same time?
    a. Panel.
    b. Flipper.
    c. Sweller.
    d. Springer.

31. (412) Which is *not* true of glass used in food packaging?
    a. Can be transparent if desired.
    b. Capable of being manufactured into virtually any shape.
    c. One of the strongest materials on earth in its virgin condition.
    d. Must be treated, coated, or laminated to improve its protective qualities.

32. (413) Which guide is used for food storage, determining shelf life and humidity requirements of both perishable and semiperishable foods?
    a. AFI 48–117, *Public Facility Sanitation.*
    b. DeCA Directive 40–2, *Food Storage Operations.*
    c. DeCA Directive 40–3, *Meat Department Operations.*
    d. DODR 4145.19–R–1, *Storage and Materials Handling*.

33. (413) The long standing rule for proper food rotation is
    a. first in, first out.
    b. pull the best looking food last.
    c. pull the best looking food first.
    d. use top shelf first, second shelf next, and so on.

34. (413) Which happens to food when it's stored in high levels of humidity?
    a. Shrinks.
    b. Dries out.
    c. Gets freezer burn.
    d. Absorbs the water.

35. (413) Which is an indicator that a freezer has air leaking in or out of a door seal?
    a. High temperature.
    b. Poor air circulation.
    c. High humidity level.
    d. Ice around the door.

Please read the unit menu for unit 2 and continue ➔

Student Notes

Unit 2. Food Procurement and Inspections

FOR YEARS THE military procurement system has been plagued with inefficiencies. This created a large inventory of food in government depots and created problems with food quality and food loss due to aging. The Department of Defense (DOD) is quickly moving away from the idiosyncrasies of traditional food procurement and inspection procedures and moving toward a system that is in line with our civilian counterparts. This will help ensure the highest quality foods are being procured and prepared for our personnel. In this unit, we'll cover requirements and types of contracts used in food procurement.

2–1. Approved Food Sources

As you know, public health (PH) is involved in the inspections of all foods received on base. However, before actual food inspection procedures take place; you must ensure products received are from an approved source. Procurement offices must purchase all food items from approved sources in collaboration with PH. Vendor requests to sell to the military are to be forwarded to PH for review.

Approved sources (establishments) must conform to the criteria in the appropriate directories. The sources must be listed either in the *Worldwide Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement (CIR 40–1),* maintained by the US Army Public Health Command, unless exempt according to *Worldwide Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement Appendix A,* or are on your locally approved establishment list. Electronic versions of these sources are available through the US Army Public Health Command website.

414. Approved source publications

The *Worldwide Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement* lists approved establishments by country and state. It also includes the company name, approved product(s), plant address, city, zip code, and the inspector responsibility code of the Army office that performed the inspection.

Other federal approved sources

The table below lists products and their source requirements for foods to be served in dining facility.

SOURCES	
Products	**Description**
Meats	Offer products bearing the mark of a federal or state agency. Federally inspected approved plants are listed in the USDA publication *Meat and Poultry Inspection Directory* available through the US Army Public Health Command website under Federal Approved Sources link.
Eggs And Egg Products	Offer products listed in the USDA, *Listing of Plants Operating Under USDA Poultry and Egg-Grading and Egg Products Inspection Program* available through the US Army Public Health Command website under Federal Approved Sources link.

SOURCES	
Products	**Description**
Milk And Milk Products	Sources must have a pasteurized milk compliance rating of 90 percent or higher certified by a state milk sanitation officer, and must appear on the *Sanitation Compliance and Enforcement Rating of Interstate Milk Shippers List (IMSL)* available through the US Army Public Health Command website under Federal Approved Sources link. These source plants may supply dairy products indicated by product codes, flavor drinks, and other novelty fluid drinks.
Fish	Sources must be listed in the *US Department of Commerce Approved List of Fish Establishments and Products.* Fish, fresh or fresh smoked, modified atmospheric packaged (when distributed in a chill state) must be Packed Under Federal Inspection (PUFI) by the USDC or listed specifically in the *Worldwide Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement.*
Dairy Products (Other Than Milk)	Sources must appear in *Dairy Plants Surveyed and Approved for USDA Grading Service*.
Shellfish Products	For oysters, clams, or mussels, the sources must appear on the *Interstate Certified Shellfish Shipper's List (ICSSL),* the listing covering all shucking, packing, and processing of these shellfish available through the US Army Public Health Command website under Federal Approved Sources link.

Other government approving agencies

In the continental United States (CONUS), imported packaged foods of foreign origin are approved at the point of entry. The inspection is conducted by the United States Department of Agriculture (USDA), United States Department of Commerce (USDC), or the Food and Drug Administration (FDA).

United States Department of Agriculture

The USDA provides two publications that list approved food sources—the *Meat and Poultry Inspection Directory* and the *Dairy Plants Surveyed and Approved for USDA Grading Service*. Both publications are readily available for download on the USDA website. Automatic updates can be received by subscription.

Meat, Poultry, and Egg Product Inspection Directory

The Meat, Poultry, and Egg Product Inspection Directory is a listing of establishments that produce meat, poultry, and/or egg products regulated by USDA's Food Safety and Inspection Service (FSIS) pursuant to the Federal Meat Inspection Act, the Poultry Products Inspection Act, and the Egg Products Inspection Act. The directory is updated monthly, and the current edition replaces all previous editions.

Directory of Grading offices and Plants Operating Under USDA Poultry and Egg Grading Programs

The Poultry Program of USDA's Agricultural Marketing Service provides voluntary poultry and egg grading and certification services. These services are usually performed by resident graders who are assigned to a specific plant on either a full-time or part-time basis. Most grading services provided to resident plants are also available on a temporary plant basis; that is, on an as-needed basis. The following lesson gives you the information needed to identify plants that utilize voluntary grading services.

Dairy Plants Surveyed and Approved for USDA Grading Service

The *Dairy Plants Surveyed and Approved for USDA Grading Service* is updated once a quarter and is divided into two sections.

1. Section 1 lists each company (by state) that has been inspected and found eligible for USDA grading or inspection services. It also includes the plant number, location, and the code explaining the approved product or operation. The plants found in section 1 produce products that are manufactured from dairy ingredients meeting the requirements found in the

regulations or originate from USDA-approved plants and are there for eligible for USDA grading or inspection service.

2. Section 2 lists companies that meet USDA requirements for processing or packaging operations. It's usually free to food inspectors. The plants found in section 2 may have products produced from dairy ingredients that did not originate from USDA-approved plants.

United States Department of Commerce

Semi-annually, the USDC/National Oceanic and Atmospheric Administration (NOAA) Seafood Inspection Program updates the "*USDC Approved List of Fish Establishments and Products*. "It's a reference to determine which fishery products have been certified by the USDC. The USDC inspects, approves, and certifies establishments as being sanitary and capable of producing safe, wholesome products. Companies request inspections at their own expense and voluntarily subscribe to the USDC standards of sanitation. The list is merely a compilation of those companies participating in the National USDC Seafood Inspection Program. AFI 48–116, *Food Safety Program* states companies selling fish to the government must be listed in this document. All products must be processed in accordance with (IAW) specific quality regulations written by the USDC. This document includes the company listings for crab, scallops, lobsters, shrimp and finfish. The listing is divided into three sections as noted in the following table.

SECTIONS OF THE USDA USDC APPROVED LIST OF FISH ESTABLISHMENTS AND PRODUCTS

Section	Description
One	Establishments approved only for sanitation. Lists the company code, establishment name, and plant address.
Two	Establishments approved for sanitation and processing which have been inspected and bear the official USDC inspection and grade markings. Lists the establishment name and plant location.
Three	Establishments approved for sanitation and processing of animal feed products. It also lists products by category and includes brand names, package sizes, and plant code numbers.

Food and Drug Administration

The FDA publishes two documents of approved food source procurement—*IMSL* and *ICSSL*.

Interstate Milk Shippers List

The *IMSL Sanitation Compliance and Enforcement Ratings of Interstate Milk Shippers List* is available in electronic format. The list is divided by state and gives the company name, city, plant code, product code, and the sanitary compliance rating for raw milk, plant operations, pasteurized milk, and the overall enforced rating for the plant. Each company must have a sanitary compliance rating of at least 90 percent to be approved. The document also lists the rating agency and the date inspected.

Interstate Certified Shellfish Shippers List

The *ICSSL* lists the state, company, city, plant code, operations code (Shucker Packer is the only approved operation code for military instillations) and the certificate expiration. The shellfish included under the National Shellfish Sanitation Program are fresh and fresh frozen oysters, clams, and mussels. Other shellfish such as scallops, shrimp, crab, and lobster are not included.

Locally approved lists

If a company wants to sell to your base only, it can be approved locally. Your office is responsible for conducting the inspections and maintaining the locally approved lists.

415. Wholesomeness and quality assurance markings

There are many different markings used on foods in the United States. As a food inspector, you need to know what the markings are and what they mean.

Wholesomeness stamp

When a plant meets USDA standards, its products are stamped with a round USDA wholesomeness stamp. This indicates products were produced in a sanitary environment and were wholesome at the time of stamping and packaging. However, the stamp does not mean the product meets contract requirements. You still inspect the product for wholesomeness upon delivery.

Federal grades for meat

The federal government has two grading systems—quality and yield. A quality grade is a guide to the eating quality of meat based on tenderness, juiciness, and flavor. The quality grade is based on the maturity of an animal at slaughter and the quality and muscularity of the muscles. A yield grade estimates the amount of lean meat to fat and bone. Some of the factors that affect the yield are size of muscle, size of bone, amount of fat, and location of fat.

Beef grades

Official quality beef grades (from highest to lowest) are prime, choice, select, standard, commercial, utility, cutter, and canner. Choice beef is the most common and is what the commissaries sell. The lower grades are used for processed meat products, such as hamburger meat, hot dogs, bologna, potted meat, and so forth. Official beef yield grades (from highest to lowest) range from 1 to 5.

Lamb and mutton grades

Official quality lamb grades (from highest to lowest) are prime, choice, select, utility, and cull. The lamb yield grades are the same as those for beef, 1 to 5. Official quality grades for mutton (from highest to lowest) are choice, select, utility, and cull. The yield grades are the same as beef, 1 to 5.

Pork grades

Official pork quality grades (from highest to lowest) are US No. 1, US No. 2, US No. 3, US No. 4, and utility. There are no yield grades for pork.

Poultry grades

The only poultry grades are quality grades of US Grade A, B, and C. However, there are other common terms used for poultry you should be aware of—class, type, and style.

- Class refers to the age and sex of the bird.
- Type means fresh, frozen, or type of preservation.
- Style refers to the way the product is cut. For example, whole, quartered, halved, pieces, and so forth.

Federal grades for shell eggs

There are certain external and internal factors used to grade shell eggs. External factors include shape, soundness or condition, and cleanliness of the shell. Internal factors include the depth of the air cell; the visibility and shape of the yolk; and amount of thick white and the height of the white. The official grades for shell eggs (from highest to lowest) are AA, A, B, Dirty, Check, Leaker, and Loss. A size or weight class is usually combined with the quality grade; these are Jumbo, Extra Large, Large, Medium, Small, and Pee Wee. Most grocery stores carry AA and A eggs; the best economic value is Grade A Large.

Federal grades for fresh fruits and vegetables

There are literally hundreds of grades used for fresh fruits and vegetables (FF&V)—too many to mention in this unit. Keep in mind, however, that grading factors for all types of FF&V are always similar. Some of these grading factors include condition, quality, appearance, variety, maturity, and size.

Acceptance stamps

The USDA will inspect products for the user upon request. The USDA inspector inspects the product and stamps the product or sealed carton with a shield-shaped stamp, bearing the words "USDA Accepted as Specified." This stamp means the product was wholesome and met the grade, trim, weight, and other requirements requested by the purchaser. This stamp is usually used for chilled or frozen meat items.

United States Department of Commerce markings

USDC markings are used for processed fish. The markings assure products were inspected for wholesomeness, sanitation, grade, quality, and classification. The "US Grade" mark, which signifies a product is clean, safe, and wholesome, is followed by a letter designation, such as A or B, to designate the grade level. Each grade level has a specifically established standard for products to meet in order to be stamped. The USDC also has rectangular and circular stamps, both of which are used to signify a product was packed under federal inspection. "Packed Under Federal Inspection" may be displayed as an official mark on the product label. This signifies the product was clean, safe, and wholesome when packaged and has been produced in an acceptable establishment with appropriate equipment under the supervision of federal inspectors. The product is not graded for a specific quality level; rather, it's an acceptable commercial quality as determined by federal inspectors IAW approved standards or specifications.

416. Contracts

The Defense Commissary Agency (DeCA) Services, and Army and Air Force Exchange Services (AAFES) each have their own system for ordering and purchasing foods. Regardless of the system, the primary objective in purchasing food is to order only the minimum amount needed and reduce the amount of food placed in storage.

Prime Vendor program

The Prime Vendor program is DOD's way to reduce costs and improve food quality and customer service. The Prime Vendor program consists of local distributors delivering food as needed to government agencies to include Services, DeCA, and AAFES. Contracts are developed with a few local distributors that carry all the foods needed by services. Again, food is delivered as needed, so no specified quantities or frequencies are mentioned in the contracts. Ordering personnel can order any amount of food, as often as necessary to meet their needs.

Public health responsibilities

Public health responsibilities in relation to the contract are to evaluate sanitary conditions of the carrier, ensure the food is from approved sources, and determine if products are wholesome.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

414. Approved source publications

1. Federally inspected approved plants selling meat products are listed in what USDA publication?

2. What must the percentage pasteurized milk compliance rating be for milk and milk products to be served in a military dinning facility?

3. Sources for dairy products other than milk must appear in what publication?

4. In CONUS, which federal inspection agencies approve imported packaged foods of foreign origin at the point of entry?

5. Which two publications does the USDA provide that lists approved food sources?

6. How often is the Meat, Poultry, and Egg Product Inspection Directory updated?

7. What service does the Poultry program of the USDA's Agricultural Marketing Service provide?

8. How often is the *Dairy Plants Surveyed and Approved for USDA Grading Service* updated?

9. What is the purpose of the *United States Department of Commerce (USDC) Approved list of Fish Establishments and Products*?

10. What is found in section one of the USDA USDC Approved list of Fish Establishments and Products?

11. What two documents of approved food source procurement does the FDA publish?

12. What directory lists the sanitary compliance rating for raw milk?

13. Shucker Packer is the only approved operation code for military installations in which directory?

415. Wholesomeness and quality assurance markings

1. What type of stamp is used when a plant meets USDA standards?

2. What does yield grade estimate?

3. What are the official quality grades for beef?

4. What are the official quality lamb grades?

5. What are the official quality pork grades?

6. What are the official quality poultry grades?

7. What are the external factors used to grade shell eggs?

8. What are the grading factors for fresh fruits and vegetables?

9. What is written on the USDA inspector's acceptance stamp?

10. USDC markings are used for what type of product(s)?

416. Contracts

1. What is the purpose of the Prime Vendor program?

2. Services utilize what type of contract?

3. What are PH's responsibilities in relation to a food contract?

2–2. Evaluate Safety and Security of Foods

Now that you know how the Air Force (AF) purchases food, you need to understand your role in the food procurement process. As a food inspector, you are the next link in the food safety chain. Your job is to ensure items meet the provisions listed in the procurement documents. These inspections are known as receipt inspections. Receipt inspections are normally shared with the in-checker for the facility.

417. Receipt inspections

There are three classes of receipt inspections used when receiving food at an installation—4, 5, and 8. Class 4 and 8 inspections are conducted before the government purchases the food. Class 5

inspections are conducted on food already owned by the government. Let's look at a general overview of each inspection, then in lesson objective 418 we'll look at how to conduct each type inspection.

Class 4

Class 4 inspections are conducted upon receipt of food products at an appropriated funded activity, which means the government provides tax dollars for support. The commissary and dining hall are two examples of appropriated funds activities. Depots and supply points also fall into this category. Army inspectors conduct Class 4 inspections at these facilities.

Class 5

Class 5 inspections are also receipt inspections, but the food products are already government owned. This means the products are arriving from another government facility, such as a depot or another base.

Class 8

Class 8 inspections are very similar to Class 4 inspections; the only difference is product destination. If products are going to a nonappropriated funded activity, a Class 8 inspection is conducted. Nonappropriated fund activities are supported from the profits they generate and do not receive money from the government. Some examples of nonappropriated funds activities are clubs, shoppettes, recreation facilities, and AAFES food courts.

Contracts, Prime Vendor program, and inspections

Inspections are rarely completed according to their respective classes with the use of contracts and the Prime Vendor program. The *Joint Receipt Inspection Manual* does not cover the Prime Vendor program and other contracts. It's important to periodically review the quality assurance provisions (QAP) in contracts to ensure food safety standards are being met. The following table lists the type contracts used by various agencies.

AGENCY CONTRACTS	
Agency	**Type Contract**
Defense Commissary Agency	Uses several types of contracts—Indefinite Quantity Contracts, Blanket Delivery Orders, Resale Ordering Agreements (ROA), and Blanket Purchase Agreements (BPA).
Force Support (Services)	Mostly Prime Vendor and BPA's.
AAFES	Uses only Prime Vendor.

Inspection procedures

There are some standard procedures that apply to all receipt inspections regardless of class of inspection. This lesson briefly describes the standard inspection procedures; you may find more detailed information listed in the *Joint Receipt Food Inspection Manual* (29 Jan 96). PH is mainly concerned with vehicle sanitation, unwholesomeness, and temperature of product.

Inspection policy

As soon as possible after food shipments arrive at your base, inspections of the food products must be conducted by PH or an equally trained receiving authority. Make every effort to complete the inspections and appropriate documentation within 24 hours of delivery.

Retail

An establishment where food or food products are offered for issue or resale to the final customer is considered a retail activity (e.g., commissary stores, clubs, and exchanges). For retail activities, a contractor's quality history will be established by evaluating each delivery. After a reliable quality history is established the inspection frequency may be reduced.

Rejection

Class 4 and 8 foods are rejected if they are found to be unwholesome or in violation of federal or state regulations. Class 5 foods found to be unwholesome or in violation of federal or state regulations are placed on medical hold until disposition is made. Remember, Class 5 foods are already government owned; rejection is not an option.

Inspection procedures

Inspection procedures require you to determine the origin of a product, conduct inspections, and prepare reports.

Origin

Determine if required origin inspection documentation is present at time of receipt and if the product originates from an approved source. Determine the temperature of the delivery vehicle as it's opened to deliver the food products.

Inspect

Perform a sanitary inspection on the delivery vehicle and a product inspection IAW *Joint Receipt Food Inspection Manual*. The primary focus is in five main areas:

1. Wholesomeness.
2. Source approval.
3. Packaging integrity.
4. Age at the time of delivery.
5. Sanitary conditions of the delivery vehicle.

Report

Report any violations of documentation, source, or vehicle sanitation immediately to the appropriate ordering officer prior to completing the inspection.

Minimum receipt verification frequencies

Foods are broken down into four groups (I, II, III, and IV), as listed in the table below. After a reliable quality history has been established, a reduced frequency inspection may be implemented, which is listed in the table below.

FOOD GROUPS AND REDUCED INSPECTIONS	
Group	**Explanation**
I	Foods with the greatest potential for nonconformances. The majority of these items is highly perishable and has high potential to cause foodborne illness. Food items in this group include fresh beef, fresh waterfoods, fresh poultry, fresh lamb, fresh pork, and shell eggs. Group I foods are inspected at each delivery.
II	Require frequent verification due to wide fluctuations in quality and wholesomeness because of the nature of the product. These foods include fresh vegetables, fresh dairy products, and fresh fruits. Group II foods are inspected weekly.
III	Have less potential for nonconformances because of nonperishability or quality requirements, such as cheeses, bakery products, specialty foods, frozen foods/desserts, processed meats, and infestibles. Prepared foods with meat ingredients are also included in Group III. Group III foods are inspected monthly.
IV	All other food items such as canned foods, grains, and grain products locally classified as noninfestibles; they are inspected as needed.

418. Retail inspections

As mentioned earlier, all receipt inspections are conducted using the *Joint Receipt Food Inspection Manual*. This manual streamlines inspections and standardizes procedures for each military service. This lesson briefly describes Class 4 and 8 inspections, and then discusses Class 5 inspections.

Class 4 and 8 inspections

For food delivered to DOD appropriated and nonappropriated fund activities, routine destination inspections are normally limited to Groups I, II, and III foods. The inspection determines wholesomeness and quality according to contract quality assurance provisions and applicable regulatory standards.

Receipt inspections

The standard provisions of receipt inspections are temperature, wholesomeness, and approved source determination and are explained in the table below.

PROVISIONS OF RECEIPT INSPECTIONS	
Inspection	**Description**
Temperature	In addition to conveyance temperatures, product internal temperatures must also be taken. Sampling criteria and temperature requirements are contained in the BPA, ROA, or applicable regulatory standards. As a minimum, three temperatures must be taken.
Representative Sampling	For results to be representative of a shipment, sample containers may be drawn from various locations throughout the load (rear, center, and front) during off-loading.
Open Package Inspection (OPI)	An OPI or destructive open package inspection (DOPI) is performed on each sample unit to determine product temperature and wholesomeness.

Perishable subsistence receipt inspection

A perishable subsistence receipt inspection includes all perishable subsistence *except* commissary meats, fresh fruits and vegetables, and shell eggs. The inspection criteria are listed in the table below with its description.

PERISHABLE SUBSISTANCE RECEIPT INSPECTION CRITERIA	
Inspection	**Description**
Sampling	Strict random sampling is not required; however, take representative samples from each line item inspected.
Lot Size	Lot size is expressed as the number of shipping containers for each line item delivered. Grandlotting is allowed for multiple line items of the same national stock number (NSN). However, a product is not rejected based on grand lot sampling. The number of shipping containers and the number of pallets from shipping containers are selected IAW the sampling table in the *Joint Receipt Food Inspection Manual*.
Sample Unit	A sample unit is one unit of product, one pound of product, or the sample unit prescribed by the recognized inspection procedures for the items inspected per sample shipping container.

Commissary chilled red meats receipt inspection

The inspection of newly received chilled red meats at the commissary is sampled, the lot size determined, and any defects reported. This inspection is predominately done by the receipt meat personnel. PH can assist when asked. The chilled red meat inspection criteria are listed in the table below with its description.

CHILLED RED MEAT RECEIPT INSPECTION	
Inspection	**Description**
Sampling	Strict random sampling is not required; however, take representative samples from each line item inspected.
Lot Size	Determined by the number of each subprimal or subcomponent of the market-ready cuts received.
Sample Unit	Is one unit of product. In order to determine the number of units delivered, determine how many items are packed in each box and how many boxes were delivered. Pull samples from different boxes (e.g., if your sample size is 5, pull one unit from 5 different boxes). Again, sample units are selected IAW the *Joint Receipt Food Inspection Manual*.

Defects are reported as defects per hundred units (DHU). However, multiple instances of a single defect (e.g., two-bone or two-score defects on a single cut) are scored only once per cut. PH is still responsible for maintaining and documenting discrepancies.

Fresh fruits and vegetables receipt inspection

FF&V are sampled, the lot size determined, and any defects reported, which is described in the table below.

FRESH FRUITS AND VEGETABLES RECEIPT INSPECTION CRITERIA	
Inspection	**Description**
Sampling	Strict random sampling is not required; however, take representative samples from each line item inspected. The destructive sample size will be one unit of product or the amount prescribed by other recognized inspection procedures.
Lot Size	Expressed as the number of shipping containers.
Sample Unit	The entire contents of a sample case or sample unit prescribed by other applicable inspection procedures.

Defects are reported as percent defective. Defect classification and tolerances will be IAW applicable US standards for grade or specification. The product is evaluated for grade/specification requirements and for any appearance factors which will affect the customer's acceptability. Factors that are included in the customer acceptability evaluation include those listed in the US standards as basic requirements and those abnormalities that are known to be unacceptable to the customer but that are not scoreable as grade defects.

Shell egg receipt inspection

Establish a shell egg contractor's quality history. The routine inspection criteria required during shell egg inspection consists of product temperature, wholesomeness, and approved source determination.

Semiperishable subsistence receipt inspection

Semiperishable subsistence items are sampled, lot size determined, and any defects reported as depicted in the table below.

SEMIPERISHABLE SUBSISTENCE RECEIPT INSPECTION CRITERIA	
Inspection	**Description**
Sampling	Strict random sampling is not required; however, take representative samples from each line item inspected.
Lot Size	Expressed as the number of primary containers. The number of primary containers, shipping containers, and the number of pallets are selected IAW with the *Joint Receipt Food Inspection Manual*.
Sample Unit	The number of sample units per sample shipping container is one unit of product, one pound of product, or the sample unit prescribed by the recognized procedures for the items inspected.

Defects are reported as DHUs. Any defects observed are classified according to their appropriate severity (critical, major, or minor).

Reporting receipt inspections

Reporting receipt inspections involve suspected unwholesomeness or violation of federal or state law and reporting product characteristic defects.

Suspected unwholesomeness or violation of federal or state law

When you suspect food unwholesomeness or that there has been a violation of federal law, you're required to complete certain reports and notify the appropriate offices.

Reports

Report all instances of unwholesomeness or violations of law to the responsible PH officer. Report meat, poultry, and related product violations to the lowest practical level of USDA, Food Safety Inspection Service. Report other product deficiencies to the FDA.

Notifications

Notify by telephone and provide a written report containing the following information:

Inspector making the report	Name Grade Organization
Contractor information	Contractor number Lot number Date of pack Product nomenclature Location of product Manufacturing establishment number Name Address
Rejection information	Quantity Date Time Place Cause

Reporting product characteristic defects (other than AAFES)

Report receipt inspections involving suspected unwholesomeness or violation of federal or state law and report product characteristic defects for agencies other than AAFES.

Reports

Describe defects as product characteristics that do not comply with applicable requirements. Report all defects noted on the inspection on DD Form 1232, Quality Assurance Representative's Correspondence, or DD Form 1237, Shell Egg Inspection, as applicable. Be as descriptive as possible to reflect a clear understanding of the defects found. Consecutively number each DD Form 1232 or DD Form 1237 generated for each contract in the upper right corner.

Notifications

If the product does not meet applicable requirements, immediately notify the accountable officer.

Accountable officer

The accountable officer decides to accept, reject, or accept the food items with price adjustment based on the inspector's findings. The final decision is noted on DD Form 1232. DD Forms 1232 are forwarded to the responsible ordering/contracting officer.

Class 5 inspections

Remember, these are receipt inspections on DOD-owned foods. Your primary concerns are wholesomeness and suitability for use when conducting Class 5 inspections. These items cannot be rejected. Noncomformances must be placed on medical hold and sent for further testing.

Disposition

The proper disposition of foods found defective during a Class 5 inspection is according to the table below.

CLASS 5 FOOD DISPOSITION	
Disposition	**Recommendation**
Issue	By normal means.
Unwholesomeness	Condemnation.
Alternative Storage	For aged, infestible, or slightly stressed foods.
Extended Shelf Life Or Inspection Test Dates (ITD)	For sound foods that have exceeded their ITDs.
Percentage	Defects are expressed as percent defective.

Overseas shipments

Supplies that are source loaded in the CONUS for overseas shipment become government-owned supplies at the port of embarkation. However, the government doesn't always inspect supplies leaving CONUS. You perform receipt inspections on these products for contractual compliance upon arrival overseas. Reports of nonconformances at overseas receipt inspection are crucial to warranty action. Furnish reports of nonconformance to the accountable officer. The accountable officer submits reports for warranty action, transportation claims, or discrepancies in shipment.

Surveillance factors

The following surveillance factors are considered important parts of Class 5 inspections:

- Evidence of actual or potential deterioration or spoilage due to contamination by microorganisms or their toxins.
- Exposure to biologicals, chemicals, radioactive material, or other foreign matter.
- Suitability of the item for the purpose intended.
- Transportation damage and deterioration.
- Evidence of insect or rodent infestation.
- Potential keeping-time requirements.
- Warehousing requirements.

Receipt inspection procedures

Receipt inspection procedures include determination of resale factors, which vary depending on the condition of the food items, and issuance directions.

Resale subsistence

When inspecting resale subsistence, you must determine if:

1. Age of the product is within the manufacturer's guidelines (i.e., sell by date, best if used by date, or shelf life guidelines).
2. Intended purpose matches product.
3. Delivery requires warranty action.
4. Condition of product is good.
5. It's a troop issue subsistence.
6. Special handling is required.

Perform an inspection of all troop-issue subsistence to include OPI and other guidance provided in the table below.

TROOP ISSUE SUBSISTENCE	
Action	**Description**
OPI	OPI will be one sample unit for lot sizes less than 8,500 and two sample units for lot sizes of 8,500 or more. Report significant discrepancies to the accountable officer.

TROOP ISSUE SUBSISTENCE	
Action	**Description**
Sample Units	When you remove sample units from cases, tag, label, or otherwise identify cases. After resealing, mark cases with the number of units removed and by whom.
Overage And Infestible Products	Of particular concern are overage products and infestible products arriving at overseas locations where shipment times are prolonged, temperatures and humidity are frequently very high, and pest losses are excessive. Determine the extent of destructive sampling after considering the type of product (perishable, semiperishable, infestible, etc.), environmental condition, findings during closed container inspection, and so forth.

Extended inspection test dates or approximate keeping times

After considering the factors listed above and performing necessary OPI, you may decide to extend or not to extend ITDs or approximate keeping times (AKT). Normal projections range from an extended ITD or AKT is 90 to 120 days. However, products that exhibit mild or minor deterioration (but maintain wholesomeness) might only receive a 30- to 60-day extension period. Similarly, products that show absolutely no signs of deterioration or quality loss may be considered for an extension of 180 days. If AKTs and ITDs are adjusted, advise the property custodian in writing of the new adjusted date. The property custodian will make the appropriate changes on all affected cases or units.

Products approaching approximate keeping times or inspection test dates

To minimize in-storage inspections, you can perform OPI on products which are approaching their AKT and ITD (within 30 to 60 days) when performing Class 5 inspections. Undertake this type of inspection and extension only if warehouse personnel anticipate the product being on hand at the expiration of the current ITD or AKT.

419. Wholesale inspections

Wholesale activities differ from retail activities. At wholesale, food products require further preparation or distribution, such as at supply points or depots, prior to reaching the consumer. Knowledge of the quantity and lot size of products is important in planning inspections.

Initial inspection procedures

Initial inspections are conducted promptly when products arrive with emphasis placed on foods that are infestible. Use Military Standard 904 for further guidance whenever any pest infestation or contamination is detected.

Quantity

The number of primary containers, shipping containers, and pallets that should be sampled for initial inspection is determined IAW the *Joint Receipt Food Inspection Manual*.

Lot size

Lot size and sample units are based on the type of product. For semiperishables, the lot size is the number of primary containers (i.e., bag, can, jar, etc.) or unit of issue or as otherwise specified by inspection documents. The sample unit will be a primary container.

For perishable foods, the lot size is the number of shipping containers of the product. For shell eggs the lot size is the number of “30-dozen” cases or the equivalent. The sample unit is a shipping container.

Contractor receipts

Inspect items IAW the general inspection procedures discussed earlier. Nonconformances are reported to the contract quality assurance element (CQAE) or the ordering officer. If you find nonconformances, the CQAE may still direct you to proceed with the inspection for that product.

Inspections

Inspections are conducted IAW the *Joint Receipt Food Inspection Manual*. OPIs are performed during every inspection. If temperature is a factor condition, the internal temperature of three samples is checked before off-loading from the delivery vehicle. Select samples from the rear, center, and front of the vehicle. If a potential contract nonconformance is detected, calibrate all thermometers immediately and draw additional samples before reporting a temperature nonconformance. The total number of temperature samples equals the contractual sample size for a full inspection. Immediately report product temperature nonconformances to the CQAE, before continuing the inspection.

Compliance with requirements

The primary containers that are selected from the shipping containers are the samples used to determine compliance with shipping and intermediate container identity and condition requirements. If unitization is a contractual requirement, only those pallets from which sample-shipping containers were selected are inspected for unit load requirements.

Obvious defects

Perform product identity, condition, and net weight examinations for obvious defects. As a food inspector, be familiar with contractual requirements before performing this inspection.

Accepted or additional inspection

If the initial inspection reveals a conforming item, accept it. If you find obvious defects, perform an additional, full inspection for all terms of the contract.

Interdepot or supply-points shipment receipts

First, obtain appropriate inspection reports—quality history record, and/or shipping documents. Samples are selected IAW the *Joint Receipt Inspection Manual*. OPIs are performed during every inspection. Inspect the samples to the extent necessary to determine if the products delivered are the products ordered and manifested, and they are fit for continued storage and issue. Accomplish eggshell candling if there is suspicion of loss of quality or carrier damage. If no obvious defects are noted and the product is determined to be fit for issue, continue storage, and no further inspection is required.

If obvious defects are noted and the product is within its warranty period, a warranty inspection is required. If the product is not within its warranty period further inspection will be at the discretion of the Defense Personnel Support Center (DPSC). Warranty inspections are conducted IAW inspection procedures of DSCP 4155. 7, *Perishable Subsistence In-storage Quality Control and Inspection*.

Full inspection procedures

Develop a sampling plan IAW contractual requirements. Select sample units required by the contractual end item criterion.

Strict random sampling

If an end item examination cannot be performed without excessive destructive inspection, call the CQAE for further guidance. Strict random sampling is required. OPIs are performed during every inspection.

Egg inspection

For shell eggs, follow the USDA regulations governing the grading of shell eggs or the local procurement regulation for overseas bases.

No sampling criteria

When the contractual documents do not contain sampling criteria for a particular requirement or the obvious defect is for other than grade or weight class (shell eggs), the inspection for that requirement

is accomplished IAW single sampling plans for normal inspection in Military Standard (MIL–STD) 105E, *Sampling Procedures and Tables for Inspection by Attributes*.

Reports

Once you perform an inspection for identity, condition, and net weight requirements, complete the required inspection reports and report the findings. Accept items that are conformant and report nonconformant items to the CQAE or ordering officer. A DD Form 1232 will be completed for all nonconformances.

Fresh fruits and vegetable inspection at supply points

FF&V are inspected for all contractual requirements IAW the quality assurance provisions. After completing the inspection for administrative, sanitation, or product protection requirements, examine the items for product identity, quantity, condition, and quality.

Vendor delivery

Product grade or quality verification is done IAW the grade or quality specified in the procurement documents. US Standard for Grade is usually referenced when contracting for produce. The most frequently purchased grade is US Number 1. However, some items may be purchased as US Fancy or Extra Fancy grade. The specific grade procured is found in the procurement documents.

Initial inspection procedures

Sampling for closed package inspection (CPI) is conducted IAW the *Joint Receipt Food Inspection Manual*. The destructive sample size will be one unit of product or the amount prescribed by other recognized inspection procedures. Defect classification and tolerances is IAW the USDA, Agricultural Marketing Service (AMS), and the applicable United States Standard for Grade or procurement description. Defects are expressed as percent.

Fresh fruits and vegetable quantity

FF&Vs are examined for product size, count per container, and weight ranges or weight per container as required by the product standard and/or the procurement documents.

Condition and identity

A product condition and identity evaluation is performed to determine if obvious defects exist. The product and product sizes must be the same as ordered, invoiced, and listed on labels. The product must be of the quality and condition required by the grade. The product defects are evaluated for grade requirements and for appearance factors that will affect the customer’s acceptability. Factors that are included in customer acceptability evaluation include those listed in the US standard/procurement description as basic requirements and those abnormalities that are known to be unacceptable to the customer but which are not scored as grade defects. If examination of a sample shows the product to be acceptable for grade and customer appeal factors, the product will be accepted with no further inspection. If examination of samples reveals the number of defects found will meet or exceed the tolerances of the US standard/procurement description or if individual sample cases have large amounts of defectives or if appearance factors will cause the product to be unacceptable to the customer, a full inspection is required.

Full inspection procedures

Sample sizes are determined by the *Joint Receipt Food Inspection Manual*. Defect classification and tolerances will be IAW the applicable US standard for grade/procurement description and the corresponding market inspection instructions. The product examination and defects classification concepts are the same as explained in the initial inspection procedures. If examination of the samples reveals defects that exceed the tolerances of the US standard or if the individual sample cases have

defectives that exceed the "Application of Tolerance Provisions" of the US Standard for Grade, the product lot will be reported as nonconforming. Submit a written description of unacceptable appearance factors to the receiving/accountable officer.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

417. Receipt inspections

1. Match each class of inspection in column B with its description in column A. Items in column B may be used once, more than once, or not at all.

Column A	*Column B*
____ (1) Used to inspect nonappropriated fund activity foods.	a. Class 3.
____ (2) Used to inspect appropriated fund activity foods.	b. Class 4.
____ (3) Used to inspect government-owned foods.	c. Class 5.
	d. Class 6.
	e. Class 7.
	f. Class 8.
	g. Class 9.

2. What type contracts does the Defense Commissary Agency use?

3. How soon after arrival at an installation are food products inspected?

4. An establishment where food or food products are offered for issue or resale to the final customer is considered what?

5. What is the disposition of unwholesome class 4 foods?

6. What are the five primary focus areas when conducting a sanitary inspection on a delivery vehicle and a product inspection?

7. When may an inspection frequency be reduced?

8. Highly perishable foods that have a high potential to cause foodborne illnesses belong to what food group?

9. How often is Group III, reduced frequency, foods inspected?

418. Retail inspections

1. Class 4 and 8 food inspections are normally limited to what food groups?

2. How many internal temperatures *must* be taken upon receipt of food products?

3. How is sampling conducted for perishable subsistence?

4. What two factors are considered for defect reporting for fresh fruits and vegetables?

5. How are defects classified for semiperishable subsistence?

6. When reporting unwholesomeness or violations of federal or state law, what needs to be included in the written report?

7. Who decides to accept or reject food products when product characteristic defects are reported?

8. What recommendations for disposition can be made during Class 5 inspections?

9. Where do supplies that are source loaded in the CONUS for overseas shipment become government-owned?

10. What reports are submitted by the accountable officer for overseas shipments of nonconformance?

11. What are some surveillance factors that are considered important parts of class 5 inspections?

12. When inspecting troop issue subsistence, what is the normal extension period for ITDs and AKTs?

13. Why would you perform an OPI on products that are approaching their AKT or ITD (within 30 to 60 days) when performing Class 5 inspections?

419. Wholesale inspections

1. When initially conducting an inspection at wholesale, what type of products is given priority?

2. Lot size and sample units are expressed based on what factor(s)?

3. Who may direct you to continue with inspection procedures if nonconformances are found during an initial inspection?

4. What must be done if you find obvious defects during an initial inspection?

5. How often are OPIs performed?

6. How are the sampling criteria determined if it's not contained in a contractual document?

7. What is the most frequently purchased food grade for FF&V?

8. What factors are considered when inspecting FF&V for quantity?

9. Who receives reports of unacceptable appearance factors?

Answers to Self-Test Questions

414

1. *Meat and Poultry Inspection Directory*.
2. 90 percent or higher.
3. *Dairy Plants Surveyed and Approved for USDA Grading Service.*
4. *United States Department of Agriculture, United States Department of Commerce,* and *Food and Drug Administration.*

5. *Meat and Poultry Inspection Directory* and *Dairy Plants Surveyed and Approved for USDA Grading Service.*
6. Monthly.
7. Voluntary poultry and egg grading and certification services.
8. Once a quarter.
9. It is a reference to determine which fishery products have been certified by the United States Department of Commerce.
10. Establishments approved only for sanitation. It lists the company code, establishment name, and plant address.
11. *Interstate Milk Shippers List* and *Interstate Certified Shellfish Shippers List.*
12. *Interstate Milk Shippers List.*
13. *Interstate Certified Shellfish Shippers List.*

415

1. A round USDA wholesomeness stamp.
2. Amount of lean meat to fat and bone.
3. Prime, choice, select, standard, commercial, utility, cutter, and canner.
4. Prime, choice, select, utility, and cull.
5. US No.1, US No.2, US No.3, US No. 4, and utility.
6. US Grade A, US Grade B, and US Grade C.
7. Shape, soundness or condition, and cleanliness of the shell.
8. Condition, quality, appearance, variety, maturity, and size.
9. "USDA Accepted as Specified".
10. Processed fish.

416

1. It's DOD's way to reduce costs and improve food quality and customer service.
2. Prime Vendor program.
3. To evaluate sanitary conditions of the carrier, ensure the food is from approved sources, and determine if products are wholesome.

417

1. (1) f.
   (2) b.
   (3) c.
2. Indefinite Quantity Contracts, Blanket Delivery Orders, Resale Ordering Agreements (ROA), and Blanket Purchase Agreements (BPA).
3. Within 24 hours of delivery.
4. Retail Activity.
5. They are rejected.
6. (1) Wholesomeness, (2) Source approval, (3) Packaging integrity, (4) Age at the time of delivery, (5) Sanitary conditions of the delivery vehicle.
7. After a reliable quality history is established.
8. Group I.
9. Monthly.

418

1. Groups I, II, and III.
2. Minimum of three.
3. Representative samples should be taken from each line item.

4. Grade/specification requirements and appearance factors.
5. According to their appropriate severity (critical, major, or minor).
6. Inspector making the report, contractor information, and rejection information.
7. The accountable officer.
8. Normal issue; condemnation for unwholesomeness; alternative storage for aged, infestible, or slightly stressed foods; or extended shelf life or ITD for sound foods that have exceeded their ITDs.
9. At the port of embarkation.
10. Warranty action, transportation claims, and discrepancies in shipment.
11. Evidence of actual or potential deterioration or spoilage due to contamination by microorganisms or their toxins. Exposure to biologicals, chemicals, radioactive material, or other foreign matter. Suitability of the item for the purpose intended. Transportation damage and deterioration. Evidence of insect or rodent infestation. Potential keeping-time requirements. Warehousing requirements.
12. 90 to 120 days.
13. To minimize in-storage inspections.

419

1. Infestible products.
2. Type of product(s).
3. The CQAE.
4. Perform an additional, full inspection for all terms of the contract.
5. During every inspection.
6. IAW single sampling plans for normal inspection in Military Standard (MIL–STD) 105.
7. US Number 1.
8. Product size, count per container, and weight ranges or weight per container.
9. The receiving/accountable officer.

Complete the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter.

36. (414) Which is the *minimum* sanitary compliance rating (Percent) a company must have to be listed in Food and Drug Administration's (FDA) *Interstate Milk Shipper's List*?
    a. 80.
    b. 85.
    c. 90.
    d. 95.

37. (414) Which approved publication is published by the United States Department of Agriculture (USDA)?
    a. *Interstate Milk Shippers List*.
    b. *Meat and Poultry Inspection Directory*.
    c. *Interstate Certified Shellfish Shippers List*.
    d. *Directory of the Sanitarily Approved Food Establishments for Armed Forces Procurement*.

38. (414) Section 2 of the *Dairy Plants Surveyed and Approved for United States Department of Agriculture Grading Service* may have products produced from dairy ingredients that didn't originate from which type of approved plant?
    a. Food and Drug Administration (FDA).
    b. *Interstate Milk Shipper's List* (IMSL).
    c. United States Department of Commerce (USDC).
    d. United States Department of Agriculture (USDA).

39. (414) Which organization certifies establishments as being sanitary and capable of producing safe, wholesome products?
    a. Food and Drug Administration (FDA).
    b. Intrastate Department of Agriculture (IDA).
    c. United States Department of Commerce (USDC).
    d. United States Department of Agriculture (USDA).

40. (415) The round US Department of Agriculture (USDA) wholesomeness stamp indicates products that
    a. meet contract requirements.
    b. are from an approved source.
    c. meet Army food inspection requirements.
    d. meet Air Force and Army commissary food requirements.

41. (415) A yield grade is
    a. a guide to the eating quality of meat.
    b. an estimate of the maturity of an animal at slaughter.
    c. an estimate of the amount of lean meat to fat and bone.
    d. an indication that meats were processed in a sanitary manner.

42. (415) In reference to poultry products, the term "style" means
    a. type of cut.
    b. age and sex.
    c. quality grades.
    d. type of preservation.

43. (415) When a product receives the US Department of Agriculture inspectors stamp it means the product meets the
    a. purchaser's requirements.
    b. minimum safety standards.
    c. meat standards for grade, style, and yield.
    d. Food and Drug Administration requirements.

44. (416) Which is the *main* reason Prime Vendor contracts were developed?
    a. Reduce the number of inspections.
    b. Increase the number of inspections.
    c. Reduce costs and improve food quality.
    d. Increase the amount of food in storage in case of deployments.

45. (417) If Class 4 foods are found to be unwholesome, they are
    a. rejected.
    b. destroyed.
    c. placed on medical hold.
    d. scheduled for lab analysis.

46. (418) Who determines to accept or reject items based on a food receipt inspection?
    a. Military treatment facility commander.
    b. Public health officer.
    c. Accountable officer.
    d. The food inspector.

47. (419) Which military standard is used whenever any pest infestation or contamination is detected?
    a. 105.
    b. 409.
    c. 501.
    d. 904.

48. (419) The number of primary containers, shipping containers, and pallets that should be sampled during an initial inspection is determined in accordance with
    a. *Joint Receipt Food Inspection Manual*.
    b. Defense Logistics Agency's, *Troop Support Manual.*
    c. United States Department of Commerce regulations.
    d. Food and Drug Administration's, *Food Receipt Manual*.

Please read the unit menu for unit 3 and continue ➔

Student Notes

Unit 3. Surveillance and Special Instructions

THE PREVIOUS unit discussed procurement inspections, also known as receipt inspections. In this unit we'll explore information concerning surveillance inspections, which consist of classes 6, 7, and 9 inspections. A surveillance inspection is performed on foods that are already government owned and are either in storage, being served or issued, or transported to other installations or agencies.

3–1. Surveillance Inspections and Procedures

The Air Force (AF) spends a tremendous amount of money on dining hall food products. Foods specially purchased and packaged for dining halls are known as troop issue foods. These foods must be kept in excellent condition to prevent loss while in storage awaiting issue.

Due to the difference in the nature of foods, inspection procedures will differ even if the type of inspection is the same. This section also describes in-storage inspection procedures for semiperishable and perishable foods.

420. Food classes and general information

Surveillance food class inspections 6, 7, and 9 are explained in this lesson. The inspection of semiperishable and perishable foods is also explained. Let's begin by discussing food class inspections.

Food class 6 inspection

Class 6 inspections are performed prior to making food shipments to another base or agency. A detailed inspection need not be performed if scheduled inspections have been performed and a quality history record is available for review. An inspection is done to see that no obvious deficiencies or discrepancies are present. If the product has been fumigated, a quality history report goes with the product.

Food class 7 inspection

Inspections performed at issue or sales are class 7 inspections. They are walk-through inspections to look for obvious defects. Class 7 inspections include dry pet foods.

Food class 9 inspection

Class 9 inspections are conducted on foods in storage and are conducted to detect early signs of deterioration. If deterioration is found, advise the accountable officer so arrangements can be made to issue or otherwise dispose of such foods before losses are sustained. Class 9 inspections are performed on a planned, recurring basis to determine food condition, note incorrect temperatures, faulty warehouse facilities, or other practices that may lead to deterioration.

With the popularity of prime vendor, this style of inspection is almost nonexistent. Most facilities on base will order just enough food for the week; therefore long-term storage is not needed. However, there may be a facility that uses long-term storage.

General information

As a food inspector you'll inspect subsistence as required. Give priority to products that have the oldest date of pack (DOP) and are highly susceptible to insect and rodent damage. Priority products also include dry pet food and distressed products.

Inspection methods

Inspection methods include statistical sampling, 100 percent inspections, and biased sampling. The table below explains each one.

SURVEILLANCE INSPECTION METHODS	
Type	**Description**
Statistical Sampling	Estimates the condition of a lot based on examination and testing of a portion of the lot. Samples must be as representative of the lot as practical. Strict random sampling is used during warranty inspections.
100 Percent	Every unit of the product is inspected.
Biased Sampling	Performed when storage conditions have been less than ideal. Samples may be selected from areas of distress.

Other inspections

Other inspections include warranty and special inspections, inspection of isolated lots, inspection of unit basic loads (UBL), and conveyance inspections.

Warranty inspections

Subsistence contracts, except for some perishable items, require that the contractor guarantee supplies after the procurement receipt date at destination. The supplies furnished are guaranteed to be free from defects in material and workmanship and conform to all contract requirements. The warranty inspection is usually initiated by findings of excessive defects or deterioration during another inspection, such as receipt or surveillance inspections. The length of the warranty period varies depending on the type of subsistence item.

Special inspections

These inspections are requested by the accountable officer or the contract quality assurance element (QAE) of the Defense Logistics Agency (DLA) or at the discretion of the food inspector.

Isolated food lots

Food lots of unknown storage history, such as the following require inspection:

- Captured enemy rations.
- Returned stocks to depots.
- Lots found in storage area with no record of inspection.
- Supply points or troop issue subsistence activities (TISA) from ships, dining facilities, or other food service accountable officers.

Inspect these lots for all appropriate defects that may be applicable.

Unit basic load inspections

UBLs are individual operational rations stored by units. UBL inspections are performed in accordance with DLA Handbook 4155.2.

Conveyance inspection

The carrier is inspected to determine if it meets the requirements for sanitation, product protection, and temperature.

Extension of approximate keeping times and inspection test dates

Approximate keeping times (AKT) and inspection test dates (ITD) may be extended after performing open container examinations of products. AKTs can be extended up to 180 days, if products are in

excellent condition. You can extend AKTs 90 to 120 days or only 30 days if a product displays noticeable deterioration but is still wholesome. Likewise, you may extend ITDs up to 360 days, but more commonly ITDs are extended 90 to 180 days. If a semiperishable product has undergone considerable change but is still wholesome, extend the ITD only 30 days. If ITDs or AKTs are extended, line out the old date and mark the new ITD or AKT, so the lot does not lose its identity.

Reports

Reports prepared during surveillance inspections include DD Form 1714, Product Verification Record, DD Form 1608, Unsatisfactory Material Report (Subsistence), and DD Form 361, Transportation Discrepancy Report (TDR).

DD Form 1714

DD Form 1714 is used to report warranty inspections. Routine inspections are reported on a locally developed form. The table below explains the minimum contents of the DD Form 1714 and how it's distributed.

DD FORM 1714 GUIDANCE	
Minimum contents	Location of lot. Lot number (if applicable). Estimated remaining shelf life. Disposition recommendations.
Report distribution	One copy is filed in the food inspection office. The original is forwarded to the accountable officer after receipt of all inspection results. The second copy is forwarded to higher headquarters, when requested. For warranty inspections, a third copy is prepared and forwarded to the original acquisition agency.

DD Form 1608

A DD Form 1608 is prepared for foods that are unwholesome or unfit for their intended use or considered unsatisfactory. These unsatisfactory foods are reportable if the conditions are beyond normal base control, such as the product not meeting specification requirements or foreign material found in the product. Mechanical damage does not warrant reporting an unsatisfactory material report (UMR).

DD Form 361

A DD Form 361 is prepared according to *Joint Service Regulation*, AR 55–38, AFR 75–18, NAVSUPINST 4610.33C, MCO P4610–19D, DLAR 4500.15. Food inspection personnel must notify the accountable officer and/or transportation officer immediately upon discovery of a discrepancy in shipment. This allows the accountable officer or transportation officer time to prepare a DD Form 361.

421. Semiperishable food inspections

When inspecting semiperishable foods, your primary concern is deterioration. You need to know at what level they are inspected and how often you need to inspect them.

Semiperishable food deterioration

Poor storage conditions and particularly high temperatures can greatly accelerate deterioration of semiperishable foods. As a general rule, each rise of 18°F (–8°C) from specified storage temperature doubles the rate of the chemical reaction.

Frequently listed critical defects

The following are critical defects frequently associated with semiperishables:

- Vacuum loss.

- Insect or rodent infestation.
- Leakers—due to any reason.
- Swellers—due to any reason.
- Oxidation or rancidity—due to chemical changes.
- Mildew, mold, or dry rot—any discoloration, growth, or decaying caused by fungi.
- Contamination—presence of matter which is foreign to or deleterious to the product or substance in which it is contained.

Other frequently identified defects

The following are other frequently identified defects associated with loss of packing and packaging protection:

- Dents.
- Breakage.
- Water damage.
- Closure failure.
- Physical damage.
- Corrosion or rust.
- Reinforcement failure.
- Soiled (spots, stains, dirt).
- Separation or delamination.
- Cuts, abrasions, or scratches.
- Peeling, flaking, or chipping.
- Brittleness (flexible packing).
- Etching, grazing, or checking.
- Detinning or flaking of enamel lining.
- Product intermingling (flexible packaging).

Inspection level

Inspection levels and sample sizes may differ based on the type of inspection. Inspection levels and samples sizes are derived from the *Joint Surveillance Food Inspection Manual*.

Lot formations

When studying lot formations, you need to learn and understand the meaning of contractor's, grand, and isolated lots.

Contractor's lot

A contractor's lot consists of units of a product that are identical as to national stock number (NSN), package size, contractor, contract number, DOP by month/year or Julian date, quality, and storage history.

Grand lot

The grand lot consists of two or more lots of like quality grouped together to decrease the cost of surveillance inspections by reducing the number of samples. Grandlotting is authorized, but the identity of sublots must be maintained and samples must be drawn from each sublot in proportion to its size. When defects are concentrated in a particular sublot, reinspect the sublot separately as a contractor's lot. Grandlotting is limited to inspection procedures and paper transactions which require no rewarehousing or reworking of material prior to the inspection and to units identical as to NSN, package size, DOP by month/year or Julian date, quality, and storage history.

Isolated lots

Isolated lots are captured enemy rations and other lots of unknown storage and inspection history. They must be handled on an individual basis. If the lot is composed of sublots, the sublots are inspected separately. These items are inspected under General Inspection Level II in the surveillance manual.

During storage inspections

You need to know what foods are to be inspected with the specifics of the inspection to be conducted. You also need to know how often foods are to be inspected, what the rejection numbers are, and what to do with defective lots and sublots.

Class 9 inspections

Accountable officers (except commissary officers) must provide food inspection personnel with a monthly listing of all foods requiring inspection. As a minimum the food listing will include the following:

- Date of pack.
- Date of receipt.
- Contract number.
- Product nomenclature.
- Number of cases in the lot.
- Warehouse lot number or location.
- Name and address of the storage facility.

Semi-annual inspection

Each lot of semiperishable subsistence is inspected every six months from date of receipt. OPI is performed on all products with extended inspection test dates (ITD). Frequency can be adjusted when there is evidence of infestation or premature deterioration (i.e., rancidity, swellers, flippers, etc.); or when there are adverse storage conditions affecting item serviceability; or if directed by a command.

Infestible items

Food items (to include dry pet food) whose nature and method of packaging make them subject to actual or potential pest infestation are inspected on a frequency consistent with climatic conditions. In some locations, all grains may be considered infestible. In temperate climates these items will require inspection monthly from April through October and every three months from November through March. Other climates may require a different frequency. If infestation is found, refer to MIL–STD–904A, *Guidelines for Detection Evaluation and Prevention of Pest Infestation of Subsistence* for guidance.

Warranty inspections

Warranty inspections are usually not applicable to the AF, but food supplies received from vendors may be subject to the supply warranty clauses of the contracting agency. The warranty inspection must be scheduled no earlier than 90 days after receipt. This does not preclude the scheduling of another inspection within the six-month warranty period if evidence of early deterioration is detected.

Rejection numbers

The rejection number constitutes a warning signal. When defects found do not equal or exceed the rejection number, the inspection is complete.

When products meet or exceed the rejection numbers for closed package inspection (CPI), OPI, or both, they require further inspection according to the surveillance inspection manual. The samples for further inspection are selected as randomly as possible considering available resources and conditions. When further inspections are performed, the combined inspection results are used in determining disposition recommendations.

Defective lots and sublots

If defective lots and sublots are found and if the defects equal or exceed the rejection numbers, a report of the findings is submitted to the accountable officer as prescribed by the inspection manual and AR 40–657/NAVSUPINST 4355.4/AFI 48–116/MCO P10110.31. If defects are concentrated in one or two particular sublots, even if the rejection numbers are not equal or exceeded for the whole lot, the sublots in question can be individually inspected as contractor lots.

422. Perishable food inspections

When you're inspecting perishable foods, your primary concern is their deterioration. You need to know at what level they are inspected and how often they need to be inspected.

Perishable food deterioration

Storage conditions and, in particular, high temperatures, can greatly accelerate deterioration of perishable foods. Defects need to be detected and identified before consumption.

Storage conditions

Chilled and frozen subsistence continues to deteriorate during storage. The rate of deterioration is directly dependent upon storage conditions; such as temperature, humidity, sanitation, and enzymatic, and microbiological action.

NOTE: See Air Force Joint Manual (AFJMAN) 23–210, *Joint Service Manual (JSM) for Storage and Materials Handling*, for more detailed information and guidance on storage conditions.

Defects

The following are defects frequently associated with perishables.

Defects Frequently Associated with Perishable	
• Brittleness. • Crumbling or cracking. • Hardening. • Caking. • Loss of crispness. • Swellers. • Oxidation or rancidity. • Mildew or mold. • Odor change. • Decay or rot. • Flavor change. • Physical change.	• Freezer burn and dehydration. • Separation. • Contamination. • Discoloration. • Freeze damage (chill items). • Defrosting. • Insect or rodent infestation. • Friability (easily crumble). • Coagulation (thicken into a mass). • Product intermingling—grease or moisture transfer. • Liquefaction (Becoming a liquid) or syneresis (becoming a liquid from a gel). • Evaporation or leakage.

Other frequently identified defects

Other frequently identified defects associated with loss of packing and packaging protection are as follows.

Frequently Identified Defects	
• Mildew or mold. • Separation or delamination. • Closure failure. • Water damage. • Soiled with spots, stains, or dust. • Physical damage.	• Brittleness. • Corrosion or rust. • Leakers, pinholes, or improper closures. • Detinning, flaking, or enamel lining. • Vacuum loss.

Inspection levels

Inspection levels for CPI and OPI are found in the surveillance manual. With the use of the serviceability quality level (SQL), you accept and reject subsistence based on the numbers. Critical, major, and minor defects are not applicable to surveillance inspection of perishable subsistence; however, acceptable quality levels (AQL) are necessary for warranty inspections. When subsistence is government-owned awaiting issue, a more general form of inspection is sufficient to monitor serviceability on a cyclic basis.

NOTE: OPIs need not be performed until product will exceed its ITD by the next cyclic inspection or unless obvious defects are noted. If a more detailed inspection is necessary, the sample size may be increased.

Lot formations

The lot size is normally expressed as the number of shipping cases in the lot. Total units (packages or pieces) are used only when determining open-package sample size. The sample unit for CPI is the shipping case of a product. The sample unit for OPI is a package or piece. Samples can be selected and inspected from a contractor lot or grand lot. The DOP for perishable subsistence is shown by month and year.

Class 9 inspections

Each lot of perishable food is inspected at least every 90 days. Perishable foods with a shelf life less than 30 days are closely monitored during class 7 inspections. Fresh fruits and vegetables (FF&V) subject to rapid deterioration receive a daily inspection after they have been in storage 24 hours to determine condition and remaining storage life. If deterioration is noted on the daily inspection, notify the produce manager.

Storage compatibility of fresh fruits and vegetables

Although it may be necessary to store various FF&V together, there are some products which must be separated whenever possible. Do not store apples, pears, bananas, peaches, plums, cantaloupes, ripe honey dew melons, avocados, tomatoes and other ethylene-producing fruits or vegetables with lettuce (causes russeting), carrots (become bitter), cucumbers, green peppers, acorn or hubbard squash (loss of green color). Odors from apples and citrus are readily absorbed by meats, eggs, and dairy products. Pears and apples acquire an unpleasant earthy taste and odor when stored with potatoes. Apples and pears can be stored together, however, the combinations to avoid in storage rooms are apples or pears with celery, cabbage or onions; celery with onions or carrots; green peppers with pineapples, and citrus fruit with any of the strongly scented vegetables. Onions, nuts, citrus fruit and potatoes should be stored separately whenever possible.

Accountable officers (except commissary officers)

Accountable officers provide food inspection personnel with a monthly listing of foods requiring inspection. As a minimum, the listing will include the following:

- DOP.
- Date of receipt.
- Contract number.
- Product nomenclature.
- Number of cases in the lot.
- Warehouse number or location.
- Name and address of storage facility.

Other inspections

Other inspections include warranty, special, and conveyance inspections.

Warranty inspections

Any inspection conducted within the 120-day warranty period is considered a warranty inspection. If, during the warranty period, the results of any inspection show excessive deterioration or the stocks are determined to be unserviceable by the inspector, an inspection is performed immediately using the end-item inspection criteria (for only those defects found) cited in the contract. This inspection constitutes the official warranty inspection and all nonconformances are immediately reported to the procurement agency.

Special inspections

The accountable officer or the contract quality assurance element (CQAE) from the procurement agency, usually because of a customer complaint, requests special inspections. The accountable officer or CQAE may tell you which inspection level to inspect by.

Conveyance inspections

Inspections determine if the conveyance meets the requirements for sanitation, product protection, and temperature. Ensure the refrigeration units are operating properly.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

420. Food classes and general information

1. Match each class of inspection in column B with its description in column A. Items in column B may be used once, more than once, or not at all.

Column A	*Column B*
____ (1) An inspection performed at issue or sale.	a. Class 3.
____ (2) An inspection conducted on foods in storage.	b. Class 4.
____ (3) An inspection performed prior to shipment.	c. Class 5.
	d. Class 6.
	e. Class 7.
	f. Class 8.
	g. Class 9.

2. What foods *must* be given priority when inspecting subsistence during surveillance inspections?

3. What surveillance inspection method estimates the condition of a lot based on examination and testing of a portion of the lot?

4. What is the length of a warranty period for food subsistence?

5. What inspection can be done at the discretion of the inspector?

6. Why do captured enemy rations require inspection?

7. UBL inspections are performed in accordance with what guidance?

8. A food conveyance carrier is inspected to see if it meets what requirements?

9. What is the *maximum* extension period for AKTs if products are in excellent condition?

10. A DD Form 1714 is used to report what type inspection?

11. When is a DD Form 1608 prepared?

12. Who completes the DD Form 361?

421. Semiperishable food inspections

1. What two factors can greatly accelerate deterioration of semiperishable foods?

2. List three critical defects for semiperishable foods.

3. Dents, breakage, and water damage are defects associated with what?

4. What are the units of a product that make up a contractor lot?

5. What is a grand lot?

6. What section of the surveillance manual are isolated lots inspected under?

7. Who is required to provide a monthly listing of all foods requiring inspection?

8. From date of receipt, when is semiperishable subsistence due to be inspected?

9. When will food items whose nature and method of packaging make them subject to pest infestation be inspected?

10. When must a semi-perishable warranty inspection be scheduled?

11. Why are rejection numbers used?

12. What must happen when defects equal or exceed rejection numbers in defective lots and sublots?

422. Perishable food inspections

1. The rate of deterioration of chilled and frozen foods is dependent upon what factors?

2. Brittleness, separation, and freezer damage are defects associated with what?

3. Closure failure, vacuum loss, corrosion, and rust are defects associated with what?

4. Inspection levels for CPIs and OPIs are found where?

5. How is a lot size expressed?

6. As a minimum, how often should perishable foods be inspected?

7. What happens to pears and apples when stored with potatoes?

8. Who provides food inspection personnel with a monthly listing of foods requiring inspection?

9. What is considered a warranty inspection in relation to food?

10. With regards to special inspections, the accountable officer and who else will tell you which inspection level to inspect by?

3–2. Special Inspections

There are some programs Public Health (PH) is involved in that do not fit into a particular class of inspection. They are designed for a specific purpose and require your attention. These programs have been around for a long time. The way the programs have operated has changed several times; however, the purpose is still the same.

423. Operational rations inspections

The Department of Defense (DOD) has a special program for inspecting operational rations due to the importance of the food item. Our ability to sustain a fighting force in a combat zone depends upon the ability to keep the troops supplied with the necessities of life. Part of that plan is to feed our troops operational rations until other food supply lines and equipment have been established and received. A DOD rations' inspection program ensures consistency and accuracy among the services. Keep in mind, there are several types of rations. The most common ration you see as Public Health is the meal, ready-to-eat (MRE.)

Publications

Defense Logistics Agency (DLA) (formerly known as Defense Supply Center Philadelphia [DSCP]), troop support division publishes the DLA Troop Support Handbook 4155.2, *Inspection of Composite, Operational Rations, Appendix A, Inspection of Meal, Ready-to-Eat (MRE) Rations* is used to inspect the MREs used by our troops. The table below shows additional appendices and their purpose.

OTHER APPENDICES USED FOR OPERATIONAL RATIONS	
Appendix	**Purpose**
A	Meal, Ready-to-Eat (MRE)
B	Unitized Group Ration (UGR) Heat and Serve (H&S) modules
C	Cold-weather and Long Range Patrol rations
E	Food packet, Survival, Aircraft, and Life raft
F	Food packet, Survival, Abandon ship
G	Food packet, Survival, General purpose—Improved
H	Humanitarian Daily Rations
I	Unitized Group Ration (UGR) B
J	Unitized Group Ration-Express (UGR-E)
K	First Strike Rations (FSR)

The DSCP Form 5117, Report of Inspections of Government Owned Meals, Ready to Eat, is used to record the results of inspections performed on MREs. The AF liaison to this joint service program is Air Force Personnel Center (AFPC)/Services Directorate (SV) at Randolph AFB, Texas. Policy changes and program information is sent through SV to base offices. Direct your questions to SV for guidance.

Frequency

How often you inspect foods is known as the “frequency” of inspection. Each type inspection (receipt, surveillance, warranty, and special) may have their own frequency.

Receipt inspections

A receipt inspection is accomplished when rations are first received into AF inventory. MREs are inspected at most AF bases upon receipt from an Army or DLA storage facility.

Surveillance inspections

Surveillance inspections are normally performed:

1. Prior to issue, sale, or shipment.
2. When rations are received from another AF installation.
3. When the rations reach their original ITD and annually thereafter.
4. At three-month intervals, once the rations have been classified as Condition Code B.
5. At six-month intervals, once the rations have exceeded their estimated serviceable storage life.
6. At a frequency requested by the accountable officer or as deemed necessary by the inspection activity to ensure the rations are fit for the purpose intended.

Warranty inspections

A warranty inspection is performed at the first DOD destination to receive the rations from the assembly contractor. Ideally, warranty inspections are conducted between five and six months from the date of receipt at their destination. However, if defects are found during any inspection within six months of receipt, perform a warranty inspection.

Special inspections

A special inspection is performed when deemed necessary based on routine inspection findings, customer complaints, requests from supply points, or whenever reasons exist to conduct a special inspection.

During a special inspection, pull an additional quantity of only those components that meet or exceed the action numbers during a normal inspection. All defective samples will be classified by the most serious defect they possess. If performing a grandlot inspection and defects are present for a particular lot or lots, complete the normal inspection and then perform a special inspection on the lot(s) that require further examination. There may be situations in which it’s not necessary to perform a special inspection. Normally this would be due to a deteriorative condition throughout the lot that is readily apparent during a normal inspection. Possible examples would be heat stress or infestation throughout the lot. When action numbers are reached or exceeded, but you believe that a special inspection is not necessary, discuss it with your chain of command and request approval to forego a special inspection. The name of the approving officer and the reason for not performing the inspection should be documented on the inspection report.

Ration inspections

Ration inspections use various terms that you must become familiar with such as monograph, component classification, and condition coding just to name a few. A complete list can be found in the DLA Handbook, which also identifies 13 steps contained in ration inspections. Those 13 steps are listed below:

Step 1: Cursory or Full Inspection—The type inspection is based on where the MRE is coming from and when the last inspection was completed.

Step 2: Evaluation of Storage Conditions—As a minimum MRE storage areas should be clean and dry. MRE’s should not be stored directly on the floor. The area should also be free of pests IAW MIL−STD 904.

Step 3: Determine if Grand Lotting is Appropriate—Samples from grand lots must represent all individual lots proportionally, even if the next highest sample size must be used. Identity of samples from each sublot must be maintained throughout the inspection. Refer to DLA handbook for specific instructions.

Step 4: Determine Lot Size—Verify there is an equal or nearly equal number of both case "A" and case "B." Use Table A in DLA Handbook Appendix A for more specific guidance.

Step 5: Inspect Shipping Containers and Selection of Menu Samples—Use Table A for sample size criteria. Also use the list of defects found in Table C of Appendix A.

Step 6: Perform Closed Package Inspection of Menu Bags—Use Table D of Appendix A to select the appropriate number of menus, be sure the samples are proportionally representative of the menus in the lot. Inspect for defects listed in Table F.

Step 7: Perform Closed Package Inspection of Menu Bag Contents and Accessory Bag—Menu bags will be inspected for defects IAW Table G. Accessory bags will be inspected for defects IAW Table F.

Step 8: Perform Destructive Open Package Inspection (DOPI)—This portion of the inspection is completed IAW Table H and those defects listed in Table J.

Step 9: Recording Results—Record the following information on DSCP Form 5117 for all defective components:

1. Menu number.
2. Number defective.
3. Description of defect.
4. Assembler's lot number.
5. Specific defect code (if applicable).
6. Component nomenclature and code.
7. Processor's and/or plant name (if available).
8. Tally defects according to type of components.

Step 10: Determine if a Special Inspection is Required—Required when any action number is reached or exceeded.

Step 11: Determine Disposition—Disposition is based on a routine inspection. Disposition is determined when no Major A or B defects were noted or the action number for minor defects combined has not been reached. If further sampling or testing is required based on inspection, rations will be placed on Condition Code J pending the results of the tests.

NOTE: All components with Major A or B defects will be discarded whether they are part of the sample or not.

Step 12: Provide Results and Recommendations to Accountable Officer or Agency—Complete DSCP Form 5117 and provide a copy of the report to the accountable officer.

Step 13: Scheduling the Next Surveillance Inspection—Condition Code A requires a reinspection in six months. Condition Code B requires a reinspection within three months.

424. Consumer protection programs

One of your functions as a food inspector is to listen to the complaints registered by consumers against particular food items that may or may not be stocked in the base's local food facilities. The complaints are usually taken first by the facility managers or their representatives and then forwarded to your office. They are an extension of your surveillance inspection program and could indicate serious problems in the base warehouse. If there is a problem with food in a warehouse and you have

not found it in your inspections, customer feedback is extremely important. Granted, not all complaints are indicators that problems exist in a warehouse; in fact, most are not. However, there is a chance that you could find a problem with a product early enough to prevent a total loss of a product. The customer complaint system is designed to prevent a total or partial food loss.

Customer complaint system

DeCA, headquartered at Fort Lee, Virginia, seeks to provide military consumers with the best available product for the best available price.

Form completion

When customers experience problems with a product purchased at the commissary, they may return the product to the store, complete a DeCA Form 40–45, Food Quality Report, and wait for a reply. Your job is to evaluate the product as well as other similar products in the store or, if necessary, send the product to your local area lab for analysis.

Check the stock

The complaint forms are usually completed at the store customer service counter. The form, along with the product, is brought to the food inspection office for analysis. First try to determine what the problem is through a quick sensory analysis. Check shelf and warehouse stocks of the identical product to determine if the same problem exists. If you cannot determine the problem, send the required number of samples to your local area lab.

Forward copy

Once the tests are completed and the results are known, complete the form and forward a copy to the commissary officer. Also, call or follow up with a typed, official letter on the results of the analysis if the patron has requested notification. If the product is defective, place the entire lot on medical hold and perform a surveillance inspection and make recommendations for disposition.

Hazardous food and nonprescription drug recall system

Air Force or military food inspectors may discover food items in the military food chain which pose a potential, or actual, public health danger. Someone from the food inspection office must then contact the proper authorities as described in Defense Logistics Agency Regulation (DLAR) 4155.26, *DOD Hazardous Food and Nonprescription Drug Recall System*.

The All Food/Drug Activities (ALFOODACT) system is designed to inform other DOD agencies of potential hazards in foods and nonprescription drugs. This message system is a DOD response system to ensure that hazardous foods and nonprescription drugs are taken away from the resale shelf to protect the patron’s health.

The table below lists and explains the types of food recall (if required).

TYPES OF FOOD RECALLS	
Class	**Explanation**
I	Where there is a reasonable probability that the use of, or exposure to, will cause serious adverse health consequences or death.
II	Where there is a reasonable probability that the use of, or exposure to, may cause temporary or medically reversible adverse health consequences, or where the probability of serious adverse health consequences is remote.
III	Where the probability that the use of, or exposure is not likely to cause danger to health.

These ALFOODACT messages are very important documents and must be logged in when received on base. Once the message is received, take action as described. As a minimum, check the base food facilities for the product described. If you find the product, place it on medical hold until you get further instructions on its disposition. Do not just check once and think that the investigation is over. Remember, food facilities are receiving products every day, and those stocks must also be checked.

Usually higher headquarters is involved and issues the messages for disposition of the defective product. Make sure you completely carry out these directives. Make a memo for record describing your actions for future reference.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

423. Operational rations inspections

1. What does the ability to sustain a fighting force in a combat zone depend upon?

2. What document covers the inspection procedures for MREs?

3. What form is used to record results of MRE inspections?

4. What type inspection is performed when rations are first received into AF inventory?

5. When are surveillance inspections performed?

6. When would a warranty inspection be performed?

7. What is required when you find a Major A defect in a lot of rations during a routine inspection?

8. When would a special inspection be performed?

9. List the 13 steps required to complete a ration inspection.

10. What table(s) is used to inspect shipping containers and selection of menu samples for defects?

11. What is condition code J?

424. Consumer protection programs

1. What form do DeCA customers use to report complaints?

2. What two items are returned to the food inspection office during the customer complaint system process?

3. What action is taken if you can't identify the problem with a food product that was identified on a customer complaint?

4. What actions are taken in the customer complaint system if the product is defective?

5. What directive gives guidance on what to do with hazardous food items found on base?

6. What messages are used to notify other installations about hazardous foods?

Answers to Self-Test Questions

420

1. (1) e.
   (2) g.
   (3) d.
2. Products with the oldest DOP and highly susceptible to insect and rodent damage, including dry pet foods and distressed products.
3. Statistical sampling.
4. Varies depending on the type of subsistence.
5. Special inspection.
6. Unknown storage history.
7. DLA Handbook 4155.2.
8. Sanitation, product protection, and temperature.
9. 180 days.
10. Warranty inspections.
11. When foods are found to be unwholesome or unfit for intended use or considered unsatisfactory.
12. The accountable officer or transportation officer.

421

1. Poor storage conditions and particularly high temperatures.
2. Vacuum loss, Insect/Rodent Infestation, Leakers, Swellers, Oxidation or rancidity, Mildew, mold, or dry rot, contamination.
3. Loss of packing and packaging protection.

4. Units of a product that are identical such as NSN, package size, contractor, contract number, DOP by month/year or Julian date, quality, and storage history.
5. A lot consisting of two or more lots of like quantity grouped together to decrease the cost of surveillance inspections by reducing the number of samples.
6. General Inspection Level II
7. Accountable officers.
8. Every six months.
9. On a frequency consistent with climatic conditions.
10. No earlier than 90 days after receipt.
11. They are used as a warning signal for further inspection.
12. A report of findings is made to the accountable officer.

422

1. Storage conditions; such as temperature, humidity, sanitation, and enzymatic and microbiological action.
2. Perishables.
3. Loss of packing and packaging protection.
4. Surveillance manual.
5. As the number of shipping cases in the lot.
6. Every 90 days.
7. They acquire an unpleasant earthy taste and odor.
8. The accountable officer.
9. Any inspection conducted within the 120-day warranty period.
10. CQAE.

423

1. The ability to keep the troops supplied with the necessities of life.
2. DLA Handbook 4155.2, Appendix A.
3. DSCP Form 5117.
4. Receipt inspection.
5. Prior to issue, sale, or shipment, when rations are received from another AF installation, when the rations reach their original IDT and annually thereafter, at three month intervals, once the rations have been classified as Condition Code B, at six month intervals, once the rations have exceeded their estimated serviceable storage life, and at a frequency requested by the accountable officer or as deemed necessary by the inspection activity to ensure the rations are fit for the purpose intended.
6. At the first DOD destination to receive the rations from the assembly contractor.
7. A special inspection must be performed.
8. When deemed necessary based on routine inspection finding, customer complaints, requests from supply points, or whenever reasons exist to conduct a special inspection.
9. Step 1: Cursory or Full Inspection.

   Step2: Evaluation of Storage Conditions.

   Step 3: Determine if Grand Lotting is Appropriate.

   Step 4: Determine Lot Size.

   Step 5: Inspect Shipping Containers and Selection of Menu Samples.

   Step 6: Perform Closed Package Inspection of Menu Bag Contents and Accessory Bag.

   Step 7: Perform Closed Package Inspection of Menu Bag Contents and Accessory Bag.

   Step 8: Perform Destructive Open Package Inspection (DOPI)

   Step 9: Recording Results.

   Step 10: Determine if Special Inspection is required.

   Step 11: Determine Disposition.

Step 12: Provide Results and Recommendations to Accountable Officer/Agency.

Step 13: Scheduling the Next Surveillance Inspection.

10. Tables A and C.
11. If further sampling or testing is required based on inspection, rations will be placed on Condition Code J pending the results of the tests.

424

1. DeCA Form 40–45.
2. DeCA Form 40–45 and the product.
3. Send food samples to your local area food laboratory.
4. Place the entire lot on medical hold and perform a surveillance inspection and make recommendations for disposition.
5. DLAR 4155.26
6. ALFOODACT messages.

Complete the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter.

49. (420) Which type of food inspection is performed when storage conditions have been less than ideal?
    a. Biased sampling.
    b. Special inspection.
    c. Warranty inspection.
    d. 100 percent inspection.

50. (420) A food warranty inspection is usually initiated
    a. within three months of receipt.
    b. within six months of receipt.
    c. by finding excessive defects.
    d. when requested by the accountable officer.

51. (420) Where does the original copy of DD Form 1714 go?
    a. Public Health.
    b. Major command.
    c. Accountable officer.
    d. Defense Logistics Agency.

52. (421) Which type of food lot consists of two or more lots of like quality grouped together to decrease the cost of surveillance inspections by reducing the number of samples?
    a. Contract's.
    b. Uniform.
    c. Isolated.
    d. Grand.

53. (421) Under which situation can an inspection frequency be adjusted on a semi-annual semiperishable subsistence inspection?
    a. Loss of personnel.
    b. Evidence of infestation.
    c. Directed by the accountable officer.
    d. When no record of inspection exists.

54. (422) When using the serviceability quality level (SQL), which do you base acceptance and rejection of food subsistence on?
    a. Numbers.
    b. Storage history.
    c. Class of defect.
    d. Degree of defect.

55. (422) Perishable food class 9 inspections are conducted
    a. every 30 days.
    b. every 60 days.
    c. every 90 days.
    d. only if requested.

56. (422) Which takes place, if during the warranty period for rations, an inspection is performed and the results show excessive deterioration?
    a. Stock is returned.
    b. Stock gets put on medical hold.
    c. Stock is placed on Condition Code H.
    d. Another inspection is conducted using end-item criteria.

57. (423) Which appendix of Defense Logistics Agency (DLA) Troop Support Handbook 4155.2, *Inspection of Operational Rations*, is referenced for meal, ready-to-eat (MRE) rations?
    a. A.
    b. B.
    c. C.
    d. D.

58. (423) Which term is used to define how often food is inspected?
    a. Cycle.
    b. Rotation.
    c. Frequency.
    d. First in, first out.

59. (424) Which is the next step once a recalled product is found in a base facility?
    a. Discard it.
    b. Notify a supervisor.
    c. Place it on medical hold.
    d. Notify the accountable officer.

Please read the unit menu for unit 4 and continue ➔

Unit 4. Conducting Evaluations

FAST FOOD services have become increasingly popular because of our fast-moving society. Because these services are provided by food facilities, part of your job as a public health journeyman is to ensure the food prepared in those facilities is safe for public consumption. Before you can evaluate a facility and determine whether or not it offers safe food, you need to familiarize yourself with the types of food facilities and the sanitation requirements for each. This unit discusses the sanitation requirements for appropriated and non-appropriated funded food facilities. It also gives you information to use as a guide for evaluating food facilities.

4–1. Food Facilities

The food facility sanitation evaluations you perform on your base may include dining halls, base club, cafeterias, snack bars, mobile units, aircraft, hospital dining facilities, and vending machines. In this section some factors or problems that could contribute to a foodborne disease outbreak are presented along with possible solutions.

It's important for you to be aware of the problems that occur in a food facility. By recognizing these problems, you can identify conditions in a facility that could lead to someone becoming ill. Then you can help facility management take steps to eliminate these conditions and prevent illness. Prevention is the heart of your job.

425. Foodborne disease outbreak factors

There are many factors that can contribute to a foodborne disease outbreak. These factors can include poor personal hygiene, obtaining foods from unapproved sources, preparing foods to far in advance, failure to cook foods thoroughly, food cross contamination, improper holding temperatures, and many others. In this lesson we'll discuss these foodborne disease outbreak contributors and more.

Person in charge

The person in charge (PIC) is the individual present at the food establishment who is responsible for the operation at the time of inspection. The PIC is responsible for ensuring that the facility operations comply with the preventive measures in the Tri-Service Food Code.

Food employees

A food employee is any person who works with unpackaged food, food equipment or utensils, or food contact surfaces in any way.

Employees infecting food

Food facility patrons are truly at the mercy of the food employees. You learned about how foodborne diseases are transmitted previously under *food pathogens*. Keeping this in mind will help you identify and correct food handeling situations; such as employees coughing or sneezing over uncovered foods, employees who blow their nose, sneeze into their hands, wipe their nose with an arm or sleeve, or rub secretions out of their eyes without washing their hands afterwards. Food employees can't have open cuts, sores, or burns that can be infected and lead to contamination of food. Also, if the food employees are experiencing vomiting, diarrhea, jaundice, sore throat with fever, or lesions containing pus could increase the risk of foodborne disease transmission.

Food employees do not have to show signs of illness to contaminate the foods they prepare. Naturally occurring human pathogens such as *Staphylococcus aureus* can easily contaminate food if it's improperly handled.

Poor personal hygiene

Food employees who practice poor personal hygiene are also a threat to the patrons. Poor personal hygiene includes failing to wash one's hands after using the bathroom, smoking, or handling raw foods prior to handling prepared foods. Employee clothing also can be a source of contamination. For instance, cooks often wipe their hands on their aprons rather than washing their hands. They must be educated on the importance of hand washing and the risk of contamination if they don't. Many times employees complain that the sink is either difficult to get to or it's a hassle to stop and wash every few minutes. They sometimes feel that they won't get anything done if they wash their hands like they should. Help them overcome this "feeling" through education.

Obtaining foods from unapproved sources

It's important for employees to know that foods must be purchased only from approved sources in accordance with AFI 48–116, *Food Safety Program*. Facilities may want to purchase specialty items, such as raw dairy products. Since these products may be unpasteurized, they can be very dangerous for the patrons. Other examples of foods from unapproved sources include home canned foods and seawater plants from waters infected with Red Tide. These foods could make people ill.

Preparing foods several hours or days in advance

Some managers believe it's easier to prepare large quantities of popular foods in advance to ensure they will have plenty of these particular items. These foods might be prepared several hours or even days prior to serving the meal. The Center for Disease Control and Prevention (CDC) published a list of top ten factors contributing to foodborne disease outbreaks. The excessive time between preparing and serving foods was the contributing factor for 26 percent of the reported outbreaks. Having excessive time between preparing and serving food can be an unsafe practice for a number of reasons. But one main reason is that certain microorganisms can multiply while food is cooling in the refrigerator. Even though the food is refrigerated, pathogens continue to grow until food is below 41ºF (5ºC). These foods require careful monitoring to ensure proper storage temperatures and proper handling procedures. It's best to serve foods immediately after cooking to prevent microbial growth.

Failure to cook foods thoroughly

Since certain foods are likely to carry pathogens, it's important to cook these foods properly to destroy the pathogens. For example, meats such as beef rounds are often contaminated with *Clostridium perfringens,* while *Salmonella* organisms are commonly found on poultry. If these foods are not cooked thoroughly, the chances of foodborne illness increase greatly. The following table contains the minimum temperature that must be achieved and the amount of time the food must remain at that specified temperature.

REQUIRED TEMPERATURES AND TIMES		
Type of Food	**Minimum Temperature**	**Minimum Time**
Eggs, fish, and red meat.	All parts must reach 145°F (62.8ºC).	15 seconds.
Beef roasts and corned beef.	145°F (62.8ºC) internally.	3 minutes.
Pork, ratite, comminuted fish and meats (like hamburger), injected meats, and immediate service eggs.	155°F (68.3ºC) internally.	15 seconds.
Any poultry, stuffed foods, or reheated leftovers.	165°F (73.9ºC) internally.	15 seconds.
Animal origin food cooked in a microwave.	All parts must reach165°F (73.9ºC).	Stand covered for 2 minutes

Food cross contamination

There are several methods of cross contaminating foods. Food employees may handle raw or contaminated foods and then handle uncontaminated foods without washing their hands. Pieces of equipment, such as cutting boards and knives, also might be sources of contamination if they are not properly cleaned and sanitized after use. Storing both contaminated and uncontaminated foods together may also cause problems. A common mistake is to mix raw or contaminated foods with cooked foods. If the mixture is not thoroughly cooked, microbial growth may occur and lead to a foodborne disease outbreak. Another problem often overlooked is thawing meats on the shelf above vegetables or ready-to-eat foods. The juices from the thawing meats dripping onto the foods below could contaminate them.

Improper holding temperatures

This is the most frequently occurring factor contributing to a foodborne disease outbreak. Since there are two temperatures at which potentially hazardous foods must be kept, we'll look at each a little closer—cold and hot.

Cold holding temperatures

The internal temperature of cold food needs to be at or below 41°F (5°C) to prevent the growth of most pathogenic microorganisms. Some common problems related to cold temperatures are malfunctioning freezers or refrigerators, thawing frozen foods at room temperature, and failing to store foods in shallow pans for more rapid cooling.

Hot holding temperatures

Potentially hazardous hot food needs to be kept at 135°F (57°C) or higher to prevent the growth of pathogenic microorganisms. All foods that are considered hot must be held at 135°F (57°C) or above at all times, especially while on the serving line. The temperature at which food is held during all phases of preparation and serving is extremely important to prevent the growth of pathogens or production of toxins. For example, microorganisms need proper temperatures (41°F to 135°F [5ºC to 57ºC]), adequate time, and necessary nutrients for growth. Consequently, there are a number of factors that can be controlled to prevent a foodborne disease outbreak.

426. Controlling factors that contribute to foodborne disease

Now that you know the factors contributing to foodborne disease outbreaks, let's look at some ways to control these factors and prevent foodborne disease outbreaks. The primary purpose of performing food facility sanitation evaluations is to prevent foodborne disease outbreaks. In order for you to do this, there are certain requirements that must be met.

General areas with potential for disease

Food employees are the *first* line of defense in preventing foodborne disease outbreaks. They have specific responsibilities for food safety, including personal and facility cleanliness. They report all potentially hazardous situations to the PIC. This person not only manages facility operations but is

also the critical link between PH and the food employees. In this capacity, the PIC ensures the prevention of foodborne disease outbreaks through his or her responsibilities.

Personal responsibilities of food employees and the person in charge

By now you should have an understanding of some of the problems that food employees and the PIC face on a day-to-day basis. They have many responsibilities such as disease reporting, proper cooling and thawing procedures, serving and storage restrictions, and temperature requirements. Now, let's look at what they are required to do when they recognize a problem.

Report disease or illness

Food employees have a critical responsibility to report to the PIC and to the base medical facility or their health care provider information about their health and food activities as they relate to foodborne diseases or illnesses. A food employee or applicant must report information in a manner that allows the PIC to prevent the likelihood of foodborne disease transmission, including the date of onset of jaundice or any other past or present illness. The following are diseases that are extremely hazardous and must be reported promptly:

- Norovirus.
- Shigella spp.
- Salmonella typhi.
- Hepatitis A virus.
- Escerichia coli (E. coli) O157:H7.

There are other instances in which food employees must report illness to the PIC. One is when employees are experiencing symptoms from an illness, infection, or other source associated with acute gastrointestinal illness, such as diarrhea, fever, vomiting, jaundice, or sore throat with fever. Another is when employees have lesions containing pus—such as boils or an infected wound that is open or draining—that are located on the hands, wrists, exposed portion of the arms, or other parts of the body. When reporting to a medical facility, food employees must identify themselves as such to medical treatment personnel.

Food employees must report not only their health to the PIC, but also their exposures to incidences of foodborne disease outbreaks. If he or she is living with a person known to have *Norovirus, Salmonella typhi, Shigella spp., Escerichia coli O157:H7,* or *Hepatitis A* virus, or are living with a person who attends or works in a setting where there is a confirmed disease outbreak, he or she must report it. He or she must notify the PIC when he or she travels outside of the country. The PIC notifies the supervisor and public health when the employee reports the above information. Also, if a food employee is removed from duty, notify the supervisor and public health flight. The food employee will not return to food handling duties until cleared by a medical authority.

Medical examinations

Food employees can be required to obtain a medical examination before starting food handling duties. The purpose of this examination is to prevent individuals with diseases such as hepatitis, typhoid, dysentery, diphtheria, streptococcal or staphylococcal infections from handling food. The Aerospace Medicine Council (AMC) establishes the criteria for medical examination frequency and type of examination to be performed. The examination is performed by the primary care element (PCE) team designated to perform these duties and is documented in the food employee's medical record on an SF 600, Health Record—Chronological Record of Medical Care, or SF 600 overprint.

Receive training

All food employees must be trained in the principles and practices of preventing a foodborne disease outbreak. Meeting this requirement is done through training programs conducted by public health and facility supervisors—initial and supervisory.

Initial food employee training

Initial food employee training is required before an individual can actually perform the duties of a food employee. This training concentrates on the basic principles of food safety, which includes the CDC five foodborne illness risk factors:

1. Inadequate cooking.
2. Poor personal hygiene.
3. Food from unsafe sources.
4. Improper holding time and temperature.
5. Contaminated equipment and cross contamination protection.

This initial training, minimum of four hours, is given by the individual facility supervisor. Food sanitation refresher training is given annually to reinforce the five foodborne illness risk factors. Public health approves initial formal food safety training for food service employees.

Supervisory training

Supervisory training is given annually by PH to all food facility supervisors. It's presented at a more advanced level than that given to food employees. The training identifies the supervisor's role in preventing a foodborne disease outbreak and cites the implication of problems noted during food facility sanitation evaluations. This training must include the importance of complying with the Tri-Service Food Code to ensure the safe receipt, storage, preparation, and service of foods. Training should also highlight the unique aspects of a military population and impact food handling can have on readiness. Nationally recognized training system with prior approval (i.e., ServSafe training) can be used to replace basic food safety training; however, training still needs to be accomplished to highlight the unique aspects of a military population as well as food defense.

On-the-job training

On-the-job training is an ongoing process. Specific training sessions are arranged or conducted by management as the need arises.

Practice personal hygiene

Food employees are a point of contact and thus are critical in preventing foodborne disease outbreaks. They must keep their hands and exposed portions of their arms clean at all times.

General cleanliness

In addition to medical examinations and training, food employees must maintain basic personal hygiene standards. It's the responsibility of both the food facility supervisor and the food employee to make sure these standards are followed. These standards include at least the following:

- Bathing daily.
- Wearing clean, light colored outer garments.
- Wearing hair restraints such as hats or hairnets.
- Keeping facial hair clean and wearing a beard restraint.
- Keeping hands and exposed portions of arms clean at all times.
- Washing hands after using the restroom, coughing, sneezing, or blowing one's nose.

Hand washing

Hand washing is vital to preventing the spread of disease, and it becomes even more important for food employees serving and handling our food. Food employees are expected to wash their hands before beginning or returning to work. To ensure hands and exposed portions of their arms are thoroughly cleaned, they should vigorously rub together the surfaces of their lathered hands and arms for at least 20 seconds and then thoroughly rinse with clean water. While washing their hands, food employees must pay particular attention to the areas underneath the fingernails and between the fingers.

Preparing, serving, and keeping food

When preparing and serving foods; food employees play a key role in preventing foodborne disease outbreaks. They must follow some basic rules for preparing and serving food in order to control microbiological growth.

All foods that arrive at a food facility are either perishable or semiperishable. Examples of perishable foods are frozen vegetables, milk and dairy products, meats, and fresh vegetables. Examples of semiperishables are flour, sugar, cereals, and canned products. Your primary concern is for foods that can sustain bacterial growth, mainly the perishable foods.

Controlling time and temperature

The Tri-Service Food Code lists the time and temperature requirements for most foods. These are controls set to prohibit or slow the growth of pathogenic microorganisms. There are two basic rules for controlling the time and temperature of foods.

1. Maintain perishable products below 41°F (5°C) or above 135°F (57°C).
2. Do not to let food remain in the dangerous temperature zone of 41°F (5°C) to 135°F (57°C) for more than four hours total, from receiving to consumption.

Cooling foods

Cool food quickly to prevent the growth of microorganisms. To speed up the rate of cooling, leave food uncovered and in a location that is protected from contamination, such as, from dripping meats that are thawing. Then cover the food being cooled when it reaches the proper internal temperature. Keep foods covered during all other aspects of food storage, to protect from contamination.

When cooling food, it needs to reach 41°F (5°C) within four hours. Ideally, potentially hazardous food should be cooled from 135°F (57°C) to 70°F (21°C) within two hours, and from 70°F (21°C) to 41°F (5°C) or below within four hours. Placing foods in shallow pots and pans and increasing the airflow, such as by using a blast chiller, will also speed the rate of cooling.

Thawing foods

Another critical point in the preparation process is thawing foods prior to cooking. Food employees follow certain procedures for thawing potentially hazardous foods. When thawing foods in the refrigerator, maintain foods at 41°F (5°C) or below. Foods can also be thawed as part of the cooking process. Microwaves can also be used for thawing if the food will be transferred immediately to a conventional oven with no interruption in the process. Foods can start thawing under room temperature as long as the item is placed under refrigeration when the surface of the food reaches 41°F (5°C). As a last resort, completely submerging foods under running water is the least preferred method. If it's necessary to use this method, the water must be potable with a temperature of 70°F (21°C) or less. The water must have sufficient velocity to agitate and remove loose particles, and the process must be continued for a period of time that does not allow thawed portions to rise above 41°F (5ºC).

Serving and handling foods properly

Protect food from contamination and handle it properly to ensure that any pathogenic microorganisms present do not grow to harmful levels when displaying and serving.

When serving, food employees cannot touch ready-to-eat food, or the eating surface with their bare hands while loading food onto a plate or bowl. Food should be handled with utensils whenever possible. The serving utensils can be stored in the food as long as the handle sticks out of the food.

Practicing proper storage techniques

The requirements for storing dry, cold, or hot foods are the same except for temperature and humidity requirements. Store all foods, regardless of how perishable, at least six inches above the floor on pallets or similar devices. This practice permits personnel to clean the floor easily. Storing foods at least six inches above the floor is especially helpful when storing sugar and flour bags that

occasionally spill or leak. Store foods at least 18 inches from the ceiling and 4 inches from a wall to allow air circulation.

Dry storage areas are perfect targets for insect and rodent infestations. These areas can be insect and rodent proofed by ensuring the facility has screens on the doors, and sealed walls around pipes and structural supports. Store food items separately from nonfood items such as cleaning agents and chemicals. This prevents personnel from using toxic substances as food additives in a recipe.

Do not store food items (food preparation equipment, and utensils), in latrines even if other storage space is nonexistent.

427. Controlling microbial contamination by cleaning and sanitizing

Personal hygiene and proper temperature control and storage are not the only important factors in keeping food safe. Cleaning and sanitizing are crucial in controlling microbial contamination. Cleaning and sanitizing is a two-fold process. A food contact surface must be cleaned properly before it can be sanitized adequately. Before you can evaluate a food facility's cleaning and sanitizing procedures, you need to understand the principles and common methods used in food facilities.

Cleaning factors

Effective cleaning is a lot more complicated than the simple combination of soap, water, and scrubbing. Many variables such as type of soil, water, cleaning agent, and applied pressure can affect the cleaning process. Let's take a look at a few of these.

Soil type

Soils and stains can be classified as protein-based (eggs and raw meat juices), grease or oil-based (margarine or animal fats), or acid or alkaline-based (tea or dust). These different types of soils necessitate different types of cleaning agents.

Water

Water used for cleaning must be potable. Dirty water and mineral impurities limit the effectiveness of the cleaning agent. Cleaning agents dissolve most effectively and quickly in hot water.

Surface

The surface of the item being cleaned is important. Some surfaces may be difficult to clean, such as wooden countertops, while others like steel are easier to clean.

Types of cleaning agents

The role of a cleaning agent is to lift soil from the surface being cleaned and keep it suspended so it is not redeposited on the surface. A cleaning agent is anything such as steam, water, soap, or chemical compound that removes soil.

Select a particular cleaning agent for its specific cleaning properties. A cleaning agent needs to fit the needs of the facility and be stable, noncorrosive, and nontoxic when used as directed. There are three main types of cleaning agents that you may see while performing evaluations, they are listed and described in the table below.

TYPES OF CLEANING AGENTS

Cleaning Agent	Description
Alkaline	Normally alkaline cleaners are in the form of detergents. They are effective for removing soil from floors, walls, most equipment, dishes, and utensils.
Acid	Used to remove lime deposits in warewashers (also referred to as dishwashers), rust stains on equipment, and other soils not removed by alkaline cleaners.
Abrasive Cleaners	Sometimes soil is attached so firmly to a surface that alkaline or acid cleaners will not work. When this occurs, a cleaner containing a scouring agent, usually finely ground feldspar or silica, is used to attack the soil. Rinse all items thoroughly after cleaning.

Sanitizing methods

The term *sanitized* means the microbial contamination of an object or surface has been reduced to a safe, consumable level. It's a step above clean, which is the absence of unwanted soil, but a step below sterile, which is the absence of all microbial contamination. All food contact surfaces must be sanitized after cleaning. Sanitizing can be done in two ways—by heating or by the use of chemicals.

Usually the medical treatment facility (MTF) commander approves sanitizers for use in food facilities. Regardless of the sanitizing process, the object to be sanitized must be cleaned and rinsed properly for the sanitizing process to work. Caked-on soils, not removed by cleaning, may shield bacteria from the sanitizing process.

Heating

An object can be heated to a temperature high enough to kill microorganisms. The most frequently used method of heat sanitization is rinsing or immersing an object in water at 171°F (77°C) or above for a minimum of 30 seconds. This time and temperature relationship is necessary to bring the plate contact surface to 160°F (71°C), which kills most disease-causing microorganisms.

Chemical

Chemical sanitizing can be performed in two ways: (1) immersing an object in a chlorine solution for a minimum of 10 seconds, or (2) immersing the object in an iodine solution for a minimum of 30 seconds.

Other sanitizing methods

Other methods used to sanitize include rinsing, swabbing, or spraying using double the recommended concentration of sanitizer on the item to be sanitized.

Warewashing methods

Warewashing means the cleaning and sanitizing of food contact surfaces of equipment and utensils. Warewashing is performed in two ways—manually or mechanically.

Warewashing manually

Warewashing manually is done using a three-compartment sink, which is separated by function; washing, rinsing, and sanitizing. The sink compartments need to be large enough to accommodate immersion of the largest piece of equipment or utensil. If equipment or utensils are too large for the warewashing sink, use a warewashing machine or alternative equipment. This work area should be equipped with separate drain boards for clean and soiled items, and an area for scraping and rinsing food soil into a garbage container for disposal.

Warewashing mechanically

Properly operated and maintained machines are more reliable in removing soil and microorganisms from tableware and kitchen implements than warewashing manually. Because of this factor and the needs of high-volume operations, the food service industry has moved to the use of warewashing machines.

Warewashing machines are stationary machines in which a rack of items to be washed sits in one place while the machine goes through wash, rinse, and sanitizing cycles. There is also conveyer machines that move the dishes through the machine on racks or conveyers equipped to hold them. Conveyor or clipper-type machines are required to have baffles or curtains to prevent internal cross contamination between the washing and rinsing phases of the cleaning process.

While warewashing machines can be the most reliable way to clean and sanitize tableware and utensils, they also can be the source of innumerable problems if installed or operated improperly. If asked, recommend that food facilities refer to the manufacturer's instructions for troubleshooting problems with individual machines.

Cleaning of facilities

There are many locations that are critical in controlling microbial contamination in a food facility. These critical areas include the food preparation areas, the clean pot/pan and dish storage area, and the latrines where food employees must wash their hands prior to returning to work, and hand washing stations.

Food preparation and serving areas

Food preparation areas include the salad-making area, steam kettles, ovens, cutting boards, food preparation tables, grills, and the serving line. These areas must be cleaned to avoid an accumulation of food debris.

Floors

Mop floors often and wash as needed. Make sure walls, ceilings, light fixtures, and ventilation systems are kept clean and free from dust and dirt buildup to prevent contamination of food or food contact surfaces. Grease traps need to be cleaned out periodically to prevent grease build-up that clogs the system.

Latrines

Latrines need to be kept clean and free from excessive dirt. Hand-washing facilities must be available, and stocked with supplies, in all latrines to allow food employees to wash their hands prior to returning to work.

Outside and back dock area

Evaluate the mop and broom rack, garbage can cleaning area, garbage dumpster, and surrounding grounds for sanitation. The dumpster must be emptied and cleaned to avoid attracting insects, and the area around the dumpster needs to be cleaned as well.

Cleaning and sanitizing equipment

Stationary food preparation equipment should come with the manufacturer's instructions for disassembly and cleaning. Make sure these instructions are followed if they are available. For general equipment cleaning, unplug the unit if it's electrically powered. Remove parts, if possible, prior to cleaning and sanitizing. Ensure the remaining food contact surfaces are washed and then rinsed with a solution of chemical sanitizer mixed to 50 parts per million (ppm) if the temperature of sanitizing solution is 75°F (24°C), warm water, or 100 ppm if the temperature of the sanitizing solution is between 55°F (13°C) and 75°F (24°C), cool water. Wipe down the non-food contact surfaces and allow them to air dry before reassembling.

Make sure cloths used for wiping down stationary equipment and other surfaces are rinsed frequently in a sanitizing solution, stored in the solution when not in use, and laundered daily. Cloths used for food contact surfaces must be kept separate from other wiping cloths.

Some stationary items are designed to have detergent and sanitizing solutions pumped through them. This is called cleaning in-place. Personnel need to consult the manufacturer's instructions for these items.

Floor-mounted or large equipment

Floor-mounted equipment, such as a steam kettle, must be cleaned in-place. These items are cleaned and sanitized before and after each use with power spraying equipment and sanitization solution as described above.

Table-mounted equipment

Probably the dirtiest item in most food facilities is the can opener. Many food employees forget to run it through the warewasher or hand-wash it at least daily. This is one area where cross contamination of foods can easily occur.

Loose equipment

Loose equipment includes utensils, small pots and pans, mixers, blenders, funnels, or other items used to prepare, serve, or handle foods. These items must be washed and sanitized as any other equipment.

428. Your role in reviewing a facility design

Include public health in the process of reviewing the plans of a new or remodeled facility, as well as the plans for purchasing the food preparation equipment to be installed. We don't attempt here to cover all of the factors of a properly designed facility; rather we try to cover some of the most common requirements or design features that you should verify in the building design. You are not necessarily a design expert, but you can use your experience in performing sanitary evaluations and use good common sense to determine if the design is satisfactory.

Most requirements are listed in the National Sanitation Foundation (NSF) Standards; the NSF reference guide entitled "Sanitation Aspects of Food Service Facility Plan Preparation and Review," and the Tri-Service Food Code. Use these documents in the continental United States (CONUS) and as a guide in overseas locations.

Kitchen

Obviously, this is the most important part of the design within a food facility. The first thing you need to determine is the type of food service operation. Will it serve hazardous foods or only non-hazardous foods? How many people will be served? Once you have answered these questions, then you can look at some specific aspects of the kitchen design.

Movement or flow of food through the kitchen

Is there a possibility of cross contamination through a design flaw, such as placing the walk-in refrigerators next to the garbage dumpsters outside? The food should come in the back door and flow logically through the preparation area to the front serving line and on to the customer. Ensure that this flow is not interrupted by latrines or other sources of contamination.

Type and location of sinks

There must be separate sinks for food preparation, equipment cleaning and sanitization, and hand washing in appropriate locations throughout the kitchen. Each sink needs to be equipped with hot and cold water, as well as a wall-mounted paper towel dispenser.

Grease traps

These are traps that collect grease from kitchen wastes. They should be located where emptying and cleaning will not contaminate any food contact surface. The best location is on a wall with outside access so trucks can be hooked up to the trap from outside the facility.

Pot and pan room

Have the pot and pan room accessible to the kitchen. However, make it a separate room to reduce cross contamination between the kitchen and the dirty pots and pans.

Storage areas

There are a variety of considerations when reviewing storage area plans. Cooling units must be located where they can discharge condensation outside the facility. They should be accessible and well insulated. Storage areas need to follow the flow of food from the back of the facility to the front. Doors must be tight fitting, and holes and cracks in storage areas should be sealed to reduce the possibility of insect or rodent infestation. This is especially important in the dry storage area where flour or sugar products are stored.

Outside area

The design of the outside back dock area is important. This is the first line of defense against insects and rodents. Since there are often flies present near the back dock of food facilities, install a fly fan or curtain at the doors of the facility and put screens on all windows. These measures prevent flies from

entering the facility. The design of the outside area is to include the position of the dumpster. Ensure the dumpster is easily accessible but far enough away from the dock area to prevent insect and rodent infestations.

Equipment

When designing a facility, engineers first consider the type of service the facility will provide. Then they consider the type of equipment before the actual facility design is finished. If not, the equipment may be too large for the area. This will waste money and time. The requirements for cleaning equipment must also be considered when selecting equipment and designing the facility. Consider locations for water connections, if hoses are needed, and requirements for water heaters. Identify the location of drains, and determine a requirement for a garbage disposal.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

425. Foodborne disease outbreak factors

1. Define the term “food employee.”

2. Give examples of foods from unapproved sources.

3. Why is preparing foods several hours or days in advance an unsafe practice?

4. What is the major problem with inadequately cooked poultry?

5. What is the most frequently occurring factor contributing to a foodborne disease outbreak?

6. What are some common problems associated with keeping food cold?

7. What are the required temperatures for holding hot and cold foods?

426. Controlling factors that contribute to foodborne disease

1. Who serves as the link between public health and food employees?

2. What should a food employee do when suddenly becoming ill while on the job?

3. What form(s) may be used when a medical examination is completed?

4. Who provides initial food employee training in food handling responsibilities?

5. How often and who provides training to food facility supervisors?

6. What is the hand-washing procedure for food employees returning from the latrine?

7. Potentially hazardous foods cannot be in a temperature danger zone for longer than what amount of time?

8. List at least three of the different acceptable methods for thawing foods.

9. How high off the floor should foods be stored and why?

427. Controlling microbial contamination by cleaning and sanitizing

1. List the specific variables that affect cleaning a food facility.

2. What is sanitizing?

3. Who approves the use of sanitizers in food facilities?

4. What is the *minimum* temperature and time requirement for hot water sanitization?

5. List the two chemicals commonly used for food service sanitation and the minimum time an object should be immersed in each to become santized.

428. Your role in reviewing facility design

1. Where can you find most design requirements for food facilities?

2. Where should grease traps be located within a food facility?

3. Why should the facility equipment be chosen before the final facility design is finished?

4–2. Mobile Facilities and Special Evaluations

Sanitation evaluations take place in many different environments. You may have to evaluate mobile units, aircraft, off-base facilities, temporary facilities, and even vending machines. These food service operations deserve special attention. As a public health journeyman, be aware of the special problems these operations have. In this section, we discuss these special food service operations and vending machine sanitation so that you'll have an idea why they are so special.

429. Mobile, temporary food facility operations, and vending machines

Have you ever bought a chili dog from a street vendor or a tuna sandwich and chips from a catering truck? Did you become ill several hours later? It's almost impossible for civilian public health authorities to police these food operations adequately. There are so many of them and very few inspectors. You might be gambling on stomach upset and illness when you get a quick bite to eat from your friendly neighborhood hot dog cart.

General restrictions and requirements for mobile facilities

The dispensing of foods on a military installation is a carefully controlled and evaluated process. The Army and Air Force Exchange Service (AAFES) operate the mobile food facilities on most AF installations. Although these mobile facilities have little space for food storage, trash disposal, or for cleaning and sanitizing materials, they are still food service areas. These facilities must comply with most requirements in the Tri-Service Food Code. However, there are some special requirements and exemptions that apply to mobile facilities. Mobile food facilities need not comply with requirements for water and sewage systems, or for cleaning and sanitizing equipment and utensils if they comply with the following:

- They only serve foods prepared in a permanent facility that meets all requirements of the Tri-Service Food Code.
- The food service facility that supplies the mobile unit or pushcart has all the required cleaning and sanitizing equipment.
- The foods are packaged as individual servings and transported and stored in accordance with the Tri-Service Food Code.
- They serve nonhazardous beverages dispensed from covered urns or other protected equipment, including single service cans or bottles sealed in proper commercial facilities.

The food employees must follow the same guidelines as other food employees for such things as personal hygiene and food handling practices. The foods must be handled and protected the same as foods in a stationary facility, and the same temperature requirements apply.

For patron use, single-use cups, plates, spoons, forks, and knives are recommended. However, the mobile unit may use normal metal utensils for preparing foods and serving them to patrons provided the utensils could be washed and sanitized properly.

Water and waste requirements

Units that require a water system for washing *must* have the following:

- Potable water under pressure.
- Enough water for preparing food, cleaning and sanitizing utensils, and washing hands.
- A water inlet that is located where it cannot be contaminated by road dirt, waste discharge, oil, or grease. The inlet must be used only for adding potable water into the tanks. If the mobile unit produces liquid wastes, the waste tank must have a capacity for at least 15 percent more than the capacity of the water tank.

Supply and servicing area requirements

The mobile facility must operate from a supply point or fixed food facility and return to that facility at least once each day for re-supplying, cleaning, and servicing.

General restrictions for temporary food establishments

Temporary food establishments operate for a period of no more than 14 consecutive days in conjunction with a single event or celebration. Some examples of temporary food establishments might be a concession stand near the base softball fields or booths open during a base open house. As with any other facility, temporary food establishments must comply with the requirements outlined in the Tri-Service Food Code and AFI 48–116 for food establishments. At most AF bases, public health must be notified in writing of such an establishment and when it will be open for operation. The AMC and public health determine the frequency of inspection for these facilities.

Vending machine sanitation

Vending machines have become a part of every day life and can be overlooked as a location for potentially hazardous foods. Machines that supply semi-perishable goods like candy are not so much a worry for food safety and wholesomeness but they need to be maintained at a reasonable temperature as to not degrade the foods quality. Machines that supply potentially hazardous foods (PHF) need to maintain proper temperatures in order to ensure food quality and safety. The following lessons go into more detail about vending machines.

Machine locations

Vending machines can be found just about anywhere. The location of these machines is important. Machines located outside must be protected from insect and rodent infestations and weather extremes. The area must be easily cleaned, free from pests, and well ventilated. If you find a candy machine located out in the hot sun, recommend a change of location. The area around a vending machine should be cleaned daily. There should also be trash containers at each location.

Food preparation and storage

All condiments and single-use utensils must be individually packaged or dispensed from clean, sanitary dispensers. All fresh fruits to be eaten raw, without peeling, can be dispensed unpackaged, but they must be washed in potable water prior to stocking the machine. Potentially hazardous foods must be placed in the machine as soon as possible after preparation and removed within three days of preparation or removal from frozen storage. These foods must display the pull date. All dairy products must be coded and must be removed by the manufacturer’s expiration date. Remember when conducting your inspections that there is an allowable “recovery time” after the machine is stocked for it to return to its required temperature. For chilled food, this time is 30 minutes, while hot food machines have two hours to heat the food to a hot holding temperature.

Transporting food, equipment, and supplies

Potentially hazardous foods must be protected from temperature fluctuations during transit and while in storage. All foods, single-use items, and containers must be protected from contamination while in transit.

Sanitary evaluations

The PH flight evaluates the sanitary conditions of vending machines. Ask the vendors to open the machines for you. Vending machines inspection frequencies are determined by the AMC . The form you use to evaluate vending machines is DD Form 2973, Food Inspection Report. The form is completed in duplicate. One copy is given to the agency evaluated and public health files the other copy.

430. Hospital and flight kitchen sanitation

Hospital and flight kitchens are another one of the many food establishments that you may have a chance to inspect. Whether these establishments are on your base will be determined by your bases mission. If your base has a small clinic or does not have a flying mission you probably will not have a hospital and flight kitchen. If your base does have these food establishments it's important to know the population they serve. Hospital kitchens will serve immunocompromised patients and flight kitchens will serve airman that may have a meal and then be up at 30 thousand feet within an hour.

Hospital kitchens

A hospital kitchen is different from a traditional food facility. A patient's resistance to infection may be compromised, increasing the chances of a foodborne disease outbreak when food is mishandled. Monitor the operation carefully and strictly enforce all rules, especially those that relate to time and temperature. Most patients are served in their rooms. Warming carts must keep the foods as warm as possible while the trays are being delivered. Food employees must practice excellent personal hygiene and ensure all equipment is kept clean and sanitized at all times. If a patient is allergic to the cleaning or sanitizing agents used in the kitchen, an alternate method must be available.

Flight kitchens

Flight kitchens prepare meals for aircrew members, flight line personnel, and aircraft passengers. The meals are intended to be wholesome, nutritious, and aesthetically appealing. The flight kitchen is an extension of the food service operation and normally is staffed by personnel from base dining halls. The need for good sanitation and careful food preparation is paramount here, also. An in-flight foodborne disease outbreak could result in disaster.

Environment

The mission of flight kitchens is unique. These facilities are responsible for providing meals anytime, day or night. They may have to prepare 4 to 200 boxed lunches on an hour's notice. With such a responsibility, most of the foods used in boxed lunches are prepared and stored in bulk, and the meals are actually constructed on an "as needed" basis. Examples of these foods include sandwiches, fried chicken, bagged chips, cookies, fruit, and canned beverages. Foods prepared for later use and boxed lunches must be labeled with the date and time of preparation. All foods must be stored chilled or frozen.

Frozen in-flight meals are also prepared and stored in the in-flight kitchen. These foil-packed dinners are very much like TV dinners. They have a six-month shelf life for in-flight use, but may be kept longer for ground feeding if still wholesome, and checked periodically for signs of thawing. When signs of thawing are observed, discard the meals.

Regardless of the type of meal prepared and stored in a flight kitchen, do not use potentially hazardous leftovers in the preparation of any in-flight meal.

Sanitation

Protecting food from contamination, storing foods at safe temperatures, cleaning and sanitizing food contact surfaces, and maintaining adequate personal hygiene are the basics of sanitation in a flight kitchen. It's obvious why the outbreak of a foodborne disease for an aircrew would be so serious. The loss of an aircraft, its crew, and possibly passengers would be a tragedy of terrible proportion not only to the families of the aircrew but also to the overall mission of the AF. As a public health journeyman,

make sure that all aspects of AFI 48–116 and the Tri-Service Food Code are followed exactly to prevent such a situation.

431. Commercial evaluations

Depending on your base's mission you may be responsible for conducting periodic evaluations of military and commercial contract aircraft. Therfore, you need to have some idea of what you need to observe in the aircraft, as well as what are acceptable and unacceptable conditions.

Military and commercial contract aircraft—general considerations

The health and sanitation aspects of flying have been a concern of PH for many years. Military aircraft come in all sizes and shapes. Each has a distinct mission and capability. However, one thing all military aircraft have in common is that they must carry survival equipment for the crews and passengers. Included in this survival equipment are food and water. Food may be in the form of survival rations or frozen in-flight meals, while water may be in cans. When not aboard the aircraft, these items are usually stored in buildings such as flight kitchens or survival gear storage buildings. Large passenger aircraft have water tanks on board. Food typically is brought on board just prior to takeoff. Small fighter aircraft have cans of water and survival rations stored in the rear of the cockpit.

The following standards are the minimum sanitation and hygiene requirements for aircraft. AFI 48–116, *Food Safety Program*, states that PH ensures that the food and water supplies and services for military aircraft meet the requirements unique to the AF mission.

The general requirements for aircraft sanitation and hygiene include the following:

- Food and water must be free of pathogenic organisms.
- Utensils and food contact surfaces must be clean and sanitary.
- Waste materials, especially human wastes, must be stored in a manner that prevents contamination of food and water supplies.
- All disease vectors must be kept under control.

Food and water

In military aircraft, you're virtually assured that the water and food supplied to the galley are from approved sources. They normally are stored under sanitary and safe conditions, are safe for use, and should not cause undue concern. However, the same cannot be said of commercial contract aircraft that transport military personnel. You cannot assume that either the food or the water is safe for use until you have evaluated them using your best judgment and inspection skills. **NEVER** assume anything about the sanitary status of a commercial aircraft until you have evaluated it!

The sanitary standards outlined in the Tri-Service Food Code apply to the sanitation of aircraft. Foods must be refrigerated or frozen prior to serving. The AF does not allow hot foods to be stored aboard aircraft. Meals heated by ovens must be served immediately. Foods must be labeled with the time and date of preparation, date frozen, or time and date thawed. All personnel aboard the aircraft must protect food from contamination and use proper food handling practices.

Make sure that water used aboard military and commercial contract aircraft comes from an approved source. Sample the water on a periodic basis to ensure that chlorination is effectively controlling the microbiological levels in the storage tanks. The Bioenvironmental Engineering Section (BES) is responsible for water sampling on military and commercial-contract aircraft.

Cleaning and sanitizing

It's difficult to clean and sanitize food contact surfaces adequately in the confined spaces of an aircraft galley. Monitor the effectiveness of this service closely.

Waste storage

Aircraft designed to carry passengers must have latrines on board. These latrines are evaluated for sanitary conditions. Aircraft designs allow human wastes to be stored in a belly tank near the latrines

at the rear of the aircraft. Your job is to ensure that the sewage tanks have been cleaned before the plane is airborne. Although you are not responsible for visual inspection of the cleaning procedure in every instance, ensure that cleaning using the proper procedures is occurring. Therefore, you might want to observe the area occasionally.

Disease vector control

The fact that military and commercial contract aircraft travel around the world makes disease vector control of primary importance. While you're evaluating sanitation, it's also a good idea to look for insects and animals in aircraft arriving or departing.

Aircraft evaluations

You're required to evaluate aircraft that stores or serves food and water. Usually, you'll be limited to those aircraft that provide mass passenger transport, not fighter or bomber aircraft. The frequencies for evaluating locally assigned aircraft, which food and water can be stored and served, are approved by the AMC. Evaluate Air Mobility Command (AMC) contract carriers according to the AMC contracts and any additional guidelines Headquarters AMC (HQ AMC)/SGPM provides. These evaluations are to verify these carriers do not have potential to cause a foodborne disease outbreak and are complying with the contract. Each base creates a local form that is approved by the Aerospace Medicine Council. Send a copy of the completed inspection report to the local AMC contract coordinator. If a rating is unsatisfactory, send a copy of the evaluation to the appropriate numbered AF.

Except for the evaluation of AMC contract carriers, there are no specific AF standards for evaluating the sanitary condition of military or civilian passenger-carrying aircraft. (Generally, you apply the requirements in the Tri-Service Food Code.) The regulatory authority (public health or medical unit) must use sound judgment when evaluating all aspects of flight feeding. The potential for time-temperature abuse of potentially hazardous food is high. The World Health Organization's "Guide to Hygiene and Sanitation in Aviation" provides additional information for PH inspectors.

Off-base local sanitary evaluations

Off-base local initial evaluations are performed on commercial food establishments when they request to sell to the government. Air Force PH generally is only involved in off-base sanitary evaluations when the off-base facility is supplying only one base. These evaluations approve or disapprove the establishment as a source of food for the base.

Initial sanitary evaluations

Initial sanitary evaluations are performed using one of two formats. First, the complete facility is evaluated, including the entire production process, for sanitary compliance. Second, only the sanitary control system of the facility is evaluated. The second type of initial sanitary evaluation is most often used when performing an initial evaluation on a branch plant of a large national food producer or distributor. These companies are usually so well organized and self-policed that an in-depth evaluation would be a waste of time and government money.

Routine sanitary evaluations

After an establishment gains approval to sell its product to a base, continue to evaluate it from time to time at a frequency established by the AMC. Routine sanitary evaluations determine the current sanitary status of these establishments. They result in continued approval, or disapproval if observed discrepancies are not corrected in a specific period of time.

Special sanitary evaluations

A special sanitary evaluation is made at a food establishment to determine if the plant will remain on the approved sources listing. Special sanitary evaluations are initiated when food from the establishment is thought to be contaminated or unwholesome, or when significant sanitary deficiencies are found during a routine evaluation.

Self-Test Questions

After you complete these questions, check your answers at the end of the unit.

429. Mobile, temporary food facility operations, and vending machines

1. What is the requirement for water inlet connections on mobile units having water storage tanks?

2. The liquid waste tank on a mobile food facility must be how much larger than the water storage tank?

3. What is a temporary food facility?

4. Name some examples of a temporary food facility.

5. What is the acceptable recovery time after filling cold and hot vending machines?

6. Who determines the inspection frequencies for vending machines on base?

7. What form is used to record vending machine evaluations?

430. Hospital and flight kitchen sanitation

1. What makes a hospital dining hall different from a typical food service facility?

2. Why are mobile warming units necessary in a hospital food facility?

3. What is the primary purpose of a flight kitchen?

4. When a frozen in-flight meal has been thawed completely, what must be done with the meal?

5. What should *not* be used in the preparation of any in-flight meal?

431. Commercial evaluations

1. What are the temperature requirements for hot foods stored aboard commercial contract aircraft?

2. Who is responsible for sampling water aboard aircraft?

3. What guidelines are used for evaluating commercial contract aircraft?

4. What is an initial sanitary evaluation?

5. List the types of off-base establishment evaluations.

6. What is a routine sanitary evaluation?

7. When must a special sanitary evaluation be conducted?

4–3. Requirements and Criteria for Public Facilities and Employees

Public facility is a general term that covers a variety of facilities providing a variety of services. In this section we focus on public health's role and on how our facilities are to be maintained so as not to threaten the health of users at any time. This includes the importance of good health and personal hygiene of employees of these facilities.

432. Public health

Long before the development of modern principles of public health, people recognized relationships between our environment and disease. Although most of us think of running water and flushing toilets as being inventions of the last century, their history actually goes back several thousand years. Historical records indicate that the Myceneans and Minoans (1600–1200 B.C.) were responsible for building drainage systems and water closets (toilets), and that they actually used a water-flushing system. About 1500 B.C., the Hebrews wrote what is believed to be the first hygienic code in the book of Leviticus. This code dealt with various personal and community responsibilities including such concerns as sanitation of living sites, disposal of human wastes and garbage, isolation of people with communicable diseases, and protection of water and food supplies.

The Romans are famous for their aqueduct system, which consisted of an extensive network of conduits that supplied safe drinking water. In fact, several of their aqueducts still exist and have been incorporated into the present day water and sewer systems. If the need for such things as safe water and proper waste disposal was recognized so long ago, why did the world have so many epidemics during the several hundred years prior to the 1900s?

With the coming of the Dark Ages, the Christian church played a very big part in the course of history that followed. In order to get away from the Greek and Roman lifestyles, which were considered to be

pagan, any pampering of the body was highly discouraged. During this period, it was actually considered immoral to view your own body. As a result, people began to bathe less often and wore clothes that were extremely dirty. For all practical purposes, sanitation was nonexistent, with human wastes and garbage accumulating in and around dwelling places. This lack of personal hygiene and disregard for sanitation took its toll in the form of the infamous epidemics and pandemics of plague and cholera. It's estimated that in the seventeenth century the bubonic plague, better known as the Black Death, claimed about 60 million lives. Large-scale communicable disease problems continued through the late 1800s. Between 1830 and 1860 cholera was repeatedly introduced into the Americas by groups of settlers. It quickly spread along the water routes and even followed the gold prospectors to California. Old public health data indicates that about one-third to one-half of an affected population died as a result of the outbreaks.

It wasn't until the late 1800s that a real interest and commitment to public health and the control of communicable diseases were recognized in this country and abroad. In the last 100 years, great strides have been made in all aspects of public health. The discovery of antibiotics and vaccines, along with enforcement of public health standards, has resulted in the high standards we enjoy today.

Your public health role

As a PH journeyman, your primary goal is to promote and preserve the health and wellbeing of the AF community, including military and civilian personnel, and their dependents. You do this by monitoring sanitation and communicable disease trends on your base. As you just read, the earliest concern for public health was motivated by a need to control serious and widespread epidemics.

Prevent spread of disease

Today, the primary purpose of public health programs is to establish and maintain conditions necessary for the prevention of disease. While conducting an evaluation, your main concerns are those items that affect the health of the workers and patrons. There continues to be ongoing research in areas such as disease and vector control, sewage and waste disposal, proper food handling and preparation, and water supply certification.

Promote sanitation standards

The primary mission of the military is to protect and defend the country. Personnel cannot do this if they are ill. The promotion of good sanitation standards is important for everyone from the fighter pilot to the mechanic who fixes the aircraft. If you read through history, more men were put off the front line because of communicable diseases than from battle injuries. With this in mind, you have a very important job to do.

Resolve health and sanitation problems

Changing a procedure, ordering equipment, or simply educating the personnel working in a facility can solve most sanitation problems. However, some problems are not so easily solved because of design or structural problems. You may have to suggest ways to work around these problems if it's not possible to have them physically eliminated. It's essential that PH personnel convey their ideas of good public health practice to workers and supervisors, health care providers, and commanders. If you consider the possible effects on the AF mission that inadequate public health controls have, you'll be able to appreciate the importance of public health education and making solid recommendations during public facility evaluations. When you consider that based on your observations you can make recommendations to your supervisors on ways to control, modify, or eliminate any problems you find; it's easy to appreciate the value of your recommendations.

Public health interventions

Since you're responsible for conducting periodic evaluations of public facilities on your base, you need to have some idea of what you need to observe in the facility, as well as what are acceptable and unacceptable practices and conditions. The interventions that are ongoing within a facility include facility maintenance, garbage and refuse handling and disposal, insect and rodent control, cleaning and sanitizing procedures and employee health and hygiene policies.

In order for a facility to maintain a constant high level of sanitation, these interventions must be constant priorities. You'll find specific guidance on these topics in AFI 48–117, *Public Facility Sanitation.*

Facility maintenance

For a facility to maintain a high level of sanitation, the building itself must be in good repair. The age of the facility is not necessarily important if it's kept in good repair. Both inside and outside areas should be free of rodents, insects, and trash. Floors should be constructed of materials that are easy to clean and well-sealed to prevent harboring pests. All corners where floor, walls, and fixtures meet must be sealed tightly to minimize the entrance of insects and rodents. Having good lighting is also important, as people will tend not to clean what they can't see.

Garbage and refuse handling and disposal

As an inspector you'll have many areas to inspect inside a facility—but don't forget the outside area. Generally this is where the garbage is stored until it's picked up. Ensure all trash cans and dumpsters have close-fitting covers to prevent the attraction of insects and rodents. If such pests are attracted to the outside of a building, it's only a matter of time before they will go inside.

Insect and rodent control

Insects and rodents may serve as reservoirs or vectors for disease. When conducting an evaluation in a facility with an obvious insect infestation, determine what the supervisor has already done to attempt to control the situation. Determine what type of support, if any, the Entomology personnel are providing. When are they spraying? How often do they spray? What are they using? It may be that they are not using the appropriate pesticide, or the insects may have developed a resistance. In many cases, improved sanitation will take care of the problem. The most important point to stress is the relationship between good sanitation and insect and rodent control.

Be especially concerned about insect and rodent control within a child development facility. Be concerned about the type of pesticides that are used, and most important, when they are being applied. Pesticides are not to be applied just prior to opening the facility or during hours of operation. The most appropriate time to treat the facility is immediately after it closes for the day. This allows for dissipation of the chemicals.

Cleaning and sanitizing procedures

Cleaning and sanitizing personal items are important links in preventing the transmission of many diseases. Facilities such as the child development center, beauty and barber shops, and the gymnasium are a few excellent examples. There is specific guidance on this in AFI 48–117, *Public Facility Sanitation.*

Employee health and hygiene policies

In any facility that performs a service to the public, it's absolutely imperative employees practice good personal hygiene and stay healthy. During your evaluations, ensure personnel working in public facilities follow established guidelines to avoid passing infections or communicable diseases between patrons or between themselves and their patrons. The ideal situation is to have only healthy people working in ALL our facilities so that we can prevent, as much as possible, the spread of infections and communicable disease.

433. Public facility sanitation requirements

This discussion is divided into three broad areas—personal service facilities, recreational facilities, and living quarters. Let's begin with the personal service facilities.

Personal service facilities

For the purposes of this lesson, a personal service facility is one that renders a specific personal service or issues personal use items for reuse. We cover beauty and barber shops, child development centers, family home day care, laundry services, and family services. Let's look at a few of these.

Beauty and barber shops

Focus your evaluation on the personal hygiene and sanitation practices that may influence the health and welfare of the patrons.

Employee health and hygiene

Do not permit people who have communicable diseases or infections to work in beauty and barber shops. The AMC decides what type of pre-employment medical exam that is required and the frequency of routine exams.

Make sure all beauty and barber operators practice good personal hygiene. This includes everything from washing their hands between patrons to wearing a clean uniform or smock. In addition to their own hygiene, operators must be able to recognize patrons who should not be served. This includes, but is not limited to, patrons with lesions on the scalp, face, or neck (especially if they contain pus), and anyone infested with lice.

Cleaning and sanitizing

Articles such as neck strips, towels, and headrest covers should be disposable or freshly laundered. Common-use hairbrushes, shaving mugs, shaving brushes, sponges, powder puffs, or styptic pencils cannot be used. Neck dusters can be used when they can be sanitized, using ultraviolet light, between patrons. If it's necessary to stop the flow of blood, operators can use sterile individual applicators with an appropriate powder or liquid. Operators should not use forced air to remove loose hair from patrons; however, they may use vacuum devices. Every effort needs to be made to keep the shop clean and free of accumulations of hair and trash.

In addition to keeping the environment clean, all instruments used to give manicures and pedicures must be thoroughly cleaned and disinfected after each patron to avoid the transfer of bloodborne diseases. These instruments must be washed thoroughly with soap and water, then soaked in an approved disinfectant for 15 minutes, rinsed in running water, and dried with a clean cloth or paper towel. Barber and beauty shop operators use a stiff bristle brush to clean clipper heads. The brush is not to be used for any other purpose. To clean other instruments, the operators must rinse them thoroughly with hot water after each patron.

Periodic evaluations help to identify problem areas and also give you an opportunity to educate the operators on the importance of good personal hygiene and good sanitation. Although there is no requirement for a standard checklist, most PH offices have developed a checklist of important areas to focus on for their use when inspecting these and other public facilities.

Child development center

Most AF bases have a child development center. This facility has become as essential as the MTF or the dining hall. The child development center is often the only place shift workers can leave their children. These centers often open early and close late for base recalls and mobility exercises. Our personnel are entitled to know that their children are cared for in a healthy and safe environment.

Unfortunately, the child development center may pose a communicable disease threat on your base if good personal hygiene practices and sanitation are absent. Child development centers provide the perfect environment for spreading communicable diseases by clustering children in a confined area. Children are exposed to more diseases in a child development center because they are exposed to more children. Each child brings his or her own infections to the center. Respiratory and diarrheal type diseases spread most easily in these centers. Children not only share their toys but also their viruses and bacteria. Considering these factors, it's very important that PH conduct good surveillance in these facilities to ensure children are not subjected unnecessarily to communicable diseases. In a nutshell, your job is to represent the MTF commander and monitor the sanitary conditions in these facilities.

As an evaluator, you must be thoroughly familiar with the contents of AFI 34–248, *Child Development Centers*. This instruction contains a great deal of guidance on the level of sanitation that

must be maintained in the center. Caregivers must be thoroughly familiar with the contents of AFI 34–248. The health and welfare of each child is their highest priority.

One practice that supports the health and welfare of the children is the separation of children by age, which is done in all AF child development centers. Especially important is the fact that children still in diapers are kept separate from toilet-trained children. The personal hygiene of children still in diapers is very questionable. Children under the age of two years may be "silent carriers" for Hepatitis A virus, which is shed in the feces. The term "silent carrier" means that the child actually is infected with the disease but does not exhibit any symptoms.

In addition to requiring separation of children by age, AFI 34–248 specifies the ratio of caregivers to children. This requirement is to ensure optimum supervision of the children.

Employee health and hygiene

Be concerned not only about the health of the children, but also the people who are caring for them. Caregivers must comply with several health requirements before and after they are employed. They must be in good mental and physical health, including being free from pulmonary tuberculosis and other communicable diseases. They must meet the requirements established by the state health department or the MTF commander. The child development center's medical advisor usually decides if any periodic medical examinations need to be performed. If such exams are required, they may be monitored through the occupational physical examination program.

Good personal hygiene, for caregivers and children, is absolutely essential and is the FIRST STEP in breaking the chain of disease transmission. Caregivers need to be especially attentive to their daily hygiene before arriving at the center and then continue while at work. They must wash their hands after changing a child's diaper, using the toilet, or assisting a child with using the toilet, and before serving food to the children. They also need to ensure that the children wash their hands after using the toilet or before eating. Make sure there is an adequate supply of soap and disposable hand towels in the restrooms and at the sinks.

Children's health policies

All children attending a child development center have a health card on file that includes a record of all their immunizations. If their immunizations are not current for their age, they cannot be admitted to the center unless it's an emergency. Caregivers must be able to recognize common childhood illnesses and communicate this information to parents and health care providers. Each center needs to have specific guidance on the admission of children to the facility. AFI 34–248 gives very specific guidance on the admission of children with fevers, communicable diseases, and particular skin conditions. The child's primary caregiver will screen all children for signs of illness at the time of entry into the child development center. Primary caregivers will accept children with special health problems only at the concurrence of the program director and the program medical advisor. The medical advisor also may direct caregivers to refuse admission to children with any other diseases they feel may impact the health of the other children or the caregivers. At the same time, caregivers who arrive with contagious diseases or illnesses must not be allowed contact with the children. However, if a child becomes ill while at the child development center, move the child to an isolation room until the parent or guardian arrives. Caregivers need to also be familiar with the readmission policies as outlined in AFI 34–248. The medical advisor may recommend more stringent readmission policies based on the incidence of communicable diseases in the community.

Cleaning and sanitizing procedures

Because of the potential for communicable disease transmission in this type of facility, strict sanitation is a must. Children are very curious and love to touch everything. They put things in their mouths and crawl all over the floors. There are very specific guidelines in AFI 34–248 on the cleaning of toys, furniture, equipment, surfaces (especially diaper-changing areas), walls, floors, and toilet facilities. Ensure child development center employees use agents that are appropriate for the

task and approved by PH. It's very important that employees follow these guidelines and maintain a safe environment for children.

Family child care

The family child care program is an AF program that authorizes child-care in on-base family quarters. AFI 34–276, *Family Child Care Programs,* contains specific guidance on the requirements for giving care to children in family quarters. The purpose of this program is to supplement the child development centers, since it's impossible for them to handle all military and civilian dependents requiring child-care services.

Each program has a family home day care coordinator. As part of the licensing process, the coordinator will notify all the agencies required to conduct inspections, including PH. Public health is required to make an initial inspection of each home and forward recommendation for approval or disapproval to the family home day care coordinator. If approved, a sample of at least 10 percent of the homes is inspected each year.

Before an inspection is conducted, formulate a realistic checklist. The focus of your evaluations is on practices that contribute to the spread of communicable diseases and infections. Your evaluation should focus on the level of general sanitation in the home and the prospective caregiver's personal hygiene and ability to recognize situations when children should not be admitted.

Laundry facilities

Laundry facilities include coin-operated laundries, dormitory laundry rooms, and other base laundry facilities. AFI 48–117, *Public Facility Sanitation* contains specific guidance on the requirements for handling clean and dirty linen in laundry facilities.

During your evaluation, there are several factors you need to keep in mind. Your main concern is the sanitary condition of the facility. Your next concern is the flow of the linen from its arrival at the laundry until it exits at the clean end. Make sure that dirty linen doesn't contaminate the facility or clean linen when being handled, stored, or transported during the laundering process. Linen should arrive at one end of the facility for sorting; then proceed to the wash, dry, and pressing areas.

Family services

Most bases in the AF have a family services facility on the base. This is a non-profit service that is usually run by volunteers. They have a supply of household items such as dishes, bedding, ironing boards, and linens that are loaned to military personnel and dependents to assist them until their household goods arrive. This is usually a free service. When you evaluate this facility and service, your main concern is the procedures for cleaning and disinfecting reusable linens, bedding, and eating utensils. It's also important to consider how and where these items are being stored. The volunteers that run this service often have to settle for a location that is less than desirable. Some facilities may lack the type of sinks needed to properly wash and disinfect food and beverage containers. You may have to work with these people and offer suggestions on cleaning the items, proper storage, and, in some cases, pest management.

Recreational services

You'll no doubt have a recreation supply service at your base, normally operated by Morale, Welfare, and Recreation Services (MWRS). The purpose of this facility is to rent items such as camping, skiing, and other sports equipment. The items for rent vary from base to base, depending on the recreational activities in the area. Your main concern in these facilities is the cleaning, sanitizing, and storing of personal use items, namely such items as sleeping bags, and food and beverage containers.

Recreation facilities

Facilities such as campsites and picnic areas are often located in remote areas on a base or at locations some distance from the base. Your main concern in these recreational areas is the accumulation of garbage and trash. Are there adequate containers and are they emptied frequently? If not, they will attract insects, rodents, and stray animals. If there are restrooms, what condition are they in? Are they

clean and well maintained? Do they have an adequate supply of toilet tissue, soap, and water? Do the doors and screens fit tightly? The frequency of evaluating these areas depends on the climate and when the areas are open for use. Some areas may be open only during the summer, others year round. Other factors to consider include the frequency of use, number of people using an area, and the sanitation history.

Gymnasiums, fitness centers, and swimming pools

With the present day emphasis on health and fitness, most bases have very well equipped gymnasiums and fitness centers. In addition to the usual basketball courts, racquetball courts, and weight rooms, many now have indoor pools, saunas, and whirlpool baths. These all present their own risks as far as sanitation and communicable disease control are concerned. AFI 48–117 and AFI 48–114, *Swimming Pools, Spas, Hot Tubs, and Natural Bathing Areas* has very specific guidance on the construction and maintenance of these facilities. Your job is to ensure facility personnel comply with this guidance and maintain a clean and healthy environment.

Restrooms and toilet facilities

Each restroom must be equipped with tight-fitting, self-closing doors. These doors are to be kept closed except during cleaning or maintenance, and each entryway shall be kept clean and in good repair.

When provided, each restroom will be conveniently located and have hand-washing sinks with soap and running water. If possible, liquid or powdered soap should be used, and each restroom will provide single-use towel dispensers or air dryers. Common-use towels are prohibited.

In order to reduce the opportunity for mold or mildew growth in restrooms, floors need to be constructed of watertight, easy-to-clean materials. Personnel will clean and disinfect bathrooms and toilet fixtures as needed, using a 50-ppm chlorine solution (one teaspoon of household bleach, that is, 05**.**25 percent sodium hypochlorite per gallon of water) or an equally effective sanitizer. All restrooms must have garbage cans for the collection of trash.

Dressing and locker rooms

Each dressing and locker room must be cleaned daily, including the floors. Floors must be disinfected at least once each week using a 50-ppm chlorine solution or an equally effective sanitizer. To ensure proper cleaning and reduce objectionable odors, each area must have adequate lighting and ventilation. In addition to dressing and locker room ventilation, each clothing locker must be ventilated. To ensure safety and prevent mold or mildew growth in wet areas, nonskid, easy-to-clean, and durable floor coverings must be provided. Floor coverings that support bacterial growth must not be used.

Saunas and steam rooms

If your base has an indoor pool and whirlpool bath, are they being monitored by the bioenvironmental engineer (BE)? Keep in mind that whirlpool baths are kept at temperatures around 100°F (37.8ºC) and, consequently, chlorine evaporates more quickly than in a swimming pool. There are also more people in a much smaller body of water, increasing the potential for bacterial multiplication and the need for close monitoring of the chlorine level. It’s very important that people with infections and skin lesions do not use a whirlpool bath. A sign also should be posted near the whirlpool bath to inform people of the potential health problems from heat stress. There should be a requirement for patrons to shower with soap and water prior to entering pools and whirlpool baths. This all boils down to good personal hygiene on the part of patrons and good sanitation on the part of the staff in charge of the facility.

Living quarters

We know you want everyone who resides on base to have a clean, safe, and healthy place to live. However, you do not normally inspect facilities assigned to individuals for private use. However, there are occasions when you may be asked to assist occupants or base officials by making

recommendations for managing a problem in such a facility. Let's discuss factors related to problems in several types of individual living quarters.

Family housing

Ordinarily, you do not inspect family housing unless requested to do so by the occupant or by the base commander. Occupants often call PH when they are experiencing insect or rodent problems. It's advisable to consult with the housing office prior to making such a visit. You may discover that the problem has already been taken care of. You cannot inspect a home based on a neighbor's complaint. The neighbor should direct concerns to the housing officer who will then investigate the situation and call you if necessary.

Billeting facilities

This includes facilities such as billeting officer quarters (BOQ), temporary living quarters (TLQ), and dormitories. As in the case of family housing, you don't normally inspect individual rooms. However, you can inspect common areas, such as kitchens and lounges that are used by all occupants. Other areas you may evaluate include linen storage and housekeeping services.

Contract quarters

At many bases there are insufficient visiting officers and airmen quarters on the base to accommodate all the transient personnel who report to the base. The base must often contract with motels and hotels in the local area to house the overflow. The billeting office lets a contract in the local area to house transient personnel when quarters on base are filled. The billeting office agrees to pay a set price for each room under the contract.

Before a contract is awarded, the motel or hotel under consideration is subject to evaluation by key personnel on the base. A joint evaluation is normally conducted by representatives from billeting, safety, public health, and the fire department. Each representative evaluates the areas of concern and then makes a recommendation to the billeting officer to approve or disapprove the facility's bid for the contract.

As a representative of PH, evaluate the sanitation aspects of the facility, just as you do an on-base facility. In general; is the facility clean, well maintained, and free of insects and rodents? Ask to see an unoccupied guest room and look at the general condition. Is the bathroom clean and odor free? What types of cleaners and sanitizers are used? How often is the linen changed? Observe the housekeeper's cart to determine if clean and dirty linen is handled properly and separately. Ask to see the clean and dirty linen storage areas. Are they separate? Is clean linen subject to contamination? How are drinking glasses and ice buckets cleaned and sanitized in-between guests? How and where is trash disposed? Is there evidence of good insect and rodent control?

Evaluation frequency criteria

As we mentioned earlier, PH conducts evaluations of on-base facilities to ensure the health, welfare, and enjoyment of all people who use them. How often these evaluations are conducted varies from one base to another and one facility to another, based on a number of different factors. Factors that PH considers when recommending the frequency of evaluations include geographical location, local conditions, sanitary history of the facility, potential for public health problems, and the number of people who use the facility.

AFI 48–117 states that the minimal inspection frequency of a public facility is once a year, but this is strictly a minimum. Most facilities need to be considered on an individual basis using the criteria mentioned above. Public health normally determines the frequency using these criteria and then presents it to the AMC for approval. Here again, this establishes a minimum frequency. Public health may evaluate a facility as often as necessary based on local conditions or the potential for health effects. However, if it's found that a facility's frequency of evaluation can be decreased, the AMC must approve it.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

432. Public health

1. What is the primary purpose of public health programs today?

2. Why is it so important for you to promote good sanitation on an AF base?

3. What value are the recommendations you make during a facility evaluation?

4. Why is it important to have good lighting in a facility?

5. Why is garbage and refuse handling important?

6. What is the most important measure in good insect and rodent control?

7. When is the best time to spray for insects in a child development center?

8. Which AFI gives specific guidance on the cleaning and sanitizing procedures in public facilities?

9. Why is good personal hygiene so important for people working in public facilities?

433. Public facility sanitation requirements

1. What should be the focus of your inspection at the beauty and barber shops?

2. Who decides the type and frequency of physical examinations for the barbers on base?

3. What should barbers use to stop the flow of blood?

4. What should be done with manicure and pedicure instruments after they have been used?

5. Why does the child development center provide the perfect environment for spreading disease?

6. Why are diapered children and nondiapered children separated at the child development center?

7. What is the first step in breaking the chain of disease transmission in a child development center?

8. Which AFI provides guidance on the admission of children with illnesses to a child development center?

9. What happens when a child becomes ill while at a child development center?

10. What should be the focus of your evaluation in support of the family day care program?

11. What is your first concern during an evaluation of family services?

12. Why is the management of garbage and trash at picnic areas and campsites so important?

13. When would you conduct an evaluation of private living quarters?

14. When evaluating a BOQ, what areas do you inspect?

15. Who accompanies PH during an evaluation of contract quarters?

16. What are some of the factors considered in determining the frequency of public facility evaluations?

17. What is the minimum frequency for conducting an evaluation of a public facility?

18. Who is the approval authority for the frequency of evaluations?

4–4. Directives and Techniques

We have already mentioned some of the directives outlining the sanitation requirements in various facilities. In this section we review those directives, and we also introduce some others that you need to be aware of when conducting your sanitary evaluations.

434. Facility sanitation directives

In this lesson you'll learn about directives used to conduct facility sanitation evaluations for on-base food facilities. The directives listed in this lesson will provide you with guidance and forms needed to accomplish facility evaluations.

Tri-Service Food Code

The Tri-Service Food Code is the primary reference for sanitation in food facilities. The Food Code applies to both appropriated and nonappropriated fund food facilities. It's imperative that any food service contracts, for any part of the food service operation, include this regulation as a reference. Without this reference, managers of contractor-operated facilities may not be aware of sanitation requirements.

Defense Commissary Agency directives

DeCA directives cover the sanitation of the different departments within the commissary; such as meat, produce, grocery, and customer service departments. Keep in mind that the Food Code is the only directive that we can *enforce* in a food facility. The table below lists DeCA directives and their explanation.

DeCA DIRECTIVES		
Directive	**Title**	**Explanation of Directive**
40–3	Directive, Meat Department Operations	Covers the sanitation of meat departments and delicatessens operated within the commissary. Certain sections give temperature requirements, cleaning and sanitizing procedures, personal hygiene requirements, the prohibition of tobacco use, and the requirements for a self-inspection program.
40–4	Produce Department Operations	Lists procedures to operate the produce department in all DeCA commissaries. The directive is broken down into areas of interest within the produce department, including storage, rotation (first in, first out), handling, and general sanitation.
40–5	Grocery Department Operations	Covers sanitation requirements within the resale store area—the area where customers shop. There is a specific paragraph that discusses the routing of satisfactory and unsatisfactory sanitary evaluations, and it states that the regional commissary officer or commander will ensure corrective action is taken, based on your sanitary evaluation reports.
40–6	Customer Service Department	Sets procedures for the operation of the commissary's customer service department. Customer service operations that involve public health include handling customer complaints (DeCA Form 40–45) and general store sanitation.

Exchange operating procedure

The Exchange Operating Procedure (EOP) 25, Food Operations and 40–11, Special Retail Programs contains the responsibilities of the PH office to provide medical evaluation services to AAFES. The responsibilities are not only in the areas of facility sanitary evaluations and environmental surveys, but food inspection as well. EOP 25 and 40–11 explains the reporting procedures for nonconformances found during an AAFES sanitary evaluation. All unsatisfactory reports are sent to HQ AAFES (food-drug.safety@aafes.com).

AFI 48–116, *Food Safety Program*

This instruction is another primary reference (along with the Tri-Service Food Code) for sanitation in food facilities. It contains information on ensuring that foods are obtained from an approved source and the procedures to conduct a kitchen inspection.

AFI 48–117, *Public Facility Sanitation*

This instruction outlines the sanitation requirements for barber and beauty shops, bathing facilities, laundry facilities, sleeping areas, outdoor recreation areas, and other public facilities. It also presents insect and rodent control procedures for public facilities. It describes the installation and MTF commander's responsibilities concerning sanitation for these facilities.

AFI 34–248, *Child Development Centers*

This instruction specifies in detail the requirements for the operation of a child development center and the family day care homes program. There are sections covering health, safety, personnel, facilities and equipment, operating policies, medical care, sanitation, and food service operations. Use this instruction as a guide when conducting an evaluation of the child development center or family day care homes.

435. Facility evaluation techniques

You have learned the sanitation requirements for food facilities and public facilities, as well as the directives you use to conduct evaluations of these facilities. Now let's look at the evaluation process.

Performing an evaluation

There are steps you must take before performing an evaluation to make sure you're ready to conduct the evaluation. Then, there are certain actions you must complete while performing an evaluation.

Preparation steps

Be prepared before you actually enter a facility to perform an evaluation. Be very familiar with pertinent instructions, have a good idea of what you are likely to find in the facility, and then determine what equipment or supplies you'll need. Finally, decide on the best time to visit the facility.

Review regulations and history

Proper review is a key step to effectively evaluating foodservice facilities. What do you need to review? First, pull the facility folder and review it for trends; that is, discrepancies that never seem to go away!Also, check the time periods of other evaluations. You don't want to be predictable, nor do you want to evaluate facilities during the same times of the day.

Be sure to review regulations and other instructions that pertain to the facility. Being familiar with the requirements will better enable you to relate them to management and workers.

Determine required equipment and supplies

After reviewing a facility's sanitation history and pertinent facility instructions, your next step is to make sure you have all of the equipment needed to evaluate the facility. Equipment might include thermometers (both a holding and baby dial thermometer), paper, pens, chlorine test strips, a flashlight, and a good supply of evaluation forms for both food and public facilities. The bottom line is to be prepared. Know what to evaluate and have the right equipment to test the sanitary conditions of the facility.

Select a time

The time selection is very important. There are many things to consider before selecting the time of the evaluation. First, consider when past evaluations were performed. If many of the evaluations were conducted in the morning and seldom in the afternoon, then schedule the next evaluation in the afternoon. Evaluate facilities during all phases of operation, including after-duty hours. Group the evaluation times into periods such as morning, lunchtime, afternoon, evening, and after-duty hours (which includes weekends).

Procedure

You've completed your preparatory work and now you're ready to start your inspection. While there is no formal set of procedures to follow, below are some guidelines to make your evaluation productive and meaningful.

Notify management

Notify the manager upon your arrival at a facility. This serves several important functions. First, you are telling the manager the purpose of your visit. Since there are many reasons you might visit a facility, it's essential the manager understands why you are there. Try to understand the problems of the facility manager, but at the same time do not jeopardize the sanitation standards that might make someone ill. Establish a good rapport. Remember, you're evaluating to help, not hurt the facility. Storming into a facility like a police raid will shut off communications and cripple your ability to adequately perform the evaluation. If the facility manager knows you're there to help, you'll get a lot more done. Once a rapport is established, invite the manager to join you on the evaluation. Health education is a big part of facility sanitation evaluations. For this reason, it's important the manager, or designated representative, accompany you on the evaluation.

Select a starting point

After notifying the manager and establishing a rapport, select a starting point for your evaluation. Don't let the manager lead you around. You choose the area to begin the evaluation. Be careful not to start every evaluation at the same point. Select the starting point at random to keep your perspective fresh.You may see something this time that you missed during past evaluations.

Take notes

While performing the evaluation, bring a few sheets of plain paper with you to keep track of the discrepancies you find. Also, ask the manager about the sanitation practices you observe. For example, if you find meat thawing on a table, ask how they plan to use it, and how long it will be out at room temperature. If you see a discrepancy, use the opportunity to educate the manager and workers about the possible consequences. Don't forget to annotate how well management is or is not following up on past discrepancies. Do not hesitate to write up management if management is the real problem. Make sure you have all of the facts before you write the report. By taking notes during the evaluation, you're giving yourself a method to recall the discrepancies and to organize your report. Note the temperatures you take and any discrepancies you see, as well as any good practices you notice.

Educate management and workers

The overall purpose of performing sanitary evaluations is to prevent foodborne disease outbreaks. The purpose of identifying discrepancies and writing a report is to provide management with recommendations to correct the discrepancies and prevent them from recurring.The only way to change the behavior of facility workers is to educate them. This process must begin with management, since management has the primary responsibility for educating workers. Timely and effective education results in fewer discrepancies in a facility.

436. Writing evaluation reports and identifying trends

After walking through a facility and making notes of the sanitary conditions, you're ready to type your evaluation report. This should take place at the facility or in the PH office. The form you use will be either a DD Form 2973, *Food Operation Inspection Report*, for a food facility, or a local form or checklist for a public facility. You'll give your recommendations and assign a rating to the facility.

Food facility sanitation evaluations

Use DD Form 2973 to document a food facility evaluation. This form has three functions:

1. Officially notifies the facility management of discrepancies and provides recommendations to correct them.

2. Provides management with information to educate their employees.
3. Provides a follow-up tool to prevent repeat discrepancies.

Evaluate items

First, complete the top section of DD Form 2973, blocks 1–11 which includes the administrative information of the facility. Annotate in Block 12 the appropriate noncompliance for each deficiency identified during the evaluation. The printed items on the DD Form 2973 correspond to Appendex E in the Tri-Service Food Code. Note that those items in the Tri-Service Food Code that are marked with an asterisk (*) are considered to be critical items. Critical items are provisions of the Tri-Service Food Code that, if in noncompliance, are more likely than other violations to contribute to food contamination and increase the risk of a foodborne disease outbreak.

Document observations

Provide a detailed and concise summary of the deficiencies marked in *Compliance Status* (block 12) section; all item numbers must be addressed in the *Remarks* (block 17) section. To satisfy the intent of why you are doing sanitary evaluations, the *Remarks* section should have the following three parts:

1. List the *Item Number* and the provision that is not being followed. In other words, what deficiency was observed?
2. Was the deficiency "corrected on-site" (COS)?
3. What "corrective actions" where taken to correct the noted violations at the time of inspection?

Example: *Item Number*: 7.

[2–303.11]—Cook observed wearing three rings with gemstone and a dangling bracelet. Item were COS. Only a single, plain band-style ring may be worn.

Inspection types

The five types of food safety and sanitation inspections are listed and described in the table below.

FIVE TYPES OF FOOD AND SANITATION INSPECTIONS	
Inspection	**Description**
Routine	Unannounced, formal sanitary inspections conducted as part of regular, ongoing public health surveillance activities.
Follow-up	Announced, formal sanitary inspections that are limited in focus, depending on the circumstances triggering the inspection.
Compliant	Initiated in response to a customer complaint involving a food establishment and/or food related public health issue. The investigation shall be conducted within 24 hours of the reported issue or as soon as reasonably feasible based on the PH inspector's mission priority and operation tempo.
Preoperational	Conducted on new or modified food establishments. The inspection provides assurance that a food establishment can safely store, prepare, serve, or sell food.
Other (Walk Through)	Informal, sanitary inspections performed to assist management in preventing FBIs, protecting the public's health, and maintaining the establishment in a sanitary condition. Also, the inspection is used to identify potential problems with facilities, equipment, or food handling procedures and to initiate corrective actions before a formal sanitary inspection is conduct.

Inspection rating

At the conclusion of the inspection, report the total number of inspection items containing critical and noncritical violations.

First, count the number of inspection items containing a critical violation by counting the number of boxes checked in items 1–51 (DD Form 2973) that contain an asterisk; include non-asterisked items containing critical provisions (bold font) that were circled within the item grouping. If multiple critical violations were noted in a single item grouping, score the critical violation only once for that group.

For example, if two violations occurred in item 15, one for provision 3–302.11* and one for 3–304.11*, each would be circled, but only 1 point would be added to the total number of critical items when the scoring the inspection report. Place the total number of critical items under Block 10, *Number and Type of Violations.*

Next, count the number of inspection items containing noncritical violations by counting the number of boxes checked in items 1–51 that do not contain an asterisk and did not contain a critical violation circled within the provision grouping. If multiple violations were noted in a single item grouping, score the noncritical violation only once for that group. Place the total count in the space provided under Block 10, *Number and Type of Violations.*

Determine if the deficiency is an imminent health hazard (IHH). By definition a IHH is a significant threat or danger to health that is considered to exist when there is evidence sufficient to show that a product, practice, circumstance, or event creates a situation that requires immediate correction or stop of operation to prevent injury based on: the number of potential injuries or illness and the nature, severity, and duration of the anticipated injury or illness.

At the conclusion of the inspection, score the food operation's level of compliance of Code provisions using the following criteria:

- Fully Compliant = no deficiencies.
- Substantially Compliant = No IHH; ***and*** 2 or less critical findings (all COS); ***and/or*** 5 or less non-critical findings.
- Partially Compliant = No IHH; ***and*** 3 or more critical findings (all COS); ***and/or*** 6 or more non-critical findings.
- Non-Compliant = an IHH is present; ***or*** 1 or more critical findings were not COS.
    - Follow-up inspection must occur within five calendar days of the non-compliant inspection.
    - Follow-up inspections are optional for all other inspection ratings and are not required to conform to the 5-day rule or to be announced.

NOTE: An IHH is a critical finding. Always look for the IHH first, the number of critical findings second, and then the number of non-critical findings when determining the inspection rating. If an IHH was found at the beginning of the inspection, but was COS and a complete remediation of the situation occurred by the end of the inspection, an IHH is no longer considered "present" as stated in the condition for scoring the facility non-compliant.

Public facility sanitation evaluations

There is no standard AF form to report a public facility sanitation evaluation. Each PH office establishes criteria for rating these facilities. Many offices use a separate checklist developed for specific facilities such as gymnasiums, barber and beauty shops, and laundry services. The evaluations are basically the same as for food facilities. The ratings are the same, and you brief management in a similar manner. The only difference is the form used to document your evaluation. You write up the results of your evaluations in a report similar to the example in AFI 48–117. All marginal and unsatisfactory reports require follow-up evaluations if public health deems them necessary. For AAFES facilities found to be unsatisfactory, the PH officer must send a copy of the report to the local Exchange manager and to AAFES headquarters (food-drug.safety@aafes.com).

Trend analysis

A trend analysis is the tracking of data in one specific area for a period of time and then analyzing the data. Public health personnel use trend analyses to identify sanitary trends in food and public facilities. The analyses also can be used to determine the effectiveness of management practices.

Poor sanitation trends over a period of time can indicate a management problem. Trend analyses are excellent tools to keep commanders and managers informed of the status of base food service and public facilities. The facility managers use this analysis to prevent future discrepancies.

Self-Test Questions

After you complete these questions, check your answers at the end of the unit.

434. Facility sanitation directives

1. What are the two primary documents used for the medical evaluation of food facilities?

2. What does EOP 25 contain?

3. What regulation do you use to evaluate sanitation procedures performed in public facilities?

4. Use AFI 34–248 to evaluate what two facilities?

435. Facility evaluation techniques

1. What is the first step in preparing for a sanitation evaluation?

2. What are some considerations for selecting the time of an evaluation?

3. Why would you take a few sheets of plain paper with you on an evaluation?

4. What is the overall purpose of performing sanitary evaluations?

436. Writing evaluation reports and identifying trends

1. Name the three functions of the DD Form 2973 when used to evaluate food facilities.

2. What are the three parts used to document observations of a deficiency on a DD Form 2973?

3. What are the four different ratings you can give a facility?

4. How soon is a follow-up inspection conducted after a non-compliant food facility sanitation rating has been given?

5. Who establishes criteria for rating public facilities on a base?

6. How do you report unsatisfactory AAFES public facility sanitation evaluations?

7. How do PH personnel use trend analysis reports?

Answers to Self-Test Questions

425

1. Any person who works with unpackaged food, food equipment or utensils, or food contact surfaces in any way.
2. Raw dairy products, seafood from polluted waters, and home-canned foods.
3. The CDC reports this is a contributing factor for about 26 percent of reported outbreaks of foodborne disease. Certain microorganisms grow rapidly in food even while cooling in the refrigerator. Also, the time and extra handling involved can contribute to contamination.
4. *Salmonella* contamination.
5. Failure to keep hazardous foods at proper temperatures.
6. Malfunctioning freezers or refrigerators, thawing frozen foods at room temperature, and failing to store foods in shallow pans for more rapid cooling.
7. Cold—41°F or below; hot—135°F or above.

426

1. The PIC.
2. Report to the medical facility or his or her health care provider and the PIC.
3. AF Form 1021 or an SF 600 or SF 600 overprint.
4. Facility supervisors.
5. PH; annually.
6. They should clean their hands, exposed portions of their arms, and areas underneath the fingernails and between the fingers by vigorously rubbing together the surfaces of their lathered hands and arms for at least 20 seconds, and thoroughly rinsing with clean water.
7. Four hours.
8. In the refrigerator, by cooking, microwave oven if transferred to a conventional oven immediately following thawing, in a rapid thaw cabinet, at room temperature, or under potable running water of 70°F or lower provided the velocity is strong enough to agitate off the loose particles. NOTE: the temperature must never exceed 41°F.
9. At least six inches above the floor to make cleaning under the food items easier.

427

1. Type of soil, water, surface, pressure, duration, and cleaning agents.
2. Reducing the microbial contamination of an object to a safe, consumable level.
3. Usually the MTF commander.

4. At least 171°F for at least 30 seconds.
5. Iodine for 30 seconds and chlorine for 10 seconds.

428

1. NSF Standards; NSF Reference Guide and the Tri-Service Food Code.
2. Near an outside wall with easy access to hook up to trucks. This will make cleaning easier and will not contaminate any food contact surface.
3. To ensure the equipment fits into the area designed for that specific function.

429

1. Must not be located where it can be contaminated by road dirt, waste discharge, oil, or grease. The inlet must be used only for adding potable water into the tanks.
2. 15 percent larger.
3. A food establishment that operates for a period of no more than 14 consecutive days in conjunction with a single event or celebration.
4. A concession stand near the base softball fields or booths open during a base open house.
5. 30 minutes for cold and two hours for hot vending machines.
6. The AMC.
7. AF Form 661.

430

1. A patient’s resistance to infection may be compromised, increasing the chances of a foodborne disease outbreak when food is mishandled.
2. To keep the food warm as it is delivered to the hospital patients in their rooms.
3. To provide meals for aircrew members, flight line personnel, and aircraft passengers.
4. It must be discarded.
5. Potentially hazardous leftovers.

431

1. The AF does not allow hot foods to be stored on board these aircraft.
2. BES.
3. AMC contracts and any additional guidelines HQ AMC/SGPM provides.
4. An evaluation performed on commercial establishments when they request to sell to the government.
5. Initial, routine, and special.
6. An evaluation done to determine the current sanitary status of a commercial establishment.
7. If food from the establishment is thought to be contaminated or unwholesome, or if significant sanitary discrepancies are found during a routine evaluation.

432

1. To establish and maintain conditions necessary for the prevention of disease.
2. To ensure a level of sanitation that prevents illness and to ensure personnel are ready to serve should the situation arise.
3. Based on your observations you can make recommendations to your superiors on ways to control, modify, or eliminate any problems you find.
4. If people can’t see dirt, they probably won’t clean it.
5. To discourage the attraction of insects and rodents.
6. Good sanitation.
7. Immediately after it closes for the day.
8. AFI 48–117.
9. To avoid passing infections or diseases between patrons or between themselves and patrons.

433

1. Personal hygiene and sanitation practices.
2. AMC.
3. Sterile individual applicator with an appropriate powder or liquid.
4. The instruments should be thoroughly cleaned and disinfected after each use.
5. Children are clustered in a confined area and exposed to more diseases because they are exposed to more children.
6. The personal hygiene of children in diapers is questionable. Children under the age of two are silent carriers for the Hepatitis A virus, which is shed in the feces.
7. Good personal hygiene.
8. AFI 34–248.
9. The child should be moved to an isolation room until the parent or guardian arrives.
10. Practices that contribute to the spread of communicable diseases and infections, and general sanitation and personal hygiene of the family day care home providers.
11. Procedures for cleaning and disinfecting of reusable linens, bedding, and eating utensils.
12. Because garbage and trash attracts insects, rodents, and stray animals.
13. When requested by the base commander or a representative, or the occupant.
14. Common areas such as kitchens, lounges, linen storage, and housekeeping services.
15. Representatives from billeting, base safety, and the fire department.
16. Geographical location, local conditions, sanitary history, physical condition of the facility, potential for public health problems, and number of people who use the facility.
17. Annually.
18. Aerospace Medical Council.

434

1. Tri-Service Food Code and AFI 48–116.
2. The responsibilities of the public health office for providing medical evaluation services to AAFES.
3. AFI 48–117.
4. Child development centers and family day care homes program.

435

1. Review the facility folder for its history of sanitation evaluations.
2. Consider past evaluations, phases of the facility's operation, and whether the facility operates after normal duty hours.
3. To take notes of discrepancies while walking through the facility.
4. To prevent foodborne disease outbreaks.

436

1. (1). Officially notifies the facility management of discrepancies and provides recommendations to correct them.

   (2). Provides management with information to educate their employees.

   (3). Provides a follow-up tool to prevent repeat discrepancies.
2. (1). List the *Item Number* and the debited provision. What deficiency was observed?

   (2). Were *item* "corrected on-site" (COS)?

   (3). What "corrective actions" where taken to correct the noted violations at the time of inspection.
3. Fully Compliant, Substantially Compliant, Partially Compliant, and Non-Compliant.
4. Within 5 calendar days.
5. Each base's PH office establishes its own criteria.

6. By sending a copy of the report to the local Exchange manager and one to AAFES headquarters.
7. To identify sanitary trends in food facilities, identify the effectiveness of management practices, and to evaluate the inspection practices of PH.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field-Scoring Answer Sheet.

Do not return your answer sheet to the Air Force Career Development Academy (AFCDA).

60. (425) Who is responsible for ensuring the food facility operations comply with the foodborne disease outbreak preventive measures listed in the Tri-Service Food Code?
    a. Person in charge.
    b. Dining hall manager.
    c. Food preparations officer.
    d. Facility operations manager.

61. (425) Adding raw ingredients to foods already cooked is an example of which contributing factor to foodborne disease outbreaks?
    a. Failure to keep potentially hazardous foods at proper temperatures.
    b. Failure to clean and sanitize food contact surfaces properly.
    c. Failure to cook foods thoroughly.
    d. Cross contamination of foods.

62. (426) What organization establishes the criteria for the type and frequency of medical examinations that are required for food service employees?
    a. Aerospace Medicine Council.
    b. Food and Drug Administration.
    c. Center for Disease Control and Prevention.
    d. Foodborne Illness and Disease Administration.

63. (426) Which statement *best* describes hand-washing procedures that food employees should follow to prevent the spread of disease?
    a. Wash hands with soap and water for at least 10 seconds.
    b. Vigorously rub hands and arms with soap and water for 20 seconds.
    c. Wash hands twice after handling potentially contaminated beef or poultry.
    d. Wash and sanitize hands and arms after using the restroom or touching one's nose.

64. (426) Which method of thawing potentially hazardous food prior to cooking is the *least* preferred?
    a. In a refrigerator.
    b. Under running water.
    c. In a microwave oven.
    d. In a rapid thaw cabinet.

65. (426) At least how many inches above the floor should foods be stored to provide for easier cleaning?
    a. 4.
    b. 6.
    c. 8.
    d. 10.

66. (427) The purpose of a cleaning agent is to
    a. sanitize the surface being cleaned.
    b. dissolve the soil from the surface being cleaned.
    c. lift soil from the surface being cleaned and keep it suspended.
    d. loosen the soil where the surface can then be scrubbed to remove all the soil.

67. (427) There are three main types of cleaning agents: alkaline, acid, and
    a. bleach.
    b. abrasive.
    c. ammonia.
    d. disinfectant.

68. (427) Which defines the term *sanitized?*
    a. Removal of visible soils from a surface or area.
    b. Removal of the microbial contamination of an object or surface.
    c. Reduction of visible soils on a surface or area.
    d. Reduction of the microbial contamination of an object or surface.

69. (428) Why is the design of the outside back dock area important in a facility where food is being prepared?
    a. Allow management to monitor the dock entrance for security.
    b. First line of defense against insects and rodents.
    c. Give the workers a designated smoke area.
    d. Allow the delivery truck easy access.

70. (429) When, if ever, may normal metal utensils be used for preparing foods and serving them to patrons of a mobile food facility?
    a. When they can be washed and sanitized properly.
    b. When running water is available in the mobile facility.
    c. Never, they are not authorized on mobile facilities.
    d. Never; only single-use items are permitted.

71. (429) Which statement meets the requirements for dairy products in an approved vending machine?
    a. Keep refrigerated below 41°F, and pull after seven days.
    b. Keep refrigerated below 30°F, and pull after seven days.
    c. Coded, and removed by the manufacturer’s expiration date.
    d. Coded, and removed one day before the manufacturer’s expiration date.

72. (429) Which organization *evaluates* the sanitary conditions of vending machines?
    a. Base Vending Machine Advisory Council.
    b. Aerospace Medical Council.
    c. Center for Disease Control.
    d. Public health flight.

73. (430) Which is the *primary* reason why hospital kitchens differ from other food facilities?
    a. Hospital kitchens have a unique mission.
    b. All hospital patients have special dietary requirements.
    c. Hospital kitchens need to be larger and more specialized.
    d. Hospital patients are more susceptible to a foodborne disease outbreak.

74. (430) Which is the shelf life for frozen meals when they are to be used in-flight?
    a. Three months.
    b. Six months.
    c. Nine months.
    d. One year.

75. (431) Who is responsible for sampling the water aboard *commercial aircraft* that are under contract with the Air Force?
    a. Bioenvironmental engineering section.
    b. Base civil engineering squadron.
    c. Director, Base Medical Services.
    d. Chief, Environmental Health.

76. (431) After an establishment gains approval to sell its product to a base, it must continue to be inspected at a frequency established by the Aerospace Medicine Council. What are these inspections called?
    a. Follow-up.
    b. Routine.
    c. Special.
    d. Update.

77. (432) When is the most appropriate time to have a child development facility sprayed with insecticides or pesticides to control insects and rodents?
    a. During the time the children are outside playing.
    b. Early in the morning prior to opening.
    c. Immediately after closing for the day.
    d. Only during holidays or weekends.

78. (433) At a minimum, how often should base public facilities be evaluated?
    a. Bimonthly.
    b. Monthly.
    c. Semiannually.
    d. Annually.

79. (434) Which Defense Commissary Agency (DeCA) directive covers the prohibition of tobacco use by employees and the requirements for a self-inspection program?
    a. 40–3, *Meat Department Operations.*
    b. 40–4, *Produce Department Operations*.
    c. 40–5, *Grocery Department Operations*.
    d. 40–6, *Customer Service Department*.

80. (435) Changing the behavior of food facility workers begins with
    a. the workers.
    b. management.
    c. food producers.
    d. policies and procedures.

81. (436) Which sanitary inspection is announced, is formal, and limited in focus?
    a. Follow-up.
    b. Compliant.
    c. Walk through.
    d. Preoperational.

Student Notes

Glossary of Abbreviations and Acronyms

AAFES	Army and Air Force Exchange Service
AF	Air Force
AFI	Air Force instruction
AFIOH	Air Force Institute for Operational Health
AFJMAN	Air Force Joint Manual
AFPC	Air Force Personnel Center
AIDS	Acquired Immunodeficiency Syndrome
AKT	approximate keeping time
AMC	Aerospace Medicine Council or Air Mobility Command
AMS	Agricultural Marketing Service
AQL	acceptable quality level
Aw	water activity
BE	bioenvironmental engineer
BES	Bioenvironmental Engineering Services
BOQ	billeting officer quarters
BPA	blanket purchase agreement
C	Celsius
CA	controlled atmosphere
CDC	Centers for Disease Control and Prevention
CONUS	continental United States
COS	corrected on site
CPI	closed package inspection
CQAE	contract quality assurance element
DeCA	Defense Commissary Agency
DHU	defects per hundred units
DLA	Defense Logistics Agency
DLAR	Defense Logistics Agency Regulation
DOD	Department of Defense
DODISS	Department of Defense Index of Standards and Specifications
DOP	date of pack
DOPI	destructive open package inspection
DPSC	Defense Personnel Support Center
DSCP	Defense Supply Center Philadelphia

EOP	Exchange Operating Procedure
ESR	Exchange Service regulation
F	Fahrenheit
FBI	foodbourne illness
FDA	Food and Drug Administration
FF&V	fresh fruits and vegetables
FIFO	first in, first out
FSIA	Food Safety and Inspection Service
FSR	first strike rations
GRAS	generally recognized as safe
H&S	heat and serve
HAV	hepatitis A virus
HQ	headquarters
HSC	Health Services Command
IAW	in accordance with
ICSSL	Interstate Certified Shellfish Shipper's List
IHH	imminent health hazzard
IMSL	Interstate Milk Shipper's List
ITD	inspection test date
KGy	kilogrey
MAJCOM	major command
MIL-STD	military standard
MRE	meal, ready-to-eat
MTF	medical treatment facility
MWRS	Morale, Welfare, and Recreation Services
NAMA	National Automatic Merchandising Association
NCO	noncommissioned officer
NCOIC	noncommissioned officer in charge
NOAA	National Oceanic and Atmospheric Administration
NSF	National Sanitation Foundation
NSN	national stock number
º	degrees
OIC	officer in charge
OPI	open package inspection

PCE	primary care element
PES	Physical Examinations and Standards
pH	potential hydrogen
PH	public health
PHF	potentially hazardous foods
PHO	Public Health Office
PIC	person in charge
ppm	parts per million
PUFI	Packed Under Federal Inspection
QAE	quality assurance element
QAP	quality assurance provisions
ROA	recurring ordering agreement
ROA	Resale Ordering Agreement
SCR	sanitary compliance rating
SDE	Surveillance Directorate, Epidemiological Surveillance Division
SQL	serviceability quality level
SV	services directorate
TDY	temporary duty
TISA	troop issue subsistence activities
TLQ	temporary living quarters
TRD	Transportation Descrepancy Report
UBL	unit basic loads
UGR	unitized group ration
UGR-E	Unitized Group Ration-Express
UHT	ultra-high temperature
UMR	unsatisfactory material report
USDA	United States Department of Agriculture
USDC	United States Department of Commerce
WHO	World Health Organization

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