

chapter five

Food and kitchen safety

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he importance of storing and preparing food properly cannot be overemphasized. In addition to the precautions necessary to guard against food-borne illness, care must also be taken to avoid accidents involving staff or guests. Practicing and monitoring safe procedures will keep both your employees and customers safe from food-borne illness and injury.

Food-borne illness

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Food contaminants

Food can serve as a carrier of many different illnesses. The most common symptoms of food-borne illnesses include abdominal cramps, nausea, vomiting, and diarrhea, possibly accompanied by fever. The symptoms may appear within a matter of hours after consumption of the affected food, but in some cases several days may elapse before onset. In order for food-borne illness to be officially declared an outbreak, it must involve two or more people who have eaten the same food, and it must be confirmed by health officials.

Food-borne illnesses are caused by adulterated foods (foods unfit for human consumption). The severity of the illness depends on the amount of adulterated food ingested and, to a great extent, the individual's susceptibility. Children, the elderly, and anyone whose immune system is already under siege will generally have much more difficulty than a healthy adult in combating a food-borne illness.

The source of the contamination affecting the food can be chemical, physical, or biological. Insecticides and cleaning compounds are examples of *chemical contaminants* that may accidentally find their way into foods. *Physical contaminants* include such things as bits of glass, rodent hairs, and paint chips, which might cause injury as well as illness. Careless food handling can mean that a plastic bandage or an earring could fall into the food and result in illness or injury.

Biological contaminants account for the majority of food-borne illnesses. These include naturally occurring poisons, known as *toxins*, found in certain wild mushrooms, rhubarb leaves, and green potatoes, among other plants. The predominant biological agents, however, are disease-causing microorganisms known as *pathogens*, which are responsible for up to 95 percent of all food-borne illnesses. Microorganisms of many kinds are present virtually everywhere, and most are helpful—even essential—or harmless; only about 1 percent of microorganisms are actually pathogenic.

Food-borne illnesses caused by biological contaminants fall into two subcategories: intoxication and infection. *Intoxication* occurs when a person consumes food containing toxins from bacteria, molds, or certain plants and animals. Once in the body, these toxins act as poison. Botulism is an example of an intoxication. In the case of an *infection*, the food eaten by an individual contains large numbers of living pathogens. These pathogens multiply in the body and usually attack the gastrointestinal lining. Salmonellosis is an example of an infection. Some food-borne illnesses have characteristics of both an intoxication and an infection. *E. coli* O157:H7 is an agent that causes such an illness.

The specific types of pathogens responsible for food-borne illnesses are fungi, viruses, parasites, and bacteria.

FUNGI, which include molds and yeast, are more adaptable than other microorganisms and have a high tolerance for acidic conditions. They are more often responsible for food spoilage than for food-borne illness. Fungi are important to the food industry in the production of cheese, bread, and wine and beer.

VIRUSES do not actually multiply in food, but if through poor sanitation practice a virus contaminates food, consumption of that food may result in illness. Infectious hepatitis, caused by eating shellfish harvested from polluted waters (an illegal practice) or by poor hand-washing practices after using the bathroom, is an example. Once in the body, viruses invade a cell (called the *host cell*) and essentially reprogram it to produce more copies of the virus. The copies leave the dead host cells behind and invade still more cells. The best defenses against food-borne viruses are purchasing shellfish only from certified waters and maintaining good personal hygiene.

PARASITES are pathogens that feed on and take shelter in another organism, also called a host. The host receives no benefit from the parasite, and in fact suffers harm, or even death, as a result. Amoebas and various worms, such as *Trichinella spiralis*, which is associated with pork, are among the parasites that contaminate foods. Different parasites reproduce in different ways. An example is the parasitic worm that exists in the larval stage in muscle meats. Even after it is consumed by a human being or another animal, its life cycle, and reproductive cycle, continue. When larvae reach adult stage, the fertilized female releases more eggs, which hatch and travel to the muscle tissue of the host, and the cycle continues.

BACTERIA are responsible for a significant percentage of biologically caused food-borne illnesses. In order to better protect food during storage, preparation, and service, it is important to understand the classifications and patterns of bacterial growth. Bacteria are classified by their requirement for oxygen, by the temperatures at which they grow best, and by their spore-forming abilities. *Aerobic bacteria* require the presence of oxygen. *Anaerobic bacteria* do not require oxygen and may even die when exposed to it. *Facultative bacteria* are able to function with or without oxygen. In terms of sensitivity to temperature, bacteria fall into the following categories:

1. **MESOPHILIC** bacteria grow best between 60° and 100°F/16° and 38°C. Because the temperature of the human body as well as of commercial kitchens falls within that range, mesophilic bacteria tend to be the most abundant and the most dangerous.
2. **THERMOPHILIC** bacteria grow most rapidly between 110° and 171°F/43° and 77°C.
3. **PSYCHROPHILIC** bacteria prefer cooler temperatures, between 32° and 60°F/0° and 16°C.

Bacterial growth and hazardous foods

Many bacteria reproduce by means of fission: One bacterium grows and then splits into two bacteria of equal size. These bacteria divide to form four, the four form eight, and so on. Under ideal circumstances, bacteria will reproduce every twenty minutes or so. In about twelve hours, one bacterium can multiply into sixty-eight billion bacteria, more than enough to cause illness.

Certain bacteria reproduce via sporulation: They are able to form endospores, which protect them against adverse circumstances such as high temperatures or dehydration. Endospores allow an individual bacterium to resume its life cycle if favorable conditions should recur.

Bacteria require three basic conditions for growth and reproduction: a protein source, readily available moisture, and a moderate pH level. The higher the amount of protein in a food, the greater its potential as a carrier of a food-borne illness. The amount of moisture available in a food is measured on the water activity (*A_w*) scale; this scale runs from 0 to 1, with 1 representing the *A_w* of water. Foods with a water activity above 0.85 can support bacterial growth.

A food's relative acidity or alkalinity is measured on the scale known as pH. A moderate pH—a value between 4.6 and 10 on the scale, which ranges from 1 to 14—is best for

bacterial growth, and most foods fall within that range. Adding a highly acidic ingredient, such as vinegar or citrus juice, to a food can lower its pH and extend its shelf life, making it less susceptible to bacterial growth.

Many foods meet the three conditions necessary for bacterial growth and are therefore considered to be potentially hazardous. Meats, poultry, seafood, tofu, and dairy products (with the exception of some hard cheeses) are all categorized as potentially hazardous foods. Foods do not have to be animal-based to contain protein, and cooked rice, beans, pasta, and potatoes are also potentially hazardous, as are sliced melons, sprouts, and garlic-and-oil mixtures.

Food that contains pathogens in great enough numbers to cause illness may still look and smell normal. Disease-causing microorganisms are too small to be seen with the naked eye, so it is usually impossible to visually ascertain that food is adulterated. And because the microorganisms—particularly the bacteria—that cause food to spoil are different from the ones that cause food-borne illness, food may be adulterated and still have no “off” odor.

Although cooking will destroy many of the harmful microorganisms that may be present, careless food handling after cooking can reintroduce pathogens that will grow even more quickly, without competition for food and space from the microorganisms that cause spoilage. Although shortcuts and carelessness do not always result in food-borne illness, inattention to detail increases the risk of an outbreak that may cause serious illness or even death. The expenses a restaurant can incur as the result of an outbreak of food-borne illness can be staggering. In addition, negative publicity and loss of prestige are blows from which many restaurants can simply never recover.

Avoid cross contamination

Many food-borne illnesses are a result of unsanitary handling procedures in the kitchen. Cross contamination occurs when disease-causing elements or harmful substances are transferred from a contaminated surface to a heretofore uncontaminated one. To avoid cross contamination, adhere to the following practices.

Good personal hygiene is one of the best defenses against cross contamination. The employee who reports for work when he or she has a contagious illness or an infected cut on his or her hand puts every customer and other employees at risk. Any time your hands come in contact with a possible source of contamination, especially your face, hair, eyes, and mouth, they should be thoroughly washed before you continue work.

Food is at greatest risk of cross contamination during the preparation stage. Ideally, separate work areas and cutting boards should be used for raw and cooked foods. Equipment and cutting boards should always be cleaned and thoroughly sanitized between uses. For example, before cutting a piece of pork on the same surface you used to cut chicken, it is important to clean and sanitize not only the cutting surface, but also your hands, the knife, and the sharpening steel. Wiping cloths for this purpose should be held in a double-strength sanitizing solution and placed near each workstation to encourage use.

All food must be stored carefully to prevent contact between raw and cooked items. (See “Receive and Store Foods Safely,” page 75.) Do not handle ready-to-eat foods with bare hands. Instead, use a suitable utensil (deli tissue, spatula, tongs, or the like) or single-use food-handling gloves (intended to be used only for a single task and replaced before beginning a new task).

proper hand washing

To cut down on cross contamination and avoid spreading illness, wash your hands as often as you need to, and wash them correctly. The 1999 Food and Drug Administration (FDA) Model Food Code states that hands and forearms should be washed using soap and 110°F/43°C water for twenty seconds. Wash your hands at the beginning of each shift and each new task, after handling raw foods, after going to the bathroom, and after handling money or other nonfood items, to mention just a few points in the workday.

First wet your hands, then apply soap. Use enough soap to work up a good lather. Use a nail brush to clean under your nails and around the cuticles if necessary, and scrub well. (It takes about ten seconds to sing “Happy Birthday”; in order to be sure you have lathered for twenty seconds, try singing this song to yourself twice while washing your hands.) Rinse your hands thoroughly in warm water, and dry them completely using paper towels.

Keep foods out of the danger zone

An important weapon against pathogens is the observance of strict time and temperature controls. Generally, the disease-causing microorganisms found in foods need to be present in significant quantities in order to make someone ill. (There are exceptions, however, *E. coli* 0157:H7 being one.) Once pathogens have established themselves in a food source, they will either thrive or be destroyed, depending upon how long foods are in the danger zone of 41° to 140°F/5° to 60°C.

There are pathogens that can live at all temperature ranges. For most of those capable of causing food-borne illness, the friendliest environment is one with temperatures from 41° to 140°F/5° to 60°C—the danger zone. Most pathogens are either destroyed or will not reproduce at temperatures above 140°F/60°C. Storing food at temperatures below 41°F/5°C will slow or interrupt the cycle of reproduction. (It should be noted that intoxicating pathogens may be destroyed during cooking, but any toxins they have already produced are still there.)

When conditions are favorable, pathogens can reproduce at an astonishing rate. Therefore, controlling the time during which foods remain in the danger zone is critical to the prevention of food-borne illness. Foods left in the danger zone for longer than four hours are considered adulterated. Additionally, one should be fully aware that the four-hour period does not have to be continuous, but is in fact cumulative—which means that the meter starts running again each time the food enters the danger zone. Once the four-hour period has been exceeded, foods cannot be recovered by heating, cooling, or any other method.

Receive and store foods safely

It is not unheard of for foods to be delivered to a food-service operation already contaminated. To prevent this from happening to you, inspect all goods to be sure they arrive in sanitary conditions. Make a habit of checking delivery trucks for signs of unsanitary conditions such as dirt or pests. If the truck is a refrigerated or freezer unit, check the ambient temperature inside to see that it is adequate. Use a thermometer to check the temperature of the product as well. Check expiration dates, and verify that foods have the required government inspection and certification stamps or tags. Randomly sample bulk items, as well as individual packages within cases. Reject any goods that do not meet your standards.

Once you have accepted a delivery, move the items immediately into proper storage conditions. Break down and discard cardboard boxes as soon as possible, because they provide nesting areas for insects, especially cockroaches.

Refrigeration and freezing units should be cleaned regularly. They should be equipped with thermometers to make sure that the temperature remains within a safe range. Although in most cases chilling will not actually kill pathogens, it does drastically slow down their reproduction. In general, refrigerators should be kept at between 36° and 40°F/2° and 4°C, but quality is better served if certain foods can be stored at specific temperatures:

Meat and poultry	32° to 36°F/0° to 2°C
Fish and shellfish	30° to 34°F/-1° to 1°C
Eggs	38° to 40°F/3° to 4°C
Dairy products	36° to 40°F/2° to 4°C
Produce	40° to 45°F/4° to 7°C

Using separate refrigerators for each of these categories is ideal, but if necessary, a single unit can be divided into sections. The front of the box will be the warmest area, the back the coldest.

Reach-in and walk-in refrigerators should be put in order at the end of every shift. Before it is put in the refrigerator, food should be properly cooled, stored in clean containers, wrapped, and labeled clearly with the contents and date. Place drip pans beneath raw foods to catch drips and prevent splashing, and store raw products below and away from cooked foods to prevent cross contamination by dripping. Because air circulation is essential for effective cooling, avoid overcrowding the box, and make sure the fan is not blocked.

Do not stack trays directly on top of food: This will reduce the amount of air that can circulate and may also result in cross contamination. Use the principle of “first in, first out” (FIFO) when arranging food, so that older items are in the front.

Dry storage is used for foods such as canned goods, spices, condiments, cereals, and staples such as flour and sugar, as well as for some fruits and vegetables that do not require refrigeration and have low perishability. As with all storage, the area must be clean, with proper ventilation and air circulation. Foods should not be stored directly on the floor or against the walls, and there must be adequate shelving to prevent overcrowding. The FIFO system should be practiced here as well, and all containers should be labeled with a date. Cleaning supplies should be stored in a separate place from foods.

Hold cooked and ready-to-serve foods safely

Keep hot foods hot and cold foods cold. Use hot-holding equipment (steam tables, double boilers, bain-maries, heated cabinets or drawers, chafing dishes, and so on) to keep hot foods at or above 140°F/60°C. (Do not use hot-holding equipment for cooking or reheating; it cannot be counted on to raise the temperature of the food through the danger zone quickly enough.)

Use cold-holding equipment (ice or refrigeration) to keep cold foods at or below 41°F/5°C. If using ice, the foods should be in a container of some sort, not directly on the ice. Use a perforated insert and drip pan to allow melting ice to drain away from foods.

Cool foods safely

One of the leading causes of food-borne illness is improperly cooled foods. Cooked foods that are to be stored need to be cooled down to below 41°F/5°C as quickly as possible. Cooling to below 41°F/5°C should be completed within four hours or less, unless you use the two-stage cooling method endorsed by the FDA in its 1999 Model Food Code. In the first stage of this method, foods should be cooled down to 70°F/21°C within two hours; in the second stage, foods should reach 41°F/5°C or below within an additional four hours, for a total cooling time of six hours.

The proper way to cool hot liquids is to transfer them to a metal container (plastic containers insulate rather than conduct heat), then place the container in an ice water bath that reaches the same level as the liquid inside the container. Bricks or a rack set under the container will allow the cold water to circulate better. Stir the liquid in the container frequently so that the warmer liquid at the center mixes with the cooler liquid at the edges of the container, bringing the overall temperature down more rapidly. Stirring also discourages potentially dangerous anaerobic bacteria from multiplying at the center of the mixture.

Semisolid and solid foods should be refrigerated in single layers in shallow containers, to allow greater surface exposure to the cold air and thus quicker chilling. For the same reason, cut large cuts of meat or other foods into smaller portions, cool to room temperature, and wrap before refrigerating.

Reheat foods safely

Improperly reheated foods are another frequent cause of food-borne illness. When foods are prepared ahead and then reheated before serving, they should move through the danger zone as rapidly as possible and be reheated to at least 165°F/74°C for at least fifteen seconds. As long as proper cooling and reheating procedures are followed each time, foods may be cooled and reheated more than once.

Food handlers must use the proper methods and equipment for reheating potentially hazardous foods, which should be brought to the proper temperature over direct heat (burner, flattop, grill, or conventional oven) or in a microwave oven. A steam table will adequately hold reheated foods above 140°F/60°C, but it will not bring foods through the danger zone quickly enough to be used for reheating them.

Always use an instant-read thermometer to check temperatures; carefully clean and sanitize the thermometer after each use.

Thaw frozen foods safely

Frozen foods can be safely thawed in several ways. Once thawed, they should be used as soon as possible, and for optimal quality and flavor should not be refrozen. The best—though slowest—method is to allow the food to thaw under refrigeration. The food, still wrapped, should be placed in a shallow container on a bottom shelf to prevent any drips from contaminating other items stored nearby or below.

If there isn't time to thaw foods in the refrigerator, covered or wrapped food can be placed in a container under running water that is approximately 70°F/21°C or below. Use a stream of water strong enough to wash loose particles of ice off the food, and do not allow the water to splash onto other food or surfaces. Be sure to clean and sanitize the sink both before and after thawing.

Individual portions that are to be cooked immediately can be thawed in a microwave oven. Liquids, small items, or individual portions can be cooked without thawing, but larger pieces of solid or semisolid foods that are cooked while still frozen become overcooked on the outside before they are thoroughly done throughout.

Do not thaw food at room temperature; it is an invitation to pathogens.

Serve foods safely

The potential for transmitting food-borne illness does not end when the food leaves the kitchen. Restaurant servers should also be instructed in good hygiene and safe food-handling practices. They should wash their hands properly after using the bathroom, eating, smoking, touching their face or hair, and handling money, dirty dishes, or soiled table linens (particularly napkins). Ideally, some servers should be designated to serve foods and others should be responsible for clearing used dishes and linens.

Servers should touch only the edges and bottoms of plates as they transport them from kitchen to dining room. When setting tables, they should never touch the parts of flatware that will come in contact with food, and they should handle glassware by the stems or bases only. Servers should clean side stands, trays, and tray stands before the start of each shift and as necessary during service. They should always fold napkins on a clean surface and handle used napkins as little as possible; table linens should only be used once. And they should serve all foods using the proper utensils; ice and rolls should be handled with tongs, never with fingers.

Hazard analysis critical control points (HACCP)

HACCP is an acronym that is fast becoming commonly used in food service and food safety. It stands for Hazard Analysis Critical Control Points, which is a scientific state-of-the-art food safety program originally developed for astronauts. HACCP takes a systematic approach to the conditions that are responsible for most food-borne illnesses. It is preventive in nature: It attempts to anticipate how food safety problems are most likely to occur and takes steps to prevent them from occurring.

The HACCP system has been adopted by both food processors and restaurants, as well as by the FDA and USDA. At this time, there is no mandate that HACCP must be used by food-service establishments. However, instituting such a plan may prove to be advantageous on a variety of levels.

If you decide to begin instituting HACCP procedures in your restaurant or bakeshop, you should know that an initial investment of time and human resources is required. It is becoming obvious, however, that this system can ultimately save money and time, as well as improve the quality of food you are able to provide your customers.

The heart of HACCP lies in the following seven principles:

- 1. ASSESS THE HAZARDS.** The first step in an HACCP program is a hazard analysis of each menu item or recipe. It requires a close look at the process of putting that menu item together, beginning with the delivery of the starting ingredients. Every step in the process must be looked at by designing a flowchart that covers the period from “dock to dish.” In addition, it is best to have all persons involved in the flow of the food present when setting up an HACCP program, for the person receiving the food on the loading dock may have an important bit of information that can help set up the program and identify the true flow of food.

The types of hazards you should be concerned with are the biological, chemical, or physical conditions that could cause a food to be unsafe for consumption. The biological hazards are typically microbiological, though the possibility of toxicity (such as from poisonous mushrooms) should not be ignored. Microbiological hazards include bacteria, viruses, and parasites.

2. IDENTIFY THE CRITICAL CONTROL POINTS. After you have established a flow diagram and identified the potential hazards, the next step is to identify the critical control points (CCPs). From the moment food is received at your food-service establishment, and throughout production, you have the ability to control what happens to that food (including not accepting it from your vendor if it does not meet your specifications). You must decide which of the different control points (steps) are critical ones. One of the most difficult aspects of putting together an HACCP program is making sure not to overidentify these critical control points, because that could lead to a cumbersome amount of paperwork. In addition, a profusion of CCPs could obscure the real control issues. A critical control point is the place in the utilization of the food in a restaurant or bakeshop where you have the ability to eliminate or reduce an existing hazard or to prevent or minimize the likelihood that a hazard will occur. According to the 1999 FDA Food Code, a critical control point is “a point or procedure in a specific food system where loss of control may result in an unacceptable health risk.”

The cooking step, as a rule, is a critical control point. Other critical control points are usually associated with time-temperature relationships (thawing, hot-holding, cold-holding, cooling, and reheating). Some other considerations that should be addressed in identifying a critical control point are as follows: At this step, can food be contaminated? Can the contaminants increase or survive? Can this hazard be prevented through some kind of intervention (commonly referred to as “corrective action”)? Can hazards be prevented, eliminated, or reduced by steps taken earlier or later in the flow? And, can you monitor, measure, and document the CCP?

3. ESTABLISH CRITICAL LIMITS AND CONTROL MEASURES. Critical limits are generally standards for control measures at each critical control point. Many will have already been established by local health departments, but you may want to establish new critical limits for your food operation that exceed the regulatory standard, or establish a new standard that meets with health department approval. (The 1999 FDA Food Code refers to these possibilities as “variances.”)

By way of example, an established critical limit for the cooking step in preparing a chicken dish is a 165°F/74°C final internal temperature. This critical limit prevents the possibility of a patron contracting salmonellosis. If you were to hold this chicken on the line before actual service, it would have to be kept at 140°F/60°C to prevent any proliferation of pathogenic microbes. Holding would be a step in the process that would be considered critical.

Control measures are what you can do ahead of time to facilitate the achievement of your critical limit. For example, when preparing to cook chicken to 165°F/74°C, you should make sure your equipment is working well. Before you roast chicken, you should preheat the oven. If you are going to monitor the temperature of the chicken with a thermometer, you should make sure it is accurately calibrated. You also have to know how to cook and how to take internal temperatures. Therefore, training is often a control measure too.

4. ESTABLISH PROCEDURES FOR MONITORING CCPs. The critical limits for each critical control point must identify what is to be monitored. You must also establish how the CCP will be monitored and who will do it. For example, one employee may be designated to monitor the temperature of the roasting chicken. For each batch, the employee should be instructed to check the internal temperature of the largest chicken and the one in the middle of the pan.

Monitoring helps improve the system by allowing for the identification of problems or faults at any particular point in the process. This allows for more control or improvement in the system because it provides an opportunity to take corrective action if a critical limit was not met. Monitoring lets you know if the desired results were achieved. In the example of the chicken, was it indeed cooked to an acceptable temperature?

5. ESTABLISH CORRECTIVE ACTION PLANS. If a deviation or substandard level occurs for any step in the process, a plan of action must be identified. For example, if the roasted chicken was held at an incorrect temperature (120°F/49°C) for too long in a steam table, the corrective action would be to discard it. If frozen fish arrives from the purveyor with a buildup of ice, indicating that it has been defrosted and refrozen again, the fish should be rejected. Specific corrective actions must be developed for each CCP, because the handling of each food item and its preparation can vary greatly from one kitchen to the next.

6. SET UP A RECORD-KEEPING SYSTEM. Keep documentation on hand to demonstrate whether or not the system is working. Recording events at CCPs ensures that critical limits are met and preventive monitoring is occurring. Documentation typically consists of time-temperature logs, checklists, and forms.

It is important to keep the forms readily accessible and easy to fill out. Keeping a temperature log on a clipboard at a grill station and recording internal temperatures of one out of every ten orders that go out to customers would be a realistic responsibility for a line cook. Having reliable and accurately calibrated thermometers on hand is also necessary. Do not make the logs or forms too complicated or cumbersome: This could encourage “dry lab,” that is, the falsifying of records.

7. DEVELOP A VERIFICATION SYSTEM. This step is essentially establishing procedures to ensure that the HACCP plan is working correctly. Have a supervisor, executive chef, or outside party verify that the plan is working. If procedures are not being followed, try to find out what modifications you can make so the plan works better. The most difficult part of putting an HACCP program plan together is going through it the first time. After the initial paperwork, it essentially involves monitoring and recording. As your employees become accustomed to filling out the forms correctly, they will be establishing positive behaviors that promote food safety. These new behaviors will naturally spill over into the preparation of other recipes, making the development of an HACCP program plan for each new dish easier.

The way in which an individual operation may apply these principles will vary. Adapt the system as necessary to fit your establishment's style. Chain restaurants, for example, receive and process foods differently from à la carte restaurants.

Clean and sanitize

Cleaning refers to the removal of soil or food particles, whereas *sanitizing* involves using moist heat or chemical agents to kill pathogenic microorganisms. For equipment that cannot be immersed in a sink, and for equipment such as knives and cutting boards during food preparation, use a wiping cloth, soaked in a double-strength sanitizing solution and then wrung out, to clean and sanitize the equipment between uses. Iodine, chlorine, or quaternary ammonium compounds are common sanitizing agents. Check the manufacturer's instructions for procedures for use.

Small equipment, tools, pots, and tableware should be run through a ware-washing machine or washed manually in a three-compartment sink. The many kinds of ware-washing machines all use some sanitation method, such as very hot water (usually 180° to 195°F/82° to 91°C) or chemical agents.

Hard water, which contains high levels of iron, calcium, or magnesium, may interfere with the effectiveness of detergents and sanitizing agents and may also cause deposits that can clog machinery. Water-softening additives can prevent these problems.

After sanitizing, equipment and tableware should be allowed to air-dry completely; using paper or cloth toweling could result in cross contamination.

Keep out pests

Careful sanitation procedures, proper handling of foods, and a well-maintained facility all work together to prevent a pest infestation. Besides being destructive and unpleasant, rats, mice, roaches, and flies may harbor various pathogens. Take the following steps to prevent infestation:

- Clean all areas and surfaces thoroughly.
- Wipe up spills immediately and sweep up crumbs.
- Cover garbage, and remove it every four hours.
- Elevate garbage containers on concrete blocks.
- Keep food covered or refrigerated.
- Check all incoming boxes for pests and remove boxes as soon as items are unpacked.
- Store food away from walls and floors, and maintain cool temperatures and good ventilation.
- Prevent pests from entering the facility by installing screened windows and screened self-closing doors.
- Fill in all crevices and cracks, repair weak masonry, and screen off any openings to buildings, including vents, basement windows, and drains.
- If necessary, consult a professional exterminator.

Kitchen safety

The following safety measures should be practiced.

Health and hygiene

Maintain good general health; have regular physical and dental checkups. Do not handle food when ill. Cover your face with a tissue when coughing or sneezing, and wash your hands afterward. Attend to cuts or burns immediately. Keep any burn or break in your skin covered with a clean waterproof bandage, and change it as necessary.

Observe the fundamentals of good personal hygiene. Keep hair clean and neat, and contain it if necessary. Keep fingernails short and well maintained, without polish. Keep your hands away from your hair and face when working with food. Do not smoke or chew gum when working with food.

Begin each shift in a clean, neat uniform. Do not wear your uniform to or from work or school. Store the uniform and all clothing in a clean locker. Do not wear jewelry other than a watch and a plain ring, to reduce risk of personal injury and cross contamination.

Work safely

In addition to the precautions necessary to guard against food-borne illness, care must be taken to avoid accidents to staff and guests.

- Clean up grease and other spills as they occur. Use salt or cornmeal to absorb grease, then clean the area.
- Warn coworkers when you are coming up behind them with something hot or sharp.
- Alert the pot washer when pots, pans, and handles are especially hot.
- Beware of grill fires. If one occurs, do not attempt to put it out with water. Removing excess fat and letting any marinades drain completely from foods to be grilled will help prevent flare-ups.
- Keep fire extinguishers in proper working order and place them in areas of the kitchen where they are most likely to be needed.
- Remove lids from pots in such a manner that the steam vents away from your face, to avoid steam burns.
- Bend at the knees, not the waist, to lift heavy objects.
- Pick up anything on the floor that might trip someone.
- Learn about first aid, CPR, and mouth-to-mouth resuscitation. Have well-stocked first-aid kits on hand (see “First-Aid Supplies,” page 83).
- Make sure that all dining room and kitchen staff know how to perform the Heimlich maneuver on a choking person. Post instructions in readily visible areas of the kitchen and dining room.
- Handle equipment carefully, especially knives, mandolines, slicers, grinders, band saws, and other equipment with sharp edges.
- Observe care and caution when operating mixers. Always keep your hands away from an operating mixer.

- Use separate cutting boards for cooked and raw foods, and sanitize after using.
- Wash hands thoroughly after working with raw foods.
- Use tasting spoons, and use them only once—do not “double-dip.” Do not use your fingers or kitchen utensils when tasting food.
- Store any toxic chemicals (cleaning compounds and pesticides, for example) away from food to avoid cross contamination.
- Use only dry side towels for handling hot items.
- Use instant-read thermometers (and sanitize them after use) to ensure that adequate temperatures are reached.
- Post emergency phone numbers near every phone.

Practice fire safety

It takes only a few seconds for a simple flare-up on the grill or in a pan to turn into a full-scale fire. Grease fires, electrical fires, or even a waste container full of paper going up when a match is carelessly tossed into it are easy to imagine happening in any busy kitchen. A comprehensive fire safety plan should be in place and a standard part of all employee training.

The first step in avoiding fires is to make sure that the entire staff, both kitchen and dining room, is fully aware of the potential dangers of fire everywhere in a restaurant. If you see someone handling a situation improperly, first get the situation under control, then take the time to explain what your concern is and how to avoid the situation in the future.

Next, be sure that all equipment is up to code. Frayed or exposed wires and faulty plugs can all too easily be the cause of a fire. Overburdened outlets are another common culprit. Any equipment that has a heating element or coil must also be maintained carefully, both to be sure that workers are not likely to be burned and to prevent fires.

Thorough training is another key element in any good fire safety program. Everyone should know what to do in case of a fire. Having frequent fire drills is a good idea. Instruct your kitchen staff in the correct way to handle a grill fire and grease fire.

There should also be fire extinguishers in easily accessible areas. Check each extinguisher to see what type of fire it is meant to control, and make sure you and your staff understand when and how to operate each type.

Proper maintenance of extinguishers and timely inspections by your local fire department are vital. Fire control systems, such as an Ansul system, also need to be serviced and monitored so that they will perform correctly if you need them. Above all, make sure you never try to put out a grease, chemical, or electrical fire by throwing water on the flames.

Everyone should know where the fire department number is posted and who is responsible for calling the department if necessary.

first-aid supplies

Adhesive strips in assorted sizes
 Bandage compresses
 Sterile gauze dressings, individually wrapped
 Rolled gauze bandages
 First-aid adhesive tape
 Cotton swabs (for applying antiseptic or removing particles from eyes)
 Tourniquet
 Tongue depressors (for small splints)
 Scissors
 Tweezers
 Needles (for removing splinters)
 Rubbing alcohol (for sterilizing instruments such as tweezers and needles)
 Mild antiseptic (for wounds)
 Antibiotic cream
 Syrup of ipecac (to induce vomiting)
 Petroleum jelly

The exits from any area of the building should be easy to find, clear of any obstructions, and fully operational. Your guests may have to rely on you and other staff to get them safely out of the building. Identify one spot outside the building, at a safe distance, where everyone should assemble after they've exited safely. Then you will be able to tell immediately who may still be inside the building and need to be rescued by firefighters.

The main rule for fire is to be prepared for all possibilities. You cannot assume it won't happen to you.

Dress for safety

More than simply completing the look of the chef, the parts of the typical chef's uniform play important roles in keeping workers safe as they operate in a potentially dangerous environment. The chef's jacket is double-breasted, which creates a two-layer cloth barrier against steam burns, splashes, and spills. The design also means that the jacket can easily be rebuttoned on the opposite side to cover up spills. The jacket sleeves are long, to protect against burns and scalding splashes, and they should not be rolled up.

The same is true of pants. Shorts, while they may seem like a good idea for a hot environment, are inappropriate because they offer no protection. Pants should be worn without cuffs, which can trap hot liquids and debris. Ideally, pants should have a snap fly and be worn without a belt; if hot grease is spilled on the legs, this allows for fast removal of the pants, which could lessen the severity of the burn.

Be it a tall white toque or a favorite baseball cap, chefs wear hats to contain their hair, preventing it from falling into the food. Hats also help absorb sweat. Neckerchiefs serve a similar sweat-absorbing role. The apron protects the jacket and pants from excessive staining.

Most chefs use side towels to protect their hands when working with hot pans, dishes, or other equipment. They are not meant to be used as wiping cloths—side towels used to lift hot items must be dry in order to provide protection; once they become even slightly damp, they can no longer insulate properly.

While athletic shoes are very comfortable, they are not ideal for working in a kitchen. If a knife should fall from a work surface, most athletic shoes would offer very little protection. Hard leather shoes with slip-resistant soles are recommended, because of both the protection they offer and the support they give your feet.

Jackets, pants, side towels, aprons, and shoes can harbor bacteria, molds, parasites, and even viruses. Because these pathogens can be transmitted with ease from your uniform to foods, a sanitary uniform is important. Wear your uniform at work only, not when traveling to and from the job, where you can pick up pathogens along the way.

Proper laundering can sanitize your uniform to make it safe and clean. If your establishment doesn't use a laundry or uniform service, use hot water, a good detergent, and a sanitizer such as borax or chlorine bleach to remove bacteria and grime. Automatic dish-washing soap (used in household machines) contains an enzyme to help break up stuck-on food. These same enzymes can help to release food stains on uniforms. Add a half cup of dry household dishwasher detergent to the wash water.

Regulations, inspection, and certification

Federal, state, and local government regulations attempt to ensure the wholesomeness of food that reaches the public. Any new food-service business should contact the local health department well in advance of opening to ascertain the necessary legal requirements. A professional chef moving to a new area to work should contact local authorities for ordinances specific to that area. Some states and local jurisdictions offer sanitation certification programs. Certification is often available through certain academic institutions.

The Occupational Safety and Health Administration (OSHA)

OSHA is a federal organization, instituted in 1970, that falls under the purview of the Health and Human Services Administration. Its goal is helping employers and workers to establish and maintain a safe, healthy work environment.

Among OSHA's regulations is the mandate that all places of employment have an adequate and easily accessible first-aid kit on the premises. In addition, any organization that has more than ten employees must keep records of all accidents and injuries to employees that require medical treatment. Any employee requests for improvements in the safety of the workplace, including repair or maintenance of the physical plant and equipment necessary to perform one's job, must be attended to by the organization.

As money for many health and human service organizations has dwindled, OSHA's ability to make on-site inspections has also been reduced. It now concentrates its efforts on providing services where the risk to worker safety is greatest. This does not mean that small businesses can operate with impunity, for any employee can call OSHA's offices and report violations.

Americans with Disabilities Act of 1990

This act is intended to make public places accessible and safe for those with a variety of disabilities. Any new construction or remodeling done to a restaurant must meet ADA standards. They include, for example, providing telephones located so that they can be reached by a person in a wheelchair, and toilets with handrails. Most contractors will have the necessary information, but if you are unsure, contact a local agency.

A special note about smokers

Many restaurants have banned smoking, whether voluntarily as a result of public pressure or because of legislative mandates. While this may improve the air quality within the restaurant itself and provide a more pleasant dining experience for nonsmoking guests, there is one thing that should be kept in mind: Simply banning smoking in the dining room and the bar may not ban smoking from the entire premises. Common sense will tell you that smokers will very likely smoke cigarettes up to the moment they walk in the door, and light up as soon as they step back outside. One carelessly flung match or a single smoldering cigarette butt can spell ruin.

Place sand-filled buckets or urns near the areas where you expect or prefer to have smokers take their cigarette breaks. If you do allow smoking in your restaurant, make sure that bartenders, bus people, and wait staff have a safe way to dispose of the contents of ashtrays.

Of course, smoking should never be allowed in the kitchen area.

Drugs and alcohol in the workplace

One final topic that is of great importance in the workplace is the right of all workers to be free from the hazards imposed by a coworker who comes to work under the influence of drugs or alcohol. The abuse of any substance that can alter or impair one's ability to perform his or her job is a serious concern. Reaction times may be slowed, and the ability to concentrate and to comprehend instructions reduced. Inhibitions are often lowered, and judgment is generally impaired. As a result, people's safety or even their lives can be at stake. A poorly judged effort when emptying the hot oil from the deep fryer could result in permanent disability. A playful attempt at passing a knife could put out an eye. Forgetting to take the time to properly store and reheat foods could lead to an outbreak of food-borne illness that could kill someone.

The responsibilities of a professional working in any kitchen are too great to allow someone suffering from a substance abuse problem to diminish the respect and trust you have built with your customers and staff.